

Conference "Governing Uncertainty:
The Contribution of Social Sciences
to the Governance of Risks
in Environmental Health"

6 – 7 July 2009

Opening Remarks

Martin GUESPEREAU
Director General, AFSSET

Welcome, Ladies and Gentlemen. I wish to thank you for attending this symposium at this time of the year: we will address how the governance uncertainty, as well as the contribution of social sciences to the governance of risks in environmental health. I am pleased to welcome you on behalf of the French Agency for Environmental and Occupational Health Safety, which I am honoured to head, and on behalf of Olivier Borraz, Head of the Risk and Society Network (R²S).

This conference is the result of an encounter between R²S network and the Afsset, between social sciences and the expert assessment of risk in environmental and occupational health. In view of the impressive number of attendants, I have no doubt you support the issues raised by this symposium. This is an unprecedented endeavour for the Afsset and R²S to try and combine so-called hard sciences and social sciences. I do believe these two worlds would greatly benefit from such exchanges, which we will try and prove over these two days. More than 400 people have registered to attend, and Olivier Borraz will unveil our ambition.

I would like to say a few words about the French Agency for Environmental and Occupational Health Safety, as some members of the audience might not know it well. We provide scientific expertise for decision makers. When addressing scientific controversies that simply cannot be managed nor wielded, our aim is to turn it into something wieldable. Our fields of activities relate both to occupational and environmental health – anything to do with our environment and health, be it chemicals, asbestos, electromagnetic waves, nanotechnologies, sick building syndrome and so on. These are also the challenges that we shall address in the five workshops over the next two days.

Our method for doing this is a response to the 1980s and 1990s health crises. The dogma is that nobody owns the truth. We gather scientists from all scientific mainstreams, from all disciplines with pertinent views on the topic. To give you an idea of how important this is, we have 150 people working in-house, with another 400 experts collaborating intermittently on our external works: this is proof of the importance of casting a wide net and get a wide range of different opinions. They join forces to try and achieve a convergence of views in order to reach a conclusion. The agency follows a number of principles:

- Principle of transparency: all our works are made public and we mark out diverging opinions;
- Principle of independence;
- Principle of competence: we must be competent. We need to be competent in terms of the substance of the case.

Such method is our know-how, and it works well; however, with this symposium, we expect to be challenged by you, by your ideas. By answering some questions, for instance on participation and a number of subjects that we will address, we shall be enriched.

What does human and social sciences mean? It means riding a bike and looking at yourself as you ride the bike. We want social sciences to be part and parcel of everything. There are things that have rocked the boat of our highly hard sciences French practices, with European developments such as REACH – and you will be familiar with this European directive on chemicals. The European Chemicals Agency (ECHA, the European counterpart of AFSSET) is in charge of coordinating chemicals and contains two different scientific committees: one in charge of risk assessment and another in charge of socio-economic analysis regarding restriction proposals. These two committees work on a par with each, because, if you do not have a convergence and equality between the two committees, you cannot make sound decisions about chemicals without classifying them. For the first time at the Afsset, we have integrated economic and social sciences expertise as a prerequisite of the Committee of specialised experts on REACH. As I said, therefore, we are riding a bicycle and watching ourselves ride the bicycle, so human and social sciences are now absolutely necessary in order to call our own model into question and see how we can improve it. We therefore take un-wieldable, controversial issues and make sure that decisions can be made.

Our model is based on developments that emerged in the 1990s, which is already quite some time ago. Things have changed in ten years, in particular the emergence of expertise and skills in the world of NGO's and associative sector unknown ten years ago especially on the issues of genetically modified organisms (GMOs) and mobile telephony. There are therefore people who are true activists and they have the right skills, with a level of skills that was absolutely unprecedented just 10 years ago. The issue of participation (of the Aarhus Convention type) now belongs in the debate on how expertise operates. Various models have been proposed, particularly with regard to the high authority on biotechnologies according to latest GMO-related laws and, of course, everyone is welcome to pitch in their opinion.

These examples show that this is exactly what the Afsset wants in terms of this conference. We want to establish a robust social science that will contribute to the decision-making process, not by mixing but by adding things. How do we spark off a dialogue between social sciences and hard science? How do we pitch this in? How do we propose it and put it forward in terms of our model?

Of course, these efforts transcend geographic borders, and we must extend them to the European scale. That is why we wanted this symposium to be truly European in scale, as vouched by the programme and the participants. We will be holding four very important sessions.

- We will talk about quantitative health risk assessment – how to assess health risks. That is the basic foundation of our work. What does this mean today in terms of uncertainty?
- We will then have a session on the various kinds of uncertainty. We need to get to the heart of the matter.
- We will look at uncertainty reducing tools (cost/benefit analysis and so on).
- We will then have the conclusions and will make sure that everything is measured on the basis of what actually happens in the field, and that is where we shall have our workshops.

I thank you.

Olivier BORRAZ
President, Risk and Society Network (R²S)

Good morning, Ladies and Gentlemen. It is my pleasure to welcome you on behalf of the Risk and Society Network (R²S), and I would like to say a few words about the network and tell you exactly what we do, and then present the conference. R²S is a group whose purpose is to promote research in the social sciences on collective risks and crises. The association relies on research that has been carried out since 1984, first as part of a programme, then as part of a GIS (Groupement d'Intérêt Scientifique) under the responsibility of Claude Gilbert and Isabelle Bourdeaux. R²S is a network of researchers and practitioners who have come together over the years and we hold seminars and conferences on different topics. However, we are more than just an association. We represent a relatively original approach in the study of collective risks which was presented in a summary report which came out in 2005 and which was then published in the *Journal of Risk Research* in 2007. Our approach is based on various fields of expertise – sociology of organisations, policy studies, studies of technology and science, as well as history, law, anthropology, management, geography and so on. It seeks to ensure that risk analysis captures the broader issues, such as for example, the production of scientific research, how public policy problems are defined, or the day-to-day operations for organisations when dealing with risks.

This symposium is an opportunity to address a little-represented topic – uncertainty. Most of the time uncertainty boils down to a lack of scientific knowledge. However, we believe that that is too narrow a definition regarding health and occupational risks, and that we need a broader definition of uncertainty. That is why we would like to put forward the fact that risk is just one instrument that can be used to manage uncertainty, and that there are other ways of looking at the problem. For this to happen, social sciences need to extend and better define the concept of risk and uncertainty so that we can manage uncertainty more effectively. The symposium is based on these questions.

We shall address the various aspects of this question on the first day and talk about the very foundations and uses, as well as the construct of the concept of uncertainty, in various fields. Later, during the plenary session and in the course of five simultaneous workshops, we will explore the ways in which social sciences can shed further light on occupational health and environmental health issues. This will be an opportunity to go above and beyond the usual expectations – that is, we will not work solely on public perceptions or on how the public debate should be organised; there are other approaches in terms of social sciences that can help us understand the issue and these will be presented in the workshops.

Tomorrow, we will talk about ways of reducing uncertainty. Experts are asked to assess risk and sociologists to organise communication on risk and sometimes authorities will call on the Precautionary Principle. There are therefore various arrangements and ways of going about governing uncertainty, and we shall bring these together. In the afternoon, we will discuss the potential contribution of social sciences to a broader understanding of uncertainty so that we can manage uncertainty better. We need to put together more sustainable, democratic and robust management systems. The symposium is therefore an

opportunity to bring together academic challenges with management and policy-related issues.

Social sciences are often instrumental in turning scientific or technical subjects into political issues. But as we introduce more social and political angles into the debate, we must also take the responsibility to suggest policy instruments and methods capable of bringing together and managing the different uncertainties.

The conference is based on collaboration between AFSSET and R²S and I would like to thank AFSSET for asking us to work with them. This decision is both original and courageous. From their inception, health agencies have had a hard time working with social sciences. Some of them have simply refused, while others have decided to explore the issues, although only three agencies have really pulled it off and managed to work together in close collaboration. These are the HAS (Haute Autorité de Santé), the Institut de Veille Sanitaire and AFSSET. This may be because the agencies work in fields characterized by strongly controversial issues, but it is also a question of individuals: I would like to thank Benoit Vergriette, without whose help this conference would not have been possible, along with the two successive directors of AFSSET, Henri Poinsignon and Martin Guespereau. I would also like to thank the Ecole des Mines for hosting us, and particularly the Centre for the Sociology of Innovation.

At a time when there is talk of merging several agencies, I hope that the work of today and tomorrow will be fruitful and help us renew our level of expertise and further our understanding of risk and uncertainty.

SESSION 1 - The Quantification of Risks as a Mode and Science of Government

Monday 6 July

Paul FRIMAT
Head of Scientific Committee, AFSSET

Good morning, everyone. For those of you who do not know me, I am a hard scientist, and if I understand correctly, we shall bring together hard science and soft science this morning. As a doctor, I am delighted that this symposium is being held. In a past life, I facilitated research teams that tried to bring together scientific fields of this kind. I have worked with legal experts, in particular, and know how hard it is to try to move forward and understand each other, which is the first step, and then produce an outcome, as a second step, to try to facilitate the decision-making process. I have therefore been asked to 'moderate' this morning's proceedings – in other words, I have been asked to be the time master. We shall hear two presentations and will then have a discussant who will spark off a dialogue with the audience.

Without further ado, I would like to hand over to Bernard Chevassus au Louis, General Inspector for Agriculture. Some of you have known him for many years, as he has worn many hats over the years and, in particular, he has worked at AFSSA.

Quantification or Qualification: **Which Risk Assessment?**

Bernard CHEVASSUS AU LOUIS
General Inspector for Agriculture

I. Dealing with Uncertainty

I am a biologist and I do not know whether that makes me a hard scientist or not. In any case, I focus more on empirical data as opposed to the theory of risk. How can we introduce the concept of uncertainty – with uncertainty being the absence of certainty? The Precautionary Principle was based on an empirical conclusion, according to which certainty does show up, but very often when it shows up, it is too late. Hence, just

because there is uncertainty, it does not mean that we should not take action. If you talk to people who are supposed to take action, as soon as you talk to them, questions emerge – ‘Tell us more about this concept of uncertainty. What am I supposed to do?’ Decision-makers have a choice between a wide range of different initiatives and responses. They can inform the population and also take much tougher decisions, where they can, for example, establish temporary or permanent bans. You therefore need a scale and a spectrum for risk assessment purposes – and that is the very subject of my presentation. It is based on the idea, according to which, in the traditional approach to risk assessment, you have variables that are well known, to various degrees of precision. The impact of the risk, if it materialises, is generally well known. Uncertainty is something that you can throw probabilities into. You have statistical tools to break things down mathematically speaking and we agree that the ways in which you can combine risk and uncertainty obey a matrix, according to which you multiply the impact by the probability factor. You therefore have a single-dimensional method and you can then place all the various risk levels on a single scale.

The problem with uncertainty is that you are very often dealing with data that is not specific or accurate, and you cannot therefore use it traditionally speaking in the decision-making process. What I suggest, therefore, is that we use so-called semi-quantitative variables to further our understanding of the impact and the levels of uncertainty – and I will explore this further. The fact that this time it is not legitimate to simply combine impact on the one hand and probability or uncertainty on the other – in other words, what we looked at before in terms of the theory that I was talking about. It is not relevant, whether we are talking about social sciences or mathematics. In mathematical terms, we are dealing with situations where there are undetermined forms. There is a very large impact being multiplied by something uncertain – from zero to infinity. Additionally, from a sociological point of view, we know that when there is a very strong impact, but the probability is uncertain, something that you see experimentally speaking is that people no longer apply this theory, but apply the two components separately. We therefore need a different combination for impact on the one hand and uncertainty on the other.

II. The Impact of Risk

1. Severity

In terms of impact, there are three different parameters: severity, acceptability and irreversibility. With severity, we realise that for a lack of a specific estimate of the potential global damage, there are a number of aspects that are important in terms of how to characterise the severity level. Firstly, will there be individual damage? That can be tracked down. Are there deaths that we can identify? For example, this person was indeed a victim – a victim of Mad Cow’s Disease, for instance. What about probability? Is average mortality likely to increase or not? That means that we are indeed dealing with a person who was a victim of Mad Cow’s Disease, for example. When there is individual damage – and we saw this with Mad Cow’s Disease – the impact on public authorities and decision-makers is even stronger.

The second important thing is the following. Has the target population – all the people who could be at risk – been clearly delineated or not? Let us take a risk such as exposure to low-dose chemicals. We could say that the entire French population could potentially be affected. We therefore introduce the concept of disaster potential and, at the end of the day, everybody is concerned. Even if the number of people who will be actual victims is low, the concept of disaster potential is very important.

2. Acceptability

I am sure that you are familiar with acceptability. This is an approach that shows that a risk can be low quantitatively, but from a qualitative perspective it is completely unacceptable. There are about 20 attributes here that mean that a particular risk is either acceptable or not. Is it a risk that you take deliberately or is it being forced upon you? Let us take the Chernobyl situation. Will the risk be manifested immediately after you take a chance or do you find out 10 years later?

Another parameter that I think is very important, particularly in terms of GMOs, is whether the risk is fair or unfair. In other words, are the people generating the risk exposed to it or are they dissociated from the people who actually bear the risk? We have modern and traditional food-related risks. If we idealise things a little, this has to do with the production and consumption of your own food. We all know that experts usually say that food-related risks have never been so low – they mean from a quantity point of view. However – and I will not go into detail here – if we look at the traditional food risks, they are usually on the right side and are so-called good risks. Modern food-related risks in connection with prions, pesticide residues and GMOs and so on have all the attributes of so-called bad risks. I have produced a grid that we can use to ascertain the concept of acceptability, as there are various levels of risk, some of which are acceptable and some of which are not.

3. Irreversibility

The third parameter is irreversibility. If I make a decision at a particular point in time, the risk will decrease at varying degrees of speed. However, if I make that decision later, there is a so-called good risk from a reversibility point of view, meaning that at any time the risk will decrease accordingly. If I postpone my decision, it does not increase the irreversibility of the risk. Conversely, if I put off my decision, I have less control over the situation – and that is the situation that we are dealing with in Mad Cow's Disease. In other words, the irreversibility factor is low.

III. The Uncertainty of Risk

1. Plausibility

We also need to characterise the concept of uncertainty, and here again I will use three different parameters: plausibility, reducibility and observability.

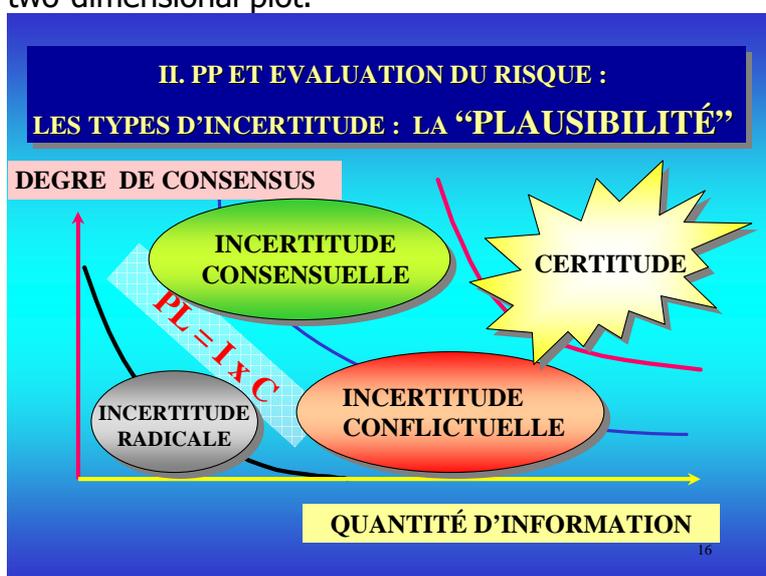
Looking firstly at plausibility, when you are dealing with a phenomenon, the very existence of which you doubt – and that is why things are different from probability, where you do not doubt the existence of the phenomenon, but just wonder about its

frequency – what you can do is ask yourself how much information you have. Is there a lot of literature or reports published on the subject and so on? How is the information processed? In other words, how much consensus is there between the various experts in terms of how we should interpret this information? We have a lot of information and everybody is in agreement, and we then have a traditional situation where there is a lot of certainty. However, we can also deal with other types of situations.

There are different kinds of controversies and the question is how they should be ranked. To give some examples:

- The controversy has to do with the very validity of the data. A former Research Minister said that all the data on climate change could be disputed, so the debate is about the very validity of the data.
- You can then also have controversy on the scientific models that you will use. It all depends. Are we talking about dissemination of GMOs? Is it geneticists or biologists who are talking? Are they ecologists? Depending on where you are coming from, you will have a different interpretation.

All this, of course, has an impact on the concept of precision, for example, the confidence interval, and the extent of climate change and cross-pollination with GMOs. That has an impact on how you calculate the precision level. There is therefore a very first situation that I call “radical uncertainty”: there may be very little information and this leads to violent controversy, and here we have the example of “water memory” or “cold fusion”. There was a single publication on water memory, and cold fusion also made headlines at one point in time. However, you then have intermediate situations. For example, there is so-called “consensual uncertainty”. In other words, you do not have a great deal of information. Nevertheless, there is a convergence between experts. In 1996 and 1998, with mad cow disease and other such prions, there was very little information or experimental data and very few publications on the subject. However, experts gradually converged and said that we needed to admit that the idea of the prion being transmitted from cow to man was more and more plausible. At the opposite, there are also other cases that AFSSET is very familiar with and a lot of literature on the subject, such as the impact of electromagnetic waves. Yet there is still a lot of controversy, despite the extent of the literature. You can therefore draw some curves for this, and these curves are equi-positive, and you can signpost the very concept of plausibility, using a two-dimensional plot.



2. Reducibility and Observability

As regards the other two parameters of reducibility and observability, as we saw earlier, there is a wide range of situations that go from one point to another. These range from several models being possible, with very few parameters, all the way to a so-called radical lack of determinism. No matter how much respect we have for research, just doing research does not mean that you reduce the level of uncertainty. You either test models or you need to estimate your parameters better. However, in some complex situations, all you can do is take a better look and identify the phenomenon better. Nevertheless, targeted research is unlikely to reduce the level of uncertainty. Reducibility is therefore actually the possibility of reducing the level of uncertainty within a short period of time, using research.

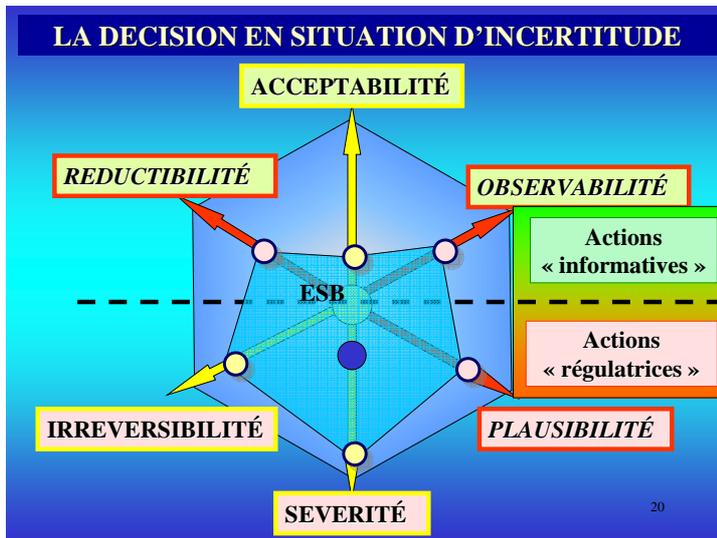
This then raises the issue of vigilance. If we strengthen vigilance, does it mean that the phenomenon can therefore be observed? With the well-known example of GMOs, will GMOs lead to more allergies within the population? I believe that current vigilance systems indeed detect the global signal, but they have a very hard time ascertaining the causes of a potential increase in allergies.

IV. Applying the Impact and Risk Parameters

Going back to the initial question, of the various possible decisions that public decision-makers can make, some are of an informational nature – setting up a vigilance system and targeted systems and warning the population. You then have regulatory decisions, such as restricting usage. If I introduce my six parameters – and I am not putting them in at random – we can see that some parameters will push actions of an informational nature, where we can strengthen vigilance and launch a research programme and, where if it is a serious matter, the research agency at the national level will be motivated on the issue. If the acceptability is good, the social perception of this risk will not be too problematic.

At the other end of the spectrum, where rapid decisions need to be made because the irreversibility may deteriorate, when the plausibility becomes strong and the observability is a major element, there will be a move towards regulatory action.

When we were at primary school and wanted to know where the centre of France was, we used needles and cardboard maps – and that is similar to the principle that we are going to use. We will use the levels of impact and uncertainty and plot a small polygon of the risk analysis. I used the case of Mad Cow's Disease because in 1996 and 1998, we were in a similar situation. Acceptability was very bad, because it looked like a bad risk – as I mentioned earlier – and even if we had targeted research, the non-conventional vehicles were quite disturbing for biologists. The observability was bad: we knew that there was a deferred effect and even if we were to strengthen vigilance and surveillance, it would take years to observe the extent of the phenomenon. Epidemiologists at the time said that there would be between 75 and 140,000 deaths, so the range was very large. The situation could deteriorate rapidly in terms of irreversibility, not to mention severity, and experts were saying more and more – and this was the key phrase for AFSSA – that they regarded the transmission to human beings as being admitted.



My barycentre holds the regulatory actions, which is a typical situation where you have to make hard decisions on soft science. We demonstrated that it was necessary to take regulatory actions, even though we were in a situation of high uncertainty.

V. Conclusion

I could mention further examples, but to conclude I would like to say that the possible interest in this exercise is to have a kind of stability and style of management for decision-makers where stability is a function of their situation. A decision-maker may be quite sensitive to the issue of irreversibility and will say, for instance, that he will need to make sure that the person who replaces him will not have a situation that has deteriorated. He will favour irreversibility and will not be as sensitive to social acceptability. He will be an "enlightened technocrat". At the other end of the spectrum, there may be a decision-maker who is highly sensitive to the social acceptance of the risk, and he can plot his own diagrams, with the criteria he wishes to favour. He knows that if he adopt this decision-making diagram on one criterion it will be useful to him.

This is therefore a tool that I am happy to put forward to address uncertainty and help make decisions. It is a decision-making tool and those of you who assess risks know very well that the link between assessment and risk analysis is not deterministic.

Paul FRIMAT

Thank you for looking at all this in a mathematical and algorithmic way and for defining a number of terms. You have made the distinction between informational action and regulatory action, and this is a useful tool. Through it, we might be able to decide which direction we should take.

I would now like to invite Denis Bard, a physician and professor, to talk to us about the uncertainties in the assessment approach to health risks.

Uncertainty in Quantitative Health Risk Assessment

Denis BARD
EHESP

I. Background

Good morning. I would like to thank R²S and AFSSET for inviting me to speak and for organising this symposium. We have a very interesting agenda and, additionally, the symposium is being held at the right time, as we will see through our discussions.

The organisers have asked me to revisit this basic decision-making tool of the risk assessment approach in the field of environmental and health risks. This is not a new approach, dating back to 1983, which is some time ago. It is made up of four steps and I will look in detail at each step and at the uncertainties related to each phase. The first step is the identification of hazard and the establishment of a causal link between a chemical or physical agent and a noxious effect on health – and this is in line with the previous presentation. We will see the different variables there.

Secondly, once we have identified the noxious or hazardous agent, we need to know at which level it is dangerous and what the severity and consequences of the agent are. This is therefore about assessing the link, dose and response, and it is also essential to assess whether there is a dose threshold below which there is no effect.

The third step is to assess exposure within the impacted or exposed populations. The fourth step, which is the summary of all this, is the impact that Bernard Chevassus au Louis mentioned. You may need to check the past and the situations of exposure, such as the nuclear fallout from Chernobyl in France for e.g. liability purposes or from a regulatory perspective, making projections based on an industrial facility and seeing whether it goes beyond acceptability limits in terms of impact.

II. The Four Steps to the Assessment Approach

The Identification of Danger

a. Experimental data versus epidemiology

Let us therefore look at the first step of identifying hazards. Traditionally, and very often, there is a base that is made up of the results of experiments obtained from animals: it is quicker and cheaper, in most cases, to produce experimental data from animals rather than carrying out epidemiological studies. However, there is radical uncertainty here. This is the predictive value of the data obtained from the animals transposed on the human population. Even if we know the action mechanisms in detail, present in observed in animals as well as in human beings, which is quite seldom, there is a radical uncertainty. We can never be sure that what we observe in animals is valid in humans. However, epidemiology can lead to a final decision because it looks at human populations.

The problem is to have appropriate epidemiological data since, as I said, it is costly, takes time and is uncertain. I am an epidemiologist, of course, and we may have some discussions with the experimentalists and biologists, but the causality evidence is brought forward, according to the epidemiologists, by the epidemiological studies, provided that we have convincing causality arguments and evidence – and I will look at that in detail. Apart the causality evidence, a very strong argument is brought by intervention studies, where an observable effect follows circumstances reducing exposure. These circumstances occur quite seldom, but in the case of air pollution, we were faced with quasi-experimental situations that were observed during the Atlanta Olympic Games in 1996 or in Dublin in 1990, where the use of coal for heating was forbidden and air pollution dropped to a very large degree and a very rapid decrease in heart and respiratory mortality caused by air pollution was subsequently observed. Also, the recent ban on smoking in public places in several countries, including France - although we still need to quantify it there - shows that within a few months of the ban on smoking in public places coronary mortality dropped.

b. Assessing causality

I have taken two examples relating to air pollution and tobacco, but it is of course much more difficult to assess the results when you have, for instance, a multifactorial and long-latency disease such as cancer. We rarely have in this case the possibility of observing the impact of an intervention. What do the epidemiologists do to conclude the causality? They discuss the various pieces of evidence or arguments that are put forward to establish this causality. This was addressed early in modern epidemiology, as early as 1965 by Austin Bradford Hill. An association between an exposure and an effect is regarded as causal if there is a 'sufficient' set of positive arguments. It is not appropriate to say criteria, but viewpoints. When you say criteria, it is as if you are able to weigh those criteria, and may consider that overall you could compute a score: below a certain figure, you would consider that there is no causal link. It does not work that way.

The first argument is the existence of a strong association – what is called a relative risk. For instance, we see that the fact that being exposed to ionising radiation increases significantly the risk of leukemia and we observe the same phenomenon when looking at cancer of the larynx in uranium miners, where there is also a high risk. Another argument, which is not specific to epidemiology, but which is inherent to the scientific approach, is the replicability of results – and I will return later to the cancer of the larynx in French uranium miners.

The specificity of the effect is another argument. That a cause comes before an effect is the only point that may be considered as necessary – a true criterion. This may appear as trivial, but deserves to be checked. If we take the example of the thyroid cancer from the Chernobyl accident, this type of cancer has increased significantly in France. That is perfectly true. However, if we look at the sequencing and whether the cause comes before the effect, we see that the increase in this type of cancer started well before Chernobyl and that the rise in the incidence rate is due to improvements in diagnosis. Another argument is that there should be a link between the dose and the effect and there are other arguments, such as plausibility, which has already been mentioned, consistency with the acquired knowledge, the analogy principle and the experimental evidence. If we revisit the association of ionising radiation and leukemia, we can see that

the argument set is positive for almost all points except the specificity of the effect. The ionising radiation is not the only cause of leukemia, although there is no doubt that there is a causality link between ionising radiation and leukemia. Conversely, for larynx cancer, we may argue about it and the strong association is of interest to epidemiologists. However, this causal association was put off because we observed a strong rise in the number of larynx cancers among uranium miners in France, but not in the other countries where very similar miners cohorts are followed up. Significant risk is therefore not enough to establish this link between cause and effect.

Dose/Response

a. Thresholds

Let us talk now about the uncertainty in terms of the relationship between the dose and the response. The first uncertainty is the quality of data available and the second uncertainty is of an epidemiological nature – is there an effect threshold? The only way of answering that point is to say that for all possible noxious effects, there is a threshold of action below which nothing happens. However, there is one exception to this – the geno-toxic, carcinogenic agents, where there is no threshold. However, this is an epidemiological choice. These principles are basic principles and they help us organise the approach. However, there are exceptions, such as formaldehyde, which is a geno-toxic, carcinogenic agent. Nevertheless, everyone agrees that there is a threshold here.

Conversely, an effect that does not give rise to cancer and where we do not see any apparent threshold is in the relationship between the dose and the response with regard to the effect of lead on the neuro-behaviour of children, measured by intellectual quotient. We therefore have an overall framework and there is no threshold for the geno-toxic, carcinogenic agents, with just one for the others. Nevertheless, it is just a framework.

b. Defining a low level

What will happen if the dose is at a low level? In order to protect ourselves, we need to define the exposure value below which there is no effect, or there is an effect which we may regard as being negligible, although we need to be extremely cautious here. It is not up to the risk assessment officer to say what a negligible effect is and perhaps after this symposium we might be able to understand better who the legitimate person should be who defines this negligible effect.

To have this protection, therefore, we need to start from observable data, and from the observable data, we will need to make decisions and choices on what we cannot observe. The further away we are from the observable fields, the more uncertain we will be.

c. Choosing the principle of action

How, then, are we going to choose this principle of action? Once we say that there is a threshold, most of time, whether the data are available or not, we are going to take experimental conditions. The determination of a threshold will therefore be very often based on observations under experimental conditions. However, is sensitivity sufficient, given that we want to mitigate this uncertainty? There is unavoidable statistical uncertainty in terms of threshold, because we have population constraints. Often, we may observe that for a given substance there is a threshold of action at 10 micrograms per

kilogram of body weight, with groups of 10 animals. However, if you were to move from 10 animals to 100, what would happen?

In terms of a model without a threshold, here we change our language. Using epidemiological data - although we also use animal data - we model the response relationships, and the modelled observations are compatible with an effect up to zero plus. The extrapolation models that we use give rise to major deviations in the assessment of risk at a very low level.

For example, in an animal experiment on dioxins, we had three models. Without doing any statistical tests, which are too complicated, we can see that it is quite consistent. However, where it is a very low dose or an extrapolation, we see that in the relationship between the dose and the response, the dose slopes are extremely different. It is not possible to make a choice on purely scientific criteria. It is done on the equations but several models are compatible with the data and the choice is made on the most pessimistic models, which is better in terms of protection. Alternatively, it is not a pure statistical model and incorporates a series of biological considerations, which is more satisfactory. However, overall, a choice needs to be made.

The initial choice of the principle of action with a threshold versus without a threshold depends on the availability of data, as I have already said, and the quality of the data and their relevant experimental species. With the example of dioxins, there is very old data and a very approximate approach to toxicology. Dosing kills half of hamsters that were treated with almost 1,200 micrograms per kilogram, but for guinea pigs the same dose is 0.6 microgram per kilogram. You can therefore see that there is a huge discrepancy in terms of the relationship between the dose and the response. Which, then, is the most relevant? How can we say that the hamster is closer to man? Of course, the choice is going to be completely different. We are going to make a judgment on the quality of the data that are available and on the relevant experimental species.

Assessing Exposure

With regard to exposure, this is traditional sequencing. The ideal thing would be to have the environmental experimental data direct. You often do not have that and you therefore have to model exposure with a number of variables or data that you might have. There will be data on emissions and we will therefore have to model what happens between the source of emissions and the experimental data, knowing that this modelling is not certain as regards the different variables, such as the accumulation in the environment, the channel of exposure and so on. There are also meteorological questions – do we have the right meteorology and is it precise and accurate? In terms of the source of emissions, for example, with an incinerator I use a super three-dimensional (3D) model and validate it in situ somewhere in the centre of France. I validate it because I have data in the field and nothing proves to me that if I did it in the northern part of France it would be the same.

III. Conclusion

In conclusion, therefore, at every step of the way, as you assess the risk, there is uncertainty. At the end of the day, the risk assessment approach is an old one. However, it is still an approach that is operational when it comes to providing an ordered and

systematic framework for qualifying and quantifying uncertainty. Risk assessment is a vital approach and is instrumental in facilitating the decision-making process. However, we of course need to base ourselves on scientific data as much as possible, and make a decision and pass judgment at every step of the way. This is therefore an object that is so-called trans-scientific.

Paul FRIMAT

Thank you. It is true that this approach, which combines epidemiology and is the assessment of health risks, is important and you correctly outlined the importance of points of view as opposed to criteria, as well as looking at the predictive value of everything that you achieve and read about, bearing in mind that the decision-maker will wonder about thresholds, and that models with and without thresholds are possible. However, it is also difficult to interpret the various observational models and the recent examples you gave us show that, as part of the scientific approach, there is some lingering uncertainty and even subjectivity. For symposia like today's and as part of Scientific Committee meetings held in health and safety organisations and agencies, it is very important to have a multidisciplinary approach and to trade our experiences.

I would like to hear now from Sylvio Funtowicz's replacement. Sylvio has been delayed and Pierre-Benoit Joly from the Institut Français des Relations Internationales (IFRIS) will stand in for him. Pierre Benoît is also a member of the Institut National de la Recherche Agronomique (INRA).

Discussant

Pierre-Benoit JOLY IFRIS/INRA

Thank you. I am delighted to introduce this discussion. To save time for a full questions and answers (Q&A) session, I would simply like to discuss two points. Firstly, I want to come back on an underlying question which runs through the two presentations. How can we introduce uncertainty in the standard risk assessment model? Then, I will make some comments on the place dedicated to the "social" (i.e. general public, stakeholders, policy makers, etc.) in the two presentations and in more widely in models of risk governance.

I will be very quick, but of course that means that I will have to simplify things as much as possible. In the two presentations, we heard about two different concepts and approaches of uncertainty. Denis Bard talked about uncertainty as something that could be calculated – and I really enjoyed his presentation. We saw the wide spectrum of arrangements, standards and agreements that are necessary to change the level of uncertainty and ensure that it is no longer radical and that you can turn it into something that you can calculate and factor in the risk assessment. I will not paraphrase what Denis said, but I would just like to stress what he talked about in terms of the inferential methods. How do you extrapolate whether you are talking about the dose/response relationship or when you extrapolate pre-clinical results to human beings? You need to bear in mind that when

there is a threshold and a MLR (Maximum Limit Residue) or a ratio, it is the result of a calculation, and the calculation brings into a play a number of agreements. Some people might call this a black box.

I. Understanding Uncertainty

The first presentation referred to radical uncertainty, and here we need to focus our attention on situations where we do not know what will happen. We know neither the various states of the world nor their probabilities, which means that we cannot perform the calculations required in the standard framework. In such situations of radical uncertainty, we do not have experimental, statistical or scientific proof of a causal relationship. Uncertainty is therefore defined on the basis of an absence of scientific knowledge and on certain cause to effect links, which take pride of place.

As I said earlier, it all boils down to knowing whether we can turn radical uncertainty into something that you can calculate, so that you can factor uncertainty into your standard approach in terms of risk assessment. Perhaps because we asked the presenters to focus specifically on the quantitative methods, the two presentations have provided a positive answer to the question. However, to tell the truth, I really doubt that this is the case. If I may say so, when you introduce uncertainty into traditional risk assessment models, as Denis Bard has done, the risk would be that you exclude all the quality-related impacts, for which traditional science does not have consolidated data. It seems to me, therefore, that the standard risk assessment method remains deeply focused on prevention.

In fact, Bernard Chevassus au Louis has proposed an alternative method, which I think is very interesting because it is part of a broader effort to address the lack of knowledge. When you are using a traditional risk assessment model, how do you deal with a lack of knowledge? You have a multi-criteria approach and there is a measurement system for each single criterion, and here we see clearly why this approach is useful.

The question we then need to ask ourselves is this – what price do we pay as we switch to a quantification method? I would like to refer here to a book written by Nassim Taleb, called *Black Swan*. This is a book on uncertainty and the unpredictable. Nassim Taleb warns against what he calls 'platonicsim' – in other words, where you take a model and think that it is reality. You therefore crush reality and its very thickness, its singularity, its unpredictability, which is inherent. You crush it using a model, which in terms of management and how to anticipate people and stakeholders' actions takes the place of reality. The question is how do we ward off risks like that, which are traditional by nature? We can see the potential gain if we try to create a model for such radical uncertainty and unpredictable factors.

II. The Role of Stakeholders in Risk Governance

What role do stakeholders play in terms of risk governance? The two presentations used two different approaches. Bernard Chevassus au Louis introduced social sciences via the idea of acceptability and based himself mostly on the results achieved thanks to the psychometric paradigm, and I believe that it is important to pursue this avenue further and to branch out. There are three different points that I would like to make here.

Firstly, the psychometric paradigm defines acceptability as an attribute which is specific to objects. Against this, we may argue that risk is not simply attached to objects but based on relationships. For instance, The Institut de Radioprotection et de Sûreté Nucléaire's (IRSN's) barometer study shows clearly that the perception of risk is deeply associated with trust. We may feel (or not) that public authorities are actually telling the truth (etc.), and that has an impact. Various international benchmarks have shown to what extent acceptability is not just related to objects, but to political cultures, institutions and systems and so on as well.

Secondly, again with regard to acceptability, conditions of implementation may be central. When there is uncertainty and action is needed, the stakeholders in charge of implementing the necessary measures need to be convinced that those measures are useful, and this can sometimes pose problems. We could demonstrate that one of the problems with the whole mad cow disease adventure was not the lack of scientific knowledge and had nothing to do with acceptability by public opinion. Instead, in the UK, the key problem was lack of compliance and poor implementation of the measure. The question is therefore the following. In terms of risk assessment, how do you factor in all the management and implementation conditions? This then raises the issue of the border between assessment on the one hand and management on the other.

Thirdly, the state of uncertainty is, of course, based on the available knowledge, and the available knowledge is based on the interplay between various stakeholders. There are three different kinds of phenomena here. For example, they are various cases of strategic manipulation of uncertainty. Key actors may use to put forward a number of scientific studies that shake the scientific consensus and rock the boat. With climate change or the impact of carbonated soft drinks on health and obesity, for example, there are difficulties in terms of access to data, and that is hard to solve. The question is not how much information we have, but how to make it accessible and available. This information is left in the hands of just a handful of stakeholders – industrial players, for example – and we need to look at how we can encourage them to divulge the information they have.

Lastly, it is about the production of data on the one hand and the interplay between stakeholders on the other, particularly in terms of environmental health. There is a wide spectrum in terms of knowledge and information and you therefore need a monitoring and assessment system that will leave a lot of room for early warning systems. For example, if unconventional information emerges – unconventional vis-à-vis the traditional framework – the way you detect it and bring more value to the appraisal and expertise systems is by bringing into play other types of experts.

Questions and Answers

André CICOLLELA
Réseau environnement santé

Denis Bard gave us a presentation that looked a bit like the one we heard at a symposium on risk assessment in Metz in 1996. It brought me back at least 10 years. This is a useful

advance, but risk assessment problems today cannot be looked at in the same way as before. Endocrine disruptors have to come into play and we can no longer see the dose/response relationship as being linear. We need to take into account all of the technological and scientific advances. I am not saying that risk assessment is unnecessary, but we need to change the paradigm against which we are asking these questions. We need to factor in the latest scientific advances.

Denis BARD

You are absolutely right. However, we need to present the tool which is at the very heart of today's risk assessment method and decision-making process in terms of environmental health, and this tool needs to take pride of place once again. We know that there is some level of uncertainty and it is not just based on quantity. Uncertainty comes from all the decisions you make every step of the way. Perhaps we need a paradigm shift in terms of endocrine disruptors – why not? However, I am still waiting for this new paradigm. I do not think that endocrine disruptors, as an issue, are well delineated. It is a pell-mell term, encompassing lots of different things, and I am really sorry that the term is being used everywhere you go. I simply do not have a mechanistic point of view with regard to endocrine disruptors. I think that this is a very specific issue that is about the way cells and oestrogen receptors work, but we of course need robust scientific foundations for a new paradigm shift.

It is true that this idea is being materialised and there have been a number of publications, but it is still in its infancy because the methodology is posing problems. It is all well and good to welcome a paradigm shift, but we need the scientific arguments to back it up. However, you of course always need to pass judgment and make decisions every step of the way. We need a decision-making tool which, no matter how you look at it, will remain so-called trans-scientific.

Daniel OBERHAUSEN **Priartem**

I would like to sound the alarm with regard to exposure to electromagnetic fields. I am very interested in symposia like today's, which bring together hard and soft science. However, let us be honest – how hard is hard science? My association is composed of activists and we work in the field. Some people call us troublemakers, but we believe in having a rational approach. There are a number of aspects to our work, but we believe in rationality and do not rank among those who like to spread panic.

There are three points that I think are very interesting, particularly with regard to threshold effects. In terms of electromagnetic impacts, as a physicist, I was wondering why people protest against mobile telephony when they never thought of traditional terrestrial Hertz waves. People seem to wonder why they are coming under attack. With natural exposure, frequencies between 1 gigahertz and 10 gigahertz have extremely low cosmic noise within that window, and I wonder whether the threshold concept should not be addressed with the utmost caution with regard to electromagnetic radiation, particularly with in terms of the paradigm.

There is some confusion regarding the interaction between thermal effects and the environment. At the time of Chernobyl, there was a lot of emotion and public opinion around the world, and the number of thyroid cancers grew. In terms of mobile telephony, I think that what we are trying to do is to ensure that a particular configuration and a particular key scenario is rejected. Low doses of non-ionising radiation are dangerous. If you look at what happened with the National Association of Securities Dealers Automated Quotations (NASDAQ), it was quite brutal. I think that social and economic sciences have a fundamental role to play.

There is then a third very interesting point with regard to gambling theory. Some organisations are very familiar with this theory and employ a lot of actuaries – insurance companies and reinsurance companies. In terms of electromagnetic nuisance and disturbance, reinsurance companies have shown their ignorance, but they have been very cautious. This risk is, of course, non-quantifiable, yet they have decided not to cover electromagnetic risks in their reinsurance policy.

Paul FRIMAT

As an occupational doctor, I welcome the participation of every stakeholder in this discussion. Thank you for trying to be very clear in your question and presentation.

Yorghos REMVIKOS Versailles University

Bernard Chevassus au Louis talked about the multidimensional problem and did so in a very interesting way. However, with regard to the interface between science and decision-making, decision-makers focus mostly on plausibility, while others focus mostly on acceptability. How do we do this in practical terms? What structure, approach or process should we use, when we try to bring together two different visions of the same truth? Analysis is all well and good, but in practical terms how do we move forward?

Bernard CHEVASSUS au LOUIS

Thank you for raising those very important questions. In the traditional risk assessment paradigm, we have the evaluation phase, the management phase and the communication phase – so there are three different steps – and according to the guidance manual from 1983, there should be functional separation between all three steps. Decision-makers in France have transposed this and call it a structural separation. This has not been written down, but that is another story.

We need to address the requirement to reconcile assessment and management, as well as management and communication, in this process. However, where we need to dig deeper is in terms of strategy. We need strategies and to have no regrets. There is a wide spectrum of uncertainty, so there are things that we absolutely must do. What about learning strategies? Will the decisions that we make today help us collect the relevant information? We know that there are interesting things under the Precautionary Principle. For example, we should not dissociate acquisition of knowledge in the decision-making process. On the contrary, we need to work on the two different fronts at the same time,

because this will cause a shift in the level of uncertainty. We do not have enough time to go into detail here, but I think that we need to totally revisit the whole principle.

Pierre Benoit Joly has addressed the issue of how to assess management, but how do we manage assessment? There are therefore new aspects that we need to add to the whole risk assessment system when trying to factor in uncertainty. We need a new paradigm shift.

Simon GALAS

Centre National de la Recherche Scientifique (CNRS), Montpellier University

Going back to what was said on endocrine disruptors, which change our working assumptions slightly, I would like to go beyond this and the low doses of endocrine and ask about the trans-generational impact? Are things already being done? Is this a consensus for research programmes? Has this aspect already been taken into account or do we need to wait longer?

Denis BARD

We are not just talking about endocrine disruptors, and it is not just there where we are starting to observe a trans-generational impact. As regards how it works, we need to take a look at it. However, there are substances that show either paternal and/or maternal transmission. This is absolutely a problem that we need to address. There is a recent highly documented publication on the impact of paternal exposure, which was published last year by Sylvaine Cordier.

David GEE

European Environment Agency, Copenhagen

I have two specific questions.

Firstly, I enjoyed Bernard's framework and I wonder whether it would be helpful to add explicitly the issue of the distribution of impacts across groups, regions and generations to the three dimensions of severity, reversibility and acceptability. That then brings in very much the politics and the economics to the area of social sciences and it is the distribution of impacts that itself has a big impact on the process of evaluating and dealing with risks.

Secondly, I would like to thank Denis for reintroducing Bradford Hill's famous nine features or criteria for moving from association to causation. However, a problem that he pointed out was the asymmetrical nature of these things. In other words, if the nine features are present, you can move with some confidence from association to causation; if they are absent, you cannot move with confidence to say that there is no causation. They are asymmetrical criteria. Bradford Hill pointed that out then and the gap between the symmetries has widened considerably now because of our knowledge of complexity and multi-causality. If we take consistency, for example, if there is consistency across research results, it is a robust piece of evidence that helps you to move from association to causation; if you do not have consistency, it is not very reliable at all to use

the absence of consistency as a reason for denying causality. I think that this point about the asymmetry, which has widened since 1965, is rarely brought out when dealing with these things, and I would like your view on that.

Bernard CHEVASSUS au LOUIS

Very briefly, you have perhaps two possibilities. Firstly, you can consider it to be part of the severity or you might introduce a new parameter, such as equity or something similar.

Denis BARD

This is a difficult question. Again, Bradford Hill spoke about viewpoints, not criteria, and I think that it is key. It is a matter of judgment. I am not sure that I fully share your point on asymmetry. In any case, just to caricature things, for instance in the case of leukaemia and ionising radiation, we have a set of positive arguments, and this is still a matter of judgment for a group. It is not about one single epidemiologist in the calm of his office saying that he has a sufficient set of positive arguments that conclude that there is a causal link. I think that that is the first important point.

The other point we need to consider in this example of leukaemia and ionising radiation is one of the most documented. In the field of environmental health risks, the picture is generally much more complicated and it is necessary at some point to say that there is probably, or possibly, a causal link. However, this is still a real matter of debate in the broad field of science since in the 1930s up to now. You have brilliant US epidemiologists, such as Kenneth Rothman, who argued about the problems of causality in such a way that they were considered by others as supporting an anarchistic theory of knowledge. There is therefore room for discussion on causality in epidemiology.

Paul FRIMAT

It is now a pleasure for me to introduce the second part of the morning session, where we will concentrate on political sciences and human sciences, next to the epidemiological and mathematical approaches that we saw in the first part. The organisers of the symposium asked Robert Hoppe, from the University of Twente in the Netherlands, to talk about scientific uncertainty and the political structure of risks. Robert will therefore be our first speaker in this session.

Scientific Uncertainty and The Political Structure of Risks

Robert HOPPE
University of Twente, the Netherlands

I. Background

Key Thinkers on the Politics of Risk and Uncertainty

a. William Beveridge

Thank you for that introduction and for inviting me to speak here today. I have to say that this is by some way the largest audience that I have addressed in the last couple of years – I am much more used to smaller seminars and conferences.

I will talk about risk and uncertainty and the difference between politics and analysis of risk and certainty. I think that the previous speakers did an excellent job in painting a picture of the analysis of uncertainty and risk assessment, so I will look at that very quickly and will therefore be talking mainly about the politics of risk and uncertainty. I will do so partly through the authority of two very famous political thinkers and policy analysts. One is William Beveridge, who most people will know as one of the founding fathers of the European welfare state, although he did so particularly for Great Britain in the last years of the Second World War. This distinguished policy analyst and political figure differentiated between power, which he defines as the ability to give orders to other men and force by sanctions – man has power when he can mould events by an exercise of will – and influence, which is changing the actions of others by persuasion – an appeal to reason. It is obvious when talking about the analysis of risks and uncertainty that you are in the field of influence, were you to follow Mr Beveridge.

b. Bertrand de Jouvenel

William Beveridge is not the only one to set out this kind of difference. Bertrand de Jouvenel, who is probably well known to most of you, in his theory of pure politics also made that kind of distinction, although he stressed particularly the nature of power as being the central ingredient in any type of politics. However, he said that the working of words upon action is the basic political action, which actually means that he thinks that persuasion, which is words after all, is also one way of doing politics. Nevertheless, he says that politics is essentially a matter of collective will formation, which itself is a matter of instigation and response. The instigation/response relationship is the core of politics and it means that politicians always want to spark off contributory actions by others, and contributory actions, occasionally, are not just support, but also indifference – you can do what you want, I will not oppose it. That would be another form of instigation. He also stresses what he calls 'that capital feature of the political animal', namely the propensity to comply, and that is also something that needs to be kept in mind as a very important part of politics.

c. *Aaron Wildavsky and Hecla*

Following these two great stars in their fields, there are other political scientists who have reproduced these kinds of things – and I was trained as a political scientist and not a medical doctor or epidemiologist, although I turned to policy studies later and I am now in a group that looks at science technology and policy studies, so the relationship between knowledge and power and between knowledge and politics is my topic. These people include Aaron Wildavsky, the famous American political and policy scientist, who talks about the differentiation between cogitation, which is basically analysis; and interaction, which is about power relationships; and Hecla, one of Wildavsky's co-authors of a couple of well-known books, talks about puzzling and powering, which is something I like because I think that power is not something that you have or exercise, but a relationship that means that you work with it; it is a verb. Like thinking or knowing, it is not necessarily something that you have or a body of knowledge; it is dynamic and something that you do: you puzzle.

d. *Bent Flyvbjerg*

I have worked previously with this distinction where I have said that there is something like *judgment*, as the deliberate design or evaluation of policies; and *will formation* or decision-making. Regarding implementation, decisions are mediating between thought and action and between policy preparation and policy implementation. More recently, the Dane, Bent Flyvbjerg, has written a book on rationality and power, which I also think is very enlightening.

I am therefore not alone in making this distinction, although I realise that there are those, especially in the sociology of science or the sociology of technology, who now adhere to a kind of seamless web model of politics and science where they do not make that distinction any more. I think that it is still worthwhile to make the distinction and focus exactly on the transactions and the boundary between the two. That is therefore what I will do in the rest of my talk.

II. The Analysis of Uncertainty and Risk

The Scientific and Analytical Context

The previous speakers made it very clear that if you want to make politics rational – and that is what you want to do if you are talking about uncertainty and risk – you will try to separate the rationality part from the political part in the process architecture of uncertainty analysis and risk assessment and risk analysis. Basically, what the previous speakers were saying was that you establish the context and identify the risks, you then analyse them in terms of likelihood and consequences, combine them, either by sheer multiplication or other ways of judgment, and you then assess the risk and prescribe particular treatments or measures. You then, of course, start monitoring and reviewing them, preferably by Bayesian statistics analysis, and adapt your theories later.

The question, in fact, is what do we know about uncertainty and risk? First of all, we know that there is this difference between an analytical and a political context. The analytical context is the scientific way of constructing risk and uncertainty. We therefore talk about rationality and there is a discourse of sound science and the practices of sound science.

We talk about probability calculation and false and positive negatives and the ratio between them. We look at frequency distributions, particularly historically constructed frequency distributions, and we see learning as a game of skill and capacity-building and gradual error elimination. I think that that is a fair summary of the scientific and analytical context, and I will briefly explore it by looking at it from van Asselt's typology of scientific constructions, although it basically brings up all the things that the previous speakers have been talking about.

The Political Context

However, there is also a political context, which is a context of practitioners and people who have experiential knowledge – stakeholders and politicians, as well as their staff, who are usually bureaucrats, who think in terms of power and power relations. They think in terms of having to make tough choices under time pressure and of acceptability and accountability - to a Parliament, for instance. They do not necessarily argue in terms of probability calculus, but in terms of plausibility reasoning and plausibility heuristics, which is a much looser type of reasoning than the strict logical argumentation in probability calculus. They also think in terms of ex-ante expectations - not necessarily looking back, but looking forward, through scenarios and design. Learning is a matter of coping capacity and somehow making risks and uncertainty governable and controllable, or at least giving it the semblance of controllability. Error prevention is much more important than error correction or elimination, because if you have a couple of hundred or perhaps thousands of deaths, you are wrong as a politician. You will have made wrong decisions and will be held accountable for them. They therefore want to prevent that.

The Political Structure of Risk and Uncertainty

I will explore this political context, which is about narrative and storytelling, through Ravetz's typology of the narrative, in terms of the political structure of risk. Again, very briefly, on the typology of sources of risk, I will just reproduce what van Asselt, who is now a member of the Dutch Scientific Council for Government Policy, has written in her dissertation on this.

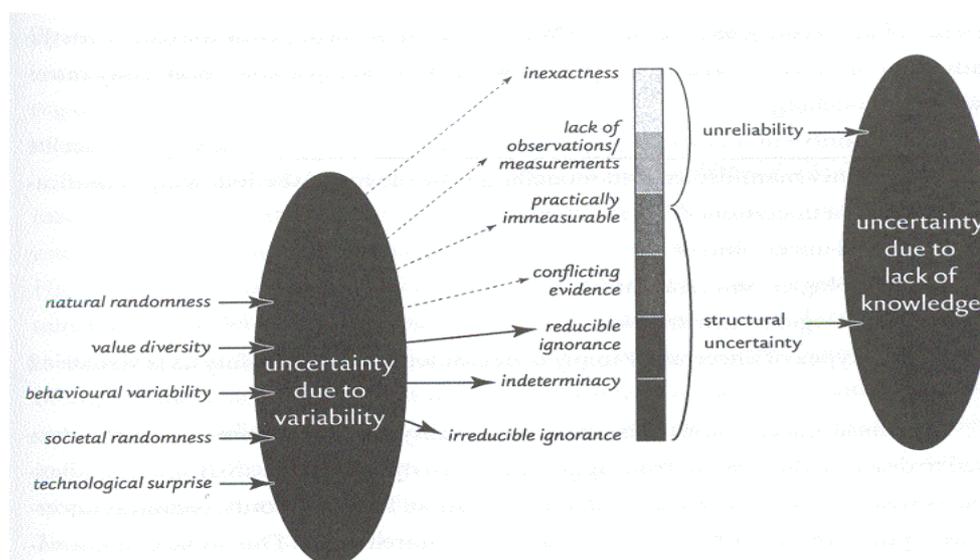
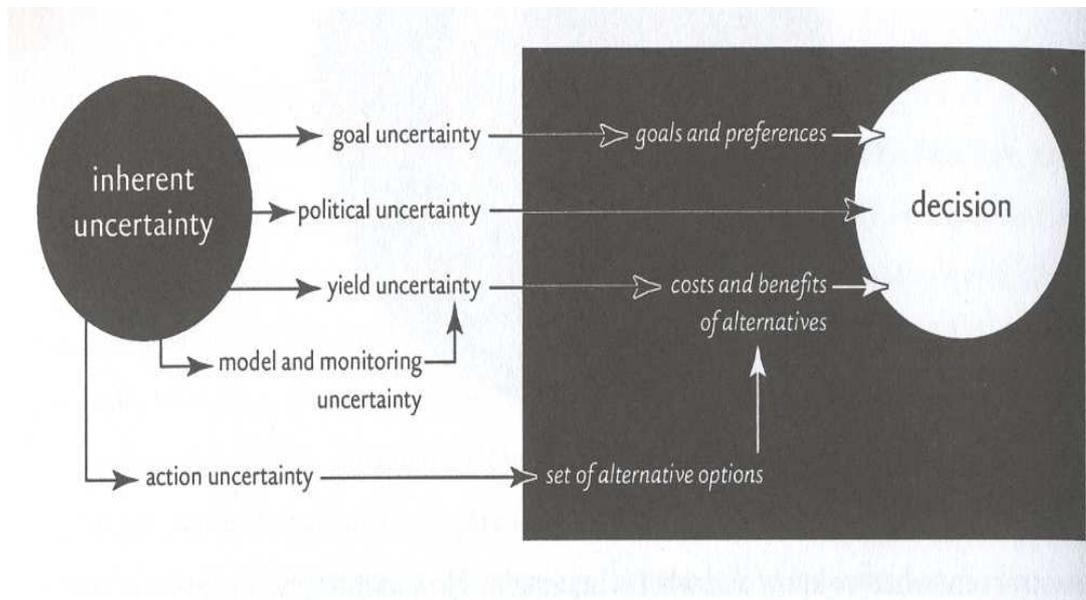


FIGURE 2 Typology of sources of uncertainty

She says that there is basically uncertainty due to variability. This has a number of causes, which produce a number of problems with models, data and so on, which produces unreliability and structural uncertainty, and that basically enters into the uncertainty, due to a lack of knowledge and is filtered into policymaking and decision-making processes. This filtering means that there are particular types of uncertainty that are political.



There is uncertainty about goals when there is inherent uncertainty in the models and there is political uncertainty, as we have seen, because there are all kinds of judgments that need to be made, either through political agreement or negotiations that enter into the political decision-making structure, which are frequently unrecognised, even by the politicians themselves. There is yield uncertainty in the sense that the costs and benefits are unclear because the models are not specified sufficiently and there is action uncertainty because the models frequently do not cover all the systematic possibilities of action or action alternatives.

What we usually see in political decision-making is a focus on one, two or three decisions, which only incrementally differ from the status quo or the existing situation. This is basically a matter of coping with uncertainty in a political way. There is also a connection between the two, which I will not go into now, and we know that there is a connection between the different sources of uncertainty and particular scientific methods for dealing with them, such as hedging methods, formal scenario analysis methods, probability-based methods, Bayesian statistics-based methods and so on, which we heard all about in the previous talks.

source	method
Inexactness	<ul style="list-style-type: none"> • Probability-based methods • Formal scenario-analysis
Lack of observations/ measurements	<ul style="list-style-type: none"> • Probability-based methods • Formal scenario-analysis • Hedging-oriented methods
Practically immeasurable	<ul style="list-style-type: none"> • Probability-based methods • Formal scenario analysis • Hedging-oriented methods
Conflicting evidence	<ul style="list-style-type: none"> • Formal scenario-analysis • Hedging-oriented methods
Ignorance	<ul style="list-style-type: none"> • Validation • Qualitative scenario-development • Interactive problem and uncertainty structuring
Indeterminacy	<ul style="list-style-type: none"> • Interactive problem and uncertainty structuring • Qualitative scenario-development
Natural randomness	<i>Stochastic modelling</i> ¹³⁹
Value diversity	<i>no methods</i>
Behavioural variability	Scenario-approaches
Societal randomness	Scenario-approaches
Technological surprise	<i>no methods</i>

TABLE 5 Potential of discussed methods in addressing different sources of uncertainty

III. The Narrative Aspect of Uncertainty and Risk

Ravetz's Views on Interpretive Policy Analysis

If we move from the analysis to the politics of uncertainty and risk, as I have already said, we are moving out of the field of calculation and into the field of the narrative and storytelling. Politicians and stakeholders, as well as policy analysts in translating scientific data to politicians in such a way that they can understand, somehow have to transform data, models, frequency distributions into stories. What, then, are these stories?

There is a lot of theory on this and it has basically been thematised in the policy sciences under the title of interpretive policy analysis. I will not go into this deeply, because I would then have to cover a lot of theoretical material, but will just use one particular typology of the major characters and a typical cast in narratives on risk, which has been produced by Jerry Ravetz, who has written about this on several occasions. While it is quite complex, it is still worthwhile looking at it.

	collective	isolated
insider	<i>political role</i> : risk regulator <i>action type</i> : administrator <i>scientist's role</i> : monitor, inspector, technical expert <i>scientific rules</i> : normal applied science	<i>political role</i> : risk imposer <i>action type</i> : entrepreneur <i>scientist's role</i> : advocacy expert, consultant, advisor, research expert <i>scientific rules</i> : some normal applied science + professional consultancy
outsider	<i>political role</i> : risk rejector <i>action type</i> : campaigner <i>scientist's role</i> : critical scientist, conceptual or value clarification, discursive mediator <i>scientific rules</i> : professional consultancy and post-normal science	<i>political role</i> : risk endurer <i>action type</i> : survivor <i>scientist's role</i> : citizen's science/'guru's', sensitizing science, clarifier/mediator <i>scientific rules</i> : post-normal science

Firstly, he says that in the particular roles that are prominent in any risk narrative, there is an *insider and an outsider perspective* and a perspective which says that the incumbent role of the policy actor is to act on behalf or as *part of a collective* or that the policy actor more or less acts *alone or in isolation*. Moving through this typology, if you are an insider actor acting as part of or on behalf of a collective, your political role is that of a *risk regulator*, which means that you are usually an administrator. Scientists have a particular role to play here as monitors, inspectors or technical experts. In terms of Funtowicz and Ravetz's theory on different ways of doing science, the idea is that you just do normal applied science and therefore act on the basis of received scientific wisdom.

Looking at the insider role, but where you are basically acting on your own, you are a *risk imposer*. This could be, for instance, the nuclear industry or a GMO producer. You act as an entrepreneur and the scientist's role then differs and shifts towards advocacy and expertise and being a consultant, adviser or research expert who acts within the research policies of these usually commercial enterprises. The scientific rules then change. It is partly normal applied science, but it also becomes part of professional consultancy, dealing with slightly more complex issues.

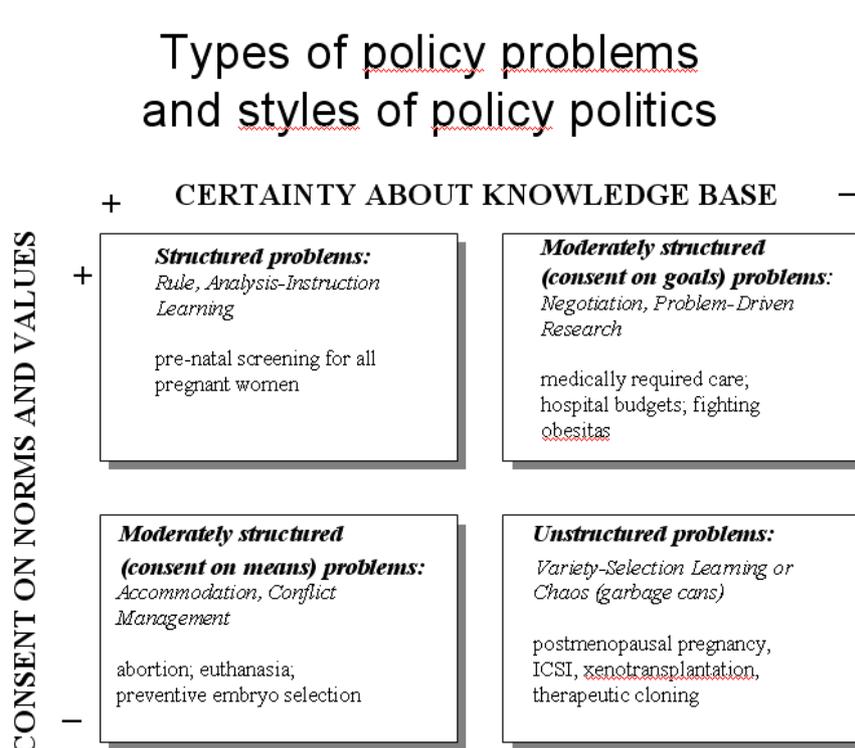
Looking at the outsider role, you may be a total *risk-rejector*. For instance, you live under the flight trajectories of Schiphol or Charles de Gaulle airports and you do not like it. The action type is a campaigner and here too scientists play a role. They are critical scientists or conceptual or value clarifiers, and sometimes they are called in as discursive mediators and have a role to play there. Again, the scientific rules shift to a higher level of complexity. It remains partly inside the boundaries of normal professional consultancy, which is still considered normal; although, there may also be a move into the post-normal sphere of doing science. The same goes for the outsider in the isolated situation. You are a *risk endurer* and, culturally, a survivor, and there is a particular role for science here as well, which is entirely post-normal science.

The Different Problems in the Risk Field

e. *Structured problems*

If you look at the evidence, I believe that there are different types of problems in the risk field – although it is not only in the risk field – because any problem is a conjunction of two things. It is a conjunction of consent on values and certainty on a particular knowledge base. Knowing that there is a problem means that you need particular knowledge and facts, which are compared with particular normative standards. This is a very interesting area. The concept of a problem straddles the fact/value distinction, which is so crucial to any type of knowledge and science, and basically combines spheres that cannot be combined epistemologically, because we are always told that they have to be kept distinct. However, politics deals with problems and is largely a problem-processing process.

In terms of task fields and political epistemology, there are different situations. Firstly, there is the case where you have high certainty on knowledge and high consent on values. This is what I call 'structured problems' – there is no problem with the problems. The idea here is that you can delegate the problem to a professional community, which by way of analysis and instruction learning, learns how to tame the problem. Pre-natal screening of pregnant women, at least in the Netherlands, for example, is considered to be a 'domesticated' or fully structured problem.



f. *Where the knowledge base is uncertain*

You then have a kind of in-between case where there is consensus on norms and values, but the knowledge base is contested and uncertain. You do not know everything or perhaps you do not know a lot. This means that you have to negotiate about the risks and

the distribution of the risk and who is responsible for what and who is to shoulder particular risky burdens. Although you can also have problem-driven research in order to reduce uncertainty, if that is possible. Definitions of medically required care and hospital budgets, as well as tackling obesity, would qualify, I think, as this type of problem.

g. Where you know what to do, but there is low consent on values

There is another in-between situation which is different from the previous one, where you have low consent on values, although you know exactly what you need to do. With abortion, for example, through the ages people have known how to provoke an abortion. The only issue is whether it can be done in an assisted way by a medical doctor. The same goes for euthanasia and, now, preventive embryo selection. Here, accommodation strategies or conflict management strategies are the politically prudent way of dealing with these kinds of problems.

h. Unstructured problems

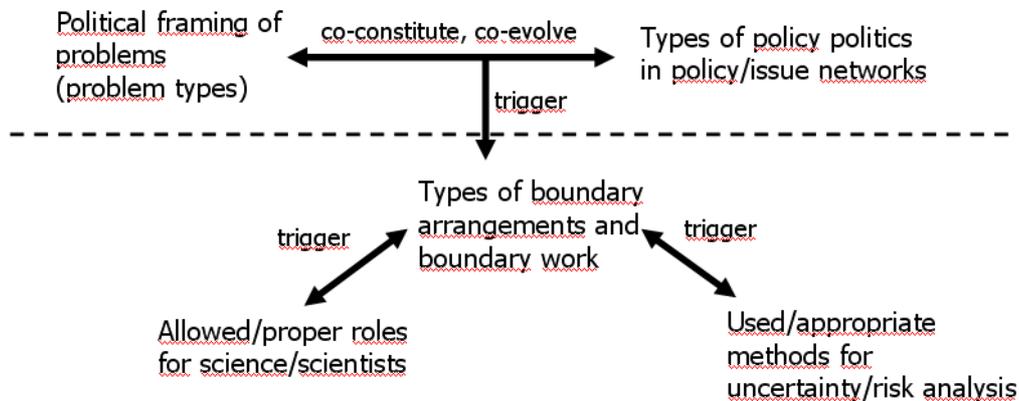
You then have the totally 'wicked' or unstructured types of problems, where there is a kind of chaotic, variety-selection type of learning, which is purely evolutionary driven, or garbage-can driven, as others would say.

What you see, therefore, is that from a political perspective, there are very different task fields and political environments where you have to process particular problems. Sometimes you can delegate things to a professional community, as in the structured case, but in other cases you have to do a very agonistic type of wild politics, as in the case of unstructured problems, where agenda setting and priority setting and the fight about the definition of the problem is still going on. We may have some cases of this here in mobile telephony and endocrine disruptors, judging from people's responses.

The Prevalence of Politics Over Analysis and Risk Policies

I think that all this means that in a very surreptitious way, covertly or overtly, politics usually trumps analysis and risk policies. It weighs more heavily. You could basically say that the political framing of problems and types of policy politics hangs together, where there is a correspondence between them, and they trigger particular ways of boundary arrangements between science and politics and science and policy, and these boundary arrangements trigger allowed or proper roles for science and scientists and appropriate methods for uncertainty and risk analysis. This means that the political process in general generally prevails, even though it might be very difficult to detect where exactly it trumps the analytical part, because it is basically in this congruence dynamic between the political framing of problems and the types of policy politics and the way that politics is creeping into particular policy domains of risk analysis and risk assessment.

Politics and analysis in risk policies



There are particular cases of this and -- possibly contrary to what Jasanoff would actually do herself - I would say that her book, *Designs on Nature*, betrays this dynamic between analysis and politics. Firstly, she says that there are culturally stable narratives that trigger problem framing and policy politics in the field of bioethics – and I use cultural theory terminology here to talk about these issues. She uses the term '*monsters*' to describe entities that threaten disorder by crossing the settled boundaries of nature and society. Here, she is talking about assisted reproduction, stem cell research and genetically modified crops and food, but she could also be talking about cyborgs and enhancement medicine, such as bionic ears and eyes and so on, which cross the border between technology and human beings, which Bruno Latour also talks about. She says that in the United States the idea is that you embrace these kinds of hybrid constructions and you have a lot of decentralised norms. Whereas, in the United Kingdom, there is a kind of controlled admission or assimilation of these monsters, but you have them in a centralised way. In the Federal Republic of Germany, it is all forbidden, simply because they see it as being too analogous with Nazi-style euthanasia and racial cleansing problems. There, there is therefore also a law-like centralised norm.

These culturally stable narratives lead to different boundary arrangements and risk strategies. In the United States, innovation and risk is market-regulated, where there is a kind of winner-take-all settlement of controversy. There is usually exposed judicial accountability and sound science at the bar, as she would call it, as well as a strong opposition against the Precautionary Principle – they simply do not want it and see it as contravening trade and the economy, as well as science.

In the UK, innovation is much more expert-regulated. Controversies are consensually settled and there is much more ex ante Parliamentary and administrative accountability, with science-based expertise, but in an independent but trust-based way. There, they embrace quite a broad notion of the Precautionary Principle. In Germany, it is different again.

What we see, therefore, is that national and cultural differences and political regime shifts and differences lead to different forms of framing the risk problem and dealing politically and procedurally with risk and risk analysis. There are lots of other cases, which I will not go into here.

IV. Bringing About Better Governance

Handbooks and Guidelines of Little Help

I will conclude my talk by asking what can realistically be done about better risk governance. People usually think in terms of better guidelines, Government rules, handbooks and methods, and more transparency is one of the slogans. Usually, this means standardisation. I think that this helps a little bit, but it will not go very far, partly because I have been involved in an effort on this for the Dutch Natural Environmental Assessment Agency and have written about the different types of problems and tried to make people aware that these different types of problems require different types of risk assessment and so on. It turns out that they are not using it at all. I had a dissertation written on it and basically there was a negative outcome (De Vries, 2008). This is not just the case for Holland; there is also the case of the Environmental Protection Agency (EPA) in America. Handbooks and so on do not really work. This also means that the idea of enhancing an ethic of reflexivity, where basically you have contingent guidelines, with different guidelines for different situations, may help a little, but it is not essential.

Usefulness of Fast Enhanced Trial and Error Learning

However, I do not believe that that means that methods can do nothing. The improvement of methods is possible, for instance by what I would call fast enhanced trial and error learning. Trial and error learning is the basic policy way of doing things, and we already saw it in Lindblom in the 1950s and 1960s. However, with his co-author Woodhouse, at Rensselaer Polytechnic, he improved the whole idea by saying that if you start out with the Precautionary Principle, but generally relax it when knowledge is accumulated and leads to new insights, you can have an enhanced trial and error learning process. However, this needs to be organised well because it does not happen by itself, automatically.

Insights in Psychology and Working with Dialectical Heuristics

I also believe that there are a lot of insights on risk in psychology that are still unused, and these should be used in political decision-making. Additionally, If you take the four ideal typical risk roles: the risk-regulator; the risk-engineer; the risk-rejecter and the risk-imposer, you can work with the dialectical heuristics, with the book by Mason and Mitroff called "*Strategic Assumption Surfacing and Testing*", already in 1984, and use these dialectics between these four roles distinguished by Ravetz, and map all the differences that exist much more specifically.

The Key Requirement for More Dialogical and Horizontal Accountability Processes

However, first and foremost, I believe that more checks and balances are needed with stakeholders, as well as with concerned and informed citizens, so that more dialogical and horizontal accountability processes are created, which basically means that we need to improve the politics and procedures of dealing with risk. Of course, substance is also very important and you cannot have procedural decisions without any substantive knowledge, and in that sense methods and analysis remain very important. However, we have underdeveloped the political and procedural way of dealing with these issues and they have become more and more important. It is about whether or not you believe in a risk society or not.

Paul FRIMAT

This is indeed a broad-ranging subject and political science comes into play in terms of risk assessment. At the end of the day, we need to mull over the need to bring together all the stakeholders, as you rightly said in your conclusion, so that everyone can be empowered. As a doctor, I keep saying that people need to be in the driving seat in terms of their own health and it is therefore important not to sweep the issues under the carpet of scientific complexity. We need to explain clearly to people, who are having a hard time interpreting the situation, that their interpretation is biased. That is a starting point for dialogue.

I now give the floor to Soraya Boudia, who is a Senior Lecturer at the University of Strasbourg, where she teaches sociology, amongst other things.

Risk Uncertainty and Governance of Low Doses: A Historical Perspective

Soraya BOUDIA
University of Strasbourg
(Translation not approved by the author)

I. A Changing Concept

To begin with, I would like to go back in history and talk about low doses. This is a problem that is being raised more and more acutely for a number of health and environmental risks, but what we will see is that it is not a new problem. The issue has been discussed since the late 1940s and the interesting thing is that the issue of low doses has always been addressed by combining the two concepts of low doses and uncertainty. What are the lines along which the issue has been discussed and what kind of

of answers have people come up with, and what has the scientific community and the regulatory authorities come up with in terms of solutions to the problem? 50 years down the line, let us take stock of the situation. We need to bear in mind that the problem is far from being solved.

Let us talk about the terminology first of all. Low doses represent a problem which is being put forward in a number of reports, but when you look at the reality covered by this concept you realise that not only has the concept changed over time, which is only normal, but it is also polysemic: it generally refers to the potential effects on which no exposure threshold has been established (effects without threshold); it can also refer to doses that are not "high doses"; it can apply to effects that cannot be observed in the laboratory and thus effects which toxicology cannot measure, prove or disprove; it can apply to doses for which statistical epidemiological, proof has not attracted consensus; and it can also indicate doses received "normally", by populations and professionals, during common activities or instances of exposure.

II. The Development of Understanding of the Issue of Low Doses

1. Vast Changes from One Period to Another

The history of low doses is based on technical and scientific expertise being questioned - and scientific experts have indeed grappled with the issue for a long time -. They have tried to come up with a number of answers, as we shall see, but it is not a problem that is easy to grasp, for various reasons. A number of scientific studies were mentioned this morning, so I will not dwell on those. From a historical point of view, the very first time the issue of low doses was raised was in the late 1940s and, in the 1950s, the problem was officially formalised, as it were.

In terms of frequency, there is a timeline. I am a self-respecting historian and if I put everything into a timeline it means that I can reduce complexity – I try to cram everything into those three periods. However, the message that I would like you to take home is the following: if we cram everything into a timeline, we will be able to see the vast changes from one period to another. There was a period during which we stated the problem scientifically and another period when we tried to address it politically. What, then, have been the changes from one phase to another?

2. The Setting of Threshold Values in the 1930s

I hope that you will understand why I chose this particular method. I divided the timeline into three different periods, starting in the 1950s. However, before I talk more specifically about the 1950s, I would like to say a few words about the ways in which we address non-infectious health risks. Here, I am talking about health and environmental risks and how we have addressed those problems since the 1930s. We addressed them against a backdrop of what we call a threshold paradigm. In other words, we have a general vision of things and we set limits – exposure thresholds – for various substances. This approach was designed and formalised officially in the 1930s in the US. The National Conference of Governmental Industrial Hygienists, created in 1938, was the very first agency to propose threshold values, particularly in terms of exposure at work. That was a starting point.

Since 1938 – and we will see to what extent this paradigm is being discussed and even questioned and compared with other paradigms related to low doses – we can safely say that the terminology around the definition of thresholds and limit values has been brought into other areas. I will not go into detail here as you are probably more familiar with these areas than I am. Sometimes, there is competition between the various regions and countries in terms of terminology, but I would simply like to say that this threshold-based paradigm will be discussed and called into question as we address the issue of low doses. From the late 1930s, therefore, up to today, it has not been smooth sailing for this particular paradigm in terms of the setting of threshold values and limit values and so on, and this has obviously sparked scientific discussions. We had an example of these discussions this morning when we talked about the reasons why there is uncertainty in terms of how to set those standards, but that is also subject to political controversy. When we set standards for health at work, it all depends on whether you are exposed to the risk yourself and you will address the issue differently depending on whether you are a victim yourself.

3. Ionising Radiation in the 1950s

What is interesting here is to see to what extent we call this paradigm into question. First of all, we have the example of ionising radiation, which was also something we discussed this morning. Ionising radiation, and radioactivity in particular, takes pride of place in the history of low doses. This is an old problem. However, it is also a problem that has been documented and it is set against the backdrop of the major controversies that erupted in the 1950s on the impact of atomic tests in the atmosphere. At the time, a number of Governments tested hundreds of bombs up in the atmosphere and there was a major public discussion on the impact of this radioactivity. As part of the discussion, a number of scientists were involved and one of the scientists, Edward Lewis, was working at the California Technology Institute (CALTECH) – and most of this story obviously takes place in the US. Lewis was a geneticist and he tried to summarise a number of studies, in particular a number of epidemiological studies on the impact of radiation which combined exposure to high doses and to what could be called low doses.

At the end of the 1950s, the very first proposal emerged, with a model for a dose/effect relationship. It is no wonder that this proposal came from a geneticist because it is in the field of genetics that the issue of thresholds and threshold values was mainly discussed. Genetics had gained ground in the late 1930s, when many studies were completed and many publications issued. At the time, geneticists worked with flies, producing thousands and thousands of flies, and in some of their experiments they used to ionising flies, in bombarding them with radiation. It was very difficult technically-speaking to measure the actual doses. However, regardless of doses, they observed genetic mutations in the flies, which showed that mutations were possible. You could not therefore deny that radiation had no impact and this approach was therefore used again in the field of radio-protection.

4. The Question of Thresholds and Linear Dose/Effect Model

How do you protect people from ionising radiation? This was all structured as early as the 1930s and 1940s – between the two World Wars - and was based on threshold values. Following World War II a debate burst out around the effects of atmospheric atomic tests which referred to the studies carried out in the field of genetics. As early as the 1950s a number of scientists, who worked in the area of radio-protection, pointed out that even if

you set thresholds, you could not be sure that doses below the thresholds were completely safe. In the late 1940s, they had proposed a significant modification. There were no more talks about so-called permissible, reliable or tolerable doses; this meant that thresholds were being set, but that there was no assurance that doses below the thresholds were safe and that there was no risk whatsoever – you simply considered the risk to be negligible.

This occurred in the 1950s and, in parallel, Lewis carried out a summary of all previous studies. In the summary, he assumed that the relationship between doses and impacts should become a model. He believed this basically to be a linear model and, based on the work carried out by geneticists, he said that there was basically no threshold. This approach remains the reference for regulatory authorities and was taken up by the International Commission on Radiological Protection (ICRP) and other international regulatory authorities, with the aim of finding justification for the issue of thresholds. You therefore set a threshold and, at the same time, know that you cannot be 100% sure that there is no risk under this threshold. However, if you consider that the linear dose/effect model can be applied, you therefore justify thresholds as being the most conservative measure. That is, if you use the model, you will be sure that you are taking into account the most pessimistic case scenario.

5. Work on the Justification of Risk Taking

a. Radio-protection

However, as early as that period, a number of scientists pointed out the fact that a certain number of outcomes and results simply did not justify the adoption of a linear dose/effect relationship model. There was a whole series of papers in the 1960s which discussed other potential models for summarising the data. However, the discussion was extremely controversial when it came to justification. What can justify taking a risk, no matter how negligible it is? How do you justify taking a risk?

I would like to share with you excerpts from two reports that were published six years apart.

Excerpt 1: *"The concept of a tolerance dose involves the assumption that if the dose is lower than a certain value – the threshold dose – no injury results. Since it seems well established that there is no threshold dose for the production of gene mutations by radiation, it follows that strictly speaking there is no such thing as a tolerance dose when all possible effects of radiation on the individual and future generations are included. In connection with the protection problem the expression has been used in a more liberal sense, namely, to represent a dose that may be expected to produce only "tolerable" deleterious effects, if they are produced at all. Since it is desirable to avoid this ambiguity the expression "permissible dose" is much to be preferred... In the first place it is well to state explicitly that the concept of a permissible dose envisages the possibility of radiation injury manifestable during the lifetime of the exposed individual or in subsequent generations. However, the probability of the occurrence of such injuries must be so low that the risk would be readily acceptable to the average normal individual. Permissible dose may then be defined as the dose of ionizing radiation that causes no appreciable bodily injury to the average normal individual at any time during his lifetime. As used here "appreciable bodily injury" means any bodily injury or effect that the average normal*

person would regard as being objectionable and/or competent medical authorities would regard as being deleterious to the health and well being of the individual."

Excerpt 2: *"as any exposure may involve some degree of risk, the Commission recommended that any unnecessary exposure be avoided, and that all doses be kept as low as is readily achievable, economic and social consequences being taken into account"* (rapport n°9, 1965).

These two excerpts show that, in the late 1950s, people were aware that they were taking risks, but they thought that this risk was negligible and grounded their behaviour on this fact. As a matter of fact, that does not mean much – how negligible the risk is, from what point of view and for whom? Experts undertook vast amounts of work to try to justify this approach based on the relationship between risk and benefit, as well as cost and benefit. The cost/benefit methodology gained a lot of ground in the 1950s and 1960s, and in the mid-1960s another idea was introduced. This idea is that when you have to make decisions in terms of risks, then the data that you have is not sufficient and you have to take into account economic and social considerations in order to make that decision. This gave rise to a great deal of debate in the field of radio-protection stating that this was a problem that remained controversial and questioned the way to make a decision. How to decide what I should be taken into account in terms of economic and social considerations? We can still use the term 'economic and social considerations' today.

What can we say about this approach to low doses in the area of radiation? Very briefly, regulatory authorities approached the problem in this particular way because they dealt with a number of problems. In particular, if you admit that there is a 'risk', that means that you need to prohibit all the activities that can generate that risk. However, what does that mean? The idea was developed, in particular in the so-called Delaney Clause, which suggested that all food additives suspected to be carcinogenic should be banned. Yet at the same time, the idea of banning any activity entailing risk simply could not be considered, from the standpoint of many experts. They felt, for instance, that the development of nuclear industry was an obvious fact. They needed to find the right balance between geopolitical considerations, energetic considerations and the need to protect human health – the health of populations. From this particular point of view, therefore, the nuclear case is a very specific one, although this way of framing the problem also emerges in other areas. The only area where the approach is slightly different is food.

In the 1950s, there were a number of discussions on adding supplements to food, even in low doses. Did those additives have no impact on human health? These were chemicals. At the time, the chemicals were the subject of a major discussion in Congress, where there were many hearings, particularly around the "Delaney Clause". This was the only case where a proposal was put forward for a ban on all substances added to food that did not ensure a zero level of risk. Those of you familiar with the history of risks in relation to food are probably know this, but it is the only case where the zero risk factor was raised. It was, in fact, a scientist who initiated this. He was in charge of carcinogenic substances at the Cancer Institute in the US and was an expert in occupational health and occupational cancers. As he could not impose his idea, according to which carcinogenic substances should totally be banned at work, he thought that it might be easier to use food instead for products that were not absolutely indispensable. In terms of the

regulatory approach, how has this been applied? In fact, it remained a dead letter up until 1969. It was only in 1969 that the idea was implemented and cyclamates were banned.

6. A Growing Awareness of Environmental Health Concerns

The 1950s were a very important period when for the first time the issue of low doses was raised. However, nothing was solved; this was still an open-ended question. The controversy was significantly renewed in the 1970s in the area of radiation. Gofman and Templin were two scientists who were atomic researchers within the Energy Commission who were working on US nuclear regulatory affairs and their research had been financed for a number of years, with a focus on low doses. In the early 1970s, they publically declared something that sparked controversy, when they said that if you kept by existing standards for radioactive effluence, it would lead to an additional 32,000 cancers per year in the US. Can you imagine the impact of having two scientists - and Gofman was very well known at the time - declaring publically that existing standards were generating thousands and thousands of additional cancers? This started a huge controversy in the early 1970s and gained further ground, particularly since it was a very specific period in time. At that time in the 1970s, environmental concerns started to gain pride of place in public discussions, ahead of the Stockholm Conference, for example. However, here again in the US, there was a change and a growing awareness in terms of environmental concerns. For a long time, people in the US had thought about the environment in terms of the need to conserve resources. However, health then became more and more important, and everything related to environmental health became more and more important. This was raised in Europe, where there was a lag many years later. Specific environmental agencies were created in the US and there was a whole community that focused on environmental health. Thanks to this new framework, the issue of low doses took on further importance. It was raised not only in the areas of radiation and food supplements and additives, but also in the area of chemicals.

7. The Work of the US Scientific Academy and Others

I would now like to speak a little about the work of Rachel Carson, who wrote a book, *Silent Spring*, which introduced this discussion and played a very important role. The whole issue of low doses was raised not just for ionising radiation, but also for pesticides, which were very important in this discussion. This was therefore the area of pesticides, but also of chemicals, more generally speaking. It is very important and is something that I think we need to discuss.

When you try to address the issue of pesticides and chemicals, you borrow a number of aspects that have been stated in the discussion on ionising radiation, and it really was ionising radiation that had a structuring effect on the discussion and provided embryonic solutions to problems that emerged in other fields. Those answers were brought in the early 1970s by a committee from the US Scientific Academy (the BEIR), which still exists today. The committee first of all produced a landmark report in 1972 on low doses in ionising radiation, and included other areas as well, which put forward scientific conclusions pertaining to uncertainty of data and problems with the methodology - which is something we discussed this morning, and there is uncertainty in the methodology used to collect the data - and pointed out the fact that the scientific approach cannot be the only approach when you need to make decisions in areas where those problems are raised. Scientists therefore obviously believed that further scientific studies were needed

to provide a better foundation for the problem. However, even if there were further studies, it would not solve the problem of knowing what kind of decisions should be made and what methodologies should be used when the time came to make decisions regarding these activities. Scientists then requested reflection on the decision-making process in uncertain and risky situations, and this gave rise to a thinking process in the US, where several agencies and committees were involved, resulting in the so-called Red Book of 1983 (referring to the colour of the cover) and risk assessment as we know it today.

When you examine the work of these committees – which I have done – you really see the difficulties they were confronted with throughout their work. They were fully aware of the fact that there were uncertainties at all levels and judgments of value, as well as a political component in the methodology that they had developed. However, what can you do in those circumstances? That is the problem. The methodology which was developed in the famous 1983 Report was not regarded as the final and best one, and another report was produced on risk assessment in 1994 to take stock of the situation 10 years after the Red Book. Since then, the American agencies have organised workshops on methodology.

8. Developments in the 1990s

I will not have the time to go into further detail about this history, but would like to conclude with a brief overview of the 1990s. This period saw an increasing number of cases of health and environmental risk, with transnational bodies paying greater attention to addressing and regulating them. All the thinking took place at an international level and you could then observe major national differences. As was said this morning, the issue of low doses became quite prevalent and it is interesting to address the low doses issues from an effects point of view. The generic mutation and carcinogenic effects have been addressed for some time, but since the 1990s, the focus was put on the reprotoxic effect and in approaching and classifying things in three major categories: carcinogenic, mutagenic and reprotoxic (CMR). The idea became reality thanks to the impetus of transnational bodies. Unfortunately, I will not have the time to go into this in detail. Bear in mind, however, those new chapters are being written every day.

9. Conclusion

By way of conclusion, I would like to take some time to look at a few lessons that history has taught us, giving more emphasis on what continues to be somewhat controversial in the low-dose debate.

a. The investigation method does not result from a consensus

One central question is that of epistemic cultures (as understood in scientific terms), which is particularly acute in the field of low-dose. Various approaches are implemented, including epidemiology, toxicology and mathematical modelling, and cultures can therefore be quite different. It all depends on how you address the topic and you will not produce the same type of scientific facts, even if we can agree on a number of variables.

b. The multiplication expertise and assessment structures

Secondly, as regards the environmental and health risks, and the classification of carcinogenic agents, one problem that we can highlight is the multiplication of levels and

structures of expertise and assessment. Over the last 30 years or more, we have seen many areas where expertise can play out. Sometimes, this does not mitigate these uncertainties and it might even increase the degree of uncertainty because one organisation may not agree with another.

c. Continuing controversies

Thirdly, in risk assessment, there are some controversies and a few things are not clearly stated. Things are underlying, but not explicitly explained. There are economic considerations and some associations and trade unions know that. I am not criticising the fact that we take economic considerations on board, but there is something which is not explicit and decisions are justified in scientific and technical terms. However, in the expertise committees, when we are interested in what is discussed behind closed doors, the horizon is broader and the scope of course plays a major role. We therefore need transparency and we should clarify the parameters on which decisions are made. It is necessary to have this transparency, but that sparks off other problems, such as political issues. How can we justify maintaining an activity with a high degree of risk for one human group, yet benefits for another? This question, first raised by the issue of low-dose radioactivity in the 1950s, remains to be solved.

d. Different types of uncertainty

Lastly, as we demonstrated several times this morning, uncertainty is a term that covers a number of different definitions and there are different types of uncertainty. There is technical uncertainty, scientific uncertainty and political uncertainty (how stakeholders will react to a certain decision, for instance). In my opinion, it is important that we look at the issue from the historical perspective and analyse the concepts in order to clarify debate, in particular as concerns health and environmental issues.

Paul FRIMAT

Thank you. You talked about the concept of thresholds and whether you were a toxicologist, physician, sociologist or legal expert, and those concepts need to be discussed at length. As an expert in the area of health and work, I have discussed this concept of a threshold when sometimes asked for safety reason by society. This concept of threshold is therefore both negative and positive, as it all depends on the categories of people. Setting a purely toxicological threshold or for legislative purpose might be easy to do, but difficult when managing collective risks.

I now give the floor to Claude Henry.

Discussant

Claude HENRY
Sciences Po/Colombia University
(Translation not approved by the author)

Both presentations were extremely interesting and a good source of stimulation, and as a panellist I therefore feel at ease. However, the presentations were also different from each other. It would not be opportune for me to highlight specific questions for the discussion, although there was a key issue that linked both presentations, which is also key for our symposium. You said that you were interested in the historical explanation of uncertainty, so I will start with a bit of history.

I was a physicist before I became an economist and am old enough to have had the opportunity to talk to Werner Heisenberg about the way he achieved this principle of uncertainty, in full contradiction to the traditional physics that he learned at university. At the beginning of the 1960s, two economists, Frank Knight in Chicago and John Maynard Keynes in King's college in Cambridge, were writing books. Knight's book was famous, while the other one disappeared. It was called *The Treatise of Uncertainty*. Both writers were making a clear-cut distinction between risk and uncertainty. If we had been aware of those works, we would have agreed that the principle of Heisenberg could be called a risk principle. This principle started from quantum mechanics and in spite of its complexity and exotericism, the science is extremely clear: everything is done in terms of objective probabilities. You disintegrate a core kernel and you cannot say what is going to happen to the kernel. You disintegrate 800 million and on the basis of quantum mechanics you predict statistically exactly how they will behave, and the statistical distributions that you are going to observe are really in line with the forecasts.

We can say, in a way, that atoms leave risks – although that is ludicrous, of course. The cells leave more uncertainties, and if you deal with ecology or climatology, they are full of uncertainties and the probabilities announced are subjective and often deceiving. Climatology, ecology and possibly some other sciences of direct interest to you are therefore not certain, in the profound sense of these uncertainties, as distinguished by Keynes.

Can uncertain sciences be reliable? If the answer is no, then we, AFSSET and climatologists will all find it quite difficult to make progress. However, how can we answer the question? How can we characterise an uncertain, yet reliable science? We can show that those are both sides of the same question? How can we give rigorous content to the Precautionary Principle?

Over the last 10 years, significant progress has been made in trying to provide an answer, both qualitatively and quantitatively. These answers try to show that the results depend

on the nature of uncertainty. As we saw this morning, there is a broad range of uncertainties and it all depends on the degree of reliability of the science. It cannot be characterised only – and here I agree with Professor Hoppe – by natural and life sciences. Both economics and politics intervene.

The British physicist and science historian, John Ziman wrote a book which I would strongly recommend: *Real Science: What It Is and What It Means*. The book was written by an outstanding physicist and science historian and I have extracted two sentences. The first one gives us a way to characterise the uncertain, yet reliable science, in the spirit of Pr Hoppe presentation “*The credibility of science depends as much on how it operates as a collective social enterprise as it does on the principles regulating the type of information that this enterprise accepts and transforms into knowledge*”. We could say that AFSSET and IPCC, the Intergovernmental panel on climate change, meet the criteria of those structures generating an uncertain, but reliable science. The Bush administration denied this process, which delayed the problem at an international level.

In his book, Ziman also reminds us of a very famous sentence by Thomas Kuhn in *The Structure of Scientific Revolutions*. Kuhn wrote: “Normal science is a mindset that can take hold of researchers in almost any field of academic science”. Normality is what we could call a comfortable approach of the reliability of an uncertain science. However, it is too often the comfort of routine to the detriment of innovation. I do not know what is going on about uncertainty and reliability in life sciences or natural sciences, but I can tell you what it means in terms of climatology. However, when I say that I can tell you, I can only quote two major stakeholders of this science – one on the nature side and the other on the economy side. The first one is Dr Pachauri, the chairman of IPCC and the recipient of the Nobel Prize, and the second is Lord Nicholas Stern, the author of *The Stern Review on the Economics of Climate Change*.

If you met them every six months, what would they tell you? They would say that they were not happy with things and that an important point had been set aside in their last report or that there was something they did not take on board in their last paper – not because they had ignored it, but because they thought that the point was not well enough established. As this type of thing is a frequent occurrence in climatology, and that something abnormal can turn into normal from a report to another, you realise the dynamics and the delay there might be. Politicians and public opinion moves even more slowly and you can therefore imagine how difficult the task is and why the Copenhagen summit will probably fail.

Questions and Answers

From the floor

My question is for Mr Hoppe. In my association, we try to apply a rational approach to the questions of the proper level of exposure concerning non ionising radiation from mobile phones, but it is very difficult because facing us and our actions is the industry, and the industry has a tremendous amount of money. This money-making process is based on passion and they run a lot of advertisements for the cute, little mobile phone, especially at Christmas. We are therefore sometimes in despair because we want to promote a rational approach. However, we are facing the industry – and what do they say? They say that they have experts – and some of these experts work for the industry and handle the rational questions. It is therefore very difficult for the associations.

Robert HOPPE

I suppose that the problem is in defining rationality. It is indeed well known, in the field of mobile phones, as well as in nutrition and tobacco and smoking, that a lot of scientists are not only working for companies, but they are also in so-called independent agencies that make their money by creating uncertainty, in the sense that they permanently try to cast doubt on experimental outcomes of other scientists if they are not in the interests of tobacco or mobile phone companies and so on. I like what Flyvbjerg says when he states, 'Power has a rationality that rationality does not know, and rationality, on the other hand, does not have a power that power does not know'. What he is basically saying is that those in power, whether they are business interests or political majorities that define and impose their reality on others, they can also define what is reality, in the sense that they can decide which experts to believe and which not to believe. That is one of the reasons why I think that it makes sense to differentiate between powering and puzzling. Unfortunately, the two are strongly connected and that has important consequences for the way we need to deal with these kinds of issues, which is one of the reasons why I said at the end of my talk that more checks and balances were probably more important than more rational and analytical schemes and methods of puzzling.

Paul FRIMAT

It is therefore important for experts to be independent and have real independent agencies, and there is a real problem there.

Yannick BARTHE **Centre of the Sociology of Innovation**

I would like to thank Soraya for her presentation and for summarising such a long period of time in just a few minutes, which is a very difficult exercise. Soraya described the scientific controversy, but radiation in the US is linked to the judicial field and has to do with repair and not risk prevention. What about the legal sphere and the judicial field and our field? Are they interconnected? I think that the legislation has moved away from the

dose and dose-effect relationship to the benefit of the presumption of this causal link between radioactive fallout and the inhabitants of Nevada or Utah or other American states. A scientific debate takes place in the Court of Justice and we then feel that suddenly they are moving away from that to respond to political pressures. Could I have your view on that?

Soraya BOUDIA

You are quite right. The judiciary plays a major role in the United States. Experts are involved on both sides and there will be a discussion. However, I would be cautious regarding the repercussions of the judiciary on the way we design the topic of low doses and its evolution over time. If we examine what happened in the 1950s and the 1970s in a more detailed way, the judiciary only intervened in the second step. The public debate took place in the media and among scientific experts, and the reports that came out were produced before legal proceedings took place.

How are we going to deal with the problem with such and such a plant or such and such a worker or being under such and such an environmental exposure? In that case, the judiciary will play a major role. With the scientists on the one hand and regulation on the other, provided that there is still uncertainty, there will always be room for legal proceedings. What pushed the Environmental Protection Agency to set up risk assessment was the legal proceedings, but within the EPA a number of directors have a given vision of what the regulation and expertise should be and those directors will mobilise the legal proceedings to orientate the situation. The directors therefore play a role, but in the historical analysis you have to look at the institutions from the inside, in terms of what can be said and done. The experts generate solutions and sometimes these solutions are for the politicians. In the US, the national framework has played an adversarial role and there are controversies. However, the solutions drawn up in the American framework will be exported through international bodies to countries where legal proceedings are not so essential. The type of solutions will therefore not downsize the role played by the judiciary, although we sometimes give this too much attention.

Paul FRIMAT

I think that we can say that the principle of uncertainty and risk exists and, as Mr Henry said, we need to be careful that the problem of normality does not become a routine, because it is typically French. My thanks to all our speakers.

SESSION 2 - Varieties of Uncertainties

Benoit VERGRIETTE
Risk and Society Unit Manager, AFSSET

Our session 2 is a bit different. We have designed it as an attempt to introduce this afternoon's five workshops and we have three different topics and four different speakers. We will talk about the various kinds of uncertainty and the mobilisation of stakeholders, and our first speaker is Henry Rothstein.

The Risks of Risk-Based Governance

Henry ROTHSTEIN
King's College London

I. The Uncertainties Facing Risk Governance

As we heard this morning, uncertainty is a pervasive theme within risk governance across policy domains. Most of the debates that we have heard understandably focus on scientific uncertainty, such as debates on nanotechnology and biotechnology. But risk governance also faces other kinds of uncertainties. It faces normative uncertainties in determining the distribution of costs and benefits of regulation. For example, determining what constitutes the public interest is fraught with difficulty for government. Risk governance also faces institutional uncertainties regarding the capacity and effectiveness of regulatory institutions to actually implement laws that have been set by central government. Too often, crises have been the result of the left hand of government not talking to its right hand. These kinds of uncertainties create conditions for governance failure, both in terms of protecting the public and the environment – but also political, legal and even moral failure.

There are, of course, many ways in which governments have tried to resolve these uncertainties. For example, the Precautionary Principle has become embedded within regulatory frameworks to resolve scientific uncertainties. More participative forms of decision-making have been introduced to address normative uncertainties and increased bureaucratic scrutiny and control have been introduced to reduce institutional uncertainties. However, what I want to explore today is how the very concept of risk itself is a way of managing these uncertainties and consider what might be called the risks of risk governance, in much the same way that the last speaker this morning was discussing.

II. How the Concept of Risk Can Manage Uncertainties

1. Risk as a Central Preoccupation of Governance

In recent years, risk has certainly emerged as a central preoccupation of governance. Across the developed world, risk has been a central focus of political debate and governance activity, from contaminated blood and mad cow disease to pandemic flu and climate change. However, in the Anglo-Saxon world, at least, risk is no longer just an object *of* governance, but it has become a central organising concept *for* governance activities more generally, with numerous government reports urging regulatory activity and other government activities to be 'risk based'.

There is no shortage of theories that seek to explain the pre-eminence of risk as an object of governance. The well-known sociologist Ulrich Beck argues that risk has become more important because we face qualitatively different kinds of risk today than previous eras; they are more uncertain, catastrophic and go beyond the ability of the nation-state to manage. Others, such as Douglas and Wildavsky, have argued that as a society we have become more risk averse, demanding ever greater protection from ever-diminishing risks. However, what I want to argue is that risk has become a central organising concept for governance, not because we face greater dangers or because we have become more sensitive to those dangers, but because of the increasing need for governance to account for its own limits.

2. The Need for Governance to Account for Its Own Limits

What do I mean by that? What I mean is that governance, in general, is constrained in what it can achieve because of the well-known puzzles, conflicts and trade-offs of governing, and these problems make governance outcomes uncertain. Sometimes governance works; sometimes, frankly, it does not. However, the concept of risk helps resolve this dilemma. It may seem a very obvious point to make, but risk governance is not about ensuring safety; it is a form of governance that involves explicitly defining acceptable levels of potential harm to which individuals, groups and organisations will be exposed.

For example, we set standards for acceptable exposure to chemicals or radiation that balance the hazards posed to individuals against the societal benefits provided by the chemical and nuclear industries. Since we do not know precisely who will contract a cancer, for example, we express that standard in terms of an acceptable probability that exposed individuals might contract cancer over a lifetime. Alternatively, as we heard this morning, we think in terms of risk because of fundamental methodological uncertainties in discovering the hazards that we face.

Equally, the concept of risk does not simply have value in relation to rules of governance; it can also be used in setting levels of acceptable enforcement of those rules. Regulators often face limits on their ability to ensure compliance with rules, because, for example, of limited resources or ungovernable actors. In the United Kingdom, for example, food safety inspectors have responsibility for enforcing food safety law for over 400,000 food businesses – that is a formidable task and there will inevitably be enforcement failures. Inspectors have to decide where they will inspect first. In this case, therefore, risk-based

logics of enforcement can help inspectors prioritise their activities, but in so doing, they are effectively setting an acceptable level of enforcement failure.

The key theme here, therefore, is that risk provides a way of framing governance problems in ways that define the boundaries of acceptable and unacceptable governance outcomes. Framing the objects of governance in terms of risk therefore transforms decision-making into probabilistic calculations of success and failure in which degrees of failure can be tolerated. After all, to take a managed risk is to accept the possibility of failure and hence provide a defence against the associated blame.

3. Why Risk-Based Logics Have Become So Important

Why, then, have risk-based logics of governance recently become so important, at least in Anglo-Saxon countries? We see a lot of it in the UK, Canada, the US, Australia and New Zealand. Certainly from a UK perspective, I think that the explanation is that we are living in an age of greater accountability, in which governance systems have to find ways of accounting for their limited ability to achieve their goals. In weak or opaque systems of governance, where decision-making can be conducted in the shadow of opaque administrative procedures and with little responsibility for actual implementation, there is, frankly, little need to account for failure.

However, in the UK and many other countries, governance in both the public and private sectors has changed. The public and private sectors have become subject to ever-increasing scrutiny and accountability demands from a wide range of old and new stakeholders, which in turn has amplified the importance and management of potential failure. Failures have to be recorded, potential failures have to be anticipated and new categories of failure are defined. As a consequence, risk-based governance approaches have emerged as a way of deflecting some of the associated potential blame by determining the acceptability or otherwise of those potential failures.

This process has been seen clearly in the creation of independent regulatory agencies, which, in the absence of an electoral mandate, have had to find ways of justifying their aims, trade-offs and performance as bureaucratically rational and defensible in ever more public arenas. Under those circumstances, reframing regulatory objects in terms of risk has proved attractive for rationalising the practical limits of what governments or regulation can actually achieve.

As was referred to this morning, such developments have been very evident in the US, where the adversarial legal system drove regulatory agencies to develop legally defensible, quantitative risk-based models for regulatory action. The famous National Research Council's landmark Red Book on risk assessment, for example, was in part prompted by the Environmental Protection Agency's difficulties in justifying decision-making during its first decade of operation. Similarly, in the UK, a risk-based model for regulatory action was developed by the UK's occupational safety regulator, the Health and Safety Executive, to justify its decision-making to a public enquiry on nuclear safety. Additionally, the UK Environment Agency, amongst many others – and I stress that it is many others – have since adopted risk-based governance approaches.

4. The Transformation of Policy Problems into Risk Problems

Such attempts to manage the uncertainties of decision-making can transform policy problems, which are not conventionally understood as risks, into risk problems. Examples include offenders on probation and mental health patients, who have been transformed into risk management problems across the Anglo-Saxon world, as the probation, health and social services have been increasingly held to account for failures. Even in UK universities, increasing regulatory controls in higher education have created whole new categories of risk such as 'academic risk', which has now become a formal category for the assessment and management of UK academics!

I think that these examples show how the colonisation of governance by risk is not so much driven by a new distribution of 'ills' in society – as scholars such as Ulrich Beck would put it – but is instead driven by a new distribution of 'ills' in governance.

5. The Challenges in Framing Governance Problems in Terms of Risk

a. Risk assessment is not an exact science

First, framing governance problems in terms of risk may, of course, have appeal as a rational way of allocating scarce public resources to try to ensure optimal governance outcomes and, in the process, deflect blame. However, such approaches face a number of challenges – and these have been well rehearsed in much of the literature. Firstly, and most obviously, risk assessment is not an exact science. Assessing risk as small, when events suggest otherwise, may do little to legitimate governance practice. The current financial crisis, at least in part, was caused by paying too much attention to a narrow range of likely outcomes of financial modelling and too little to the very heavy tail distributions. It is also perhaps no surprise that there has been increasing interest in building uncertainty into risk assessment in a more explicit manner. For example, we are becoming increasingly familiar with fan-style risk assessments for climate change, weather forecasting, flooding and even macroeconomic questions that show a range of possible outcomes with associated probabilities. Whilst these provide opportunities for more nuanced decisions, they are of course a further iteration of probabilistic reasoning as a defence against failure.

b. Demands on institutional capacities

Second, risk-based governance also places considerable demands on institutional capacities and can conflict with the matrix of organisational demands on decision-makers and their working cultures. For example, regulators may simply not have the skills, capacity or competence to undertake risk assessment, or risk-based approaches can conflict with organisational ways of working. Of course, an ex ante risk-based policy that allows for failure may not reassure decision-makers that they will not be blamed if something goes wrong. For example, arguing that flood defence is risk based when people are flooded out of their homes is unlikely to satisfy the public, and it can be difficult to persuade the public not to worry about a short-term increase in knife crime on the grounds that it is likely to be a statistical fluctuation rather than a rising trend. Risk may consequently provide a lingua franca for decision-making, but actually make little impact on organisational practices.

c. Conflict with other pressures on decision-makers

Third, and relatedly, risk-based approaches pose clear normative challenges if they conflict with other pressures on decision-makers. Regulators face political, legal and reputational challenges in going about their business that conflict with so-called risk-based approaches. For example, the public may be more averse to rare high-impact risks than frequent, but lower-impact risks, even if from a risk point of view the collective consequences are identical. Equally, a risk-based approach may conflict with legal duties or political priorities.

Increasingly, we are seeing these risks to the governance organisations themselves - or 'institutional risks' - formally framed as 'political', 'legal' or 'reputational risks' that are traded off against risks to the public or the environment. The UK Health and Safety Executive and the Environment Agency, for example, have developed the concept of 'societal concerns' as an attempt to quantify and respond to public anxiety generated around issues that they consider to be well managed, but which create reputational concerns for agencies themselves, such as children's activity centres or multi-fatality rail accidents.

III. Conclusion

In conclusion, I would first like to argue that this explanation of how risk has become a central preoccupation of governance shifts attention away from the downsides of technological progress – the dangers of chemicals and radiation and so on – towards the consequences of governance failure or the limits of governance. It focuses attention on the way in which an ex ante risk-based defence of acceptable failure can reconcile increasing accountability pressures with the inevitable uncertainties of decision-making. It is a methodological solution to the problem of blame.

Second, particular attention should be paid to the risks of risk governance. Risk-based approaches may have a lot to offer, but it is important to examine how conflicts with other pressures on decision-making are managed in order to understand the impact of risk-based approaches on outcomes. Particular attention needs to be paid to which 'risks', risk governance is actually governing. There is always a danger that governments may pay too much attention to their own institutional risks – reputational and legal risks and so forth – at the expense of risks to the public and the environment.

Third, I think that more research is needed into how different governance contexts shape the development, use and consequences of framing governance problems in terms of risk. It may well be that institutional accountabilities vary from policy domain to policy domain and from country to country and thus shape the extent to which risk frames governance problems. However, if nothing else, I think that the dynamics of risk colonisation suggest that in order to understand the contemporary significance of risk, we need to address the nature of modern governance itself.

Benoit VERGRIETTE

Thank you, Henry for this very stimulating introduction to governance through risks. We saw the conceptual, the institutional and the normative aspects, the reputation risk issue will be addressed at length in the following workshops. I will now give the floor to Olivier Borraz and Danielle Salomon, who will shed additional light on the links between mobilisation controversies and uncertainties in health and the environment.

Protests, Controversies and Uncertainties in Environmental Health

Olivier BORRAZ
President R²S & CSO

Danielle SALOMON
CSO, Risks & Intelligence

Danielle SALOMON
Uncertainties Leading to Uncertainties

Our presentation on uncertainties rests on research conducted on protest movements and controversies in the field of environmental health. We saw this morning, and this is also the topic of the workshop, that the concept of uncertainty in environmental health is often understood in a narrow scientific sense, i.e. a lack of knowledge regarding causal mechanisms and effects. The consequence is that health safety has been put at the core of risk regulation, converting uncertainties into risks and striving to produce more knowledge in order to reduce the level of uncertainty. This often leads to even more uncertainties, which is paradoxical: new research will lead to further research, creating as in the case of mobile telephony an inflationary spiral. But uncertainty must also be understood as referring to the values attached to the disputed activity.

1. The Exercise of Power

Some generic work was conducted on the concept of uncertainty with regards to organisations many years ago. According to this literature, an area of uncertainty in an organisation or a system determines the distribution of power. This is relevant to the existence of an organisation; it will allow for a number of games and strategies to take place – games because there is slack in a system, and strategies around the definition of uncertainty. Those who control, determine or influence these uncertainties acquire power within the organisation – but this power is always contextual. In other words, they can push the organisation in a direction for which it was not designed initially. Power in such a context is an ability to act within the framework of interaction among stakeholders involved in the organisation or the system. This produces phases of stabilisation around

uncertainties and their “owners”, as well as phases of destabilisation. The idea here is to bring this knowledge on uncertainty in organisations – and this is what we do in sociology – into the study of environmental health, particularly in the study of crisis, controversy and dispute.

2. The Blurring of Borders

In the environmental health field, there are many social and political sources of uncertainties. The complexity of social systems in which risky activities are embedded is growing. We see many fields intertwined, such as in the cases of urban sludge treatment or mobile telephony, with a complete blurring of borders. Each sphere carries different roles, which are unknown from one field to the next, although they find themselves being interdependent. The crossing over of these different fields becomes a problem for actors within each field.

Hence, if we extend the concept of uncertainty, which was initially defined solely as scientific, we can analyse and understand the emergence of environmental health risks and the problems of governance that arise. We can also highlight the constructed nature of these uncertainties, with reference to scientific issues and the behaviours of the various stakeholders and regulatory systems. Scientific uncertainties are essential to the governance approach, but we can see that the scientific data are insufficient, and the three dimensions of scientific uncertainties, social uncertainties (in relation to the behaviour of players irrespective of the type of players who are stakeholders in the system), and political uncertainties (the regulatory systems, institutions) are all intertwined. They generate a dynamic process and they can no longer be separated from each other. We can therefore not reduce uncertainty to its scientific dimension; it is intertwined with the social and political dimensions and decisions have to be made according to those three dimensions. This allows us to put the emphasis on phenomena of stabilisation, confinement, along with destabilisation, crises, controversies and scandals.

3. The Capacity to Act

The analysis of social movements shows that they have acquired a real capacity to act: for instance, to stop the setting up of an incinerator or to protest against GMOs. Activists are able to deflect or postpone decisions and question the expertise and so contribute to new social and scientific uncertainties, and that also generates new risk of a political nature – as we heard in the previous presentation – as well as a legal nature – as we heard this morning. In the US, for instance, the judiciary plays an important role, and we are also finding this in Europe now, where courts regulate issues that cannot be solved by the scientists or the politicians. But in general, political authorities have the final say in matters of regulation. We heard this morning that those who impose the political decisions have the power.

4. The Three Uncertain Moments in the Dynamics of Uncertainty

We can distinguish three uncertain moments in the dynamics of risks – and this will be further developed by Olivier. Firstly, there is the emergence of risk; secondly, there is the

production of expertise; and, thirdly, there is the decision. The idea is to show that initially we can dissociate heuristically the scientific uncertainties from the social and political. However, in environmental health and situations of crisis or controversy, these three circles are superimposed. This creates a dynamic in which it is very difficult to dissociate what comes from one sphere from what comes from another. Scientific uncertainties are systematically associated with social and political uncertainties.

Olivier BORRAZ

Let me review the three moments that Danielle has highlighted, during which we can observe the aggregation of different uncertainties and the dynamics they generate.

Firstly, we have the emergence of a risk. Once an activity has given rise to contestation, various uncertainties will aggregate around that activity, not all of them being of a scientific nature. These uncertainties will also relate to the characteristics, properties and effects of the activity, as well as to the way that knowledge on that activity is produced. Regarding mobile telephony, for example, controversies were engaged on the effect of radiation, along with the way the antennae were deployed, operated and controlled. What is important is to see that this disputed process creates oppositions between various organisations. Some organisations attempt to demonstrate that there are too many uncertainties around an activity, and that this warrants its qualification as a risk; while other organisations may say that the situation is under control and that there is therefore no risk. In turn, it is important to position the activity that is being contested within a social system in which it is embedded and that comprises various stakeholders who are interdependent. These interdependent stakeholders do not necessarily know each other and find it difficult to understand and trust each other, and that underlies the emergence of risk since they must work together or coordinate their actions, yet find it hard to anticipate their respective behaviours. An increased labour division, a delocalisation of relationships, an increased delegation or empowerment to expert systems and complex interdependencies, adds to the complexity of many activities and the uncertainties that characterise them. Hence, it is important to look beyond scientific uncertainties to incorporate other types of uncertainties that take part in the construction of risk issues.

The second moment is the recourse to experts for a risk assessment, and this generates further uncertainties, which is paradoxical. We expect experts to mitigate uncertainty, but on the contrary, they often add new uncertainties and amplify the risk. The issues are usually very complex, and in the case of new technologies present a host of unknown unknowns. Yet experts rely essentially on stabilised knowledge, on data that is disconnected from their area of production or usage, to produce their advice. Additionally, there is the problem that experts are asked to pronounce themselves on issues that often present numerous scientific uncertainties, with an obligation that they come to a conclusion on the existence or non-existence of a risk. Finally, the process is organised in such a way that it does not allow experts to understand the reasons why the activity has become a public problem. All this encourages the production of advice that, far from closing the controversy, often tends to fuel it.

We saw this morning that the comfort provided by routine and normal science is dangerous. It is difficult to introduce new forms of knowledge and methodologies that are

not completely stabilised within the process of expertise. Yet experts are reluctant to do so. The organisation of the process and the distinction between the assessment and the management of the risk generates further uncertainties among stakeholders. Many studies have shown that the border between these two tasks is highly conflictual.

Thirdly, public authorities, when preparing their decisions, do not take into account all the uncertainties that have led to the discussion on a particular topic, such as mobile phone antennae or incinerators, but concentrate on the risk quantification that the experts have produced and will, as Soraya Boudia mentioned, reintroduce economic and administrative data in their assessment, without putting this data to discussion. They will therefore rebuild a problem around the institutional risk, as Henry Rothstein mentioned, and manage that risk before trying to solve a complex political problem, such as the risks presented by antennae.

Beyond these difficulties that the decision-making system encounters, the very organisation of the regulatory systems generates uncertainties that may amplify the risk, such as an institutional lack of consistency, decentralisation, empowerment to agencies or increased recourse to courts. Decentralisation is another source of uncertainty: with mobile telephony, for example, we saw that giving increased regulatory power to various decentralised levels of government creates potential conflicts because you cannot anticipate the behaviour of cities, regions or departments. Empowering agencies is yet another factor of uncertainty. Finally, the resorting to justice in terms of regulation also increases uncertainties.

In terms of making progress and engaging in a "politics on uncertainty", as Michael Power suggests, what do we need to do? How can we govern and manage uncertainties? We would like to suggest a few venues. Firstly, these uncertainties should remain as they are. Public authorities and experts should not immediately try to reduce or eliminate them. They should remain open to discussion and be disputed. We also need to introduce new ways of acquiring knowledge. We should not just stick to well-structured formats and should not hesitate to introduce new forms of knowledge. We should debate uncertainties without trying to reduce risks immediately, and organise discussions between the various stakeholders so that they can express their positions, expectations and claims. What is important here is that we create the right conditions for recurring negotiations on the modalities of introduction, usage, production, circulation and knowledge on different activities.

Various recent initiatives in France (Grenelle de l'Environnement, Grenelle des ondes, PNSE2) suggested solutions, in which the goal was not to put an end to disputes or controversies, but, on the contrary, to organise a recurring negotiation on the conditions relating to the usage and modalities of production of a given technology. The stake for public authorities is to recreate trust in their ability to decide on and control risky activities. However, that means that the concept of uncertainty needs to be extended.

Benoit VERGRIETTE

Thank you. I now give the floor to Yannick Barthe, who will talk about the new modalities and the production of knowledge and how non-experts become organised to recognise pathologies and establish a causal link between environmental factors and some pathologies.

Defending a Cause, Finding Causes: Mobilisation and Inquiry Work

Yannick BARTHE
CSI/CNRS

(Translation not approved by the author)

I. Background

I will try to focus on a problem that was referred to this morning, which has given rise to a lot of literature in the field of epidemiology, but also in particular among legal experts in the US. This is the problem of causality. The issue of causality cannot be escaped when one broaches the topic of legal compensation or in the discussions that shake the field of epidemiology, but has, in the end, been subject to little scrutiny as such by risk sociologists. Yet it is a central one, and one of the features of the action being taken in the field of environmental health is that it often takes on the form of surveys intended to make causal relationships more visible or plausible. This is what some American authors, such as Phil Brown, have called the 'the popular epidemiological process' and what is meant by this is the work that is done by non-professionals in collecting data, acquiring knowledge and manufacturing a causal history. One of the direct consequences of this new approach is a broadening of the mobilisation of the research community on these issues. There is competition between various types of investigation and controversy in this work aimed at "challenging" previously-accepted thought.

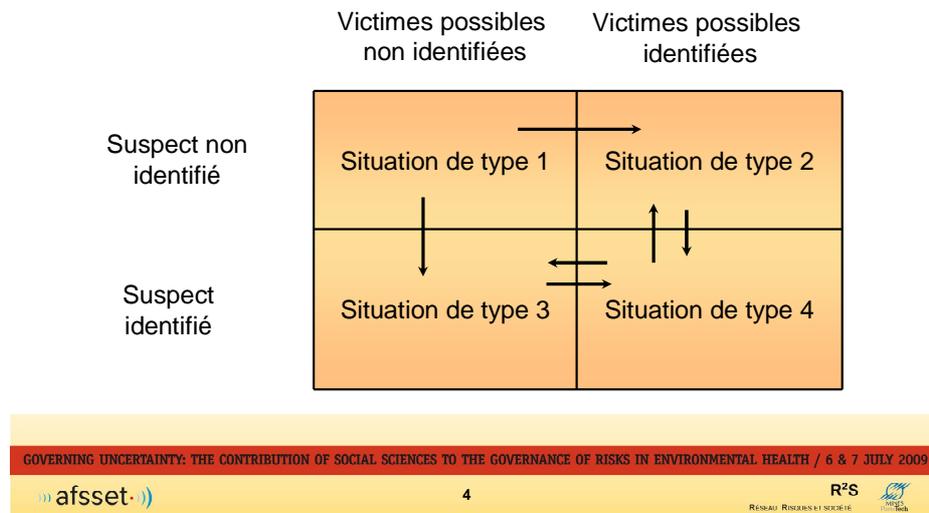
Martin Guespereau talked about "activist expertise", which others have called layman's expertise, and there are two possible attitudes toward this. One can either bring out, once again, the usual dichotomies of risk versus perception of risk, and science versus non-science – which boils down to portraying expert action as conveying a "biased" perception of risk. The second option, which is what I wish to put forward, is to take the many investigations underway seriously. One might even work from the concept of investigating the causes and revisit the controversies still outstanding by describing the "causalisation" process, to use a term that has fallen out of use.

II. Five Areas for Discussion on Causality

1. Types of Situation

My purpose is to introduce the topic, so I would like to ask five questions. What type of situation does this kind of investigation work refer to? You conduct an investigation and identify controversies and you can put forward a new classification of types of situations for this investigation into environmental health.

La dynamique des controverses



The first situation is where you have no identified suspect or victims and, as Francis Chateauraynaud said, it is just a situation of vigilance, attention or suspicion.

The second type of situation is where you have a suspected cause, for instance in a production plant, but you ignore the effects. Once again, the investigations – whether carried out by experts or laymen - make the possible effects visible and identify possible victims. The layman will create a community, collect data and describe cases, as with the case of the antennae, as Olivier and Danielle mentioned. This is the creation of a community and of people exposed as possible victims, and attempts will be made, on this basis, to establish a causal link.

The third situation is where possible victims have been identified, but there is no suspect. The work of the investigation here will be different from the previous case, where causes will be looked for, the effects explained and assumptions made, with past events being reinterpreted and analogies being made. An example here is the syndrome of unhealthy buildings or clusters of cancers, as in the cases that Marcel Calvez mentioned.

In the final situation, victims and the suspected cause have both been identified and the investigation, whether it is done by the expert or the layman, will aim to prove the causal link through the use of health questionnaires and mapping. This has been the case for radio frequencies and DMFu (Dimethyl Fumarate).

Presenting these types of typical situations allows us to produce a model and we can then analyse controversies dynamically from these investigations. An important point is to understand how we move from the first situation to the second, and from the second situation to the fourth, and how the second situation will be based on the third. In short, it is to analyse the processes.

2. The End of the Monopoly of Investigations

The second area that has been much looked into by the literature is the so-called expertise of the layman, and we have looked a great deal at the kinds of knowledge involved in the many investigations of causes. Here, two areas can be identified, showing that the investigative work in which laymen will engage will enable them to lay claim to an alternative form of knowledge to pure scientific knowledge and sometimes bring them close to the latter. I have listed a number of criteria, but others could be used as well. In all of these controversies, mobilisation is generally based on local knowledge, contrary to scientific knowledge. This is experiential knowledge, rather than experimental. This is knowledge based on testimonials or the senses, and is not conveyed by scientific instruments. It is also a form of knowledge that is shared through stories, through the press or through grey literature, rather than through publications in peer-review journals. Lastly, it is a form of knowledge aimed first and foremost toward action and designed to put an end to an activity, rather than at achieving scientific consensus.

3. The Path of Causalities

The third area is the path of causalities – how have stakeholders linked the very causes? We can take the existing causality models here and I have taken the model developed by Rochefort and Cobb from 1994, which dealt more with issues of how questions are put on the agenda. We can distinguish multiple and simultaneous causalities and, in that case, we can explore causes in various directions and these causes will then generate the same direction. This is the model sometimes used in epidemiology. On the other hand, we may take a sequential causality model or causality where there is a favourable environment which might be regarded as a cause, such as a lack of social equality or the question of racism, as in the US. There is also an intricately causal model, wherein you have an initial cause, but it acts upon an already-favourable terrain, which can also be considered a cause itself. A classic example is that of social inequalities or ambient racism, a topic very prominent in the United States. Lastly, there is causality by presumption, which is opposed to causality that has scientific evidence, and presumption is adapted to uncertainties. In a presumption, you gather together a number of clues, which are then sufficient to produce a causal link, even if the causal link is not proven. Presumption is often present in cases where compensation needs to be provided. I hope that we will have the opportunity to explore this particular concept more tomorrow, with Christine Noiville.

4. Types of Causality at Hand

What kinds of causes are therefore involved in this causation work? The interesting point here is that, in fact, there are things that we can have a close look at, such as having a more or less broader concept of risk factors. Here, the experts will take into account certain factors that are not normally taken into account in terms of traditional epidemiology, and they are considered as risk factors and causes as such. Regulatory clauses, if deemed to lenient, for example, will be considered a cause. Economic interests will also be considered a cause.

Additionally, the causes can be more or less intentional. In terms of occupational health, for example, what happens in cases of exploitation or, to phrase it differently, how priorities are established between economic benefits and health, which can be instituted

as an intentional cause of a health problem? What about the Gulf War? When they returned home, war veterans believed that they had been the subject of experiments during the war. There is therefore a whole accusation process that begins as soon as you take intention into account as a criteria. Lastly, the causal link can be long or short to varying degrees, so where does it begin and end? How do you bring the various causes together? It is this very chain of causality that can help us understand how causes can be instrumentalised and politicised.

5. Seeing Everything in Terms of Cause

Fifthly, seeing everything in terms of cause is a causation, so what kinds of challenges does that raise? We have stated this time and again this morning. Now that virtually everyone is doing the investigation work, and not just investigators or experts, scientific expertise is now being broadened to other forms of knowledge which are being produced outside the scientific realm. What about the experts? Will they accept these kinds of surveys and investigations as producing scientific knowledge or is this a way of stirring up more trouble and sparking off new issues? The great thing about uncertainty might be that it provides you with avenues that you can explore and which give you priorities for your work. In terms of the different ways that you establish causation, the upside is that you think about how you do it, and that can spark off yet another discussion. We talked about the Bradford Hill criteria earlier, but there is a whole discussion on those criteria, and it is a way of ironing out a lot of kinks.

III. Conclusion

As this is a multidisciplinary symposium, let us consider what the challenge is in terms of social sciences. The investigations of laymen pose a problem for social scientists. They force sociologists to switch to a different kind of sociology – an occupational sociology that works around the causes. The initial system, which usually pointed out the causes, meant that you needed to ask yourself about the terminology, for example. This morning, we said that a problem is first and foremost social or political in nature, meaning that the problem is caused by something political, and that is what makes it a political problem. There is therefore a whole controversy in terms of the various causation links. Referring to the “social construct” of risk or uncertainty is, in a sense, depleting the work that certain social scientists do to make the uncertainties or risks emerge. There will be a debate about this in Workshop 5, and I would like to take advantage of my having the floor now to do a bit of advertising for the workshop, as there is still some room left.

Questions and Answers

Yorghos REMVIKOS

I have a comment rather than a question. I shall try to step into the shoes of Mr Guespereau regarding the use of the term ‘activist science’ or ‘activist scientist’. Let us

not confuse lay science with advocacy science – the two have different functions. Advocacy science emerged in recent years and raises different questions. It means that civil society can organise and its level of competences has increased to such an extent that society can now challenge official experts. It can interpret international literature and does not necessarily apply all the rules of exhaustiveness that apply to general practices. It is therefore a new kind of stakeholder, and one that was not mentioned by Denis Bard this morning. Advocacy science has a role to play and it raises problems for public experts, and this calls into question our traditional ways of producing expertise.

Yannick BARTHE

I concur with you wholeheartedly. That is all I want to say.

Daniel OBERHAUSEN

I would like to go back to something that Claude Henry referred to this morning regarding quantum physics and the whole concept of non-separability. As we heard in the earlier presentation, we are living in a time when it is more and more difficult to tell the difference between lay science and scientific science. However, in our opinion, there is no such thing as popular or people's epidemiology. In the world of associations and consumer groups, we have the skills but we do not have the resources, and there are many differences in terms of the skills that are available to the various stakeholders. We do civic-minded health investigations, but we have never claimed the right to do epidemiology - epidemiology requires resources, the like of which we do not have. There is therefore no such thing as a layman's epidemiology. However, citizens can investigate, so we have this heuristic function and we are now throwing the ball at researchers so that they will carry out true epidemiological studies, which is what we want. We want epidemiological surveys and studies that are worthy of the name – perfectly scientific studies – to be carried out all around the mobile telephony infrastructure.

Danielle GADEAU

I work for an environmental association and my question is for Ms Salomon. You said that the person who determines uncertainty influences the system in the direction that he or she wants. In the course of various symposia, I have realised that in order for scientists to get the funds they need to carry out their research, they have to talk to the people who have the money, and even if you do not want to talk to them, you have to talk to them because otherwise you will not get the money you need to do the studies that you want to do that will benefit as many people as possible. There are therefore various interests at stake, and for civil society we know that there are people who would like to venture into and explore certain areas, but they cannot do so because the powers that be say, 'No. You will go where I want you to go.' This is something that I have felt repeatedly. My question is, therefore, what about researchers? Do they still have freedom of choice? What about civil society? Look at GMOs, for example. We were told that there was no research on GMO-related problems. They are saying that there are no researchers and that there is no research being done on the subject, but that there are other programmes involved. That is just an example, of course. We were talking about the people in charge of monitoring the situation and the uncertain areas.

Danielle SALOMON

This question goes well above and beyond the mere issue of uncertainty and even the topic of today's symposium, even though the two may be connected. Independence of research is a subject that is not being properly raised, particularly when it comes to the sources of funding, for example. Secondly, in today's science funding system, which is basically what you are talking about, there are more and more calls for tender and some of these are the so-called white calls for tender. In other words, researchers are free to make suggestions, such as on working in particular area, and research institutes are not "driving" everything. However, that is obviously a broader issue and I am not qualified to answer.

Francis CHATEAURAYNAUD

My question is for Yannick Barthe. Going back to the summary you made, what is the relation there to HIV positive or AIDS patients, for example? What about the connection between lay science and patients? This history goes way back and it is so public. You feel resistance here and there, but the resistance is belated. Ownership by society at large of the ability to investigate has been going on for a while now.

Yannick BARTHE

I do not quite understand the question.

Francis CHATEAURAYNAUD

Let us take AIDS, for example, which is a striking example. When it comes to breaking the monopoly on medical expertise, the cases that you are studying have to do with health and the environment and those causes are much more difficult to grasp. How do you therefore connect that with things that have been happening at the very heart of the medical world, as it happens?

Yannick BARTHE

I think that you need to take a look at the literature, and this is all part of the same trend. However, what is interesting in this environment is to come up with the specificities of this area, and there is one way in which the AIDS arena is specific. Uncertainty does not have to deal just with the cause of the disease, but with the reality of the disease as well. The most controversial health or environmental topics have to do with not just the cause of the disease, but also the reality of the disease – so the cause and the effects, and the two need to be studied jointly, and, to a degree, this shifts the discussion away from the medical world per se. AIDS patients are also stakeholders and they need to be taken on board.

THEMATIC WORKSHOPS SUMMARIES

Summary of Workshop 1. Social and Scientific Controversies: Mobile Telephony

Coordinator and rapporteur: Danielle Salomon, Hazards & Intelligence, CSO¹
Moderator: Jack Stilgoe, Royal Society

Summary: Nicolas Baya Laffite, Alexandre Koyré Centre, EHESS²

The public authorities in France, in common with a large number of European countries, have implemented several initiatives to respond to the queries and concerns of citizens with regards to mobile telephony, especially in terms of the opposition to phone masts. However, despite these efforts, the social and scientific controversy is intensifying and the media coverage of such issues is becoming increasingly widespread.

In this context, the problems involved with the methods of opening up scientific expert appraisals to lay persons and the various types of knowledge that can be applied remain topical issues. The aim of the workshop was to compare experiences from three countries (France, Sweden, UK) to opening up scientific expert appraisals in the area of the risks linked to developing mobile phone networks, the use of this information by the public authorities and the results. The aim of the workshop was not to offer a general and systematic assessment of the controversy in each country, but rather to act as the basis for debate with the participants on the management of uncertainty and the contribution of social sciences.

The three presentations were initially delivered and then followed by a more in-depth examination of the major issues raised during the discussion with participants.

In the first presentation, Jack Stilgoe, senior adviser at the Science Policy Centre of the Royal Society, presented the British case and analysed the link between the controversy and the process of opening up expert appraisals, or at least seeming to do so, on the scientific uncertainties and the dialogue with the general public. Dr Stilgoe began by emphasising that, contrary to other controversial social and technological cases, mobile telephony was not challenged at the time of its introduction into the United Kingdom. In fact, the issue of the risks associated with mobile telephony only emerged in 1999 following other major health scares such as BSE, GM crops and the MMR vaccine (measles, mumps, rubella), within a general context of reforming the model for delivering expert appraisals.

¹ French Centre for the Sociology of Organisations

² French School for Advanced Studies in the Social Sciences

In order to characterise the trends of English scientific expert appraisals, Dr Stilgoe distinguished two approaches to expert appraisals: an "old" and a "new" approach, each with opposing characteristics. Generally speaking, until the BSE crisis, the prevailing approach to expert appraisals was to rigorously assess the risks – clearly removed from political issues – based on homogenous and well-established knowledge, with a "hubristic" attitude (arrogant and all powerful). The fundamental aim of such an approach is to select the best scientific evidence available to deliver a prescriptive scientific opinion (speak truth to power), denying scientific uncertainties. However, the new approach, initiated by Lord Phillip's inquiry into the BSE crisis, perceived expert appraisals as constituting a process, involving society, which has recourse to heterogeneous information and given a wide social distribution. With a now humbler attitude, the intention of expert appraisals is to present not only proven facts but also scientific opinions and uncertainties. Furthermore, issues such as confidence and democracy are no longer dissociated from the risk assessment. In fact, according to the Phillips report, trust can only be generated through transparency towards civil society and, in turn, this requires an acknowledgement of scientific uncertainties.

Dr Stilgoe then showed that the first scientific opinion on the risks of mobile telephony issued by the NRPB (National Radiological Protection Board) represented a perfect example of the old approach to expert appraisals. Surprised by the emergence of health worries linked to mobile telephony, the NRPB drew on the best scientific evidence to issue an authoritative scientific opinion. This authority was based on an orthodox view of risk assessment, on a clear demarcation between scientific and political issues, and on the view that mobile telephony conformed to the guidelines issued by the Committee. These guidelines were based on a scientific consensus regarding the thermal effects of electromagnetic waves. The problem, however, was that public concerns were not focused on the compliance issue but rather on a lack of trust of the scientific grounds used to establish the guidelines. The lack of involvement of the NRPB in the actual social debate on the extent of the scientific uncertainty ended up by undermining its credibility.

The failure of the first report resulted in a second expert appraisal, carried out by an *ad hoc* body, the IEGMP (Independent Expert Group on Mobile Phones). This expert appraisal abandoned the "sound science" view and applied the rules of the new inclusive and open model for expert appraisals, attempting to answer the questions posed by the general public. The result of this approach was the Stewart report published in 2000, which, admitting that science did not have all the answers, recommended a prudent approach to the use of mobile phones and the deployment of networks. The recommendations touched upon more political issues, which up to that point had not been examined, such as the use of mobile phones by children, urban development, and the definition of vulnerable sub-groups of the population, and even research into the uncertainties. In the opinion of Dr Stilgoe, this report confirmed that recognising uncertainties is fundamental when devising a robust and credible policy for mobile telephony. This will be, according to the author of the report, Sir William Stewart, the main lesson from the BSE crisis: "Never again will any scientific committee state there is no risk".

Dr Stilgoe concluded that uncertainty forms a part of the public dialogue between experts and lay persons. A close link therefore exists between the various public structures, the extent of their commitment, and scientific and political uncertainties. He asserted that the controversy surrounding mobile telephony has severely tested the new approach to scientific governance. The trend for scientific expert appraisals to evolve from an approach

approach based on respect for certain thresholds to a type of public science based on various forms of public debate is not, however, without certain consequences. In fact, although expert appraisals are now socially more robust, they also risk veering towards demagoguery and making participation more technocratic.

For the second speech, Martine Hours, an epidemiologist at INRETS (French National Institute for Transport and Safety Research) and chairwoman of the Scientific Board of the FSRF (French Health and Radiofrequencies Foundation), presented the French experience of dialogue between scientists and associations concerned with radiofrequency issues. She explained how the FSRF attempted to enter into this dialogue. The creation of the Foundation was proposed in the report entitled "Mobile Telephony and Health" issued by the OPECST (Parliamentary Office for the Evaluation of Scientific and Technological Choices). Launched in 2005 at the behest of the minister responsible for research and the industries in the sector, the Foundation's mission was to define, promote and fund research on the human effects of radiofrequency electromagnetic radiation and to publicise knowledge on the subject to the general public, the general public authorities and professionals. Half of the Foundation's budget is financed by the State and the other half by manufacturing companies (founder members). Dr Hours emphasised that the Foundation was created after noting that in order to provide trust and ensure credibility, the links between manufacturing companies and researchers had to be severed and expert appraisals opened up to society. The structure and the operation of the Foundation reflect this aim. It operates, indeed, with a Board of Directors and a Scientific Board, of which the activities are separated. The articles of association and by-laws of the FSRF set out a code of ethics which guarantee the independence of the Foundation, the transparency of its operating methods, the autonomy of the decisions of its Scientific Board, and the impartiality and objectivity of its assessments and social dialogue.

This last objective led to the creation of a body whose aim is to facilitate an ongoing dialogue and consultation process open to all associations representing civil society. This body is chaired by Michel Petit, the chairman of the environmental committee at the Academy of Science, a specialist in the terrestrial environment and its electrical components, climatic trends and the greenhouse effect. He attends the meetings of the Board of Directors in an advisory capacity. The mission of this body is to inform the Foundation on the expectations of society in terms of research and information on radiofrequencies and health. Its meetings are open to the representatives of various associations (environment, living environment, users and consumers), of the medical profession, of the local authorities, of the educational system, and also scientific journalists. Although a level of understanding was not always achieved during these meetings, they did result in establishing a certain degree of trust. In this sense, the experience can be assessed in a positive manner.

Despite the progress achieved over the five years of the project, Dr Hours warned that the end of the Foundation - scheduled for January 2010 - would risk ending the research into the health effects of electromagnetic waves and destroy the reciprocal work to pool knowledge. She was not opposed to a change to the structure; however, she noted that at present no credible alternative has yet been proposed. In fact, in her opinion, entrusting the research programme to the National Agency for Research would not offer an appropriate solution as the limited field of research into radiofrequency risks being dissipated amongst the general research topics. For this purpose, the scientific board has requested that a body should be maintained specifically devoted to this issue to continue

the structuring work started by the Foundation and prevent the disbanding of the teams, which would result in slowing down the research in France in this field. The major problem seems to be a lack of interest from the State, which seems to want to overlook the work of the Foundation and make a fresh start. Dr Hours therefore regretted that the FSRF had not been invited to the round table discussions on "Radiofrequencies, Environment & Health" organised by the government in the spring of 2009.

To conclude, Dr Hours raised a number of questions: Is health not an effective lever to introduce the debate around political issues? Discussions between scientists must take place in a public forum: but how is this possible? Are scientists able to achieve this goal? On this topic, Dr Hours voiced her concern over a situation that could become a trap for scientists: confusing the absence of scientific proof of the existence of risks with proof of the absence of risks. In fact, the general public's lack of understanding of the scientific controversy is linked by certain scientists to obscurantism. Consequently, they tend to seek refuge in denying the existence of uncertainties. This attitude clouds the debate and results in an entrenched position of both scientists and civil society. In this context, any dialogue on the possible effects of radiofrequencies on health becomes impossible. To relaunch dialogue, a new scientific rationality is required. According to Dr Hours, the controversy surrounding mobile telephony should not overshadow the importance of heuristics in scientific uncertainty, which should be an essential element for any researcher. When uncertainty is recognised, a dialogue between scientists and the civil society becomes inescapable.

In the third and final presentation, Linda Soneryd, an associate professor at the University of Stockholm and director of research at SCORE (Stockholm Centre for Organisational Research) presented the Swedish case. She presented the results of a study on the ability of organisations to respond to the public controversies surrounding mobile telephony. Using concepts originating from the sociology of organisations and social problems, Dr Soneryd described two organisational processes of dialogue with the general public. These two approaches offered a different definition of the link between the process and the decision and contrasted, through an analysis of the purpose of the regulations, the relevant knowledge and legitimate players.

The first case analysed presented the Transparency Forum for mobile telephony systems. This was a process organised in 2004-2005 by the Swedish Radioprotection Authority (SSI), a typical closed expert agency, as a response to a problem defined in terms of a lack of public trust in the system used to regulate the expansion of the 3G network. To invigorate the debate between opposed stakeholders, the SSI invited representatives of the national authorities, local councils, the telecommunications industries and activist associations (including Vågbrytaren "Wave Breaker", an association set up to combat electromagnetic radiation and the Swedish association for the ElectroSensitive) to form a "reference group". The group met in 2005 and delivered its final report in 2007. To conduct this project, the SSI employed consultants who were experts in communicating with the public. The dialogue model used was based on the theory of communicative action of which the principles are participation, impartiality and fairness. The activists challenged this system which meant that any dialogue was impossible, as they did not consider the SSI to be an impartial judge of the validity of the facts. In fact, due to generally dominant technical and scientific discourse, and also to the mandate of the SSI, the debate focused on the risks, scientific proof and the scientific validity of the knowledge, which clearly limited the participants' capacity to raise questions that were not

framed in terms of risks or were based on "anecdotal evidence". Therefore, the issue of electrical sensitivity and other controversial questions continued to be marginalised and championed by an activist minority. Dr Soneryd concluded that this process, conceived as an *ad hoc* project, did lead to changes in the method of communicating; however, these changes did not result in any changes to the day-to-day running of the organisation or the decisions taken. The aim of the SSI was not to change the existing regulations but to show that the existing regulatory system responded to public concerns.

In contrast to the experience of the SSI, Dr Soneryd also presented the case of Södertälje, one of the first towns to install a 3G network. The process of opening up to the civil society was a problem the local representatives and officials interpreted as an issue of democratic governance and public health. When public concerns emerged, the town started collecting data on the electromagnetic fields in 2003. The research managed to identify areas with low radiation. The town then organised activities with the citizens in order to test the precautionary principle and the right for the community to refuse phone masts. This process resulted in a sustainable integration of actions aimed at responding to the concerns of citizens. This translated into the setting up of a management policy for the erection of masts. The town therefore managed to act despite the scientific uncertainties, by taking citizens into consideration and recognising their requirements: "We do not know whether the reason for their illness is the electromagnetic fields or another reason; however, we just want people to be able to live here".

From these two case studies, Dr Soneryd proposed that an assessment criterion be established for these systems based on the responsiveness to any concerns and the issues of external groups. Firstly, this comparison revealed the consequences of actions carried out on based on a 'poor' definition of the issue and dealing with a conflict in relation to a problem not merely reduced to scientific rationality. In the case of the SSI, interpreting the problem in terms of a lack of public trust and the scientific evidence of health effects, as well as separating the dialogue and decision-making processes, severely limited its ability to respond and implement organisational changes. However, in the case of Södertälje, the town was able to handle the political and health aspects simultaneously, ending up with a more open and effective response to the issues of uncertainty.

These three speeches, relating to experiences in different countries, offer some prudent responses with regards to the scope and impact of opening up expert appraisals in terms of the issues of uncertainty and dialogue.

Firstly, these experiences demonstrate a fairly significant change in the method of dealing with the general public. However, in most cases, these are short-term initiatives generally conceived in an *ad hoc* manner in response to the loss of public confidence and are also often followed by profound changes to expert appraisals, to the way the agencies operate or to the decision-making processes. As can be seen in the case from the UK, there is a link between the emergence of the mobile telephony controversy and the process of reforming the models for expert appraisals. This process is marked by an attempt to make scientific uncertainties more widely accessible and open up dialogue with the public, as was observed in the wake of the BSE crisis. Research in the area of social sciences has drawn important lessons from the public value of science and the processes that allow the issues raised by civil society to be incorporated into scientific work, thereby allowing researchers to act as individuals. One of the ideas is to move away from a linear model of innovation and science which takes consumers into account at a more downstream stage

and move towards a trend that forges links with social groups from the onset. However, it was also emphasised that, in general, "we are hitting the notes but missing the music".

Furthermore, scientific institutions are not always able to accept uncertainties or to handle issues raised by the general public. Despite the move towards openness, a tendency to deny uncertainties and to differentiate between scientific and non-scientific questions still remains and limits the framing of problems: radiosensitivity remains, therefore, a disputed and neglected issue. This point plays a part in maintaining a certain tension between the position of scientists and the position of civil society, rendering any debate difficult or even impossible. As mentioned by Martine Hours, the challenge is to ensure that heuristic uncertainty, which is the basis of scientific research, leads to an approach to uncertainty that broadens the debate. She considers that although the questions raised by the public were taken onboard from the onset, the situation would not be the same as it is now: overambitious. From the moment when uncertainty is recognised, dialogue between scientists and civil society becomes inescapable but possible. Dialogue can be maintained when the official and recognised studies (Interphone) report the possibility of a risk, even if it is a low one. It seems easier to reach an agreement when a hazard exists rather than when it does not. The issue at stake is managing to reach a collective agreement by carrying out joint actions in which all the players involve cooperate. The level of uncertainty decreases when carrying out work to understand what constitutes an uncertainty. This is the debate that is really required. It may create tension but it does not necessarily prevent trust from being established. In this sense, the news of the disbanding of the Foundation was not well received by its active members, its scientific committee or member associations.

In addition, as emphasised by Jack Stilgoe, when moving from an approach based on respecting thresholds to one favouring public debate, there is often a slide towards demagogy and making participation more technocratic. This case is illustrated by the case of the Transparency Forum in Sweden. Likewise, this trend towards an open expert appraisal process poses a problem in terms of defining the role of the experts. Although in the old approach described by Dr Stilgoe the experts contented themselves with presenting the scientific evidence in order to "tell the authorities the truth", within the context of the new approach, the role of the experts is redefined, as can be seen, for instance, in the recommendations made by the Stewart Report, which were much more political in nature. How can scientists respond to the contributions of civil society in scientific terms? What is the role of experts when the situation is highly politicised? A major challenge is to ensure they avoid issues that are the domain of politicians. In this sense, the case of mobile telephony is severely testing the new approach to scientific and technical governance in society.

Finally, despite the obstacles, it is clearly apparent that social sciences can play a role in opening up the field to other issues, to numerous types of uncertainty, by insisting on combining scientific and political issues. A concrete example that underpins the idea of a wider framework is the criterion of "responsiveness", which refers to the ability of organisations to handle public concerns. This criterion, used by Linda Soneryd, is an element that must be taken into account when opening up the framework in terms of risks and developing institutional structures that take multiple sources of norms into account, as well as the ability of all players involved to demonstrate connectivity. Another criterion stemming concretely from the French experience could be the attachment of all players concerned to cooperate in the form of dialogue, especially when their survival is under

under threat. However, regarding short- or medium-term decisions, the major difficulty lies in the attempt to link the idea of openness to a decision that is still based on the old model. This, therefore, is just the start of a difficult process of learning and change in which the social sciences will play the role of a benevolent guide.

Summary of Workshop 2. "Containing" occupational risks: Occupational Exposure to Toxic Substances

Coordinator and rapporteur:
Jean-Noël Jouzel, CNRS³, CSO⁴ (Sciences Po⁵-CNRS)
Moderator: Marcel Golberg, INSERM⁶

Summary: Thomas Tari, University of Paris-East

Occupational risks are a health issues of which the link to the environment has long been established. As early as the 17th century, an Italian doctor, Bernardino Ramazzini, had already established a link between the specific health problems suffered by certain professions and their working conditions. The links between work and health subsequently led to the implementation of preventative and compensatory systems, which were introduced in most industrialised countries almost a century ago. In short, acknowledgement of occupational diseases as an environmental health issue is not a recent development. Of the many environmental health crises that have arisen over the last ten years or so in western societies, however, occupational risks still remain a fairly invisible issue. The handling of such problems remains contained to limited social areas, far removed from public scrutiny. In France, the asbestos crisis in the mid-nineties seems to be more an exception than a sign that occupational health issues are gaining in political visibility. The aim of this workshop was to examine the policy of containing occupational health issues and to emphasise the role of social sciences in increasing the visibility of occupational risks.

1. Science and expertise raising the profile of occupational risks (Emmanuel Henry, University of Strasbourg)

In France, since the asbestos crisis, the area of occupational health and the administrative authorities responsible for such matters have increasingly resorted to the use of scientific expertise. France has long entrusted the prevention, compensation and research into occupational risks to organisations representing both sides of the issue; the opinions of these organisations has usually depended more on the balance of power between the areas represented (unions and management) than on the ability to use scientific expertise resources. Since the asbestos crisis, which largely discredited this type of risk governance,

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⁴ French Centre for the Sociology of Organisations

⁵ French School of Political Sciences

⁶ French National Institute for Health and Medical Research

the French State has sought to obtain an independent expert system for such issues; firstly, by using existing bodies (through the collective expert appraisals of INSERM), then by creating new bodies to implement various health safety policies over the last ten years (the Occupational Health Office of the InVS⁷, then Afsset). Paradoxically, however, the increased use of such expertise has made the issue of occupational risks even more socially invisible.

Occupational risks are, in fact, characterised both by changes to the agencies but also by a certain inertia in the management methods and the direction of policies. The approach to expert appraisals and the production of scientific knowledge is relevant when questioning this duality. Emmanuel Henry is, first and foremost, advocating a rapid re-examination of the structural reasons for the invisibility of occupational health issues. He has identified three causes:

- First, occupational health policies are based on specific configurations. They are public health policies that operate on the basis of social relations policies: consultation and consensus between unions, employers and government representatives. In France, the State has not been highly committed to such issues.
- Second, these are necessarily low-profile policies, which are marked by contradictions and are, therefore, difficult to summarise. In the area of protecting workers, it is difficult to legislate the management of known risks. This management system - different for the workplace and the general population - is based on the notion of acceptable risks; however, this idea is never mentioned in discussions.
- Finally, these are problems for specialists: these specialised issues are formulated in terms that make them difficult to popularise outside specialised circles. The transnational expert authorities keep a tight grip on their own specialised areas and it is extremely difficult for external parties to take over such issues; this issue also applies to mainstream journalists. However, when issues do arise despite these barriers, the presentation of the problem is distorted: to disqualify asbestos, for instance, the environmental argument of an epidemic was used.

On a more optimistic note, Emmanuel Henry proposed analysing the vehicles for change in this area through the intervention of science and expertise. This is an important change. Since the asbestos crisis, certain questions can no longer be framed in the same way, especially when separating the scientific expert appraisal and social negotiation phases, and the taking of decisions. What seems obvious in terms of public health risks is always problematic for occupational risks. The increased use by the French State of types of independent expertise in this area therefore remains tenuous. However, it has resulted in significant changes to the fields concerned with occupational health by favouring, for instance, the development of sub-disciplines. Dr Henry concluded his presentation by asking how these changes could influence occupational health policies. He mentioned several working hypotheses:

- Changing the balance of power between the interested parties. The example, in the case of asbestos, of the call by INSERM for a collective expert appraisal showed that the authorities' use of the expertise allowed the debate to be concluded with regard to certain issues by clearly placing the weight of the State and the authorities behind certain opinions. In the same way, the regular enquiries and multiple expert appraisals have consolidated knowledge and obliged the parties

⁷ French Institute for Public Health Surveillance

involved to take clearer positions, and move away from the system of tacit agreements that previously prevailed. Does this imply a reversal of the balance of power and a trend towards an increased symmetry of the parties' ability to use expertise resources? Can unions compete with employers in an area where they have historically shown little interest?

- Redefining the boundaries of occupational health problems. It is suggested that the growing ability to analyse and process data will increasingly contribute to establishing knowledge. Quantifying the risks and producing figures: scientific data can be more easily exported into the public arena. Increasing the awareness of such issues among other public health concerns will allow them to be taken on by non-specialists.
- Changing relations with the public arena. This change is observed in the way agencies operate, as information is now published on websites, which leads to a wider distribution. When information is made public, it is harder to challenge. The expert commissions and consultative committees constantly question the information. This leads the parties involved to internalise highly sensational risks, as certain arguments cannot be voiced in public, such as arguments that tend to favour employment over health.

2. How Social Sciences Contribute to the Production of Knowledge on Toxicological Hazards in Agriculture (Nathalie Jas, University of Paris 11)

Nathalie Jas proposes two changes: first, a concentration on the agricultural occupational environment, a sector which sees itself as different, through legislation and changing the way occupational diseases are handled; and, second, an analysis of the literature produced not in France but in the United States, on a number of regions: the United States, Latin America and parts of Africa, which has a heuristic value. Interested in public health issues linked to the use of pesticides in France, Dr Jas reported that these concerns seem finally to have been brought to the attention of the general public, particularly following the epidemiological investigations and court cases involving farmers seeking an acknowledgment that the problem constitutes an occupational disease. However, there are very few social science studies relating to this issue.

The English-language literature on the link between pesticides and health in farming is much more abundant. Interest in this issue arose in the wake of the anti-pesticide environmental movement, and was taken up by historical and political sociology researchers in the 1970s. The first major work was a thesis on the social history of medicine: *Before Silent Spring: Pesticides and Public Health in the Pre-DDT America* in 1974. The vast majority of these social science publications, from the end of the 1970s to the start of the 1980s, were not concerned with occupational risks in farming; however, oblique reference was made to this topic when certain pesticides were banned as a result of more visible public health issues. The titles are evocative: *It's not All Sunshine and Fresh Air* and *The Death of Ramon Gonzalez: The Modern Agricultural Dilemma*, an academic mainstay of environmental studies in Mexico on the subject of occupational health. From the 1990s onwards, other publications took inspiration from these initial works and historians have shown renewed interest in this field, which combines the social history of medicine and environmental history. Some of the archives have not yet been fully exploited; this is the case for the thousands of accident reports from California and the Deep South of the United States from fruit farms and cotton fields.

Dr Jas highlighted three important issues from this literature, which differs from the situation in France due to the strong moral commitments that motivate most of the authors, whilst still managing to produce serious academic work:

- An attachment to the reality of health problems. The English-language literature has attempted to remain close to observable health problems and support the moves to increase the visibility of these issues in the public arena. Work carried out in the past has made a vast amount of facts accessible, which enables arguments denying the reality of occupational health problems or those stating that such issues are being correctly handled to be challenged.
- An in-depth analysis of the mechanisms ensuring that the diseases suffered by agricultural workers remain invisible. These are the traditional mechanisms used by those who defend the use of pesticides: denial of facts, disregard for expert appraisals, reluctance to issue medical or scientific data, upholding disputes, withholding finance, training and preventing the distribution of information, emphasising the risk of job losses, etc. These practices affect those least able to defend themselves and put up a challenge: temporary workers, immigrants, etc. The literature focuses on the way this invisibility is further reinforcing the existing social inequalities. Dr Jas explained the reasons for and behind the active system, or one that is presented as such, used by a number of groups to keep health problems away from the area of public debate. She also showed that one of the effects of an increase in concerns for environmental health is a deeper questioning of intensive farming, which enhances the visibility of the related occupational health issues.
- The establishment of extremely beneficial heuristic methods to reflect upon intensive farming issues and the major paradoxes of the unfulfilled promise of a better world, as well the reality of the complex social and economic world of agriculture.

3. Technical Expertise and Social Experiments: How Do They Interact? Some observations and lessons (Omar Brixi, Consultant in Public Health)

Omar Brixi is a witness and his experience is much stronger than just words. Former head of the Federation of French Health Insurance Funds, he participated in the actions taken against the use of glycol ethers in the workplace. Since the end of the 1970s, these solvents, whose use was widespread in a number of major industries (chemical and electronic) and services (cleaning), have been suspected of having toxic effects on human reproduction (embryo deformities and sterility).

In the summer of 2000, North American lawyers, representing several hundreds of IBM employees in a court case against their employer, examined the toxic effects in France of glycol ethers. They contacted the trade unions and convinced them of the need to take action. The unions at the old IBM plant at Corbeil-Essonnes, which had been purchased by Altis, agreed to call for witness statements amongst the employees of the plant. The media, starved of good stories during the silly season, rapidly took up the cause. Approximately one hundred IBM workers from Corbeil-Essonnes were mobilised, which had an extremely rapid impact on the health authorities: the Labour Relations Department announced a number of decrees classified as "CMR" (for carcinogenic, mutagenic and reprotoxic products), effective as of February 2001. For reprotoxic substances, and on a community level, these provisions apply prevention rules in the workplace in relation to carcinogenic substances. At the same time, the "Glycol Ether Collective", which brings

together health insurance funds, experts and unions, was formed. All the parties involved in this issue had the asbestos scandal in mind.

The time of confrontation was drawing near. In April 2002, at the initiative of the Employment authorities, a type of consensus conference was organised with the various parties involved in the dispute. It ended in a violent confrontation between the Collective and the experts present. The Collective then helped the victims to bring their case before the courts. At the same time, it attempted to formalise its actions by drafting a charter requesting the banning of reprotoxic glycol ethers in the workplace; it produced a map showing the affected populations, set up independent expert appraisals and drafted regulations extending the right for compensation for occupational diseases to the descendants of the employees in cases of inter-uterine deformities as a result of chemical exposure in the workplace. This mobilisation around the victims was useful for conveying this message, yet it had the unfortunate effect of masking the exemplary work of the Glycol Ethers Collective in organising a far-reaching analysis by professional organisations on the issue of health and the workplace. There have never been so many meetings, and a convergence between unions, health insurance funds, organisations of victims, all focusing on this small chemical family. However, the Collective suffered from this policy of openness: from 2005 onwards, its attempts to expand its actions to the wider problems of chemical hazards in the workplace were met with a lack of media coverage.

What are the questions and lessons that can be drawn from this case? Omar Brixii noted during his dealings with the health and health watch agencies, a single-disciplinary and elitist conception of the issue of expert appraisals. However, it should be acknowledged that social activists are struggling to become involved in these issues and to challenge this view of expert appraisals. Even now they still struggle to develop their own knowledge and often defer, whenever possible, to academic expertise. The attitude of professional organisations is, when all is said and done, marked by compromise and radical discourse, which prevents them from fully taking on the issue of the health of their employees.

4. Discussion with the attendees

Marcel Goldberg introduced the discussion by restating that, compared with most other environmental health issues, occupational risk issues are characterised by fairly low uncertainty levels. The problems are often well-known, and have been for a long time, as was the case with asbestos. In the workplace, populations and exposures are easier to define, which reduces the difficulties encountered with epidemiology and metrology. However, even when the science is straightforward, a "metabolisation" is often lacking for the actual recognition of the occupational health issues. Those who raise the alarm for occupational risks, for example, even the most effective and despite their major role, only enjoy scant public recognition compared to figures such as José Bové or Nicolas Hulot. However, Nathalie Jas added that there are still large areas of uncertainty with regard to occupational risks, especially in terms of the diseases associated with chronic exposure to toxic substances. Most of the 100,000 chemical substances on the market have still not been evaluated. For Dr Jas, the failure to undertake occupational health research in France is, with regard to this question and others, a constant problem.

What are the reasons for this? Emmanuel Henry showed that occupational health management methods are not standardised compared with those applicable to public health. This reflects the fact that the problem has existed for many years, and has long

been the subject of a policy of preventing and compensating for risk, in short, which appears to be "managed". Furthermore, in the joint consultative bodies, how can the unions act as a spokesperson for the employees, when no union represents people exposed to incinerators, to telephones, and so on? Paradoxically, union and management representation does not increase the visibility of occupational risks but rather serves as a channel for conflicts. This situation is further exacerbated by a problem of a cultural nature: in the eyes of the general public, these issues seem "only" to concern workers. Social inequalities are translated into an uneven ability of environmental health issues to capture the public's attention. Consequently, bypassing a larger set of problems and reaching out to other areas of the public than just industrial workers is often the only way for health issues to reach a certain level of public awareness: asbestos only became a concern when academics at Jussieu feared for their lives.

The situation harks back to a political system inherited from an era when the policies employed to control occupational risks contributed to containing such issues by placing them to one side. Therefore, when questioned about the risks associated with pesticides in factories and fields, Dr Jas emphasised that there is little literature relating to factories and the reasoning of managers of plant protection companies goes along the lines of: if there were any problems, they would have first been encountered in factories; or, if there have not been any, then they would be encountered in agriculture; however, they have not been any problems; therefore, consumers do not need to be concerned. In the United States, the public emergence of the problem of pesticides in the 1960s was associated with rich residents moving to suburbs near fields where such substances were spread. Alliances were then formed between environmentalists, workers, women's movements, and so on. However, this environmental justice movement that developed in the United States is difficult to export to France, where the union traditions do not greatly favour the development of such alliances.

The question of the place and role of victims was then tackled. The victims can be a factor in increasing the visibility of occupational risks. Omar Brixii did, however, mention the case of the Association of Victims of Glycol Ethers which was started after the call for evidence amongst former IBM employers, but this is an extremely tenuous association. This example demonstrates that the mobilisation of victims is not at all obvious and that the case of the National Association of Asbestos Victims constitutes an exception.

At the same time, what about changes to expert appraisal activities? A question was raised about the role of occupational physicians. Dr Henry recognised the major role of such sources of information and creators of a local networks, which can support involvement in a dedicated structure; however, he noted that this involvement is not systematic and remains dependent on individual strategies, which only occasionally affect the balance of power that contain occupational risks. This was also emphasised by Marcel Goldberg who noted that, in France, international expertise or a PhD in epidemiology was required to be invited to sit around the table, as experts, employers and union representatives reach agreements without necessarily worrying about science.

The workshop ended, however, with the optimistic words of Marcel Goldberg: major progress has been achieved in terms of the visibility of occupational risks. Changes have only occurred in recent years, supported by serious studies in the area of human and social sciences on this issue. The very existence of this workshop, specifically devoted to

occupational risks, during this conference on *Governing uncertainty: the contribution of social sciences to the governance of environmental health risks*, attests to this fact.

Summary of Workshop 3. New Dangers, New Uncertainties: Nanotechnologies

Coordinator: Pierre-Benoit Joly, Inra⁸
Moderator: David Vernez, Afsset⁹
Rapporteur: Matthieu Fintz, Afsset

Summary: Giovanni Prete, CSO¹⁰

Within a multidisciplinary perspective, the workshop pondered the issues of the “new dangers” and “new uncertainties” attached to “nanomaterials”. The inverted commas are used here advisedly. The presentations and discussions on the interventions of Francelyne Marano (Toxicologist, University of Paris 7), Stéphanie Lacour (Lawyer, CECOJI-CNRS) and Alain Kaufmann (Sociologist, University of Lausanne) led to questions rather than an acceptance of the stability of the boundaries of the nanotechnology issue¹¹; there were also questions on its specificity in relation to other issues and on the method of moving beyond the risk and uncertainty concerns.

1. Nanotechnology: an issue of high involvement

The three speakers emphasised, each in their own way, the high levels of involvement and mechanisms of which nanotechnologies have been the subject for some years now. Taking inspiration from the work of Rip and Van Amerom¹², Alain Kaufman described a well-ordered chronology of the emergence of nanotechnology as a public issue. An initial phase classified as the “Risk Denial” phase, during which, despite the emergence of alarmist statements on the consequences of the development of nanotechnologies¹³ and the critical stance of several interested parties¹⁴, a positive view of nanotechnology prevailed. A second phase, as of 2004, when the risks of nanoparticles were taken seriously and considered in conjunction with other issues, that was marked by a profusion of institutional initiatives from the scientific, legal and economic points of view. Finally, and very recently, a third phase during which nanotechnology as a public issue has gained

⁸ French National Institute for Agricultural Research

⁹ French Agency for Environmental and Occupational Health Safety

¹⁰ French Centre for the Sociology of Organisations

¹¹ In this summary, the term Nanotechnology is used to describe a fairly fluid grouping implicated with several issues raised during the workshop: nanoparticles, nanomaterials, nanotechnologies, nanosciences, etc. At present, as restated by S. Lacour, it is important to establish appropriate definitions to carry out a precise analysis and pertinent actions.

¹² “Emerging de facto Agendas Surrounding Nanotechnology: Two Cases Full of Contingencies, Lockouts, and Lock-Ins” in Kaiser M., Kurath M., Maasen S. and Rehmann-Sutter C. (Eds.) *Governing Future Technologies. Nanotechnology and the Rise of an Assessment Regime*, Springer, Sociology of the Sciences Yearbook, Vol. 27 (To be published).

¹³ Here A. Kaufman is particularly referring to the debate that followed the publication of the books by Eric Drexler *Engines of creation* et du roman *Prey* by Michael Crichton

¹⁴ The Report from the Munich Re Group “Nanotechnology – What is in store for us?” which explores the risks associated with Nanotechnology, published in 2002, passed unnoticed. Online: http://www.munichre.com/publications/302-03534_en.pdf

ground and taken shape in the form of initiatives advocating an upstream engagement and the contribution of the general public.

This dynamic presentation of the issues involved in the use of nanotechnology allows an assessment of the significance of the scientific players and their involvement. Francelyne Marano, a toxicologist and public authority expert, underlined what, in her opinion, constituted the particular nature of the nanotechnology issue: in her field of research, it is the wide-ranging past research into microfibrils and microparticles that has allowed scientists to ponder the issue of uncertainties in relation to nanomaterials. This position taken by certain scientific players in their involvement poses a number of extremely interesting questions. Did other contextual conditions exist on top of the knowledge extrapolated from other issues (such as asbestos and diesel) which allowed scientists - to use the words spoken by B. Chevassus when answering Louis¹⁵ - to believe there was an overwhelming array of corroborating evidence pointing to the possibility of risks thereby justifying involvement? For instance, could the example of nanotechnology be used to support the emergence of more introspective systems of scientific engagement? Prof. Marano also queried, as Pierre-Benoit Joly pointed out during the discussion, the issue of the link between the method of framing the uncertainties and the institutional and epistemic positions of researchers and experts, who are the main players involved in establishing the framework.

Away from their laboratories, scientists have widely participated in the process of establishing nanotechnology standards. The presentation of Stéphanie Lacour outlined the plethora of standards relating to this issue. Although there have long existed, as she recalled, legal instruments to control the risks involved with new technologies, the last few years have seen, within a context of greater precautionary principles (constitutionalised in France by the signing of the Environment Charter, which since 2005 has formed part of the preamble to the Constitution), the issuing of many standards are not all legal: resolutions, opinions from agencies and committees (e.g.: Afsset, HCSP¹⁶), quality standards (ISO TC229), good practice codes, etc. At the same time, the authorities launched a large number of research programmes that explicitly took into account the issue of risks and uncertainties. The rise in the number of initiatives seems to indicate that the national and international authorities are aware of the extent of the challenges involved with a responsible development of nanotechnology. However, according to Dr Lacour, despite appearances, this increase in awareness remains "fragmentary" and, highlighting the example of the issue of financing the research, emphasised that even though quite large amounts are allocated to such research, the amounts are much lower than those allocated to the New Information and Communication Technologies, and only marginally take into account the issue of risks.

2. Many uncertainties

In general, one of the main acknowledgments of this workshop is that despite the increased importance of nanotechnology as a public issue and the reality of involvement, many technical, institutional and social uncertainties still surround its development.

¹⁵ Intervention in the first session "Quantification or Qualification: Which Risk Assessment?"

¹⁶ High Authority for Public Health

Prof. Marano outlined some of the debates that were motivating the scientific community¹⁷. The established data on the health effects of fine and ultrafine atmospheric particles has justifiably raised the concerns of the scientific community in relation to particles manufactured at sizes below 100 nanometres, even when the only data available is fragmentary toxicological data, often carried out on cell cultures or animals. For example, the data reveals that different biological responses are observed in microparticles with the same chemical composition; differences that could be linked to the effect of surface or number. Prof. Marano detailed the case of carbon nanotubes - a product with various industrial applications - whose resemblance with type of asbestos fibre raises multiple health issues, especially in relation to their ability to accumulate in the lungs. She mentioned two recent studies on mice which, although debatable, concluded that carbon nanotubes were able - in common with asbestos - to produce lesions and induce the appearance of mesothelioma¹⁸. The toxicological studies and especially epidemiological studies required to examine these uncertainties in greater depth are currently faced with a problem of metrology: the conventional methods used to measure exposure which associate mass and chemical composition do not appear to be suitable. There is a lack of established protocols and tools for assessing the risks associated with the nanomaterials, a shortcoming that is generally undermining the mechanisms available to institutions for carrying out risk assessments.

The institutional uncertainties fall into certain categories. Firstly, Dr Lacour emphasised that most of the standards governing the protection of public health and the environment refer to technical elements (metrology, classification, quality thresholds, etc.) which do not appear to have any scientific relevance for nanoparticles and nanomaterials. This limitation is particularly noticeable in the case of the REACH regulations. In fact, these regulations do not refer to the shape, size or the manufacturing process of the substances and only request information based on production tonnage thresholds (below 100 tonnes, the information required is limited), which is not adapted to the actual industrial production of nanomaterials (low-level production and potential agreements between manufacturers to not exceed the statutory thresholds). Secondly, Dr Lacour mentioned the incoherency that could arise as a result of the proliferation of laws, emphasising, for instance, the lack of fixed terminology to describe the nanomaterials, and raised the question of the need to create a legal vocabulary for such issues. Finally, even if a fixed system of standards could be reached in relation to the development of nanoparticles and nanomaterials, and in relation to the risk assessment, a number of uncertainties would still remain with regard to the methods used by the public and private players when applying the standards: the slowness of the standardisation process compared to the innovation process, the lack of resources of the authorities responsible for applying the regulations (e.g.: checking compliance with employment law), and the companies producing the nanomaterials bypassing or ignoring these regulations, were some of the difficulties raised by the speakers and in the discussions. For example, although in France it is now seemingly possible - as emphasised by Daniel Bloch - to identify the private manufacturers of carbon nanotubes and check they are implementing the safety measures, it is

¹⁷ Reference should be made to the article in the special edition of the review *ADSP* (no. 64) of HCSP devoted to nanotechnologies, online at <http://www.hcsp.fr/hcspi/explore.cgi/adsp?ae=adsp&menu=111281&clef=104>

¹⁸ Poland, C. A., Duffin, R., Kinloch, I., Maynard, A., Wallace, W. A., Seaton, A., Stone, V., Brown, S., Macnee, W., et Donaldson, K. (2008). Carbon nanotubes introduced into the abdominal cavity of mice show asbestos-like pathogenicity in a pilot study. *Nat Nanotechnol* 3, 423-428.

Takagi, A., Hirose, A., Nishimura, T., Fukumori, N., Ogata, A., Ohashi, N., Kitajima, S., and Kanno, J. (2008). Induction of mesothelioma in p53+/- mouse by intraperitoneal application of multi-wall carbon nanotube. *J Toxicol Sci* 33, 105-116

extremely difficult to obtain a coherent overview of all the production chains and the use of the nanomaterials, as they are linked by a complex network of subcontractors.

The report of Alain Kaufmann emphasised the important role played by all the institutions involved in the participatory process and their recommendations; this role reflects – to use the words of Arie Rip - a sort of nanophobia-phobia¹⁹, i.e. a fear of experiencing the emergence of vast opposition movements. This position is mainly based on a fear of triggering a controversy similar to the one surrounding GMOs, which is used as a point of reference by the public and private players. An analysis of around one hundred participative processes, concerned with the issues involved with nanotechnology and varying widely in nature (consensus conferences, citizens' juries, scenario workshops, focus groups, citizens' hearings, etc.), did not result in the participants' monolithic rejection of nanotechnology; however, it did reveal a complex perception of the possibilities opened up by the technology (on a medical, environmental and economic level) and led to many questions regarding its potential consequences. For example, who needs such technology? Who will assume responsibility for any unforeseeable effects? What will be the consequences for poorer countries? Having raised these questions, the issue is to determine how they can be taken into account in the regulatory mechanisms and by the experts and decision makers. Alain Kaufmann emphasised that the possibilities and limitations of the participative processes should be examined at the same time as the reforms to expert appraisal methodology. The relevance of these processes resides in their ability to become an arena for collective learning where the various parties involved can explore the issues, which will only be effective if it is not marginalised in regulatory instruments²⁰.

3. Regulating nanotechnology, beyond the risk

Certain participants wondered whether it was already too late to regulate nanotechnology. However, everyone agreed with the statement that we are currently in a period of transition and it is difficult to predict future developments, although a number of questions have been raised. Dr Lacour wondered how it could be possible to ensure that, taking into consideration the way the research systems operate, the call for research in the area of reducing the field of uncertainty would not be in vain. In particular, how could it be possible to link the financing of projects - which should become the rule - with the need to train specialists whose skills are acquired over the long term? How can the theoretical frameworks for expert appraisals be updated to take into account the specific characteristics of the emerging technologies?

Within a regulatory perspective, two main questions emerged from this workshop. The first question focused on which risk regulation system should be favoured. Pierre-Benoit Joly emphasised that in the current situation, two directions were possible. Firstly, a state-dominated regime in which the authorities and public administrators create and apply standards in the public interest. Secondly, a more liberal regime where the responsibility for risk management is handed over to private stakeholders and consumers (soft law). Each of these directions has its own limitations, as illustrated by a few concrete examples.

¹⁹ Arie Rip, "Folk Theories of Nanotechnologists", *Science as culture*, Vol. 15, No. 4, 349–365, 2006

²⁰ For a detailed analysis of the virtues and limits of the approaches used in the nanotechnologies, read Joly P.B and Kaufmann A. (2008) "Lost in translation? The need for "upstream engagement" with nanotechnology on trial", *Science as Culture*, 17(3), pp. 225-247 as well as Kaufmann A., Joseph C., El-Bez C. and Audétat M. (2009) "Why enrol citizens in the governance of nanotechnology?", in Kaiser M. et al., *Op.cit.*

The Grenelle Environmental Forum was, for instance, an opportunity to explore the labelling of products containing nanomaterials. At present, most consumers are unaware that hundreds of marketed consumer products contain nanomaterials²¹. In view of this fact, some believe it is necessary to implement a compulsory labelling system for products containing manufactured nanomaterials, in common with the situation set up for GMOs. However, not only does this imply the availability of methodological and measurement tools to ensure traceability but it also implies a move towards a liberal regulatory regime for risks, which ultimately makes consumers responsible for managing their own exposure.

The second, more general, question arose during the speech of B. Wynne in the plenary session²² and his remarks aimed at encouraging a move beyond the concerns about uncertainty solely considered from a risk perspective in order to lower the uncertainty. His first comment was that debates focusing on risks are often debates about the risk of *something*. However, the discussions during the workshop showed that, in the case of the emerging field of nanotechnologies, it was difficult to identify the relevant purpose of the analysis: should the debate be focused on nanoparticles, on the risk of convergences²³ or on the risk posed by nanoscience and nanotechnologies? Each of these options is a way of framing the debate and lowering the number of questions raised. The second comment, which was mentioned several times during the symposium and illustrated by the intervention of Francelyne Marano, revealed that advances in scientific knowledge were a factor in increasing rather than reducing the levels of uncertainty. Furthermore, it may be unrealistic to expect current research to move forward on this issue before changing the regulatory instruments. Finally, it seems that focusing solely on the issue of risks is obliterating a number of essential aspects of the problems. Stéphanie Lacour illustrated this point by emphasising that it was worth taking into account the way the European institutions operate, especially the opposition between the European Parliament and Commission, when attempting to understand the changing nanotechnology standards (e.g.: the Resolutions of 24//3/2009, 25/3/2009 and 24/4/2009). Alain Kaufmann confirmed this point by emphasising that it was necessary to take into account the link between the general dynamics of the public debate, the number of players and the internal operations of the participative processes.

The move away from a focus on risks and the management of uncertainty is certainly one area where social sciences can contribute. By taking into account the values of the players and their interests, by identifying the (in-)commensurability between the different epistemic cultures and by supporting the future work to establish a framework, they can certainly contribute to maintaining the politicisation of the issues involved which, in common with nanotechnology, have reshaped the relationship between science, politics and society.

²¹ See an attempt to carry out an inventory of these products under the scope of PEN (*Project on Emerging Technologies*) <http://www.nanotechproject.org/inventories/>

²² Intervention during session 3 entitled: "Emancipating Ourselves from some Myths about the Fears of "The Public""

²³ The expression "converging technologies" (NBIC) generally refers to a combination of nanotechnologies, biotechnologies, information technologies and cognitive sciences, a combination presented both as posing a threat but also offering enormous promise.

Summary of Workshop 4. Air Pollution: An "Acceptable" Risk?

Coordinator and rapporteur:
Olivier Borraz, CNRS²⁴, CSO²⁵ (Sciences Po²⁶-CNRS)
Moderator: Sylvia Medina - InVS²⁷

Summary: Lydie Cabane - CSO

Air pollution has long been recognised as an environmental problem with risks for the health of the population. Scientists have regularly warned of the harmful effects of air pollution on personal health and, in the 1990s, managed to place the problem on the public agenda. Nevertheless, despite the recognition by the authorities of air pollution as a public health issue, the risks associated with pollution and the impact on personal health remains poorly managed and the pollution reduction policies connected to road transport, in particular, still remain fairly limited.

To understand this discrepancy, it is worth asking whether air pollution constitutes an "acceptable risk" - a notion with a double meaning. Firstly, although it is a well-documented risk, no significant policies have been implemented to limit air pollution, although there are a number of measures aimed at lowering its effects. Secondly, the subject is no longer controversial and the debates around this problem seem to have settled down. Therefore, can the risks associated with air pollution now be considered to have been accepted by all parties involved? If yes, how can the debate around air pollution be reopened to reinforce risk management policies and reduce air pollution? If the debate needs to be re-launched, what conditions, action levels and interested parties would be called upon to increase interest in this issue, and what information and knowledge could be used?

These issues were examined in the workshop using three different contributions. The first, by Franck Boutaric a political scientist, recounted the way the public issue developed and the policies used to combat urban air pollution since the beginning of the 1990s, basing his analysis on the controversies, the public action mechanisms, the official reports and the discussions of the Grenelle Environmental Forum. The second, by Philippe Glorennec, an epidemiologist at EHSP²⁸, presented the challenges of the methods used to assess the impact of air pollution since the 1990s - methods which helped to demonstrate its harmful effects. Finally, Isabelle Roussel, a climatologist and geographer, and vice-chairwoman of APPA²⁹, emphasised the proximity issues and the problems in setting up local governance and the weight of public representation. The debate was moderated by Sylvia Medina from the InVS.

²⁴ French National Centre for Scientific Research

²⁵ French Centre for the Sociology of Organisations

²⁶ French School of Political Sciences

²⁷ French Institute for Public Health Surveillance

²⁸ French School of Public Health

²⁹ French Association for the Prevention of Air Pollution

1. Air pollution, an "acceptable" risk?

The debate on air pollution arose in the 1990s with the emergence of two controversies. The first concerned transport as a source of air pollution, an issue that led to a confrontation between car manufacturers and scientists. The second concerned the effects of pollution on health, using new epidemiological methods, which contributed to opening a scientific controversy. These two controversies placed air pollution on the public agenda, and resulted in the French Law on Air Quality and the Rational Use of Energy (Laure), which was passed in 1996. At the end of the decade, the risks associated with air pollution were therefore well-known, the controversy had abated and the debate was now focused on indoor air pollution.

In the decompartmentalization that led to a reopening of the controversy, the work of epidemiologists played a central role, particularly by developing measurement instruments to facilitate the identification of the risk, thereby leading to an increase in the available information and the actions taken against air pollution. For example, the ATMO index, created in 1991 to provide information to citizens on air pollution levels, raised the level of public interest by providing information and alerts; the efficacy of the scheme has been proven despite the initial scientific controversy relating to the relevance of the measurement. Equally, the methods used to assess the impact on health of air pollution, presented in detail by Philippe Glorennec, further fuelled the public debate. The new epidemiological methods introduced in France in the 1990s provided detailed measurements of the effects of pollution in terms of morbidity and mortality in individuals and in the overall population. These techniques made it possible to consolidate scientific knowledge, to determine the effects on health of air pollution (bronchiolitis, asthma, increased mortality, etc.) and to measure the health benefits associated with pollution management scenarios. The risk is now known, confirmed and publicised and it is impossible to talk about unknown risks, especially as it has been demonstrated that no safety threshold exists and pollution always has an effect, irrespective of the length of exposure, even outside "peak" periods. These tools also have a pedagogical value as they are easy to understand by the public and use by the authorities. They have been included in parliamentary, scientific and administrative reports and have led to the implementation by French Préfets of restrictive local measures based on precise assessments of the situation on a local level.

Consequently, a relative consensus seems to be taking shape in relation to defining the problem, its causes and effects - though probably less in terms of its management, as noted by Dr Medina. Rigorous methods for assessing the effects of pollution have been established by scientists, allowing them to reach an agreement with regards to its negative impact on health. Nevertheless, despite data confirming the existence of this risk, there is still a major issue in terms of the current prevention and management measures, which remain both unsuitable and unsatisfactory. The regulations do not offer an adequate framework in terms of emissions and the limitation of pollutants, even though the positive effects of pollution-reducing policies on health and life expectancy have been well established. This issue is no longer the subject of public debate, although coronary and lung diseases are better identified, and the effects of pollution on respiratory and cardiovascular diseases, and even on reproduction, are increasingly well-known. This situation is surprisingly similar to the one observed with occupational risks where the scientific knowledge relating to the health risks did not automatically result in public action

seeking remedy against such risks. Paradoxically, the absence of scientific uncertainties does not lead to more actions. Yet is the risk accepted by everyone?

Although, on a global level, it can be said that an agreement has been reached with regard to the existence of the risks associated with air pollution, or even a certain acceptance, these risks, however, continue to be rejected by a number of individuals. Such persons clearly perceive them as a nuisance for health against which they are powerless, as clearly stated by Prof. Roussel. Moreover, the risks associated with pollution are sometimes unrecognised or not perceived as relevant. It was emphasised that major differences existed throughout the country with regard to knowledge of the risks. In Mayotte, for example, the car is not perceived as a worrying polluting element but as symbol of development and, due to a lack of alternative transport solutions, any actions is more concerned with waste or water pollution. This comment confirmed Prof. Roussel's analyses with regard to pollution constituting a matter of individual perception, which increases the importance of studying these representations.

2. What conditions are required for re-launching the debate on air pollution?

Faced with a static management of the risks associated with air pollution, opportunities to reopen the debate are appearing. These opportunities result from a series of institutional and political changes: French State reforms on a regional level, the reform of health services and the setting up of Regional Health Agencies, the 5th inter-ministerial conference of the World Health Organization on environment and health which, in 2011, will focus on children, the debates on climate change and, finally, growing attention paid to the link between health and the environment, especially around notions of environmental justice and accountability. These opportunities appear as a chance to place the problem of air pollution back on the agenda by associating it with other issues, as well as expanding the scope of involvement and action.

However, the option to reopen the debate is fraught with danger, as the pollution issue may become diluted amongst a whole raft of other problems. For example, bringing the issue closer to problems of climate change, which has appeared as a possible lever for the social movements wishing to expand the debate and obtain a greater visibility, also threatens to dilute the health issues within a generalised debate, as was experienced at the Grenelle Environmental Forum. Another limitation concerns the debate on the notion of environmental justice: localised measurement systems have revealed health inequality throughout the country and therefore increase local debate and actions; however, interested parties (associations, experts, elected representatives, the media) need to take up the issue.

Therefore, as emphasised by Jean-Michel Fourniau, although the extent of the problems has been clearly identified, the range of solutions still remains problematic and is even the source of the problem, especially due to the fragmentary method of dealing with the issue. The method of defining the problem of car pollution using technical and not health issues resulted from adopting an institutional system in the past concerned with industrial pollution, a regulatory mechanism controlled by the ministries of industry and transport and manufacturing companies which, as stated by one member of the public, have hijacked the issue of air pollution. The risk was delimited and denied by powerful economic interests. Equally, focusing on individual protection strategies when faced with pollution also limits the impact of collective efforts, especially in terms of transport, and

reinforces the perception of the risk as inescapable. This fragmentation is also experienced amongst the scientists who, as Philippe Glorennec has recalled, have never been concerned with air pollution as a whole. The technical nature of the epidemiological studies also plays a role in the fragmentation and de-politicisation of the debate on air pollution, by limiting its use by lay persons. Public policy only partly assists the issue by emphasising the most visible and exceptional phenomena (pollution peaks), despite the fact that it has been widely shown that ordinary pollution levels are the most harmful due to their recurrent nature. Ultimately, it seems it is the public policy fragmented between the various sectors, regional areas and the multiplicity of technical instruments that hinders the opportunity of reopening of the debate. Consequently, the solution seems to reside in obtaining an overall solution that integrates the various levels of action and knowledge.

3. The levers required to re-launch the debate

The reopening of the debate requires a global approach to the problem, taking into account the effects of a number of players and the interactions between various levels of action; and it could also become a political issue again by using other types of knowledge. The challenge is to create new uncertainties around air pollution by establishing new controversies, which would enhance the debate and increase the actions.

Several players appear to possess the potential to re-launch the debate or implement actions to combat air pollution. For Prof. Roussel, the answer lies with the individual: individuals can carry out actions to protect themselves, which can compensate for the heterogeneous situation with regard to individual risks and perceptions that complicate any collective and standardised management of the risk. Dr Medina, in turn, insisted upon the ability to mobilise communities. Finally, several speakers emphasised the role of social sciences in covering the entirety of the debate.

Regarding action levels, it appears that effective actions can be most easily set up on a local scale, as the local authorities need to be accountable to the direct demands of the population. Prof. Roussel believes that urban areas should be preferred as the most relevant place to carry out actions on proximity pollution, while Dr Medina, however, points to the role of regional authorities due to their increased ability to intervene and political importance. Franck Boutaric noted the importance of European regulations which, in particular, have encouraged debate on fuel specifications by widening its scope from merely discussions between the ministry for industry, oil producers and manufacturers. Another example is the 1992 European Ozone Directive promoting the right to information, which is a tool used by healthcare professionals and environmentalists to increase the visibility of the problem and interest of the population. Nevertheless, although each of these levels includes significant margins for action, alone they cannot solve a problem with multiple dimensions that is not confined to a limited regional area. It is therefore important that the interactions between the various public policies should not be overlooked, and action taken to coordinate them, as the core problem especially concerns transport policies, on which the power to act of local or European authorities is limited.

The irrefutable pollution analyses issued by epidemiologists have had the paradoxical effect of failing to produce the desired effects; therefore, what other types of knowledge could be used to re-launch the debate? One solution could consist in using the knowhow

of activists or lay persons, who are able to voice the issue of new uncertainties with regard to the risks associated with pollution. For example, the Provence Health and Safety Association measured pollution levels in daycares – an action seen as a way for local players to reclaim the debate by imposing their own concerns rather than those of epidemiologists - who rejected this method as being non-scientific. The activists' knowhow represents a move away from the highly technical arguments which the general public find difficult to understand. In conjunction with the militants' concerns, Dr Medina insisted, as an epidemiologist, on the importance of sharing scientific information with the general population and of the need to work harder on developing the links between the scientists and social movements to reinforce the actions taken to achieve a common goal: reducing air pollution.

Finally, the issue of the role of social sciences in reopening the debate was raised. Although at present there are no attempts to bring together all the elements of the air pollution problem, social sciences, with their ability to produce a global discourse, can assist in the efforts to overcome the fragmentation of the issue. Social sciences are able to highlight the existence of powerful and structured interests, which prevent the problem from being defined. This denunciation undoubtedly presents a risk for the authorities, but it could open the way for pollution-reducing actions. Public authorities must, therefore, accept the reintroduction by social sciences of the notion of uncertainty into the definition of the problem to enhance the management of the risks associated with air pollution.

Summary of Workshop 5. Epidemics of Unexplained Symptoms

Coordinator: Yannick Barthe, CNRS³⁰, CSI³¹

Moderator: EPHE³²

Rapporteur: Madeleine Akrich, CSI

Summary: Julien Gauthey, CSI

The talks focused on situations in which health problems were caused by either totally unknown or controversial reasons. This workshop was chaired by Jeanne Favret-Saada, an anthropologist at the Practical School of Advanced Studies (EPHE): in the first presentation, Catherine Rémy (CNRS-CSI) outlined the initial findings from research she was carrying out with Yannick Barthe on sick building syndrome; after this, Mark Lorient (CNRS- Georges Friedman Laboratory) presented the results of his work on chronic fatigue syndrome and fibromyalgia; Alain Collomb (a general practitioner and member of the Health and Environment Association - Provence (ASEP)) then talked about multiple chemical sensitivity (MCS); the final contributor, Nadia Nikolova (a doctor at CAPTV Paris (Poison Control Centre), and a consultant at Fernand Widal Hospital for occupational and

³⁰ French National Centre for Scientific Research

³¹ Centre for the Sociology of Innovation

³² Practical School of Advanced Studies

environmental diseases), outlined her interest in chemical odour intolerance syndrome (COIS). Significantly, these last two presentations related to the same disease: the fact that it can be referred to by different names illustrates the uncertain and unstable state of knowledge relating to such health problems at present.

The discussions gave rise to lively and fruitful exchanges with the participants; as will be seen, the role of social sciences in the governance of health and environmental risks - the central theme of the symposium - was the main focus of the debate during this workshop.

1. Various unexplained symptoms or controversial diseases.

Catherine Rémy's speech on sick building syndrome questioned the psychological qualification of these health issues and the problematic consequences of such an aetiological limitation. Her contribution highlighted two contrasting cases. One opposed the views of the victims with those of an expert who worked on a case of sick building syndrome at the town hall of Villejuif: whilst the victims continue to seek the cause of the symptoms they are still suffering from, the expert claimed that the symptoms had a psychogenic explanation. The second contrast opposed France to English-speaking countries, especially the United States. In France, the health authorities rapidly assimilated sick building syndrome with a psychogenic syndrome; American experts, however, did not discount the hypothesis of an environmental cause. Research into sick building syndrome has also contributed to the notion of indoor pollution³³, which is now widely recognised. Conversely, for the "French interpretation", the institutional authorities used human and social sciences to provide reasons other than physical and environmental causes. However, for Dr Rémy, the acceptance of such theories tends to discredit the views of the victims and take a controversial stand. In her opinion, human and social sciences can nevertheless shed some light on the problem, especially by analysing the controversies.

The contribution of Marc Loriol sought to demonstrate the central role played by patients and patient associations in the social structuring of chronic fatigue syndrome and fibromyalgia. In his opinion, using a social structure as a metaphor allows an analysis of the role of the various parties involved in the process of determining a pathological entity. He first showed how the associations of fibromyalgia and chronic fatigue patients played an essential role in gaining recognition for these diseases. As a result of various activities (ethical company, lobbying, work on terminology, data collection, communication, etc.), these associations have not only participated in the work to define and categorise these diseases but have also helped to identify the causes and appropriate treatment. After this, Marc Loriol showed how the notion of a social structure allows the disease to be understood in terms of an individual outcome. Regarding fibromyalgia and chronic fatigue syndrome, he described the various stages that allow patients to be recognised as being unwell. He again highlighted the work carried out by the patient associations and the patients themselves to dispute a psychological explanation for their symptoms, which the medical profession frequently put forward.

³³ On this subject reference should be made to the publication of Murphy Michelle (2006) *Sick Building Syndrome And the Problem of Uncertainty. Environmental Politics, Technoscience, And Women Workers*. Duke University Press

In his talk on multiple chemical sensitivity, Alain Collomb examined the different ways various countries recognise and explain the disease. In the United States, Canada, Sweden and, recently, Germany, multiple chemical sensitivity refers to a disease with an environmental or physical origin. In the countries of southern Europe and France, this disease has not always been recognised on an institutional level. The difficulties encountered in defining non-specific symptoms and in establishing a link to the environment have long resulted in a psychological explanation. Nevertheless, Dr Collomb reported that from the mid-twentieth century, the date when the symptoms were first described, to the present day, research has revealed the environmental origin of this disease. In the footsteps of Dr Marc Cullen, who devised the term multiple chemical sensitivity in the mid-eighties, the team of Professor Martin Pall recently discovered the physiopathological mechanisms likely to occur following exposure to chemical substances. Dr Collomb then examined the consequences of the failure by the French authorities to take these results into consideration. In addition to the lack of institutional recognition, he also highlighted the risk for patients of the failure to provide treatment or medical cover for multiple chemical sensitivity.

Nadia Nikolova tackled the same health problem as Dr Collomb. Although also mentioning the difference between the North American countries and France, she focused her contribution on the various theoretical frameworks existing to gain an understanding of this syndrome. The controversy surrounding this syndrome was not related to the actual phenomenon but rather to the hypotheses put forward to explain it. In fact, the clinical picture of this disease, which is characterised by a long list of varied symptoms, was the subject of a consensus in 1999. However, there are several explanations based on different opposing medical and non-medical disciplines: an immunological theory, a neurophysiological theory, two psychiatric theories, and even two behavioural theories derived from the Pavlovian mechanism all superimposed on the physiopathological hypotheses previously described by Dr Collomb. The raft of explanations surrounding the origin of the disease reflects, in the opinion of Dr Nikolova, a major scientific and medical uncertainty. Moreover, despite advances with regard to the knowledge of the chemical odour intolerance syndrome, it is always diagnosed after eliminating other causes. Having stated the above, Dr Nikolova pointed out that the controversy surrounding the causes should not prevent the victims from benefiting from medical cover.

2. Areas of convergence and an issue for debate

There were, however, areas of convergence between the situations outlined. Irrespective of the nature of the unexplained symptoms, the contributors described, sometimes in fairly varying terms, the same controversial areas and the same trajectories. The ensuing fairly lively debate with the participants focused on the place and role reserved for human and social sciences in attempting to "resolve" these problematic situations. Amongst the areas of convergence, the first appears to have a special status, as it is in relation to this point that a certain number of more or less explicit recommendations have been formulated.

It was noted that the situations analysed were marked more by ignorance than by uncertainty. The uncertainty can relate to the very existence of the symptoms. It can also surround the causes and origins of the symptoms and refer more precisely to a situation of ignorance. The delimitation between these two situations is fairly fluid: the speakers outlined the difficulties encountered by victims to gain recognition for their symptoms in

the absence of any explanations. However, when faced with ignorance, the uncertainty related less to the existence of the unwell than to the reason for what was making them unwell. These enigmatic situations could be used to support further research into and information on environmental health; however, the contributors reported a tendency to "psychologise"³⁴ the problem. This kind of approach seeks the origin of the symptoms "in the patient's head"³⁵ or in "social" causes, when it is impossible to establish any physical or environmental explanation. Some of the participants queried the consequences of trying to psychologise the situation, which is quite prevalent in France, and the role to be attributed to psychology. Besides this tendency towards psychologisation, the contributors also shared other areas of convergence and issued several recommendations.

All the presentations emphasised the important role of patients or associations of patients to increase knowledge about their disease and to advance research. Nevertheless, in France this role is not (always) sufficiently recognised by the medical profession. Contrary to the situation in other countries, the position awarded to them is not commensurate to their potential contribution. Explaining the syndromes in psychological terms disqualifies the disease, which victims consider as a denial. For the participants, this is symptomatic of the failure to include such diseases in the medical research process.

Another area of convergence related to the need to move away from pre-established ways of thinking to find answers. The complexity of the environmental health problems obliges researchers to use other bodies of knowledge from other disciplines and update the methods of providing evidence. The health authorities and experts are aware of these new constraints. They seem, however, to be experiencing a few difficulties in admitting the limitations of their measurement and conceptual tools. The fact that they are resorting to explanations from the area of human and social sciences when nothing new is reported on a biological level also attests to a certain multidisciplinary approach. The third point focused on the relevance of the Cartesian duality between body and mind which has proved to be ineffective and counterproductive in the aforementioned situations. Finally, all the contributors agreed to the need to act on two different fronts when faced with uncertainties: initially, a clinical approach is required to ease the pain of patients when it is not possible to cure them; at the same time, investigation work should be carried out in partnership with the patients. In other words, all parties involved must be reminded that uncertainty does not imply inactivity but, on the contrary, it implies an increased workload.

The role of human and social sciences vis-à-vis situations of uncertainty was widely debated during this workshop. It can be said, by exaggerating a little, that this debate revealed two fairly divergent positions: firstly, a position that assigned a complementary role to human and social sciences when faced with a medical profession that is powerless to explain the situation; secondly, a position that refuted the ability of human and social sciences to replace medicine when establishing the causes³⁶ For those advocating this second position, not all sciences have the vocation or ability to become immediately operational. Human and social sciences should therefore be considered as a tool for reflection and re-assessing how to address the issue. Their role is not to provide the health authorities with the causes to explain a health issue, as the supporters of the first

³⁴ "Sociologisation" is also a trend that has been observed. However, the number of sociologists intervening in this way is much lower.

³⁵ Expression that refers to a psychosociological explanation. "In the brain", for example, seemingly referred to a biological explanation.

³⁶ Referring incidentally to an old well-known dispute between "explaining" and "understanding".

position believe. They should produce accurate descriptions and supply all players with a certain number of concepts to reflect upon to resolve any problems. From this perspective, human and social sciences have a duty to investigate all involved players, including the healthcare professionals, and to examine them in symmetrical manner. However, divergent opinions remained with regard to the contribution made by social sciences to the governance of uncertainty. Nevertheless, the discussions managed to shed light on certain misunderstandings and, in practice, this should result in new forms of collaboration between the health authorities and those representing human and social sciences.

To conclude, this workshop attempted to take up two challenges. Firstly, it attempted to determine how to provide patients with answers when the cause of their illness is unknown, whilst still leaving the field open to seek other causes. It was emphasised that acting in a fairly distinct manner on two fronts should be possible: when no rapid answer is available to explain the problem, an ignorance of the cause does not imply that the patients should be ignored. The participants of the workshop then questioned the new methods devised to supply information in this type of situation. The conclusion reached was that patients and patient associations should be included to a far greater extent in the research procedure and, in all cases, the patients' personal knowledge of their illness should not be ignored.

Session 3 - Reducing Uncertainties through Instruments

Tuesday 7 July

Alain GRIMFELD
French Committee for Prevention and Precaution

Session three is dedicated to the instruments to mitigate uncertainties. Yesterday afternoon, we tried to see how to define uncertainty and control it. That is what we did yesterday. We saw the complexity of the topics. This session will be devoted to the instruments to reduce uncertainty. I am the Chairman for the Committee for the Prevention and Precaution and the Chairman of the National Advisory Committee for Ethics and Health Sciences.

We have a lot of ethical problems and both topics are quite similar to the governance of insolvency so I'm very happy to moderate or facilitate this session. I will call the speakers in the right order as indicated on the agenda and could you please make sure that you do not exceed 20 minutes? What is essential is to have an interactive discussion with the audience. I would like to call the first speaker, David Demortain who is a sociologist and a science policy expert. He's working at the Centre for Analysis of Risk and Regulation at the London School of Economics.

Risk Analysis: Making Sense of the International Diffusion of a Concept

David DEMORTAIN
Centre for Analysis of Risk and Regulation
London School of Economics, CARR-LSE

Thank you, Chairman, and welcome. Thank you all. It is always a pleasure to see that the audience on the first hour of the second day of a conference is as large as on the first day. I am going to talk about risk analysis. I will share with you some findings from several years of research. You know what risk analysis is, a set of statements describing what science in a decision-making context marked by uncertainty is, and the interrelation between risk assessment and risk management.

I am going to talk about the risk analysis in food safety, but that is relevant for other sectors. I am going to talk as a sociologist interested in the “transnationalisation” of regulation, the fact that public policies are more and more framed and based on standards - international standards in particular.

Risk analysis is interesting for the fact that it was originally just a concept, turned into a norm. The origin of the risk analysis is the *Red Book* of 1983 but this concept was standardised in the 90s by a number of international organisations: the Codex Alimentarius, the International Plant Protection Convention or the European Commission. What I am interested in is whether the management of uncertainty is getting standardised under the effect of standard-setting. When you look at the stability of those wordings or statements that make up risk analysis from the NRC to the Codex Alimentarius, one wonders if indeed the way to regulate risks is not getting harmonised? Of course, there is not such a thing as full harmonisation. Risk analysis is a flexible framework which left the possibility to separate risk assessment from risk management, even though the NRC report did not recommend this.

I am interested in the fact that the risk analysis is ambivalent. It has two ways of standardising the public action. We can describe the risk analysis as a set of language categories, allowing local players to explain and compare the way they manage uncertainties. It is a way of reconstructing heuristics. However, risk analysis also takes the form of a risk assessment procedure, which is much more “mechanistics” – in reference to Ted Porter’s concept of mechanical objectivity. I will try to explain why we find such a duality and then go back to the issue of the “diffusion” of risk analysis: what is being diffused? A language or a much more codified procedure?

1. Two levels of standardisation

So let me start and enter into the cracks of the matter. I will describe that we find two levels of standardisation between the risk analyses. The first level is discursive. Risk analysis is just a language imported by players in a given context to explain the way of managing uncertainties and rebuilding their heuristics, their way of discovering facts together. I will illustrate that in various ways.

Risk analysis was the language used in the mid 1990s to make sense of the BSE crisis and of its political origins, in the European Union notably. Scientist experts, bureaucrats, political players started to talk about risk assessment and management. It was a new language and this new language allowed us to reinterpret the causes of the crisis, to tell a story: the cause of the BSE was an insufficient separation between risk assessment and risk management (even though those categories were not used beforehand). Hence, to restore trust it was necessary to separate risk assessment and risk management (something which took place with the creation of a risk assessment only European Food Safety Authority). In marketing authorisation procedures – for GMOs, additives, pesticides, etc. – the dichotomy risk assessment risk management allows industries and regulators to share a language to discuss the appropriate use of science, to discuss their reciprocal roles and to adjust the boundary separating their various actions.

Now, following the evolution of risk regulation policies across Europe, one can see that this language is used dynamically. It serves to discuss procedural matters, to put in place new routines, adjust processes.

At the beginning of 2000, you had agencies talking about risk assessment and risk management. Practical problems such as 'can a risk assessor publish a scientific opinion before the risk manager made its decision? The language of risk analysis allowed to identify these critical issues and to work around them to trigger the construction of small conventions which all contribute to manage controversies and uncertainties. From this perspective, the question of whether to separate or not separate institutionally RA and RM is almost no longer relevant. What the standard says and what it does not say is no longer the problem. What matters is the drafting of those conventions and those shared routines.

So much for discursive standardisation. But there is another level, of procedural standardisation. The representation of risk analysis is completely different. Rather than a set of activities – RA, RM, RC -, risk analysis takes the form of a linear and more closely codified protocol. Of course the protocols involves choices and interpretations, notably around the necessary tests and methods to perform , say, an exposure assessment. But the protocol has not changed in 26 years, it is still made of these famous four steps of hazard identification, hazard characterisation, exposure assessment and risk characterisation. Those four steps lead to a RM decision, which derives from these four steps. Of course, I over-simplify here, but it is in a nutshell the "decision making" theory that this procedure contains.

As I said, this protocol is a robust one, which remained unchanged and which we find in the *Red Book*. This diagram comes from a publication from the International Life Science Institute. It dates back to 2000 and this diagram can be found in a lot of publications. Let me point out that contrary to the language which is used locally by players, here we have a protocol which can be transported and is going to circulate through the transnational and almost professional community of risk assessors. The last point I would like to mention to emphasize the unchanging nature of this protocol, is the way in which it was transposed from, originally, the evaluation of chemical issues, to the evaluation of GM safety.

2. Two epistemologies

Let me insist on the fact that these two risk analysis are not two local applications of a general discourse. I am not arguing that there are two ways of interpreting the risk analysis. You should not think that sometimes the risk analysis is a language and sometimes a protocol. No, these are two "ideal-types" of risk analysis, two equal conceptions, which were present at the very origin of the framework.

Let me come back to the work of the NRC and the *Red Book* to show you that those two conceptions of the management of uncertainty are already explicitly contained in the *Red Book*. This *Red Book* is indeed ambivalent. On the one hand, it argues that science and policy can not be distinguished: science is political, policies make scientific assumptions. Therefore, the distinction between assessments and management must be at a conceptual level. An interaction and intercommunication between the risk assessors, the risk managers and later those in charge of the risk communication must be maintained, for them to build common criteria, to agree on facts and criteria and build decisions altogether. From that point of view, the risk analysis, as I said, is a language. It is a series of categories: assessment, management, communication without any specific order. The NRC does not say that we have to do one after the other or organise them in a sequence in a linear procedure.

It represents the risk analysis as on this picture, on the left of the slide. I am sure that you are familiar with this Venn diagram, present in many reports and publications. This one comes from a report over the WHO. It shows that risk analysis is an assemblage of several activities, without any hierarchical order among those three categories.

In contrast, the risk assessment procedure is much more linear, a sequence of operations that follow one another. The authors of the *Red Book* insisted a lot and still insist on the fact that the basic contribution of the *Red Book* is the codification of risk assessment in four steps. To elaborate this code took time. The Red Book succeeded in that, after several other committees failed to establish such an acceptable and "portable" code. Another illustration of the fact that the protocol may be more significant than the language of risk analysis is that the authors of the *Red Book* recommended to draw up guidelines for risk assessment to create similar protocols.

Why this ambivalence? The argument which I am putting forward and am happy to discuss is that those are two epistemologies or two ways of managing uncertainties. I will describe this in more detail now. The risk analysis language, and the choice of not standardising or imposing an institutional model of managing the relationship between science and policy, between assessment and management of the risk, is linked to the necessity to respect "local epistemologies". i.e. the conventions, the routines, the criteria that are constructed locally and shared by people who participate in a common context of decision-making.

I will compare those two epistemologies a little further. This preference to local arrangements is in line with what can be called a "dialogical" objectivity, to use a concept of Callon, Lascoumes and Barthe in their book *Agir dans un monde incertain*. The construction of shared knowledge happens thanks to common deliberation, the comparison and bridging of different world-views. This epistemology acknowledges the fact that any scientific argument is based on or mobilises particular value frames, and that these must be articulated through an open deliberation in order to bridge positions, make common assessments to emerge and criteria for decisions. On the contrary, the risk assessment protocol contains an epistemology which can be called "mechanical", to use the term of the historian of science Ted Porter. What matters, to produce objectivity, is the transparency and replicability of a procedure. Hence the necessity to avail of a protocol. As I said, if we follow the various steps and succession of phases, in the end, we get the most objective decision possible.

Why are these two epistemologies represented in the National Research Council report? According to the recollections of committee members, it appears that there were several camps within the committee. The first one was comprised of people who would later present themselves as "risk assessors", members of this emerging occupational community, who favoured a more mechanical approach, instrumental to the professionalisation of their work. At the time of the Red Book, the Society for Risk Analysis was in the process of being founded. The codification of this type of procedure in the format of a somewhat abstract knowledge was an essential way for those communities to codify and specialise an expert knowledge. The other camp included bureaucrats and people with degrees in political science, which thought and experienced the fact that science and policy could not easily be distinguished, and favoured a more dialogical approach.

Once again I am over-simplifying here. Those epistemologies are always mixed. The way of approaching the risk analysis is always dual. But still you find sometimes those two epistemologies surfacing. For instance, in the current debate about the safety assessment of GM foods, risk assessors in EFSA are accused of a positive bias: none of their scientific opinions have highlighted a serious safety concern for any GMO. One line of defense which they use is that these safety assessments have been conducted according to internationally-agreed methodologies of risk assessment. It is doubtful this argument is sufficient to convince people who may have another epistemological approach. But what is certainly more striking is that the NRC report and a part of this committee believe in the fact that the management of uncertainty is local. Even if the *Red Book* describes risk analysis, that includes the choice of not imposing a particular institutional standard but of respecting local conventions, to provide means to local actors to organise a dialogue. This particular approach in the NRC report can be linked to the fact that it was drawn up in the context of political crisis. At that time, the EPA had to give expert opinion on chemical products and additives. In such context, scientific claims tend to be deconstructed. Scientific authority is questioned, scientists are accused of making policy and political judgements. The only way to solve such political conflict is to "retreat" on locally-agreed criteria. Local conventions are a better way of coming out of and managing uncertainties than applying exogenous procedures.

3. What is being diffused?

To conclude, let me come back to the issue of diffusion. What is being diffused? Is it a language or is it a protocol? Is one way leading to the other? We can say that the language circulates between food regulators, who get socialised to it by taking part in common meetings. The language allows a sort of very gradual standardisation, through mutual observation and exchange of best practices. It is not an importation of remote, readymade standards and procedures. The protocol on the contrary circulates among experts and professionals of risk assessment through publications, symposia and through practice, of course.

To trigger a discussion and without this being a definitive judgement, my assessment is that the language is only a way of associating local actors to wider-scale standardisation, of paving the way for negotiation on standardisation and harmonisation of the decision making process according to internationally recognised protocols. The story of the creation of an international standard for risk analysis at the Codex Alimentarius supports that view, but I will stop there and leave it to the discussion. Thank you very much for your attention.

Alain GRIMFELD

Thank you, Mr Demortain. Let us hear from Nicolas Treich for the second presentation. He works for the Toulouse School of Economics and is currently in charge of research at the Laboratory of Economy of Natural Resources with the National Institute for Agronomic Research.

Economic Evaluation and Cost-Benefit Analysis

Nicolas TREICH

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I. What is Cost-Benefit Analysis?

I am going to talk to you about cost-benefit analysis. I am an economist and I am going to talk to you about assessment of public policy and about the most standard tool for assessing public policy: cost-benefit analysis.

First, I am going to share with you a number of general principles in relation to cost-benefit assessment and also the use of CBA as a public decision making tool. Of course, in keeping with the topic of this conference, I will talk to you about how uncertainty is addressed in terms of CBA. I will share with you some issues studied in economic theory as to the impact of scientific uncertainty on decisions.

I am sure everyone here is aware that one of the major difficulties we encounter is comparing and analysing decisions that have very different impacts. In the course of this conference, we have talked a lot about the need to mitigate risks, whether we are talking about morbidity or mortality. How do we compare benefits in terms of reducing mortality risks, considering all of the financial costs of prevention, all of the indirect impacts of the increase in certain prices, for example? In relation to mortality, how do you compare those physical aspects and other aspects that are easier to monitor, for example, the cost of prevention? Now CBA is a tool to address this fundamental question, which is extremely complex.

I believe that at this juncture it might be interesting to clarify one of the fundamental principles behind CBA. It is based on citizens' sovereign authority. In terms of how to assess the benefit associated with a particular reduction in cost, you try to calculate a monetary equivalent change in citizen welfare. When I talk about citizens, I'm talking about citizens in the broad sense: consumers, taxpayers, producers, etc. This is a welfare-based framework. We base ourselves on the welfare of citizens.

Now, as economists what are we going to try and do? We will try and obtain information on the choices made by citizens. There are traditionally two different methods for achieving this: revealed preferences and here we are talking about real choices, and revealed preferences, namely reported hypothetical choices based on surveys and investigations. The objective of economists will be to use those observations, investigations and surveys as a basis to infer the monetary equivalent. A fundamental concept there is that of willingness to pay.

One difficulty is how do you obtain the data? All of the market data need not give you the information that you need. Against the backdrop of this conference, this may be information about the value associated with the reduction in risks and also, in terms of

reported preferences, all of the problems associated with the various questionnaires and surveys.

This could all be hypothetical response. What is it that encourages people who respond to surveys to give specific values in terms of the change in their welfare? Also there are psychological biases. There is such a thing as psychological bias during surveys and then there are other problems such as having to deal with limited rationality and lack of information. How do you interpret the citizens' willingness to pay when citizens are misinformed? We do not really know how to address this question in economics.

What about fairness and equity? Traditionally, we aggregate citizens' willingness to pay. One euro is one euro whether you receive it or pay it, whether it is somebody wealthy or healthy or not. What about long term and future generations? There has been a lot of criticism on all of the ethical aspects pertaining to CBA. For example, the value of a statistical life, or VSL, a concept that is often used. There is a lot of empirical and theoretical literature on it. The VSL can be interpreted as a willingness to pay to reduce a lethal risk by one unit. How to understand this concept? You need to think about a community of people who are ready to pay a certain amount in order to reduce the risk by one statistical fatality.

I worked on a meta-analysis on VSL with a colleague: Henrik Andersson. RP stands for revealed preferences. That is all of the market data. This has to do with choices in terms of road safety. We have data: market prices of safer cars and airbag systems, etc. SP stands for stated preferences. In the last column, you find VSL values. Let's look at the first value at the top of the chart. 1.4 stands for 1.4 million. What does it mean? It means that as you study individual decisions, you conclude that the community of people that you are serving, are willing to pay \$1.4 million to save one statistical life.

II. How Do We Use CBA?

In concrete terms, how do we use CBA? I think it is fair to say that this approach is mostly used in the US. It is a legal obligation in the US. Under certain circumstances, decision makers have to develop CBA when the impacts of a public decision are high enough. This legal obligation is embodied in Executive Orders. The Environmental Protection Agency in the US plays a decisive role in terms of producing CBAs and in terms of impacting the methodology.

By way of illustration in the chart, there is a report that the Office Management Budget put to the US Congress. It summarises the costs and benefits of about 100 public decisions from 1995 to 2005. In the last column, it can be read that the EPA has developed 42 out of 95 CBAs contained in the chart. Also in the chart, the aggregated benefits for all of the public decisions are generally higher than the costs. The benefits outweigh the costs.

Also against the backdrop of this conference on uncertainty, you may notice that the estimated bracket for benefits is very wide. In the second last column, the bracket goes from \$58 million to \$394 million but the cost bracket is much narrower, which probably

means that it is generally harder to give a specific estimate of the benefits of public policy compared with costs.

At a European level, if you analyse the founding texts of the European Union, you find a lot of references to comparing costs and benefits of action and inaction. We also know that impact assessments are gaining ground these days. Various European programmes have recommended the use of CBAs. CBA is also used by various international organisations that produce methods and guidance manuals. France is lagging behind even though it seems that it is trying to catch up. France is currently developing impact assessments like the ones I have just referred to.

I referred earlier to the use of CBA for public policy and to the value of a statistical life. A number of values have been recommended by regulatory agencies. For example, the EPA recommends a VSL between \$1 and \$10 million dollars. Other US administrations and regulatory authorities have also issued recommendations for VSL. There is one document from the Environmental DG from the European Commission, which suggests a VSL ranging from €1 to 2.5 million. Those are the 2000 prices. The "Boiteux Report" in France is often cited as a reference in terms of CBA. Also the recent impact assessment for the draft Grenelle environmental measures uses VSL of about €1.5 million.

III. The Future of CBA

What is the future of cost-benefit assessment? It is hard to say actually. I have here some information about the new Obama administration. Cass Sunstein, a legal adviser, was appointed as the Head of the Office of Information and Regulatory Affairs (OIRA). He suggested that US administrations should use CBA more. Cass' appointment as the Head of OIRA signals the continuous use of CBA in the US in the future.

Also the US OMB is exploring new avenues for using CBA in public policy. I am not going to go into details here. Let me just take two points. What about the role played by fairness? Earlier I said that when you address fairness related issues in terms of CBA that is all controversial so suggestions are welcome for embedding fairness into CBA and into the process for assessing public policy.

What about behavioural sciences? For a number of years now, behavioural sciences including psychology have had a major impact on economics in general and on CBA in particular. Of course, I believe it makes total sense to factor behavioural science into CBA and into the public regulatory process.

IV. 13 Steps in the CBA Process

1. Steps 1-4

To conclude those very general considerations on the very principles of CBA and on the use of CBA for public policy purposes, I have a list of the various steps in the CBA process. There are 13 of them.

First you need to identify the case scenarios. It is very important. The starting point for CBA is to identify the key scenarios. You also need to define the scope of your analysis. In your assessment, you need to list the consequences of each scenario. You need to quantify those consequences. With regard to the first four steps, if you concentrate on risks, obviously this ties in with the risk assessment that we talked about in the previous presentation.

2. Steps 5-9

Steps five through eight involve monetising the consequences, aggregating the costs and benefits, discounting various costs and benefits when you value a public policy that has temporary impacts. You need to analyse the sensitivity of the outcome to the parameters. This last step is something that I shall talk about further at the end of my presentation.

3. Steps 10-13

The final part is in regard to communication. Step 10: You need to issue recommendations. Step 11: You need to talk things over with the stakeholders. This is a fundamental aspect of CBA. It is all about transparency. The idea is to provide a tool to provide information that experts can use to organise discussions, to help third parties and other stakeholders who have not carried out the analysis to possibly criticise the hypotheses and change those key scenarios and develop a competing CBA.

Step 12: You need to scientifically validate the CBA. It is all transparent. You've got scientific experts validating the study. This is not done only by bureaucrats or researchers in their ivory towers. The CBA needs to be validated by experts who are not involved in the actual study. Then the CBA needs to be accessible for the public, possibly posted on the Internet. The documents need to be published so that they can be easily accessible, etc.

V. How Do You Address Uncertainty?

Here is the second part of my presentation. How do you address uncertainty in CBA? When there is a lot of uncertainty, there is very little hope that you can actually develop a specific cost-benefit assessment. In some cases, it does not really make sense to develop CBA because there may be a pernicious effect. You may think that things are more precise and accurate than they actually are. I do not know what I can recommend in situations where there is a lot of uncertainty. However, there are things you can do. You can do CBA on small items, for example, on specific impacts. This is in line with the European Commission's guidance on impact assessment, in which it is suggested to provide qualitative information on the other aspects of the analysis, which are harder to quantify.

You might all be familiar with the Stern Report. This is a CBA on climate policy. You need to bear in mind that economists have developed Stern-type CBAs for the past 20 years. In the late 1980s, for example, scientific uncertainty on climate change was even higher and yet there were CBAs; so let us not be too pessimistic with regard to our ability to factor uncertainty into CBA.

1. Bayesian framework

I do not have enough time to talk to you much about economic theory. You just need to bear in mind the following theoretical idea based on the so-called option value, which justifies short term precautions. This is a Bayesian or sequential framework. Knowledge arrives over time, which means that you need to take extra precautions over the short term in situations such as these.

2. Aversion to ambiguity

Another theoretical justification to precaution is aversion to ambiguity. In this framework, there is uncertainty with regard to probabilities. This is a non-Bayesian framework. Due to this uncertainty, one may justify extra precautions. There are problems however with these theories, which have yet to be factored into CBA. We are dealing with a framework that is technically more complicated because we do not really know how to update people's beliefs over time. This poses problems in a sequential situations, for example, when there is a lot of environmental problems and the time factor is of the essence.

3. Theoretical literature

Theoretical literature in terms of economics justifies extra precautions over the short term. However, it is not the case for empirical literature. Various studies have suggested that we invest too much in precautionary risks as opposed to other more familiar risks. This is US data, which I am not condoning but you need to bear in mind that this data was published by a famous Harvard centre and published in various reviews and magazines dating back to 1996. This information suggests that the median cost per life year saved in relation to the environment is much higher than when you are dealing with other sectors. Why is there such a difference? Is it about the methodology? Or do we really over-invest into environmental risks? This is an interesting research question.

VI. Conclusion

In conclusion, some authors have suggested that some of those differences could be explained by risk assessment practices that are too conservative. This is a topic for discussion. Various authors suggested that some risk assessment practices are simply not compatible with the principles of CBA. Now here are a few ideas. The calculations in risk assessment are often based on virtual individuals with exposure rates that are very high, with heights and weights that are very low, which overestimate the individual risk. In these analyses, risk assessors use a blow-up factor of 10 times, 100, 1,000 times, etc. which are rarely justified from a scientific point of view. They also use high percentiles, for example, 95%, which do not reflect the mean risk, and, when you combine all of those extreme points in the distribution, can lead to massive overestimation of the risk. In other words, there is a so-called uncertainty bonus, which is not necessarily justified within CBA. In conclusion, when you over-prevent a risk, this can lead to a lack of efficiency. This argument boils down to the cost of opportunity. Sometimes it might be better to prevent other risks or to impose less of a tax burden on tax payers. It can also be a mistake to try to target an absolute risk, as often formulated in policy and medical circles. CBA suggests that you need to think about the relative benefits and costs associated with reducing the

risk, which is not necessarily compatible with the search for an absolute, say “acceptable” risk. The idea is to measure these benefits and costs using the willingness to pay concept. Lastly, let me recall that cost-benefit analysis is a tool; it is not a rule for decision making.

Thank you.

Alain GRIMFELD

Thank you, Mr Treich. I am handing over now to Christine Noiville. She has a PhD in law and works in the CNRS Research Centre for Law, Science and Technics. She is going to talk about uncertainty and the Precautionary Principle. Let us go over the past 10 years.

Uncertainty and the Precautionary Principle: **10 Years of Jurisprudence**

Christine NOIVILLE

CNRS Research Centre for Law, Science and Technics

(Translation not approved by the author)

Thank you. You have asked me to share my opinion on the Precautionary Principle as a tool for reducing uncertainty. Thank you for that invitation. First I would like to tell you that this is my point of view as a legal expert, and thus, I will talk to you, in particular, about jurisprudence and jurisprudential experience but I will explain that further.

I. The Precautionary Principle Today

What about the precautionary principle itself? It has been said over and over again that the precautionary principle applied to environmental concerns first but was then brought into the area of health. It is a break from traditional, conventional wisdom because what it says is that uncertainty with regard to the impact of a product or activity is not a sufficient reason to postpone the adoption of measures that could prevent potential damages. The idea is to break from tradition. Basically in the past, we only prevented those risks that were well known and easy to calculate from a probability point of view.

1. Historical use of the principle

Now with the precautionary principle, we are trying to be more proactive and we pay close attention to all of the warning signals so you can take the necessary measures as early as possible. We also know that this political philosophy of risk emerged as a new creed, even driving French legislators to introduce the precautionary principle into the environmental charter in 2004 and 2005. Then the environmental charter was backed against the constitution so the precautionary principle is now plastered all over our walls. Between the 1990s and today, we have come a long way. The precautionary principle now seems to have a plateau that has now reached a cruising speed. All of the old routines appear to be over and done with. There is no more paralysis, inhibitions or regression. It

regression. It is all about progress and reason, etc. Does that mean that it is done and dusted? No, let us not fool ourselves. Recent developments keep reminding us that the precautionary principle is like the Lough Ness monster.

2. Mobile telephone antennas

What do I mean by that? I am referring to all the rulings that were issued in France in recent months, particularly on September 10th with regard to mobile telephone antennas. Now those rulings often quote the precautionary principle, either explicitly or implicitly.

All of the rulings go in the same direction. What direction am I talking about? Firstly, antennas pose uncertainties with regard to their impact on human health. Basically experts cannot agree on what the impact is. There are no clear conclusions. Secondly, there is therefore a risk and because it is a risk for human health, by definition it is abnormal. Thirdly, it is therefore necessary to purely dismantle those antennas. This means that the political community or avant-garde is putting pressure on mobile telephone operators. This means indirect pressure on the state. One of the beneficial consequences has been the emergence of a public discussion on waves.

My purpose today is not to focus my presentation on those rulings. I would simply like to use those rulings as a starting point just to show you that those rulings are extremely complex. We are dipping into a pool of complexity because the past 10 years' worth of jurisprudence has been rocked. I am referring in particular to the European Court of Justice, who have tried to channel the precautionary principle so that it could be applied, not in the way that I just referred to that is every which way; on the contrary, so that the Precautionary Principle be used as a smart tool for assessing risk and uncertainty.

II. Jurisprudence and Case Law

This is what I would like to focus on. I am fully aware that in terms of jurisprudence and case law, this is just one way of looking at things. It is a way that can annoy non-legal experts but it is also a way to further our understanding of the precautionary principle, particularly with regard to environmental health risks. We do not have a whole lot of case law or jurisprudence but I believe that this is a decisive aspect. As you probably know, for the past 10 years, courts have been urged to issue a lot of rulings in this arena. In more and more practical terms, those rulings show to us what the precautionary principle is not and what cannot be done by public authorities. Those rulings have even more impact on public authorities in practical terms because very soon they may lead to cancellation of a measure that bans a particular product or an obligation to start marketing another product again following its ban, etc. It has an impact on public authorities and public action. Therefore it is very important to extract the very essence of the precautionary principle.

If we try to summarise the past 10 years in terms of jurisprudence, it really shows that there are two key words.

- Scientific rigour: Firstly, precautionary principle can be equated with scientific stringency and rigour and it is synonymous with action. With regard to scientific

rigour, this is a key word or mantra of the Court of Justice of the European Communities. You need a rigorous, stringent scientific approach and this is twofold. Firstly, the jurisprudence recalls that for the Precautionary Principle to be implemented, the fear of the risk should not be just a mere fantasy. There should be conclusive clues showing that this risk is plausible

- Serious assessment: Secondly, those conclusive components should have been obtained from a real scientific approach. This means that a serious assessment should have been conducted. In the last few years, judges have added excellent independent contradiction, taking into account minority opinions too. The judges remind us of that regularly. The Precautionary Principle is not less science but the contrary

We can give a few examples of this scientific rigour among some jurisprudence in recent years. Given the current scientific state, there are not enough risk indices to prevent France from importing sweets rich in vitamins because there is not enough robust scientific argumentation. The same applies to the community prohibition hormones with the beef by the EU and biotechnological products. Europe was condemned by the World Trade Organization because Europe did not give enough scientific evidence to show the risk was documented enough.

Sometimes there were no risk indices, were not justified enough or those indices were given but they came from an assessment which, according to WO, was not really solid enough. We can add a series of decisions regarding mobile telephone relay antennas according to which the administrative judges considered that given the current scientific knowledge, the mobile relay antennas were not presenting serious risk for the neighbouring population. To adopt precautionary measures, the mere observation of uncertainty is not good enough. We need to show that risk is at least plausible. If the condition of what is a plausible risk remains vague, what is clear is that contrary to the approach adopted by judges in the ruling on relay antennas, mere fear or anxiety is not good enough. This requirement is decisive because usually judges do not agree on the fact that with the Precautionary Principle, it is no longer necessary to know to make decisions and that the mere fear is sufficient. In most cases, the judges do not agree with that.

As I said, there is another relative consensus: the precautionary principle is a principle of action. According to judges, of course, this principle does not lead us to refrain from running risks and looking for risk zero. When public health is at stake, courts repetitively insist on the health value and remind us of the fact that in principle, requirements linked to public health should undeniably have a prevailing feature over the economic features.

When there is a series of risks for public health, judges will be tempted to protect public health. It seems quite natural but at the same time, we should not just stick to that because when we conduct much more detailed analysis of the court rulings, we see that to avoid these requirements to lead to arbitrary decisions and hyper-safety decisions, courts require the compliance of two intertwined conditions. You are quite familiar with the first one: decisions should comply with the precautionary principle. It is in the charter of environmental proportionality and means that to kill flies, it is not necessary to use a hummer. The decision maker has a series of possible simple actions: funding research or withdrawal of a product. In this very broad range of tools, the decision maker has to choose the most adapted one given the risk and knowledge we have on the risk. Of

Of course, a lot of people say that this Precautionary Principle cannot be applied in a mechanical or mathematical way when the Precautionary Principle is at stake because it is applied to situations whereby the risk is not well known and where uncertainties are high. The judge says yes but in that case, you have to adopt a provisional action step by step, as you learn more about the risk.

Secondly, in the wake of proportionality, when there is a risk index, it is sufficient. However, it is not good enough; those indices and risks should be put back into their socioeconomic context. We have to take onboard the nature of possible damage, the difficulty to control the use of a product. Is it possible to replace this product, liability of the risk and the interest in covering the risk? We have to weigh the interest at stake.

For example, in the Pfizer case regarding the withdrawal of antibiotics used for the breeding sector, the question was to know whether it was legitimate to forbid the use of some antibiotics in the farming and breeding sector. Here the judge was going to see whether the decision was really necessary, whether other replacement products were available, whether there were no alternative actions which were less difficult and whether the cost-benefit ratio was properly assessed for the public health and for economic costs. Another example is the Servier case, with the withdrawal, at the request of the European Commission, of an anorexigenic drug, which seems to lead to heart risk. The judge said, 'Well, we should not apply this principle this way.' The judge said, 'We have to wonder whether the cost-benefit ratio is good or not and whether it is worthwhile running the risks, given the benefit which may be much bigger.'

A third example, but the list is not exhaustive, is a case dating back to 2007 for GMOs. It was an appeal for applying the precautionary principle to the GMO field and that is why those activists had to destroy fields of GMO. The judge, 'The risk has to be assessed in an overall context, even if there is a risk and an uncertainty, this does not justify prohibition from the public authorities and does not justify destroying fields either.'

In contradiction with judgments relating to antenna masts, based on the principle that if there is an uncertainty for health, this means that a risk does exist, and that if there is a risk and if it relates to health, by assumption it is not acceptable – as of now this seems to me disputable- we see that judges did not have this approach usually. They wanted to put back the risk into more overall context and this approach is taken over by politicians. For example, some months ago in a GMO sector, politicians decided to set up a committee and next to the scientific committee, assessing the environmental health impact of GMOS. This committee assesses the economic, ethical and social aspects of those same GMOs, the idea being that to make the right decision we cannot just restrict ourselves to one type of indices. With the economic, ethical and social aspects, that is part of the community law.

4. The Limits of the Precautionary Principle

As you know, the WTO believes that scientific aspects are prevailing but at least we can say that there is a relative jurisprudential consensus on the fact that the precautionary principle is not sufficient. You have to make choices. You have to have common sense. To make choices, you have to use your common sense and balance all interests at stake so

prohibition is not the only way for the Precautionary Principle. Of course, sometimes it will be the only possible and acceptable option but it is not systematically, mechanically applied and dictated by the precautionary principle.

Of course, this is fine but we should not be naïve. The Precautionary Principle does not include all drifts that people think but this Precautionary Principle can still be used by the public authorities, private or public decision makers as a kind of instrument of paralysis when they are fearful and do not want to be held responsible but want an umbrella effect. Of course, this is a good argument but until the antenna ruling, this umbrella approach was not really done.

With regard to the responsibility of the state, several times in scandals such as the contaminated blood or asbestos, the state was held responsible but they were sentenced for not reacting when the risk was almost quasi-proven. It was a quasi-proven risk. What is important in all those rulings is the necessity of the state to adopt an active attitude vis-à-vis the risk and not to show inertia. What is judged is not the result but is the means used by the state to have more knowledge on the risk and to act early.

The same guideline is to be found in the jurisprudence when we have to determine the responsibilities of pharmaceutical industries or professionals exposing some categories of the population to a health risk. This is typified in the case of asbestos and distilbene. Each time in those two cases the judge insisted that the risk indices were known and that the professionals should have been more interested in that and conducted their own research works to know the risks better. That is important but beyond that we cannot say that the precautionary principle has really rocked the conditions of responsibility for either the state or for the provisional communities.

If you take all rulings on Hepatitis B and the consequences of a vaccine, it is quite clear in those cases that we either say that there was no causal link between the vaccine on one hand and sclerosis on the other hand. Some thought that it was linked to the vaccine. In that case, the liability of the manufacturer was put off or the industrialist was held responsible but in that case it was because there were precise, conclusive indices showing that there could be a statistical association link. This is not a new approach born with the Precautionary Principle. It is a very traditional approach. We see whether the inertia indicators are showing responsibility. It will show that that case is like other cases; we are far from saying that there is a mechanical link. The Precautionary Principle is not a security instrument which leads to inaction and paralysis.

In conclusion, I have two words after this overview. In the last ten years, we see that courts have really made an effort not only to scan the precautionary principle and to define the principle and make sure that it is not a restrictive principle but a tool of active vigilance vis-à-vis uncertainties and not an inhibiting tool. That is very important. Thank you very much.

Alain GRIMFELD

Thank you. I am going to hand over to our panellist. There is a change to our agenda. Matthieu Craye is going to be our panellist. Matthieu, can you please come to the rostrum?

Discussant

Matthieu CRAYE
European Commission - Joint Research Centre

I. Interpreting 'Reducing Uncertainty'

The reflections presented here are based on work carried out in the research team on 'knowledge assessment methodologies' at the Joint Research Centre of the European Commission in Ispra, Italy. They are inspired by experiences in a number of projects, that aimed at studying or intervening in the ways in which scientific knowledge is used in policy making and in public debates. These reflections do however not necessarily present the official views of the European Commission on these issues.

The different presentations in this session on 'Reducing Uncertainties through Instruments' have made clear that 'reducing uncertainty' can be interpreted in different ways.

In a first interpretation, reducing uncertainty can refer to attempts to reduce all the complexities and uncertainties in environmental health issues to a manageable form, thereby helping decision makers to arrive at a decision. In this way, instruments are used to reduce a practical form of managerial uncertainty, the uncertainty about what we have to do and how we can arrive at a decision about what to do.

A second interpretation, which fits well in natural scientific reasoning, sees 'reducing uncertainty' as increasing our confidence that we are actually anticipating negative impacts on health and the environment. This interpretation is related to uncertainty in the knowledge base and to the objective of an increased predictive capacity of that knowledge.

II. The Relationship between Knowledge and Decision Making

While both meanings are surely related, as knowledge is appealed on in debate and decision making, it is necessary to distinguish them, because both interpretations see 'reducing uncertainty' as answers to different questions, namely the practical question of what to do versus the theoretical question about what do we know.

The actual relation between these two interpretations depends on the model(s), that guides our thinking and acting about the relationships between scientific knowledge and policy making. It is only when reasoning in a very strict, modern-rational view of the relations between science and policy that both meanings coincide, a situation that has been described as 'science speaks truth to power', leading to decision making being reduced to applying certain knowledge. In such model 'reduced uncertainty' in knowledge immediately results in 'reduced uncertainty' in management and decision making.

Science and technology studies have contributed considerably to reflections on the results of deploying instruments like cost benefit analysis and risk assessment from the perspective of both meanings of reducing uncertainty.

III. Reducing knowledge uncertainty and the limitations to predictive capacity

Firstly, science studies have generated a lot of insights about the limitations of risk assessment to actually predict negative impacts. Different types and forms of uncertainty, such as ignorance and indeterminacy, have been highlighted by B. Wynne, S. Funtowicz and others. They showed how critically addressing those forms of uncertainty falls out of the scope of the risk assessment framework, and made clear that precisely these types of uncertainty can lead to surprise effects in terms of impacts on health and the environment. A typical case here is the ozone depleting effects of CFCs, which in the 1960s and 1970s could not be predicted by applying the then normal, established risk assessment frame.

As for cost-benefit analysis, critical science studies have shown the inherent impossibility of the task to precisely calculate the 'correct' prices – costs of environmental and health impacts and economic or other benefits of polluting activities and/or policy plans. For instance, in the energy field, the calculation of the external cost of different energy sources, which is the monetary valuation of the related environmental and health impacts, has been shown to decisively depend on all the assumptions and the choices that had been made in the calculation chains. A very wide range of estimates of costs is arrived at, depending on the choice and assumptions that are made about how to define the problem, how to set system boundaries, how to choose the preferred analytical approaches etc.

Science studies are a very useful contribution to the debate on how those tools are deployed as they promote reflection about their inherent limitations. While analytical attempts to improve instruments as risk assessment and CBA are valuable, science studies inspire to accompany their use by a certain humility about their predictive capacities.

IV. Reducing managerial uncertainty and the distribution of power

In relation to reducing the managerial form of uncertainty and helping decision makers to arrive at a decision, one of the questions to be dealt with is whether the presented instruments offer a framework in which divergent positions and views can be articulated

and discussed. The risk-assessment framework has been presented earlier in this session as a very robust framework as it indeed contributed to decision making in a lot of cases. It has however also been widely documented, through numerous case studies, that the application of risk assessment and cost-benefit frameworks, often only led to continuing controversy in policy debates.

One of the roles of social science is to clarify the reasons, conditions and circumstances, leading to risk assessment not solving but rather intensifying conflict and controversy. In many cases, this has been shown to be related to the fact that, when using or imposing a risk assessment framework, other types of arguments, positions or perspectives on the policy issues are dismissed and not accounted for. A clear case here is genetically modified food: opposition to GMOs is very much related to arguments of defence of traditional agriculture practices, of opposition to increasing control of multinational companies on agricultural practices, on the value attached to biodiversity etc.

There is a wide range of arguments that are not addressed in a 'pure' risk assessment framework. When policy and experts exclusively reason in terms of risks, societal groups that do not find their position recognised, continue their opposition within the risk assessment frame, pointing to the various uncertainties in risk assessment and to disagreements between experts, through making use of so-called counter-expertise. In the end, those scientific technical disputes serve as a substitute for a socio-political debate – that is *not* held – about those other type of arguments.

The qualitative difference in the justifying power and legitimacy of different types of arguments, as induced by the promotion of instruments as risk assessment in the policy context, should also be made subject to reflection by critical social sciences : what is the effect of such instruments on the distribution of power in the decision making processes. If certain types of arguments are favoured through using a CBA or a risk assessment framework, positions of actors whose arguments are very much compatible with this framework are strengthened while other actors whose arguments fit better in alternative reasonings are weakened.

V. The Precautionary Principle and surprise effects

My last remark relates to the precautionary principle: the presentation in this session discussed recent experiences with the precautionary principle from a legal perspective. It is however worthwhile to remind that, in science studies, during the 1990s, another and broader concept of precaution was developed than what eventually has been institutionalized and legally anchored as the precautionary principle, a broader concept to precisely take into account all those uncertainties that are left out of scope in the risk assessment framework. According to this alternative vision, a precautionary approach is much more a very broad appraisal process, not limited to 'action' or 'management' but also influencing the phase of gathering knowledge, through seeking contributions from a range of sources as diverse as possible. The alternative conception of precaution also sees it as the 'normal' approach to be followed when dealing with environment and health issues rather than an approach that can only be applied in very particular or specific circumstances, that warrant its triggering.

Some elements of those broader visions on precaution can be found in the institutionalised versions of precaution. The Communication of the European Commission on the precautionary principle mentions for instance the involvement of stakeholders as early as possible in the processes of risk assessment and management and also recognises qualitative sources of uncertainty, expert disagreement etc.

From the science studies' perspective, the most problematic feature of the institutionalized version of precaution is that its triggering is made subordinate to a risk assessment, through which precautionary frameworks do not succeed to reason beyond the risk assessment frame: the institutionalized version of precaution falls short in its consideration of surprise effects on health or the environment. Neither does it really consider all those other types of argument that fall out of the scope of the risk framework.

VI. The role of social sciences

To conclude, as this conference is about possible contributions of the social sciences, following the remarks presented here, the task of social sciences should not only be seen as delivering instruments and saying how instruments should be applied but also as accompanying the work on the deployment of instruments with reflections on what really happens when they are applied : what is achieved in terms of the several meanings of reducing uncertainty and what is caused, changed or maintained in terms of distribution of power.

Alain GRIMFELD

Thank you, Matthieu. To start our discussion, that is why we had our panellist saying those few words. After all presentations we heard this morning and what Matthieu said, we have our discussion, irrespective of the system retained, on what is interesting in the risk assessment, risk management and redistribution of power. This is a real economic problem, as Matthieu said and it is very pragmatic as well. We must have industrial and economic instruments and the Precautionary Principle has been well explained by Christine Noiville. There is the final essential concept of support. It is not just a matter of acquiring knowledge and getting more knowledge. We have to support people and not be rigid and set. We are in a society with a lot of societal and scientific issues but of course, everything has to be adjusted. In real time, it is nice to have a principle but this principle cannot just be set. It has to be adjusted in the course of time because the situation keeps moving. There is an exponential development of knowledge and therefore principles have to evolve as well.

There is a development in all fields, whether for hard sciences or soft sciences and social sciences. All scientific domains keep evolving; therefore principles have to evolve as well. Let me give the floor to the audience. We are 30 minutes late; we now have 15 minutes for a Q&A session. Could you please use the mike if you ask a question?

Questions and Answers

From the Floor

I have a question for Christine Noiville. As a legal expert, I would like to hear your input. I really enjoyed your presentation. You did not have a lot of time to summarise aspects pertaining the Precautionary Principle. As a legal advisor and expert, did you witness or observe any nuances or changes in the approaches to the Precautionary Principle? In criminal courts as opposed to administrative courts, do they have different approaches to the Precautionary Principle or do they agree on how they interpret it?

Christine NOIVILLE

Yes, of course there are changes in terms of jurisprudence between criminal courts and administrative courts with regard to mobile telephone antennas. This is an iconic example. As I said before, for years now, the matter was referred to administrative courts to decide whether or not it was possible to ban having an antenna in a particular place. The administrative courts decided that the risks were not conclusive enough.

However, criminal courts and judicial courts have the opposite point of view. I am sure you understand that when I talk about a relative consensus in terms of jurisprudence, I am considering all of the cases in all of the courts combined at a national, European or international level. What I am interested in are the trends that are emerging. Clearly, jurisprudence can be impressionistic. That is only normal. That is what it looks like.

With regard to the antennas, the court of cassation has yet to rule on the subject, and will probably do so quickly. Nothing indicates that there would be an opposition in terms of the rulings. Of course, I cannot tell what the future has in store for us but it is possible that the Court of Cassation will overthrow the initial ruling. This is the trend that I was referring to. I simply wanted to show you that it is pretty sad that in this trend, some judges focus on their own political agenda and they muddle the waters, going against our efforts, over the past 10 years, to clarify the situation.

Jean-Pierre GALLAND

École des Ponts

I would like to get back to what David Demortain said in his first presentation with regard to the opposition between discursive and procedural objectivity. I think that David Demortain has addressed the opposition, whether we are talking about the *Red Book* that was published in 1983 by NRC in the US. He said that there are different profiles, depending on the expert involved in designing the book. This indicates that there are two possible avenues, either dialogical or discursive. Maybe we need to think outside the box. Maybe we need to look elsewhere. Let us look at the backdrop against which the NRC book was published. There were lots of trials and proceedings over decisions made by the EPA and other agencies at the time; decisions that demanded more and more objectivity in terms of risk assessment.

Also Nicolas Treich gave part of the answer in his presentation. Executive orders have been taken by US presidents. For example, one such executive order was taken by Reagan in the 1980s. In terms of environment and health, CBA is a useful, objective tool that you can use to carry out cost-benefit assessments.

David DEMORTAIN

Thank you for what you said. I agree with you. You are absolutely right, we need to look elsewhere and that was I wanted to show you, maybe I went a little too fast. This particular committee that produced the *Red Book* was representing two different backgrounds. It was comprised of people for whom the relevant backdrop for their work was an emerging method of risk assessment. Of course, their priority was to codify the various steps in the risk assessment process. Once again, in terms of their history and their narrative and what they say happened, this is their priority, whereas other members of the committee put forward the whole crisis background around the decisions taken by EPA.

There was a true political crisis and the work of the EPA and the experts was being called into question. It is because of this backdrop that they opposed a proposal by industry at the time to create a special office or a cost cutting entity for risk assessment. However, they said, 'No, let us keep management and assessment together. On the contrary, let us try and promote interaction between assessment and management and the dialogue between decision makers and those who produce scientific knowledge.'

Soraya Boudia is currently working on archives from the NRC, it will confirm or contradict this, we will see. But in any case there are various possible strategies to organise public policy in a context of uncertainty. In order to produce a standard, obviously you need to reconcile various strategies. Even though the *Red Book* is not perfect, it struck a balance between the two potential avenues for risk analysis.

Jean-Francois VICARD Stratem

I would like to respond to the three presentations that we heard this morning. In light of French standards such as NFX-50-110; general recommendations for skills in terms of expertise or appraisal, this standard applies to significant decision making bodies such as AFSSET that take responsibility for risk assessment but the standard also applies to colleges of experts - those experts take collegial responsibility for appraisals- and to individual efforts, when there is just one single person taking responsibility for the appraisal.

There are two critical points here. Firstly, the method being used is something that we have discussed at great length. However, there is a preliminary step that we did talk about just a little bit but probably not enough. What question are we trying to address when you conduct an appraisal or carry out a study? In terms of this aspect, we often address a risk and this risk is significant.

The risk is that uncertainty is bound to increase if the question is biased, for example. This means that you limit the scope of the appraisal process. You find yourself in a situation where you need to make significant efforts to address the question that is the very object of the appraisal. Implicitly it is very easy to draft the question in a way that you think is sufficient but either you introduce bias in the question, which means that you sweep part of the question under the rug or you simply neglect essential aspects in relation to risk.

Alain GRIMFELD

Who would like to take this one? Does nobody want to take a chance? Who wants to run the risk of answering that question?

Daniel OBERHAUSEN

I am an expert with the Court of Appeals in Bordeaux. I will try and venture an answer but I do not think we have enough time to state it all. I would like to get back to what Christine Noiville said and I would like to reassure her in terms of how the precautionary principle is being implemented in the ruling by the Court of Versailles on the Tassin la demi-lune case, which has mobilised the Priartem Association of which I am a member.

Just to reassure you, we need to address the precautionary principle over time. It is not a static principle. It is a principle that is dynamic by nature. In order to perceive the dynamics behind the principle, let us just get back to what was said earlier. Of course, the measures that are recommended in terms of implementing the precautionary principle are both provisional and achievable. That is the first thing. On the other hand, this precautionary principle is a call for more science. Of course, the Precautionary Principle falls under fluctuating circumstances. Things are changing over time, which is why I want this principle to be implemented. Is the Precautionary Principle, as implemented by the Court of Appeals of Versailles, a regression? Are we going back in time? No. An appeal was launched by Bouygues Telecom, the opposing party and it is up to the Court of Appeals to rule on the issue in due time.

The good thing is that the Court of Appeals will take its time. We will see time at work in terms of how to implement the principle and we as an association or group of scientists in particular expect science to move forward. We expect the scientific advances to change the paradigm that we referred to yesterday based on interaction between the thermal impacts of electromagnetic waves and living matter. For example, the sense of vision that we share that is due to light is due to interaction between living matter and electromagnetic waves. This is long term interaction. Of course, everybody wants to go and grab a cup of coffee so I will be very short. I would like to reassure you, Christine Noiville, with regard to the Precautionary Principle, the situation is changing and there is no way we can turn back.

From a consensus point of view, it is impossible to have the two of them at the same time because by definition the Precautionary Principle is a fluctuating, moving and evolving thing.

Christine NOIVILLE

I would like to reassure you that I am not worried. I am simply sorry. I am sorry that serious jurisdictions such as the Versailles Court of Appeals are mudding up the waters by not using the procedure that I explained earlier. For example, with the first Court of Appeals -I do not know whether it is due to lack of knowledge about the vocabulary or just sleight of hand- because there is uncertainty, there is risk. That is what they said, in essence. And because there is risk, there is hazard. I am simplifying things but that is basically their message and I believe that falls a bit short of the mark. That is all I wanted to say and I think that we agree.

David GEE

European environmental agency

I have a question for the Chair and for Matthieu based on this simple typology we put in our book 'Late Lessons from Early Warnings: The Precautionary Principle 1896-2000', which is based on case studies. We differentiated risk, where you think you know the impact and the probabilities. Prevention is all you need there. Asbestos in the year 2000 is the case. Uncertainty is where you think you know the impacts but you have no idea about probabilities: so you need precautionary prevention. Antibiotics in food would be the case there. Ignorance is where you have no idea what the future impacts will be but things can be done in a precautionary way.

Matthieu, I was surprised when you said the precautionary principle cannot embrace surprises. If you remember, it was called in its German origin as the foresight principle. Of course, foresight is about anticipating surprises even though you do not know the nature of the surprise. There are things that can be done to deal with ignorance and surprises so I was a little surprised about you excluding surprises and ignorance from the Precautionary Principle and I would like some elaboration.

Chair, you have got a very interesting committee with your Committee of Prevention and Precaution that other countries do not have. I have read some of the material and it is extremely useful for everybody. I have two comments. How do you differentiate between the word prevention and precaution in your work? Secondly, what impact has your work had on, say, policy making and decision making in France, without you being too humble about that?

Alain GRIMFELD

Christine, maybe you can take that question regarding the Precautionary? Of course, prevention and precaution are the continuation of each other but as a doctor and paediatrician, I would like to base myself on examples that have been well categorised in terms of prevention. Here there is no longer uncertainty. It does not boil down to assessing the cost-benefit ratio or the cost efficiency ratio. We need to know what policy we are going to implement for prevention purposes. It is true that this applies to the medical field, particularly in terms of immunisation. Christine Noiville talked about immunisation.

In terms of precaution, of course, there is a continuum between precautions and prevention but this is something where science or rather the medical field has yet to contribute sufficient evidence to set up the necessary resources right away. There is still a certain level of uncertainty. This is why, in the medical field, we draw the distinction between prevention and precaution. With prevention, you have enough certainty while with precaution, there is no certainty at all. However, there is hazard for human health.

Matthieu CRAYE

In relation to the question whether the precautionary principle is helpful in anticipating surprise effects, I have tried to explain that what has eventually been institutionalised as the precautionary principle is in the first place a response to other types of uncertainties than to possible surprise effects. The institutionalized views on precaution make its triggering dependent of or subordinate to a risk assessment, as complete as possible, on which basis an evaluation is made of the 'remaining uncertainty'. The case on CFC's in the EEA book 'Late Lessons from Early Warnings' clearly explains how, when reasoning in the conventional and established risk assessment frame for these substances of the 1960s and early 70s, the ozone depleting effect of CFCs would never have been detected, let alone anticipated. The question about this possible effect did not have to do with remaining uncertainty, f.i. related to insufficient data, to fully evaluate the then considered health and environmental impacts of CFCs. At the time, ozone depletion was not considered in the frame of risk assessors. Only in the 70s, some scientists had the imagination, the craftsmanship and the skills to relate datasets about ozone concentration to the chemical behaviour of CFCs and ozone in the atmosphere. As long as risk assessors were evaluating data gaps in their existing frameworks, the surprise ozone depleting effect of CFCs would never have been recognized.

How Improved Models of Risk Perception Can Inform Risk Communication

Lennart SJÖSBERG

Centre for Risk Research – Stockholm School of Economics

I. Models of Risk Perception

I would like to thank the organisers of this conference for inviting me here. It has been a very interesting one and a half days and I am sure it is going to be quite as interesting in the final round-up of this conference. I am going to speak about how improved models of risk perception can inform risk communication.

Beliefs or perceptions constitute the basis of what risk communication should be about. Beliefs are both motives for risk communication and targets of risk communication. The success of risk communication is therefore dependent on the validity of the models of risk

perception that are applied. What I would like to call the received view of risk perception is based on American work which was first published back in the 1970s and has been cited many times and given much attention in literature. It is the psychometric model and the psychometric paradigm. According to this received view, there are only a few generally applicable factors of risk perception. Those factors are novelty and dread and they explain, according to very early work such as opposition to nuclear power, almost completely the reasons for which certain activities become perceived as risks.

Dread and Novelty as driving factors behind risk perception

- Explained variance between individuals of original model is typically only 20%, often less
- This is mostly due to the Dread factor
- Novelty has no explanatory power at all
- "Tampering with Nature" is a very important additional factor
- Reactions to new technology are not driven by Novelty *per se* but by other factors, such as perceived benefit or if the technology brings about unique advantages and is hard to replace
- In addition, various hazards, some new such as terrorism, require their own specific factors

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Work was also done comparing experts to members of the public. It was claimed that experts are objective and not influenced by the subjective risk factors such as novelty and dread. Somewhat later, trust comes into the picture and it is almost always social trust. It is claimed that if you can establish social trust, you can reassure the public about risk and make them believe in and accept the so-called objective risk assessment.

Also world views, as specified by cultural theory, have been claimed to have a large impact on risk perception. The social dilemma of risk management concerns different views of experts and the public. Hence, research is concentrated on these two groups, which are treated as homogenous.

This received view has been quite credible. These notions are widely spread and often cited with little or no critical comment. The reasons for this situation are many. There have been some strong empirical results. The model is close to common sense and probably also politically expedient. Perhaps that is the most important factor. Sandman's Outrage Model is a market adaptation of the basic psychometric model.

Yet, the data which has been used to establish the model has been analysed in ways which are problematic. The model is usually tested on averages, not individual variability. This means that the data is aggregated and variability is hidden. This is called the ecological error. Hence, very high correlations are produced over around 0.8. It seems from such results that the model accounts for almost all the variability.

II. Statistical Significance and the Dread Factor

Another important factor in data analysis is that many researchers and investigators have been satisfied with just having established statistical significance, which of course is easy to achieve if you have large or medium sized samples. It does not really mean very much because you can get statistical significance with very weak or small correlations. The explained variance between individuals is typically only 20 % or less, which means that 80% is left unexplained.

A factor of some importance is the dread factor while novelty does not seem to have any explanatory power at all. In my work, I found another factor, which I call tampering or interfering with nature. This is a very important additional factor. I also found that reactions to new technology are not driven by novelty per se but by other factors such as perceived benefit or if the technology brings about unique advantages and is hard to replace. In addition, various new hazards such as terrorism require their own specific factors if you want to explain and understand risk perception.

Cultural theory, which I mentioned a few moments ago, has been investigated quite thoroughly and it has been shown that the basic variables of cultural theory have only a very weak relationship with perceived risk. Other value based dimensions such as political ideology or new age beliefs are stronger and more clearly related to perceived risk but they call for a very different theoretical approach than cultural theory.

Cultural theory, world views and values

- Extensive research has shown that there is only a very weak relationship between world views and perceived risk
- Other value based dimensions, such as political ideology and New Age beliefs are related to perceived risk, calling for a different theoretical approach

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III. Trust and Antagonism

When it comes to trust, typically there have only been weak effects of social trust on perceived risk. Correlations are about 0.3 or less. At the moment, I am involved in a big European Union study of perceived risk of chemicals in consumer products. In all of the 27 member states, we have a large amount of data. We looked at the role of trust among

others and found a correlation around zero between trust and perceived risk at the individual level.

I find stronger and much clearer effects of trust in science as distinct from social trust. I call it epistemic trust. If people have trust in the knowledge base, that is a different and more important thing; to have trust in individuals and organisations is a different thing.

Another important factor is perceived antagonism; that people believe or see that society is full of antagonistic relationships and that some people are not really working for your benefit but the opposite. Of course, the prime example of that would be terrorism but there are many other examples that you can think of. Maybe only a minority of the public has such beliefs but it is a big minority if that is the case.

Trust and conceptions of knowledge

- Typically only weak effects of social trust on perceived risk, correlations of 0.3 or less
- Stronger effects of *trust in science*, as distinct from social trust (in experts or organizations) –epistemic trust
- Another important factor is perceived antagonism



IV. Personal or General Risk

Another very important thing when it comes to methodology and risk perception research is that you have to be specific about *whose* risk you investigate. Do you want to investigate the risk to the respondent him- or herself or the perceived risk to people in general? I call this personal and general risk; it is a very important difference. This distinction was missed in the psychometric paradigm where they only asked for ratings of risk without specifying the target. Some work that I did showed that such ratings of unspecified targets are close to general risk. However, if you look at perceived risk in relation to policy, you find that personal risk is more relevant than general risk to policy attitudes.

There is something called optimistic bias. Most people judge the risk to themselves as smaller than the risk to other people. People will go ahead and take risks, even if they are aware that they take them because they think that they are smaller to them personally and because they can see benefits of certain behaviours.

Prevalence of optimistic bias

- Only a few percent in typical studies judge personal risk as larger than general risk
- People will go ahead and take risks even if they are aware that they take them, because of expected benefits (pleasure, beauty, etc)

V. What is Driving Demand for Risk Reduction?

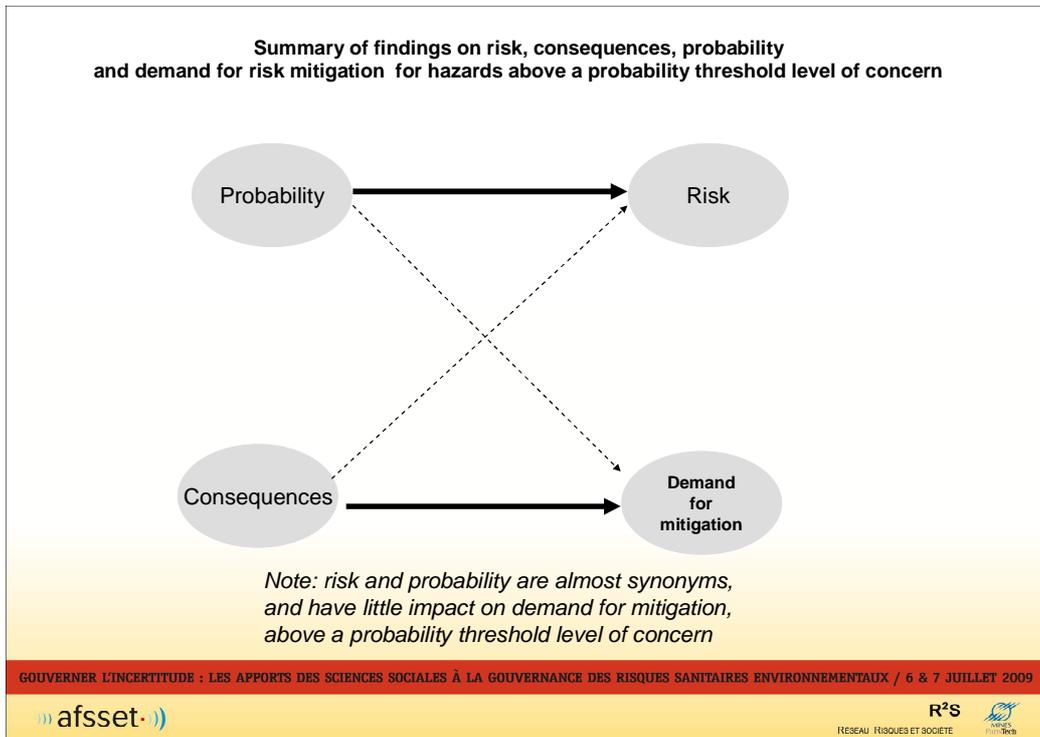
I have been talking about risk and much of the literature and research is concentrated or focused on risk but it is not self-evident that it is a good idea. This literature and research has assumed that risk is the factor that is driving risk-related behaviour such as demand for risk reduction. However, the assumption is implicit and has been seldom regarded as a problem or tested. What I have asked is: What is really driving demand for risk reduction? Is perceived risk the important factor? If not, what factor is most important?

For example, consider the risk for a Swedish citizen aged 30-45 to, one, get a severe cold in the next 12 months, and two, be infected with the HIV virus in the same time period. Which risk is the largest one? Most people will pick number one as the largest risk. Which risk is the more important one to be protected from? Of course, most people will pick number two as the most important one to be protected from. Here you see that risk is one thing; demand for protection is something else.

VI. Severity versus Probability

Risk is dependent on both probability of injury and severity should it occur. In my study, people were asked to rate probability, severity of risk and demand for risk reduction. I found that risk and probability were closely related. Severity and demand for risk reduction were also closely related. Risk and demand for risk reduction were only moderately related. If you want to understand why people demand risk reduction or risk mitigation, you must get some idea about how they see the consequences. Probability is insufficient. Risk and probability are insufficient to understand the attitudes that people have toward hazards.

In risk communication, it should therefore be clear that the public wants to hear about severity of consequences, not so much about probabilities. This is because probability is hard to understand and precise estimates of very small probabilities must rely on many assumptions and are seldom very credible. Therefore, in risk perception research, it is necessary to broaden the scope. Just studying risk is not sufficient.



VII. The Role of Emotions

A little while ago, I said that dread was not such a powerful factor for understanding or explaining risk perception. That does not mean that emotions are not important. I did some work on several emotions, not only fear, and on both negative and positive emotions. This data includes several hundred respondents from two communities, where the siting of a nuclear waste depository has been discussed. The other two groups are the nation or a controlled community. You see that the balance between positive and negative emotions is completely different in these cases.

Here is a model towards nuclear waste depository. If you look at the regression weights, again you see that the positive and negative emotions are the important factor. Epistemic trust also comes out as an important factor and is considerably more important than social trust. Attitude and risk also enter the picture. This model explained about 65% of the values of the attitude.

Conclusions about emotions

- Specific and *current* emotional reactions do seem to explain much of attitudes and policy behavior
- Compare these strong effects with the almost zero importance of anticipated dread *of others*
- Both positive and negative emotions are important
- Note that “worry” contributes beyond the effect of “fear”
- Anger seems to be more important than fear in policy contexts

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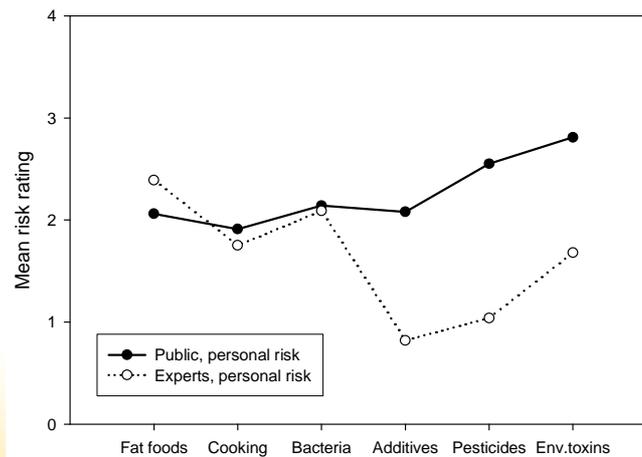
VIII. Experts and the Public

I will say a few words about experts and the public. As I said in the beginning, it was claimed that experts make correct and objective risk judgements but this work was based on a very small group of experts of questionable competence. Later work with competent experts has shown that they have a similar structure of risk perception than the public but at a lower level.

Risk perception is related to the experts' field of responsibility, not to knowledge. For example, we have data on food risks, the public and experts. There is a clear difference. The experts see a much smaller risk for additives, pesticides and environmental toxins in food but there is no difference when it comes to too much fat in your food, cooking in an appropriate manner or bacteria. I interpret that only when it comes to things that the experts feel they have some responsibility for, they judge the risk as much smaller.

What I just said refers to general risk. In fact, you see the same tendency when it comes to personal risk, if you compare experts and the public. It is a common trend found in other studies too that experts judge the risk as smaller, and often dramatically smaller, than the public does within their own general area of responsibility.

Experts and the public: personal food risk



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IX. The Silent Majority Phenomenon

Let me just finish by talking about whether groups of experts and the public are homogenous or not. If you look at the distribution, you find that the risk deniers, the people who agree with the experts, are at least four times as frequent as those who are alarmed about risks. You have a skewed distribution. This one is with nuclear waste but you find the same thing with many other hazards. The big group of the public is not concerned and does not think that there is a risk. Then you have a small alarmed group. There is a silent majority phenomenon. Those who perceive large risk are more active and are heard more in the debate arenas. If you look at the so-called stakeholders, you find that there are two types of stakeholders in a typical case: those who find the risk to be very small and those who find it to be very large. Those are the ones who are active and do something in the area but they diverge and are different from the public at large. This is a very important reason why one must study empirically the views that people have about risks.

Conclusions about individual variability

- The distributions of risk judgments are typically skew, with many people judging risks to be very small and few judging them to be large
- However, there is a “silent majority” phenomenon – those who perceive large risks are more active and are heard more often in the debate arenas
- This is one important reason for studying empirically what views people have about risks
- Experts differ widely depending on the promoter/protector role, and organizational basis (Industry, government, NGO's)

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Alain GRIMFELD

Thank you Lennart. I am going to give the floor to Brian Wynne. Brian Wynne is Professor of Science Studies. He is an Associate Professor at the Lancaster University and works at the Centre for the Study of Environmental Change. He is going to talk about myths and the public.

Emancipating Ourselves from some Myths about the Fears of 'The Public'

Brian WYNNE

Centre for Economic and Social Aspects of Genomics (CESAGen)

(Transcription not approved by the author)

I. Risk and the Public

I would like to add my thanks to the organisers of this conference which is far bigger than I expected. I am peering a long way to the back of the room and I hope that you can hear my voice okay. I am going to present in English. I apologise; I prepared this in English and I feel it will probably be better to leave the job of translation to the interpreters than to myself.

The morning session is about instruments for reducing uncertainty. I fear that I am not going to help very much in that respect. I really want to pick up on discussion and exchange, which began just before the coffee break, when David Gee, my colleague and friend from the European Environment Agency, distinguished between different forms of uncertainty around risk as a focus of interest. I want to elaborate on that in relation to the

ways in which the public at large understood and indeed enacted in expert discourses of risk, risk assessment and politics.

This is a complex story and I have too many slides so I may have to fold at points and skip up some slides. I will start with some elementary observations as I see them. Public controversy is usually over innovation and new and emerging technologies, has been biotechnologies, nanotechnologies, continuing nuclear waste technologies and so on. These are not only about risks and especially not only about risks as defined by regulatory science and regulatory scientists.

Of course, public concerns include risks but there are also others including concerns about the institutional and scientific behaviour in the risk and regulatory field and in the innovation field, for example, and I will come back to explain this in a minute, the effective denial of consequences beyond known risks. Risk by definition has unknown consequences, whether we think we can attach probabilities to those is another question. The point is that publics are also concerned about consequences which are unknown, unpredicted, unanticipated. Matthieu Craye gave the example before coffee of CFCs and stratospheric ozone depletion.

Public concerns do not usually equal opposition to whatever the new technology is. They are often expressed and articulated but they do not necessarily result in mobilised opposition. They are assumed to always do so. Also an important point, particularly in the UK with our notorious tabloid media, media headlines do not equal public attitudes. For example, in Britain at least, the frankenfood headline in the *Daily Mail* was taken by many to be an accurate representation of public attitudes and understandings. There is little evidence to show that that is true. I think there is a process here whereby politicians and ministers are recruiting often ex-media professionals as their political advisors and there is a self-referential circle which then is established between the politicians, their advisors and the media headlines. They are all part of the same media culture.

It is well recognised by sociological research. For example, the Media Studies group at Glasgow University in relation to a lot of risk issues or issues defined as risk issues; there is no connection necessarily. The connections are very loose and unstable between public attitudes typically and those kinds of media headlines.

Here we come to an important point about the deficit model of public attitudes and responses. If the public issue is imagined to be only about risk, then public concerns can only be about risk. What else could they be about if that is what the issue is and risk is how the experts define it. If this is the case, we know the risks. We are the scientists who do risk assessment. We are in the regulatory processes so we can reassure those publics who have those concerns that we have done the risk assessments and they show that the technology is acceptable. The risks are low enough.

From this premise, any opposition must be based logically on either public ignorance of risk or public rejection of science, an even worse condition than simple ignorance of science. In this sense, the public deficit model, which is supposed to explain public opposition to new technologies is dead but long live the deficit model. It is being reinvented continually within this kind of framework of meaning, which is established in the institutional policy in scientific culture.

II. The Deficit Model Explanation

It is important to note here in passing the deficit model explanation of public opposition because it has been misrepresented and misunderstood in this way. I coined the term in the late 1980s. It was never a denial that there are public deficits of knowledge. Of course there are and there are deficits of knowledge on the part of scientists as well. We have to take deficits of knowledge for granted. That is just an unfortunate condition of life. The point was to criticise and deny the assumption that it was the cause of public opposition and concerns; a very important distinction that is often forgotten.

I just want to give you a list of examples of the different versions of the public deficit model, which had been invented at one point. Then, often under a lot of pressure from social scientists who have done their research to show that these are not the main reasons why people are opposed to different technologies when they are. As Lennart has just indicated in his own work on Swedish publics and nuclear waste depositories, it is not necessarily the case at all, that typical publics are opposed to every new technology that comes along.

This is a case taken from the history of GMOs as a public issue. The first version of the public deficit model was that the public is opposed to GMOs because they do not even understand and this was found in Eurobarometer. Typically, they do not even understand that non-GM tomatoes also contain genes. How stupid could they get? That is why they oppose GM technology, of course, it is; it must be. Actually I think it was typically in the European population at large with large variations among different member countries but I think it was about 35% of publics who made that elementary biological mistake of GM and non-GM tomatoes and genes. This was continually criticised by many social scientists including myself and French social scientists.

The next version was that the public opposes GM because they do not understand that science can never deliver zero risk and certainty. They have a misunderstanding of science in the form of the scientific process now. This was the version articulated by Lord Robert May, the UK government's chief scientist through the late 90s in his role as chief scientist and defender of government policy, promoting GM crops.

Then there was the new version that public has a deficit of trust in science and that more information, transparency and more understanding on the part of the publics about our motivations as scientists will restore trust. That worked very well, did it not?

Then there was a public deficit of understanding that real science has no ethical or social responsibility for its applications or impacts. That is purely society's responsibility. We scientists just do science. It is society that decides which of those outcomes of science might be applied in new technologies, agriculture, medicine or anything else. That is society's responsibility. Those ignorant publics think it is our responsibility as scientists. They do not understand the distinction between pure science and applied science.

Then another version was that public deficits of knowledge exist over the benefits of science, which of course we scientists know. We know that GM crops will help feed the global starving. There was also a UK domestic version of this that would save UK science. In all these cases, these versions have been acknowledged to be empirically questionable

or plain false. Yet one finds an acknowledgement of the falsity of the deficit model followed almost in the same breath by a reinvention of a new version.

III. Why the Reinvention of New Versions of deficit model?

When I began to realise that this was going on, I realised there was a systematic enactment and performance. There was an accounting of publics as being emotional, dependent, epistemically vacuous, gullible to manipulation, whether by extremist NGOs or tabloid media or whoever. In particular there was a systematic avoidance of recognition of any questions about the institutional culture's own assumptions and responsibilities.

I want to move quickly to explain something of this in relation to different kinds of uncertainty in a second. With this repeated reinvention, almost as versions are being acknowledged as being wrong or mistaken, then the persistent reinvention of new versions suggested to me that this was symptomatic of something else that was going on, that was not being stated or recognised.

I am suggesting that risk governance can be seen to involve an insistent demand that the public be seen to be incompetent within the world of meaning that we experts have imposed. We have imposed a public meaning on the issue of GM crops but you can actually look at similar issues in other domains. The issue is risk and risk as we define it. Ethical concerns are also recognised to exist but they were basically privatised by saying, 'We can solve that problem. If people really believe that we are playing God, then they can exercise their private ethical judgement by choosing in the marketplace so long as we label GM foods. Label the GM foods and then it is a private issue; it is no longer a public issue.'

This is regardless of the fact that the ethical concerns of publics were about the institutions supposedly acting in the public interest; a translation from public to private. The public in this sense is something of a threat because it is coming from the unknown and the different. It is coming with different concerns, which are not actually represented adequately by risk as defined by regulatory science. Remember I am acknowledging that publics have risk concerns; of course, they do. The point is that it is not the only kind of concern they have. The issue is often reduced to that singular one-dimensional scientific meaning.

It looks as if this genuine difference, not simply an epistemic incapacity to understand, but a genuine difference coming from a different social normative position, cannot be acknowledged as legitimate. That looks awfully like a lack of democratic politics. Is governance not supposed to be a political matter, not just an administrative and technical matter? Politics is hopefully enlightened by good science and proper information but nevertheless it is a political matter about the normative issues in public life.

It looks awfully like this historical character that I have described of reinvention of new versions of a deficit model of publics as a way of explaining difference of controversy or opposition is actually reflecting some kind of larger or deeper need to avoid recognition of real difference.

I am suggesting that that is a reflection of a historical process that has been going on not just through the GM crops issue but for a while longer than that, which is about the undermining of democratic capabilities to actually articulate public meanings and normative dimensions of those public issues and to inform them with good knowledge. There is a will to set aside a certain dimension and to impose upon us some sort of knowledge in a deterministic way.

IV. Scientific Ignorance: Dogma and Denial

This is just one example taken from 2002 in London. It is a verbatim recording of an exchange between a then existing Agricultural Environment Biotechnology Commission in the UK. It was disbanded a few years ago because it had not done the job that the government had expected it to do in the GM field.

This is an exchange between a member of the Agricultural Environment Biotechnology Commission (AEBC) and the the Chair of ACRE, the advisory committee on releases to the environment, which is the decision making body for the Department of Food and Rural Affairs (Defra) on GM licensing and experimental field test licensing this far. It goes as follows.

'AEBC Member: Do you think people are reasonable to have concerns about possible unknown unknowns where GM plants are concerned?'

'ACRE Chair: Which unknowns?'

'AEBC Member: That is precisely the point. They are not possible to specify in advance. They could be from surprises arising among unforeseen synergistic effects or from anticipated social interventions. All people have to go on is analogous experience with other technologies.'

'ACRE Chair: I am afraid it is impossible for me to respond unless you can give me a clear indication of the unknowns you are speaking about.'

'AEBC Member: In that case, do you not think you should add health warnings to the advice you are giving to ministers indicating that there may be unknown unknowns that you cannot address?'

'ACRE Chair: No, as scientists we have to be specific. We cannot proceed on the basis of imaginings from some fevered brow.'

What we see there is a denial of anything beyond known possible effects or risk consequences. I will just come onto this distinction, which was mentioned just before the coffee break. We know that a scientifically defined risk varies according to the probabilities of harmful effects multiplied by the consequences from those harmful effects aggregated in different ways and under different units and so on. Uncertainty is a condition where we may know the possible plausible scientific effects but we do not know the probabilities. Ignorance is the key difference where we do not know some possible effects or unanticipated consequences so we do not even know in the risk assessment process, which questions we should be asking.

V. PABE and Other Studies

Now in the late 90s in the UK and later with a European study called the PABE studies, public attitudes towards agricultural biotechnologies in Europe, which I think reported to the Commission in 2001. There was a French partner involved in that and French fieldwork with publics and stakeholders in the GM case was conducted in France.

When we asked people to express their concerns and their reasons for opposing GM crops and food in their own language, they referred to thalidomide, CFCs and stratospheric ozone. We wondered why they were making this curious connection between GM crops and CFCs and stratospheric ozone. With further research, we realised that they were using analogy to express their concern, evidence based, that actually those technologies had also been through the risk assessment and regulatory process and that they had been licensed for commercial use. CFCs are even stated by James Lovelock, the iconic figure of the green movement, in 1980, he had been using them himself for his own atmospheric mobility research, that there was no conceivable harm that could follow from the environmental release of CFCs. That was in 1980 in the "*New Scientist*".

Five years later, Joe Farman was reporting in *Nature* the discovery of stratospheric ozone depletion from CFCs. The best science of the day does not necessarily know all of the right questions to ask when it comes to risk assessment. That is not a critique of science; that is just a human fact of life. It is a predicament more than a critique. What do we do? Normally we say that is not the responsibility of any human being so any consequences that follow from this technology, having been through that sort of state-of-the-art scientific review and risk assessment, are acts of God. Human negligence and responsibility only arise if we find decisions have been taken and commitments made in neglect of the state-of-the-art scientific knowledge at the time. In other words, was there prior knowledge possible?

VI. What Else Can We Do?

Ignorance is a difficult condition to deal with. You cannot deal with it directly by definition. You cannot just say we could not predict all the consequences. Just get better and then we will be able to. We cannot when we do not know. That is in the nature of scientific knowledge. It is finite. It is limited and so we can do other things. For example, this is where the "Late Lessons case studies" are so important; we can deliberately attempt to enlarge the bodies of expert scientific knowledge and indeed lay-knowledge when it is relevant and it often is, which is feeding into the risk assessment process. That is not a guarantee either. There are no guarantees about anticipating unpredictable consequences but we can do better.

We can also ask indirect questions, which are important. A Norwegian government did this in the Gene Technology Act, recognising these issues. It basically said we can ask about benefits in the regulatory process. If it is really important and meeting a really important benefit, then it might well be worth accepting that there might be unpredicted consequences which could be harmful. There might be nasty surprises so let us get on and do it. However, that requires you to also ask the benefits question. Is it important or not and who is it important to? Is it important to people in real need or to affluent food consumers like most of ourselves who do not need a lot more choice when we go and choose our food?

VII. Ambiguity

Ambiguity is a different kind of issue, which is about what the issue means to people; in this case, risk, for example, as defined by science or more than that. Very often, all of these different conditions are actually reduced to risk so that things become risk issues, even though all of these dimensions are actually at stake. The more difficult concerns like ambiguity and ignorance tend to be reduced and, in fact, deleted in the language of risk and risk assessment. The assumption is that uncertainty is only a kind of uncertainty which more science will actually reduce and then will bring into the domain of the manageable. It is about residual imprecision if you like and not about the kind of uncertainties that I have been talking about, which are far more difficult to deal with.

We can see how the process of externalisation that occurs here is a material process. It is not just a cognitive process. The process of externalisation means that those unanticipated consequences if they are harmful, are going to fall upon somebody at some time and we are not going to take responsibility for them. There is a big set of ethical questions there. There is also a big set of questions; if we are really committed to sustainable development, then maybe we should be taking this kind of questions seriously too. This is where I want to emphasise that methods and instruments here for reducing uncertainty are not enough. Of course, we need to do better with methods and instruments but we also need to think about what kinds of institutional change might be needed in order to address the kind of issues, which I am describing here.

VIII. Convergence between the European Publics

It is interesting by the way that our PABE study was conducted in five European countries; quite large ones, France, Britain, Spain, Italy and German. We found surprising convergence between our publics in all those countries. Even more surprising was at that same time, we came across a study being done by scientists at the Food and Drugs Administration in the US. They were finding just the same concerns amongst public in the US but it was not about risk as defined and conducted by the risk assessment authorities and the regulatory bodies and the policy authorities and experts. It was about ignorance and unpredicted consequences.

Of course, there is a connection and this is articulated by people about the speed at which commercialisation of immature laboratory knowledge was being attempted. In that case, there was huge political economic pressure to commercialise because the Americans were doing it so we should do it in Europe too. There is a connection between speed of attempted commercialisation and the likelihood of unpredicted consequences being generated. Science does not automatically reduce ignorance and uncertainty. It often actually generates more. If we decide to do scientific research, i.e. technological research, at the genetic or molecular level in organisms, we are generating more ignorance of what the consequences are that we have released.

IX. Misguided Reassurance

Science should not be seen as being an automatic relentless reducer of uncertainty and ignorance. Of course, sometimes it does, thank goodness but other times, it does not necessarily. That needs to be borne in mind when thinking about uncertainty and its governance in these domains. I think I have gone on far too long so I am going to try to draw to a close.

The point here is that in the GMO's case, and you can see it being repeated in other cases too, that in response to public concerns, as I said, found to be more about unpredicted consequences and predictable consequences and the objects of risk assessment themselves. The response of the scientific and policy authorities was to repeat the risk assessments as reassurance of those concerns, perfectly well meant but actually missing the point in a really important way. The public concerns were not about the risk assessment themselves. People were not pretending to know better than the scientists and to say, 'We know better than you and your risk assessments were wrong.' That was not what they were saying. They were saying, 'Yes, that might well be true about those risk assessments but have they asked these questions? Where is the response to the unpredicted consequences?'

X. The Epistemic Other

In repeating that risk assessment issue, in good faith and in order to reassure those who are scared, we actually dig a deeper hole for public credibility of science in this domain because we effectively deny the lack of predictive control of all the consequences of this innovation. As I said, I do not want to pick out GMOs here; that happens to be the case that empirically I am drawing from but I have also done work on Nano where similar kinds of conditions or misunderstandings can be seen to be in play.

In that sense, unpredicted effects are like the epistemic other. The public is coming at this issue with different concerns. They are the other in anthropological terms. Unpredicted effects and ignorance is like the epistemic other; it is surprise. It cannot be dealt with in the existing paradigm. That is where it is surprising and also disappointing that science, which is supposed to be the emblem of cosmopolitan ability to actually recognise and accommodate difference and diversity, is actually here externalising, denying and deleting it. That is because of the ways in which science has been institutionalised in the public domain, not only as an enlightened cultural force or a factor of production in innovation in new technology and so on.

Not only is public authority informing public decisions about these things and indeed other things, but also as the provider of public meaning. It has been given by default the role of imposing public meanings on these issues. The issue is risk. It is an instrumental issue only and we know that is about more than risk but we need to build that knowledge into the public domain and into the mainstream discourse and conduct of these issues. We do not have the institutional and maybe not even the cultural means of doing that yet. I hope 'yet' becomes significant there.

Thank you.

Alain GRIMFELD

Thank you, Brian. Moving on now to the next presentation; Francis Chateauraynaud, you have 20 minutes. You have only 20 minutes. Otherwise we may have to skip lunch. Is the trajectory or the pathway of awarding something you can manipulate; calculations and power plays in the health and environmental mobilisation processes?

Can We Observe Political Manipulation in Alarm Processes? Power Games and Mobilisations in Environmental Health Issues

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(Translation not approved by the author)

I. Trajectory-Based Sociology

Considering all of the ground we have covered since this morning, I will offer a shortened version of the already-shortened presentation which I prepared for today. I will broach four points, which I will probably not be able to present up to the end. The first one will be a new look at the concept of limiting uncertainty by reframing it as a function of the actors involved, whose prime objective is very often to regain control over a given process. The question then becomes: how can a sociology that pays careful attention to controversies and emergencies, which, up to this point, has stood out for its refusal to criticise and disclose, in line with a model that had developed in the 1990s, bring strategic aspects back into its descriptions? You will see that this is absolutely central. Then we have the fundamental arrangements. I refer you to information on the Internet that you can easily find.

I have entitled this section: "from argumentative sociology to the ballistics of public causes". The term ballistics refers to the need for us to take this concept of a pathway or development trajectory in public issues very seriously, with a target, a scope and an impact. There is a whole series of terms which we use without even thinking about it. The idea of sociological ballistics is not just a metaphor. We need to be able to organise our words and make it our goal to build a systematised sociology of pathways, rather than using these concepts episodically or inaccurately. We need to harden things up and materialise all of this soft knowledge into a hardcore model. Workshop 5 yesterday was the absolute best but we need to better understand things rather than explain everything. The third point is probably the most interesting one but I am not sure I will have enough time. How do you unveil the situation? Also how do you grasp the situation? You do it in asymmetrical fashion.

What do I mean by that? It means that some stakeholders have better access than others to the process. We know this. Despite all the buzz words about health democracy, technical and “participatory” democracy, arrangements and systems come together and become undone. It is all asymmetrical and Brian Wynne very effectively showed that this continues today. I will simply say a few words about that at the end.

II. Building the Future as You Expect It

The most interesting thing has been discussed several times is the future. I am a bit frustrated regarding sociologists’ relationship to the future. You are all familiar with these self-fulfilling prophecy summed up by Robert Merton, about which there has been a great deal of discussion. Basically, the future will materialise as you expect it because you will build it the way you expect it to become but what about the semantics of the future? The well known German historian, Koselleck, was one of the first German historians who pointed out the role played by criticism in the development of modern societies, delving into the question of time of history, in a work called *The Past Future*. Specifically, he looks at how we open up the future and what kind of angle on the future do the stakeholders have? The future is not just representation because obviously the future is not there yet so you cannot represent it. From the standpoint of the classical philosopher, the future is not “being” – and this refers us back to the well-known contrast drawn between something “in action” and something “in potential”, for instance. In the portrayal I will attempt to give of the future, the idea will be to determine which angle the actors adopt of the future. If you want to adjust an alert trajectory, you will have to do two things – to save some time, I am going to skip directly to my conclusion! You need to create an asymmetrical situation, which means having a greater grip on the process than do others – if this is not the case, it will be very difficult to be in control. And taking control of the process means working on other individuals’ angle of vision for the future. This implies offering them a way in which to see the future. Yet, concretely, what does it mean? Many of us are working on technological advances, but in order to shape how others see the future, you need to configure paths for development, and lay out, in advance, the avenues which others are to follow. If you manage to handle both of these aspects, you will be able to remain in control of your alert situation. However, what surveys have shown, is that it is hard to reconcile those contradictory constraints when there are a lot of disrupting influences. Surprise and the unexpected inevitably emerge and will disrupt this fine model, based on control and mastery, even when our thinking and action come together.

III. Entry Point as the Argument

Now there are a few statements that I shall post online because unfortunately I do not have enough time today. The entry point is the argument; that is a methodological principle. It has nothing to do with the political philosophy of Jürgen Habermas. First of all, we need to take each stakeholder’s rationale very seriously. If you look at the theory of argumentation, you quickly find that argumentation is not substantiation. It is, according to Aristotle, first and foremost, a technique. In Perelman’s view, it is a means of getting another party – an audience, judge or interaction partner – to change states. It can be as simple as telling another person, ‘I exist.’ This first concept is very important,

because there are stakeholders emerging in our environment that have no arguments. Now if you want to be bad and politicians can be really bad, some people say, 'We do not have any arguments, but we do exist and we are here and we have a say.' There are different ways of changing the state of the other. You can simply say, 'I am here and I exist.' This is a way for you not to enter into the arguments that are defined, stated and formalised, etc.

Now I love Remy Barbier's work. He has worked a great deal on sarcasm, with regard to all of the controversy regarding incinerators, etc. He examined, very seriously, the kind of individual who shows up in a debate and creates a form of distance, through sarcasm.

IV. Causing a Phenomenon to Emerge

In line with a sociological view very similar to that which Yannick Barthe presented yesterday, we can try to find out how the stakeholders will come to an agreement on facts, build up that factuality, produce causes, and interpret the world. I would like to suggest three fundamental models used to reduce uncertainty:

You need to cause the emergence of an object or phenomenon.. You need to make it tangible. You cause a particular phenomenon to emerge and that is the best way to rule on a controversy. Sometimes things emerge without your having asked. Sometimes things emerge and nobody notices because nobody cares. This is something that has been studied at great length. How do you cause things or objects to emerge? How do you make them tangible so that it will be very hard to say, 'Sorry, this did not exist,' because it did, thereby putting an end to the argument or uncertainty? You caused it to emerge. Now there is a very good term, an Anglo-Saxon philosophy, coined by Bernard Williams. He talks about negators. It is some people's job to say, 'No, sorry, it is not there.'

The second technique is to cross-reference adverse versions. You have a whole range of different versions and the only way to reduce uncertainty then is to cross-reference. In civic-, lay- or folk-epistemology these are the basic techniques that are used. You cross reference the versions and as you do, the various versions eliminate each other and you end up with more or less a stable process.

The third process is much more interesting for us because that is often what happens in terms of uncertainty. We do not know how to cause these things to emerge. You do not know how to cross-reference adverse versions because there are too many differences so you impose a space or area of calculation. You impose standards for reasoning, not about facts, and not about items that are more or less convergent, but about the perimeter for the calculation, the perimeter in which to operate. Obviously, this requires scoping. This imposes pressure on certain stakeholders. I want to show that this depends on two different things; firstly, forms of public expression, hence the importance of being attentive and secondly, the pathway adopted by the organisation themselves. How do you state things? How do you drive them? How do you convey them? There is a whole series of changes that those arguments undergo over time as they get tested. Where does it start? If it starts with the media, you will obviously not have the same results as if you end up waiting for a group like PMO ("Pièces et Main d'oeuvre"), the jolly bunch that has decided to become the critical voice on nanotechnologies, and

which came to renown in Grenoble, by handing out pamphlets at underground exits. You impose an area for calculation and you impose standards for reasoning. There were two things that are not completely obsolete, or unnecessarily redundant, now that I have heard Brian Wynne's presentation. Sociology cannot be based on risk perception because you need to take a close look at what people actually do in their own environment before you start to qualify what they perceive. The sociology of perception has been restated as a sociology of the various holds an individual can have in a sensitive world, and without which we would not be here and would not be able to build a shared environment – which is not possible, insofar as we perceive the world around us. On the concept of perception, Jon Elster jumped on me at a conference to tell me that he tried to translate Merleau-Ponty in English and he did not manage, because it was typically "Frenchy" prose. By this, he meant that he did not hold up. Yet Merleau-Ponty was one of the few philosophers that defended an irreductionist conception of perception. That is what is of value to sociology, as Yannick Barthe in particular illustrated yesterday, and as Workshop 5 did, even more so.

V. Ballistics

This brings me to the most important aspect, and I will ask that you warn me when I don't have much more time remaining. Maybe I can save this for the sake of discussion after lunch. This is a parable. It is for math people. You have a curve and that is a ballistic trajectory. You send a projectile. It reaches a certain level and then it falls back to the ground. There was an article that was much discussed in terms of social sciences in the 1980s. It is called *The Rise and Fall of Social Problems*. A social problem emerges and raises a certain level of mobilisation. Generally, it falls under a particular agenda and then it falls back to the ground so things go up and they come back down.

Look at the H5N1 as opposed to the H1N1. H1N1 has fallen back to the ground, except on the website of the WHO so as you can see it all depends on the stakeholder. Ballistics describe the efforts made by stakeholders to maintain things in suspension or at height in the atmosphere so they can have buoyancy rather than falling back down to the ground.

VI. A Definition for Arguments

There is a technical aspect but I will post this online so no worries. You cannot move forward unless you clarify what a good argument it. I was a bit surprised repeatedly to hear people say, "this argument does not hold water", or "it cannot withstand criticism". The problem, precisely, is to determine what it means to withstand or not withstand. This is why, together with a colleague with whom I am working more and more, Marianne Doury, on a definition for argumentation, one which incorporates the concept of withstanding criticism. What are arguments? It is a way in which you organise discourse to make sure it can better withstand criticism. As you can see, this definition is crystal clear and is very close to common sense. When you put forward an argument, what really matters is that this argument can withstand pressure or criticism. The trials and tribulations this argumentation goes through to build up the ability to withstand all depend on your path.

VII. The Reality Principle and the Precautionary Principle

Whether public or non-public, it is in those arenas that you see how things happen. With regard to the Reality Principle, I will get back to that later to elaborate on how it comes to a conclusion. At some point in time, the stakeholders adopted this technique. 'Enough talk,' they said. 'There is something that is forcing us to stop.' The Reality Principle is a very interesting way of spotting the threshold in a particular argument or interaction. Enough talk; now it is time for action.

We talked about the Precautionary Principle. At some point in time, there are enough deliberations and public discussions as arguments can keep going around in circles. Suddenly, the Reality Principle emerges and puts an end to the discussion. He who can state the Reality Principle and get others to recognise it is nothing more and nothing less than an embodiment of power. He who is able to state and make operable a principle of reality, putting an end to an argument, brings to life an asymmetry in control. It is important to note that, when we look at this verbal argument, we are not dealing with the same level here. I will fight to the end anyone claiming that what we are dealing with here is only discourse. The concept of discourse is usually used to disqualify the other person's claims or assertions and, within rhetoric itself, this is already anathema.

There are three different levels, which are very important for the stakeholder and the stakeholders have very different points of view on the subject.

- What exists in the ontological world? Of course, this is an assumption that you rule out right away. Maybe we have all got H1N1 already. How do you drive those entities? You cause them to exist. You cause them to emerge. That is fundamental.
- From an epistemic standpoint, what cognitive agenda are the various stakeholders developing? Modes of knowledge, tools, calculations and metrologies all form another level, which is just as fundamental. When you reason in terms of costs and benefits, for example, you bring in an epistemic view that will make certain forms of reasoning relevant and disqualify others. For instance, you might say that argumentation is but hot air, and that what matters is how much it costs. For the answer to that, just read Aristotle's *Rhetoric*. No one has managed to say anything new since. Having heard Brian Wynne just before me, it can only be plainly clear to you that the epistemic means bring various modes of knowledge into opposition with one another. There are interesting examples in which we cannot yet make calculations and where the concept of risk is not clear – the cost/benefit calculation is made downstream and this assumes having stabilised many factors. Yet there is another problem that is just as important – determining what goes into the calculation and what is withstanding that calculation. Seminars have been held about the value of human life for instance, and that is a fascinating debate. Many things have been stabilised before you can start with the calculations and be credible and what not.
- I am not an economist. With axiology, stakeholders base their actions on values and principles. There is a whole controversy in sociology. What is the common good? What is a public asset or even, what is good in itself? However there are things on which we will not compromise. I would like to refer you to various works by Peter Gärdenfors. Of course, that is not required reading for you but Pierre Livet

summarised it in more accessible fashion. He is a fantastic French philosopher. Here is the question. Why do you not overhaul your knowledge or beliefs? We prefer to revise what is less fundamental. This means that there is an epistemic rooting system. You cannot alter your point of view without entirely changing the way you are or your own being. I am a farmer from the Larzac area. Do not ask me to indulge in rhetoric. Depending on the roots that emerge, it is very pragmatic. Stakeholders gain ownership of a certain rooting system. Endangering fundamental beliefs is a prerequisite for a true controversy to emerge. One of the conclusions is this: controversies are vulnerable because it requires that stakeholders constantly oppose each other as opposed to saying, 'You were right. I am going to go back to the drawing board.' If no one ever budged, if stances were determined once and for all, what good would it do to debate? It is interesting to see how this dilemma is played out on the Web currently. Some feel controversy is no longer producing anything. They believe that it is all talk and no listening, and that the only claim on which true power can be staked now is the number of hits a given person's blog records. All of this goes to show that controversy is very vulnerable and it is due to a balance between various stakeholders that are entrenched so that they can hold on to their positions or open enough to actually reviewing their point of view. If this cannot happen, the controversy will produce no agreement and disagreements cannot be pandered out.

VIII. Controversy

You cannot prejudge the direction the stakeholders are going to go – either consensus or divergence. Sociology is totally neutral on this matter. Why are there all these groups of people who do not want to talk things over? It is because there are people who love consensus and others who do not. There are hackers or people who love to blow things up. They want to show that they are in control and that those who claim to be, in fact, are not. You need to be neutral from a methodological point of view to try to see how stakeholders can possibly switch to a different system.

The network called "Sortir du Nucléaire", between late-2004 and late-2005, totally turned things on end, because the nuclear industry was first seen as the enemy and the network as the victim. In the end, it was the Government that had undermined public debate on CNDP (Commission nationale du débat public). The same actor is indeed capable of adjusting an opinion and evolving over time.

IX. Creating a Model Using Multiple Processes

In conclusion, how do you create a model for all this? How do you compare multiple processes? Here, I agree that there is a problem when too much focus is placed on risk. I do not specialise in health and the environment contrary to appearances. It is a specific area and I look at the conditions for emergence of this trend, but have also looked at the cause of researchers or that of illegal immigrants using the same tools. We apply the same model and it depends on the research and the university doing it. We carried out a number of surveys on various subjects but the model works very well.

You need a model that is general enough so that it will not crush the basis for the survey. Yannick Barthe said it really well yesterday; you need to talk to people. You need to collect as many points of view as possible so you have to evolve over time. You need minimum points for comparison because, without a model, you remain extremely empirical and hyper-local.

Now in the model that emerged based on the systematic confrontation between the various dossiers, there are five different stages. There is a book that we published five years ago with Didier Torny. We had seven steps and now we have narrowed it down to five. That is good news in that it means I am making strides where parsimony is concerned... This is what emerges from systematic confrontation between the various dossiers. There are about 30 of them that we address systematically using tools of electronic sociologists, on whom I will not elaborate today.

At the end of the day, some people say it looks very normative. There is just one trajectory or path. No, that is not it. It is the pathway that seems to be the one that emerges when you compare all of the dossiers. It is like a skeleton that you pull out of an excavation site. Just what is this odd creature? Its oddities cannot be described as a morphotype emerging from multiple comparisons. It is not a dinosaur; it is just a skeleton. This looks like things that we have already heard in various presentations. There is a first step, emergence; then the controversy and then the denunciation, political mobilisation and normalisation.

X. Responding Environments

This is also very important, for example, when you draft a text or produce a ruling or decree, law, regulation, etc.. Obviously what I care about is the rebound or recovery. What are the conditions for this to happen? When each stage has been rolled out, how do we kick back up when all of the previous stages have been deployed? What about the relationship between the top part of the graph, the public part that is visible? Using the tools that we have today, we can aggregate the data and monitor it. What is really important is all of the intermediate environments that respond or do not respond to what happens in public arenas.

What is it that causes a phenomenon from switching from one stage to another? This is where the stakeholders are really smart: there are arguments that they put forward in terms of unveiling. You ask a particular survey, a Greenpeace one on nuclear science, etc. There are various strategies and costs involved that stakeholders ascribe to each other. You cross-reference all of those tools. As you try to interpret the situation. Who wins? Who loses? How do we kick things back into the game? Publicly, you can say what is going on in a particular file.

XI. Further References

So as to not leave you hanging, as time requires I leave the dais now, there are five key references. Two of them have not been published in collegial environments. The book by Hilgartner and Bosk, *The Rise and Fall of Social Problems*, dating back to 1998, is required reading or rereading, as it did a lot to establish the concepts of agenda and arena in the

sociology of public processes. It was originally published in the American Journal of Sociology. It has some defects but is interesting. 'Why do we get mobilised?' by Daniel Cefaï asks a question but does not answer it but Daniel is my friend so it is okay for me to say that. He raises many questions. He is very good at asking questions. Each question means that you need to get back to the field to understand how stakeholders gain ownership of a particular cause. This gets us back to the previous argument.

Then, there are two texts that are posted online recently; one in English and one in French. The first one has to do with international causes and thus, a sociological ballistics for international causes; the pathway adopted by a particular cause. This was the first text in which the term "sociological ballistics" appeared. How does a cause's pathway emerge? What impacts it and how do all kinds of causes evolve over time?

The English version, for our Anglo-Saxon friends is published on the Harvard University website. It concerns public controversies and the pragmatics that pertains towards imperialistic action. Also there is a monograph by Jeanne Favret-Saada. How do you produce a world crisis using 12 little diagrams; in other words, how caricatures and the satirical drawings of Mohamed caused a huge controversy in Denmark that went around the world?

Those were the dossiers that I could have used as examples to back up my arguments. We have a summary of all of the hotspots. Let us not dwell too long on that. There are times when public arguments and public power plays are cross-referenced but if you push something out the door, it will come back in through the window. There is no point trying to lock things under control. There will always be critical junctures. It is those critical junctures that you need to look at with the same level of seriousness as everything else. Thank you.

Alain GRIMFELD

Thank you very much, Francis. The last slide is very attractive but unfortunately we do not have enough time. I welcome the posting of those documents on the Internet. This will be extremely valuable for each and every one of us. Now I would like to welcome Alain Kaufmann as our discussant. Thank you for coming to the rostrum.

Discussant

Alain KAUFMANN

The psychometric paradigm and its development represent the main approach taken by industrialists in order to format their risk communication. Social Studies of Science and Technology, here represented by Bryan Wynne, criticized the so-called Public Understanding of Science frame in which psychometric studies are often embedded. The very interesting school of pragmatic sociology represented by Francis Chateauraynaud is unfortunately less known.

As an introduction to this brief comment, I would like to say that there is a paradoxical nature in the question: "How can we reduce uncertainties regarding the moral ambiguities felt by the public towards technology and risks?" As many good works have demonstrated, science and technology continuously produce moral ambiguities. So, the idea that more science and more technology could reduce uncertainties is quite paradoxical. Look for example at continuing discussions about bioethics and the permanent review of legal and bioethical frameworks. Nowadays, there is a prevailing narrative going from GMO to nanotechnology expressing the necessity to discuss with the public moral issues and values "upstream" technological trajectories, in order to avoid rejection of technologies by people. A lot of interesting initiatives have been undertaken this way regarding nanotechnology, particularly in England, but too often ignoring the limitations of that approach.

I. Representating the Public in the Media

How is "the public" represented in the public sphere? How is the public represented by the actors involved in risk assessment and management? The public is represented first by the media. Usually, the media ask experts from the social sciences and humanities in order to express the feelings of the public in the context of an emerging crisis, for instance regarding the swine flue (H1N1) pandemics. This is an interesting situation in which the media wonder about the ethical and deontological limits of their role in the crisis management. Recently, I was asked by the radio why everybody was talking about H1N1 and whether one should talk about it so much. Two weeks later they asked me to come again to discuss why nobody was talking about it anymore. This is an interesting situation in which the media take a reflexive turn about how to represent the public, something they usually do implicitly.

II. The Public in the Surveys

The model of the liberal public, constituted by the aggregation of individual opinions, is another way of representing the public. It constitutes the opinion poll model like the one of the Eurobarometer. It is a major source of information for decision makers and

companies. One problem is that among the plethora of works produced by the social sciences in the field of risk, only some of them - Eurobarometers, opinion polls or psychometric studies- are used by the actors. Important works like the one by Francis Chateauraynaud, more difficult to access to but much more interesting, are not so well disseminated.

III. The Public in Participation

The public who contributes to participatory processes is the third type. Here the public is conceived as opposed to the "activists". It is composed by "open minded" and "disinterested" citizens gathered to reflect upon the "common good". It is supposed to comply with the rules of deliberation specified in the protocol of the participatory process, e.g. a citizen conference. This type of representation of the public is mobilized in the "upstream engagement" efforts. Because the debate is taking place early, it is supposed to have an influence on the choices made regarding the technology at stake, but in reality, this does not happen in a linear way, as you know.

IV. The Mobilized Public

The fourth representation of the public is the organized, motivated, mobilized public as it was described by Yannick Barthe yesterday very clearly. This public produces either co-expertise or counter-expertise by adding its specific knowledge and practices of risk assessment and management to the one of the experts.

V. The Public Enacted by Social Sciences

According to me, there is a fifth category, which is the public represented by the social sciences. If the layman, equipped with a specific kind of knowledge, has become such an important figure, it is partly due to the works done here at the École des Mines de Paris by people like Michel Callon, Yannick Barthe and Pierre Lascoumes on the emergence of this kind of "lay-expertise".

VIII. The Place of Emotions

To conclude I would like to say a few words about the role played by emotions. Usually emotions are regarded as a factor to be neutralized in the process of risk communication. Positive and negative emotions play an important role in controversies. As it has been shown, they exist in laymen as well as among experts. As Francis Chateauraynaud said, emotions are important resources for action. The idea to reduce emotions and look at them as mere parasites in controversies is a sheer illusion. We must acknowledge also that the "fear paradigm" is mobilized by a lot of decision makers and companies relying on a mere stimulus-response model, a physiological model.

I will stop here by saying that the role of social sciences vis-à-vis this topic is to ask for symmetry in the quest for knowledge regarding the various actors: ignorance, emotions and modes of knowing of experts, industrialists and decision makers should be documented as rigorously as those of the various publics.

Alain GRIMFELD

Thank you, Alain. We have just a few minutes to ask a few questions.

Questions and Answers

From the Floor

This morning the title of this session was how can we reduce uncertainties? After the intervention of sociologists, could we not phrase the title differently? How can we increase uncertainties through social sciences in deconstructing some political certainties? Jean-Pierre Dupuy would like to reintroduce his idea against the reintroduction of ethics. He would like to depart from this idea. We try to have some likelihood of a short period of time. The refusal of certainty thought should be questioned.

This morning, I see that the European Commission is reflecting upon the bottom up approach; the action carried out by the public. The Commission is aware of the environmental crisis and know that it is a matter of legitimacy. Therefore, the Commission has an interesting perception of the social response, which is not necessarily the case among the scientific community. We have been talking about the layman experts. Do you not think that they are pseudo-layman people coming from state organisations and at some point, they are interested in that matter?

I remember the manager of the political science body. He is now retired and is an activist. I wonder about lobbying. Do you think that layman experts are pseudo-experts? They are lobbyists. They are at the service of industrialists or companies. Do you not think that the social sciences could shake that model and deconstruct this type of evidence? Do you not think that it is an agitation model? With the creation of arenas for this nuclear network, it is interesting to see how such individuals create a whole series of problems and questions and act on this society. It is not perceived enough so all those strategic issues could be put on an agenda.

Francis CHATEAURAYNAUD

By way of an answer, I will do a bit of counter-advertising. I think it is necessary to go a bit farther than the paralogism which Jean-Pierre Dupuy so handily uses when he states that the impossible must become certain if we are to steer clear of the worst – incidentally, that idea comes from Hans Jonas. With regard to the future, I prefer to refer to work by a philosopher who has gone quite unknown, and whom I have mentioned quite a bit for over 10 years now: the author of *Temps et vigilance*. This is a real in-depth study on the phenomenology and logic of the future. The problem of Dupuy is that the future to which he refers has little modality, and may be lacking in it entirely – yet the future is a mode, a verbal tense. Our players have several types of engaging the future and Raymond Duval – that is the author's name – really needs to be read, at the very least for his concept of the matrix of futures. I use this concept to try to explain how we

were talking about nanotechnologies and the promise. Yes, we announced that in a few years time that it might be. The media has taken over, and you can hear, "Harry Potter's invisibility cape is coming has come to the market" You have constant modalisation and remodelisation of temporal openings.

I can tell you that we are going to leave this room soon, so there is a near future. If you modalise, you cannot say anything at random on the future. We are going to leave this room soon unless there is a hostage taken – let's say, by a group of Green Terrorists, the new fad for all intelligence services - and the police will help us come out. We will end up leaving the room. There is a future when you put a topic on the agenda. I did not believe in it at the beginning but it takes place. The degrees of beliefs and angles of opening are going to vary according to the mentality of the future. That was an answer with regard to Dupuy.

For the lobbyist, if you look at the dispute on tap water and cancer, there are two opposing camps with the media in between. They criticise each other as being lobbyists. In the pathway-based concept of sociology, I look only at how these things emerge. I do not know whether lobbyists are constantly in action.

Alain GRIMFELD

Thank you. We have a few minutes left for two questions.

From the Floor

I just have one comment. With regard to Brian Wynne, it was a very useful presentation. For a number of years now after risk assessment, we observe decision makers in charge of the communication of results, whether they are governmental decision makers. Those decision makers are opposed to communication, for instance, in absolute terms because they say that the population might run into panic. This argument has been heard a lot. I would be tempted and it is not as explicit, in the field of radio protection, the results are never communicated in terms of risk.

If you take the risk factor numbers, you only need to multiply and then you can talk in terms of death probabilities. Some of us have said for some time that this argument of not communicating in absolute terms because the population could run into panic has not been proven. Nobody knows that. Why shall we have this veil and what is this veil made up of? Why do we have this opaqueness?

Brian WYNNE

Thanks for that question. It reminds me of an exchange that I had during the 1990s in London with the Head of the Spongiform Encephalopathies Advisory Committee (SEAC), John Patterson, Senior Scientist and Chair of that advisory committee. When it was discovered that the blood supplies in the British blood bank for people providing blood for

whoever might need it in hospitals and operating theatres, there was a good chance that the blood banks had been contaminated with BSE, Mad Cow Disease infected blood.

The question was on his committee's agenda to advise ministers: Should we actually say anything about this? Are we going to panic the public? He was asking for my advice as a sociologist? I expressed the scepticism that you have just spoken yourself. When one looks at most cases, one does not find any evidence of public panic. I was approached by Sky News in the continuing swine flu episode. Visitors who had just been to Mexico were just coming back and the question was whether they had swine flu and whether they were going to spread it around the British population. I have got enough experience of dealing with media to know that they always want to impose their line on you as an expert and put their words into your mouth so that they can have an independent expert actually speaking what they want the broadcast to say.

My first question to them when they phoned me was: What line are you taking on this issue? They did not admit the line but basically it was clear that their line was that they wanted to talk about public panic. I asked the question: 'Is there any public panic? I do not see any public panic around. Please can you explain?' They just could not do it. In fact, I did do the broadcast but they took up some of the line, thank goodness, so it worked okay. However, there is this continual need to define the public continually on the edge of panic and hysteria. The media are no better than most policy experts when it comes to this. In fact, they are probably worse. Supposedly, they know the public better. They are supposed to know their audiences and markets but I do not believe that to be the case at all. I just find it a curious thing that it needs self diagnosing.

Alain GRIMFELD

Thank you very much. Brian's response is very interesting. First, let us establish a self-diagnosis before talking about it. It is such an interesting topic that the media highlight that population could run into panic.

Brian WYNNE

I did not finish my story about John Patterson and the SEAC committee. I said to him, 'Basically, my advice would be for what it is worth to find the right way of making sure that it gets into the public domain. They did that a few months later. There was no public panic. People know their blood supply is likely to be contaminated with other things anyway.'

Alain GRIMFELD

Thank you very much.

Session 4 - Round Table

Claude GILBERT (Chairman)

Senior Researcher, UMR PACTE & MSH – Alpes

André CICOLELLA

Environment and Health Network

David GEE

European Environment Agency

Alain GEST

French Parliament and Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST)

Martin GUESPEREAU

Director General, AFSSET

Denis ZMIROU

High Council for Public Health and French School for Advanced Studies in Public Health (EHESP)

Claude GILBERT

We have a very diverse panel with us today, with participants from starkly contrasting backgrounds. Interestingly, the first batch of questions includes questions for all of you. Many of you have been able to follow the entire proceedings, whilst the others have received questions in paper-form from the various workshop facilitators.

I would like to ask: in your opinion, which are the interesting questions and which do you think deserve an answer?

André CICOLELLA

(Translation not approved by the author)

I am a scientist and also an activist and have been both for the past 40 years. In my opinion, the two points of view are not a contradiction in terms. The proceedings of both yesterday and today were extremely fascinating. I am not saying this just to please the organisers, but also because it strengthens my analysis.

We are at a junction in time. I agree with what I heard yesterday about a three stage process and how we are trying to understand what is going wrong, so that we can focus on prevention and define what else can be done.

Stage One is based on the idea that we need practical proof. We need to demonstrate theories scientifically: in humans, of course, because pre-clinical studies are not enough. This vision of things dates back to the 1950s, 60s, 70s, when there were major scientific demonstrations: for example, the impact of tobacco on human health. The consequence of this work was a focus on prevention. However, although we knew about harmful effects, crises still emerged, such as asbestos. Therefore, knowing about danger does not mean we can avoid it. In the 1980s this led to the global emergence of risk assessment; demonstrations thereafter were not just based on the impact of human health but also on experimental data. This is important.

I think that Stage Two played an important role. It produced a number of positive outcomes, but now we have reached the limitations of this second phase. We had intuitive experiments in Stage One, but now we have a formalised, official process. However, it does not take into account all the various risk factors and there are still a lot of divisions. This is something that was said repeatedly. The contradictions between risk management on the one hand and science on the other, mean that the societal concerns are left aside. We need to put together the tools that we need for Stage Three today.

Stage Three is about prevention. We are dealing with significant problems that we need to solve. Sometimes when we discuss those problems, we feel as though we are talking about ethereal things, such as, 'are angels male or female?' That is itself an interesting question, but modern societies are faced with health problems: namely, modern epidemics. The cancer epidemic is real. I know that a lot of people continue to explain that you have got to die of something and that cancer is only normal. However, the incidence rate for cancer has doubled in the past 25 years and people want to know why this is so. This is a request from the public and it is not an irrational one, contrary to what you may hear. What we are putting together in terms of risk assessment is designed to answer this question. In my opinion, the third stage in prevention needs to be based on other criteria besides scientific knowledge.

Denis Bard summed it up really well, but let me try to tone it down a little bit today: carcinogenic risks cannot be addressed using the tools of the 1950s. Endocrine disruptors are not a marginal issue; they have been the subject of dozens of publications. The impact of this mode of action is that it totally disrupts the risk assessment approach, so we need to factor this in. We are talking about a major chronic pathology here: cancer, diabetes, obesity, those are issues that were not discussed previously, together with the whole issue of trans-generational transmission. This is silly; we cannot afford to wait 50, 60, even 80 years because then it will be too late to take action. What is being challenged is the dose/poison paradigm. The higher the dose, the more poisonous the drug, so we need scientific knowledge to ascertain the extent of exposure. However this is different to toxicology. Exposure in an environment is a new science, so we need to anticipate what will happen and build science upon this anticipation.

The relationship between science and society is another factor to consider. Today, we can no longer reason along the lines of having science on the one hand and society on the other, with no connections whatsoever, underpinned by the premise that society is completely dumb and could not understand science. That is simply obsolete. Scientism is the religion of science but that is not science. Today we need science, society needs science. However we need a brand of science that is less self-assured, less arrogant and

less intolerant. We need scientists who listen. As a spokesman for my network, which brings together patients' groups, health professionals, etc, I say that while the scientific approach produces scientific knowledge, we must also look at the complaint. The complaint needs to be studied, particularly with regard to pathology such as hypersensitivity syndrome. When patients complain about an illness it is unacceptable for physicians and doctors to respond to this complaint with disdain or contempt.

We need to generate more science and raise the issues of expertise and a warning system. This is what Francis Chateauraynaud has been voicing for many years. All low intensity signals need to be detected and analysed before they gain momentum. Hence the importance of ethics in terms of appraisal: this whole agency-based system raises problems in terms of how it operates. Bisphenol A, is the subject of the controversy between AFSSA and us, but rejecting 95% of scientific literature raises a problem in my opinion, in terms of conflicts of interest etc. We need a top authority; we need the medical and scientific equivalent of the French Data Protection Agency, the CNIL, in order to enforce ethics. In some cases ethics are swept under the carpet. I am not saying that this happens every time, but in terms of bisphenol A, that is not the case. 95% of the literature is being rejected. So how can we talk about ethics?

There is significant change taking place and we need to address it. I have been asked which example raises the most problems. Well, the answer is, work: it is a true ghetto. We are not talking about mere confinement here; we are talking about a ghetto. There is a model, there are limited values, there are thresholds, but when we analyse the situation using second generation tools occupational cancers lead to risk levels of 10^{-1} to 10^{-2} . Let's take the example of perchloroethylene in dry-cleaning. When you calculate risks in the traditional way, the risk level is one case in two for workers and lead to results of one case in 100 for consumers. So what do we do? Do we wait for epidemiological studies before to act? It is unacceptable. And we can apply this to various cases of carcinogenic substances, it is the same rationale. We need to get work out of the ghetto and this is all about raising public awareness. Social Partners should be entrusted with the management of this problem. This is an evocative example of what we need to change, because it is no longer acceptable. Because asbestos happened, how we address the issue of risk needs to be further explored.

Thank you.

David GEE

(Transcription not approved by the author)

I decided to read out one or two points from each of the five panels because they all made so many good points. Next, I have some responses to your question, Chair, which is: 'What could the social sciences contribute to our work?'

a. Mobile Phones

The question asked was: 'The role of experts in highly contested, highly politicised, highly uncertain situations. What is that role?' I have two responses.

You have got to really spell out the implications of your research. So many papers fall short of saying what the implications of the research are for public policy. This is particularly awful when that research is funded by the public.

We need some scientists to be advocates for their science. Maria Molina and Sherry Rowland were awarded the Nobel Prize for identifying the problem of the hole in the ozone layer. They went on the road with their science to the centres of policy-making in Washington, in Geneva, in London, forcing their conclusions onto the political agenda. They quite openly admit that if they had not done that they would have lost time as the human species in dealing with the hole.

The Bradford Hill Report that was mentioned before the famous paper in 1965; he ends that paper which is entitled: 'How do we move from association to causation in environmental disease?' he last section in this paper is called: 'The case for action'. In it, he says that at a certain point the scientists must take off their scientific hats and put back on their citizens' hats and do something with their knowledge.

b. Occupational Hazards

This group had a lovely phrase, 'Trials of political strength were more important than strengths of scientific evidence in the occupational struggles'. I think that is also general to other sources of activity. Very often it is the politics which determines what happens and not the science. Being aware of that is useful.

c. Nanotubes

This group mentioned a very powerful idea, which is actually one of the nine features of Bradford Hill's evidence; and this is analogy. It is not a very scientific way of approaching life, by analogy, because the analogy can be mistaken, but when we are dealing with the future, which is unknown, and all we have to go on is the past, which we do know, then using analogies from the past is inescapable but can be very valuable and ought to be used more.

Brian Wynne mentioned it in his talk when he spoke about the Public's reaction to GMOs or Thalidomide. They were using analogies where people made big mistakes. However they were learning from the past and I think the issue of more intelligent use of analogy would be very good.

You also mentioned in your group responsible innovation. I will leave that with you to think about what that means, but it is a critical issue, as opposed to irresponsible innovation, of which we have too much.

d. Air Pollution

The issue of denial was raised by this group and possible solutions were discussed. I would like to pick up on two that were mentioned.

Environmental justice is an under-utilised concept and activity. More use could be made of that because people are sensitive to in-equity in general; people don't like unfair behaviour. There is a lot of unfairness in the distribution of the costs of irresponsible

innovations; they don't fall uniformly across populations. Small sub-groups bear most of the cost and that is often hidden, so utilising environmental justice more would be a good thing.

Fragmented political responses were also highlighted, which is a generic issue of great importance. So many issues fail to move forward because of fragmented responsibilities and dealing with that in some way would be very useful. 'Assembling pieces of the puzzle', which was the phrase used, was a good way of responding to that issue.

e. Unexplained symptoms

The power of patients to generate knowledge was highlighted by this group. The Dynamics of Patient Organisations in Europe is a book which focuses on the role which patients and their relatives across a whole range of diseases can play in generating new data, new research hypotheses and new knowledge. This under-utilised source was drawn attention to in, 'Late Lessons Early Warnings'. One of the 12 late lessons was, 'Make more use of local, lay and traditional knowledge'.

This group talked of abandoning 'psychic dualism'; i.e. mind-body. I blame Descartes for a lot of our problems because he dealt with dualities such a lot. In the 1960s we used to say, 'Ban the bomb', now I say, 'Ban the boxes'. We need to stop boxed thinking. Life is very rarely in boxes, it is always in continuums. Anything that appears as a dichotomous object: mind-body, fight-value, objective-subjective is usually rubbish, because in reality it is a continuum.

Those are the comments I have on the workshops, but I have 11 ideas as to how social sciences could contribute to our work, which I will share with everyone later on.

Denis ZMIROU

I am going to voice my personal opinions, which stem from my experience as a researcher. I am here today not as a representatives of the High Council on Public Health, though I am a member of it, and even the Chairman of the unit on Environmental Risks. My words will not, however, be binding upon the institution. I am speaking to you from my experience and with my background, as a researcher.

I want to emphasise that researchers are also citizens. I feel that my long-standing implication in expertise is the most significant contribution I can make as a citizen. The two roles cannot be confused, in my opinion however. I can, in some instances, stand as an activist, for whatever cause I think valuable. Nevertheless, in a given area, then I will take part in discussions purely as a scientist: I outrightly refuse to be involved in any kind of scientific meeting in the framework of an expertise activity wearing an "activist" cap. It is unthinkable to me that I might take part as a scientist, with the possible mindset that "I want to prove this because it is the cause I want to champion as an activist". Quite to the contrary, as a scientist my role is to explore various assumptions, such as, how a particular activity can have an impact on health through the environment. This endeavour of critical analysis of the facts and uncertainties should be inspired by the most possible impartial attitude. However, by doing so, I will be mindful of the importance of protecting

vulnerable populations and concern about factors that could lead to inequalities in terms of exposure and risk. There, values are clearly involved. They are not present with an activist mindset, but with that of a scientist. Any other approach would unfailingly give rise to a serious conflict of interest.

I thought the discussions on occupational hazards were fascinating. Though unfortunately I could not attend the discussions yesterday, I did read the abstracts.

I would like to talk about one question that was raised in the email that Claude Gilbert forwarded to us, 'To what extent do you think you might draw inspiration from the "-democracy experiment" underway over the past 100 years as risk assessment and management in the field of environmental health in general?'

In the area of occupational health, the stakeholders, that is the workers' and the industry representatives need to work together to manage risk. On this aspect, I agree wholeheartedly with what André Cicollella said earlier about the level of protection for carcinogens, other chemicals and even noise. Protection levels are incomparably lower in the occupation field than in the environmental field in general. Is this not ironic, when we want the stakeholders to be involved in the risk management process? I believe we need to think about this further in depth.

We need to realise that the involvement of stakeholders does not necessarily guarantee better protection. This will be determined by the domain of responsibility and degree of commitment of the various stakeholders who are part of the process starting from analysis of the hazards, right up to the political decision-making step. This is a serious situation. In spite of its virtues, the "democratic" system blurs together the different purposes of expertise and puts the stakeholders, here the workers' representatives, in a situation difficult to solve.

We must acknowledge that there may be a conflict between short and long-term visions where the impact on health may not be revealed for 30 years hence. I repeat that I think we need stakeholder involvement but at the same time feel that we cannot ask workers' representatives to submit a ruling, or an opinion on uncertain and delayed risk issues when, on the other hand, they also have to act in favour of jobs and wages. These issues are immediate and the employer representatives constantly putting forward that "overly" stringent standards would have an impact on competitiveness and employment". I must insist on the fact that hazard and risk assessment, on the one side, and discussions about the measures likely to lower them, on the other side, are different points in the auditing process and the players thus need to be different. This is one of the reasons for which we are currently in a more unfavourable situation where occupational risks are concerned. The time is ripe to remedy this situation.

Alain GEST

(Translation not approved by the author)

I am going to talk on my behalf as a Parliamentarian. It is difficult for me to comment on this morning's proceedings but there are some issues that are relevant for me to mention.

Public authorities are not hiding behind scientists. As a member of the Parliamentary Office for the Evaluation of Scientific and Technological Choices, I can say that we are trying to enlighten public policy and the path of public decision-makers, but it is hard to make decisions regarding the new challenges and problems pertaining to new technologies. On behalf of the OPECST I will be responsible for a report to be published in October. The report is on the potential health impacts of mobile telephony and mobile telephony antennas. This is a topical issue which has been the subject of various approaches and AFSSET will also issue a report in September.

I want to sum up what we are dealing with in basic terms. On the one hand, we find that the population is more and more risk averse. Our fellow countrymen at large are almost certain that we live in a world that could potentially operate with zero risk. Obviously there is no such thing as zero risk. As part of the work that I have been doing, I have been trying to measure the differences between the various approaches to the issue. I think that the dialogue has moved ahead quite a bit in our country, but in other countries a lot of people are hiding behind science. They are reluctant to take into account the concerns that have been raised relating to new technology, such as the safety of the mobile telephone. Part of the problem is that there is no finite consensus on the subject. There are lots of remaining question marks and those question marks generate yet more uncertainty and concerns. Today's system is extremely difficult to navigate. It is a schizophrenic system whereby on the one hand you have public authorities who request that telephone operators enhance the quality of reception throughout the country. They are currently mulling over the possibility of agreeing to a fourth licence. This will generate even more antennas at a time when in France, debate centres currently upon the assumed danger posed by mobile telephone antennas, instead of focusing on the real problem, which is the actual cell 'phone.

Public authorities are faced with a problem of how they make decisions to reconcile the contradictory interests of developing technology on the one hand and protecting the population on the other. You need to protect people, their wages and livelihoods. A number of round tables were organised by the Government recently and it was really interesting to see everyone's point of view. We listened to representatives from activists associations and trade organisations. For people who work directly in the area in question, it seems there are no major problems, but we had to take into account the actual economic reality of a particular activity and this meant talking to consumer representatives. Here, we had one group whose focus was on gaining high quality reception throughout the country and then there were other stakeholders concerned about the use of cell 'phones and they requested that a lot of precautions should be taken.

My colleagues from the OPECST have asked me to factor social sciences into my future proposals. There are two reasons for this. Scientists enjoy less and less credibility in public opinion. There is the issue of asbestos. It is obviously undeniable and although it cannot be compared with other possible risks, it is top-of-mind for everybody, with the result that scientists lost credibility and a self-stated, self-proclaimed, science emerged.

You cannot simply brush aside the opinions of some people, particularly when this leads to suffering, as is the case of mobile telephony. Hypersensitivity, for example, is not something you can sweep under the carpet because there is currently no definitive explanation for it. Those suffering from the condition have a choice: either they can ignore

ignore it and say that it is purely a psychological syndrome, or they can look at the web sites of some associations which get a lot of media attention, where there may be misrepresentations of the truth. For example, I read recently on a web site that in France some people say that Sweden has medically recognised hypersensitivity to electromagnetic waves. This is not true. On the contrary, the Swedish Government refused to push aside people who truly suffer. The disease must be recognised and people must not be sidelined without a solution to their problem. This is why, as the basis for all our approaches, we need to grasp the actual reality that is being seen on a daily basis. The doctors in this room will know what I mean. People who consult with doctors have already self-diagnosed their disease: they have looked it up on the Internet.

This is why it is vital for public authorities to take a stance on the Internet. Public authorities have 'missed the boat' in terms of Internet communication, even though they have unprecedented resources in terms of information. However, if you look up mobile telephony antennas on a search engine you will find a lot of explanations, but nothing from the public authorities. Perhaps it is because the public stance is weak but possibly before public authorities make a decision, they need to base their action on the opinions of experts. I am very receptive to new proposals on the topic. There will be a plethora of these types of issues, such as GMOs and nano-networks, and if you want to keep on accepting the technological development, we absolutely need to find answers so that public authorities be in a position to make decisions with a minimum level of expertise acceptable by the public. Thank you. I am sure that there will be further discussions.

Martin GUESPEREAU

There has been a lot of discussion about uncertainties. There are uncertainties everywhere, and they are fatal. I would like to share some beliefs with you.

Last week Afsset submitted a report on *cancer and the environment* in which we highlighted uncertainties on every page, as well, fortunately, as a few certainties. All recent publications reiterate that the situation is even more complex than we thought and that an even higher volume of cancer would derive from strong interactions between genes, ageing, the environment nutrition, thus from things of a highly incredible complexity and therefore uncertainties. What shall we do in order to govern uncertainties? One of the answers is the precautionary principle. We are not interested in it because it is the latest fashion in matter of the French constitution but because there is ground for not stopping at these uncertainties and for keeping on making progress.

As an example, dichloromethane: it is widely used, and 11,000 tonnes are sold in France every year. We find it in synthetic products, in perfumes, tyres and mass consumer goods. We are therefore all exposed to this product. Dichloromethane is a Category 3 carcinogen, hence not highly dangerous. However that is not quite so. It is classified thus because we do not have sufficient evidence; but we have some doubts. There is a possible link to carcinogens in animals, but we have no proof there is a link in human beings because the subject is too complex. It is not specific enough as a pathology, thus impossible to untangle easily. But still it is classified as Category 3. You do appreciate that this is not because the level of risk is very low, but because the level of uncertainty and ignorance is quite high. So with Category 3 substances we don't do anything? That is the traditional

answer ruling today. As per the regulatory classification in force, with Category 1 (with full certainty) or 2 (with a satisfying level of certainty), some action would be justified in the form of prohibitions, restrictions, limitations or limited exposure. That is fine when we are sure. We should not wait for further explanations to make progress. But what about Category 3? The Afsset has pleaded for a considered look at dichloromethane and that an Occupational Exposure Limit (OEL) be enforced (we have suggested reducing the recommended European exposure value in force by half, such limit being recommended, not compulsory). In this way we are trying to increase the level of safety in spite, or rather because of the uncertainties.

Let us talk about health agencies for a few moments. Their model is most interesting, as it derives from the health crises of the 1980s and 1990s. Expertise was discredited for various reasons, essentially because of its lack of independence: it was in the pay of the decision-maker, typically the minister of lobbies. This image still sticks.

Our present model roughly responds to these issues, first with a clear distinction between the production of science and the State. This implies that when we hand out a report to the minister, we make it public at the same time. Thus we make sure the information on which decisions will be made has not been biased and that there has been no interference. This is most important. However, there is something else, even more essential. How do we recruit our experts? This issue often attracts a lot of criticism. We are criticised and rightly so at times, for always working with the same experts. What is behind that? Beyond the issue of whistle-blowers often objected to us, we must admit that it is more comfortable for a scientist to stick to some form of orthodoxy and to operate by way of mutual recognition. It always operates in this way and we always end up in the same rut. Therefore it is our duty to seek diversity of scientific resources. As the Afsset has no laboratories of its own and needs researchers for its expert assessments, we must fetch them in the outside world. We have 150 people working in-house and 400 external researchers, who, typically, come on a monthly basis for a day, or more if need be, and contribute to our work. Those researchers are recruited through a public call for tender, with no pre-emption and no cooptation. The call for tender is advertised to ensure replies from all scientific mainstreams. We check competence as well as independence, i.e. that there are no links with any economic interest that may introduce a bias in the work.

This model is in my opinion very interesting, though fragile and with taxing processes. The system is not completely finalised; and that is why we are interested in social sciences here. The best example of our stance against bias is mobile telephony. This was the first crisis in the making which could discredit public expertise on such a scale. For the Afsset, it was the crisis which had the most testing consequences. I do not believe the expertise model to be totally awkward, but it forced us to follow our rules very carefully. For example a researcher bid for the tender 0.5% of the laboratory costs had been financed by an operator and we did not accept him. It is very difficult to say 'no' to a scientist, but we had to. This is why we need social scientists in our group in order to advise us what to do with a report like this. Who should be sent this report? In reality, we give it to the ministries in charge of making decisions, as well as to other decision-makers. If I only provide them with more or less quantifiable scientific information of a health nature, there is some element of cheating as they do not know how to manage this; They need explanations on what is taking place and the necessary information so that they may manage the situation.

Another example is the debate on the level of exposure to waves. There is a limit defined by World Health Organisation. The famous 0.6 volts per metre is objected to the above limit. However, there are other possible solutions, including one from the social sciences which is based on respecting people. People are concerned about the level of waves. They have headaches and believe this is due to an antenna located in their neighbourhood. They then go to court, because they cannot see other channels and they want their suffering to be acknowledged, remedy and possibly a solution. Why do we not hear that? We cannot answer with a purely scientific approach, as people actually people want us to pay them attention. There is a simple solution which can be offered: Each time we find a value which is objectively much higher than the average, we should intervene on the problem. We should ask the telcos operators involved in the level of wave inside a house to give to the public authorities a study explaining how the level of waves can be reduced. I am sure we can do that, it is completely possible thanks to the contribution of social sciences that can help us govern.

Therefore we need social sciences in our expertise, but on condition and without confusion. Hard sciences are regarded as *pure* and social sciences as *impure*. There were, in our history, too many wounds relating to social sciences being regarded as a permanent compromise. Figures were no longer truthful. Today people request information on any scientific report pointing to dangers for health. It must not be hidden owing to its complexity. We must have a clear-cut distinction, say everything, trace everything and give figures. I still believe in social sciences but they need some purification, which will vouch for their purpose, without becoming the vector of masked intentions.

The cost-benefit ratio approach is one of the excellent objective issues to put on the table for discussion; but in France people don't like it because they believe that the cost benefit ratio is a way of not enforcing precautionary measures. I claim the contrary as a good cost-benefit ratio approach is an intelligent way of seizing opportunities. For instance, we handed out a report last year on long and short asbestos fibres. Asbestos fibers being shorter and shorter makes them increasingly dangerous; short fibres of asbestos are not as dangerous, but their carcinogenicity cannot be excluded. Some cancers linked to asbestos cannot be explained by traditional fibres. We requested studies on the links with such short fibres, and were the first agency throughout the world to do so, though others are also worried. I can tell you that the scientific debate is raging worldwide and that there are many other places, particularly in the United States, where we found researchers highly convinced that we need to make progress in this field, thus preventing hundreds of cases of mesothelioma. I cannot explain here in detail the measures that this assessment will recommend, but we know that this is our objective. Today compensation in the case of asbestos-related cancer is 130,000 € in France. This is the cost to the community. This is only compensation, not to mention early retirement pension costing 1,3 billion euro each year. Beyond the human tragedy, this makes asbestos the most expensive health crisis.

It is therefore really worth preventing, taking precautionary measures, working so as to bring to light or solve controversies, and to add the social sciences to contribute to the solutions provided to the authorities. Thank you for sharing with me these convictions.

Claude GILBERT

Thank you. After this first round, I now suggest that each of you restate what you expect from the human and social sciences. You have already listed them in part, but – and this is my feeling as President of this session – they are somewhat limited in scope when compared to what the human and social sciences actually have to offer. Then, I would like the reporters of the workshops to take the microphone and respond to the contribution of social sciences once you have heard the members here.

David GEE

I would like to suggest very briefly a list of issues. Firstly we need to explore the science-policy interface even more than we have heard. We have heard some good contributions on that and we can get a lot more. Secondly, we need to understand the underlying views and values of different publics. My third idea concerns demystifying objective science. Four: exploring and evaluating different types of public stakeholder participation in risk governance. We are at the front end of lots of experiments so there is a lot of work to be done there. Five, we should look to maximise the lessons of history and the relevance of analogies.

Six, there is hardly any policy effectiveness evaluation carried out and social science would have a great contribution to make in this area. Most policy makers do not want to see policy effectiveness evaluations because it is an evaluation of their work and this is why there is an absence of them.

Seven, we should explore new kinds of liability regimes, because we are clearly going to go into situations where there will be surprises, there will be negative effects. Conventional law probably does not help us because responsibilities and liability will not be apportioned because it will be said that they were unknown. However, that is not good enough; we need to have new thinking about liability regimes that will enable us to go forward, taking some risks with new innovations. If we get a downside, then the small minorities of people who will suffer should get some kind of compensation. That needs exploring.

Eight, there should be a development of robust pro and con analyses to replace the narrow and rather inadequate cost benefit analysis. Nine, in terms of assembling pieces of the institutional puzzles that somebody mentioned, where you have fragmented political structures, then social scientists are in a good position to put the whole together and help to clarify the kind of political structures we need to stop fragmentation. We should explore the cultural and regional similarities and differences in risk perception and hazard-recognition. We have seen lots of examples of this coming up.

Lastly, ordinary people can make mistakes like top scientists can and so in order to maximise the use of lay, local and traditional knowledge, including looking at how you can quality-assess local knowledge, we need to have some methods in place.

Thank you.

Denis ZMIROU

I want to return to one very interesting discussion by Brian Wynne. He talked about ignorance, ambiguities and risk assessment and about the ignorance of ignorance. He referred to the president of an authority – the name of which I have forgotten – who was asked what he would do should he be faced with what he did not know that he did not know. I wondered what I would have answered, in his shoes. At the same time I said to myself: 'What about my great, great, great, great grandfather? If he had known that 42,000 years later, we would have put a mobile phone base station at the entrance of his cave, he would never have come out of his cave'. This is a light-hearted way of saying that, in my opinion, in terms of risk management, we cannot take unthinkable assumptions as the basis for our work. We do, however, have to look to determine how we can come up with possible scenarios. Civil society plays a part in this respect and its role is an important one. First and foremost, it must be able to tap the resources of science to address the situations we face: what questions will we ask the different sciences to reflect on and explore, with respect to hazards and risk? Society, in the broadest sense of the term, has the right to call upon scientific authorities for responses to the issues it raises. Scientists are not the only ones asking the right questions. We also need to find a place for civil society in our auditing system – in what we call "risk analysis", which is above and beyond risk assessment. Here too, the human and social sciences will have their part to play. This is an arena still ill-defined today. This, of course, implies a deep understanding of how processes and practices actually work out. The scientist cooped up in the lab will not have access to this level of knowledge, when the various stakeholders (associations, industrial players, local authorities, etc.) all have, or in any case, have awareness of this information.

We need to think about how we can bring the sciences together, either in a new authority or within existing systems, so as to explore different risk control scenarios. The High Council on Public Health is part of this risk analysis arena. Once we have identified the risks, what are the scenarios one can envision for managing and keeping them under control? To grasp this, we will need the human and social sciences. I would therefore like to call upon scientists from the human and social sciences – from all walks of life – to get involved in this auditing process. I heard about some lively debate that took place yesterday, in one of the working groups, about the idea that the role of human and social sciences supposedly is to criticise, analyse and comment, rather than to get involved. I believe, likewise, that at some point, 10 or 20 years ago, scientists from the so-called hard sciences became involved in the expertise process – and not without some struggle, in particular due to a lack of recognition for such activity in their institutions – a number of our counterparts from the human and social sciences should also commit to considering risk management scenarios and studies on the various impacts that their implementation might have. Let me tell you right away that this is not something particularly flattering. There is little recognition and it is a costly step along a career path. But it is essential. It is called being a good citizen.

Alain GEST

Let me go back to what Professor Zmirou said and to the presentation made by the AFSSET director-general. What was very interesting is that in your discussions, agencies

were called into question. In the debate I am interested in, there is the question of structure. A report in 2002 recommended the creation of a foundation to carry out research works and to provide answers or solutions to problems. However, as was mentioned earlier, this foundation committed an original sin by accepting half of its funding from the telcos operators. Naturally, this was detrimental to the foundation's credibility.

It is therefore necessary to find alternative solutions. First you have to find new solutions for the consultation methods and dialogue necessary to install antenna masts. The procedure for the installation of an antenna needs to be reviewed to include dialogue. Here, there is a defined space where social sciences can step in to ensure the development of an interface between scientific discourse and the expectation of the public.

The precautionary principle is in the Constitution. However, there is a real difficulty when you examine the interpretation of the Constitution by the Versailles Court. When the problem of antenna was discussed, the Court said that the risk was not proven; but the opposite was not proven either. This leads people to be fearful and therefore this must be taken on-board. The interpretations are extremely broad in relation to the enforcement of the precautionary principles. I believe, therefore, that some procedures and contributions should be made in order to improve the measurement of the precautionary principles.

Social sciences may help us to manage what is not rational. The last thing we should do would be to put a problem aside and say to the public: 'you are not normal', or 'this problem is a minority problem'. It is no longer possible to do that and to continue to behave as we have done. We are in a world whereby communication is essential, prevailing and ubiquitous, where some people are really masters in communication and can harness the media. Just because they are very good communicators does not mean they are right, so we have to be very careful in terms of communication, especially when dealing with such complex problems.

André CICOLELLA

A fully-fledged discussion is needed on the role played by public authorities. Public authorities should be prepared to take on responsibilities, but they do not. The reason for this is that during the Grenelle environmental talks there was a unanimous decision. I was part of the delegation which included employers' representatives. Surprisingly everybody agreed on the need for an Act on protection and expertise. However, due to sleight-of-hand, this was removed from the plenary session and removed from the legislation. This is what I am talking about in terms of political responsibility. Now politicians need to face up to their responsibilities in order to organise the ethics of responsibility. That is their responsibility. When there were discrimination problems, we called the top authority in. No-one is complaining about that today.

First I want to return to the issue that was raised regarding the place occupied by social sciences in their traditional function. In this role they act either as a mirror, which can distort the picture, or as a magnifying glass to shine light into shadowy corners. This is a very important function, however, I think that it is not enough today and in my opinion,

the second important role that they play is to spark a dialogue on societal concerns. While we have to focus on hard sciences, I say that hard science is not enough.

Technological innovation is something that we have to go along with, but why do you state this as being inevitable? We invented cars and then we invented car fuels. We have always had choices. For 80 years we used leaded fuel. In the 1950s, the issue of brake material was raised and it was recognised that we needed to develop a magic material to manufacture brakes that would not burn. We could have asked ourselves: 'do we use asbestos, or do we take something else?' We didn't have this discussion, but we could have had. What about liquids for convertors? If we have a choice should we use PCBs, considering the impact they have on the entire eco-system? There are so many examples we can take.

What is the substantive problem today? It has to do with the technological evolution. Nobody wants to go back to the Stone Age and live in caves, but the risks that combustion leads to is truly a problem. Once there were people living in caves; they had fires that burnt wood in their caves which left them exposed to the products of combustion. Today we need a more responsible vision, which is why it is important to have checks on technological developments. Against this are the costs involved and the scientists' viewpoint which is that any scientific advance means progress for humanity. That is not true, some advances mean progress but others do not. There are many technological advances that we could easily do without and be better off without.

These developments are being sold to us as progress for society at large. But today, societies have matured, they have perspective, they are able to take a step back, but we insult them by calling their behaviour irrational. On the contrary, we must demand democracy. Today, democracy does not boil down to elected representatives, even though they are very useful, but it also means having a say in terms of how society evolves over time. This applies to technology too, but for this to happen we need tools. We have a very important role to play in terms of sharing guidance with politicians. We are not going to tell people, 'This is what is good for you, just swallow it down and don't complain'. No, we need to address societal concerns using our 200-year-long experience as a modern society. This is what we need. We are not talking about irrational concerns, but about what is possible from a rational perspective.

Martin GUESPEREAU

How about some sci-fi; let us say we are 10 years from now. Social sciences are accepted everywhere, social sciences are part and parcel of every paper that is ever written. What kind of human and social sciences are we talking about? So far we have received the package, but we have yet to open it. I will come down to earth by saying that we at the Afsset need several things. First we need to do our jobs e.g. European directives on chemicals; this requires from our report to have a socioeconomic dimension accompanying restriction measures on the use of some chemicals. Such works fall under a committee dedicated to social and economic analysis. These reports contain an impact assessment approach, positive and negative consequences as per the various uses of the restrictions considered, assessments and economic calculations to be used as a basis, possible substitutions and alternatives, possibly international trends that may arise. Socio-

economists are fully aware of those problems; they can provide answers to those problems and this is where we need to move forward very quickly. France is lagging behind already; we cannot afford to wait.

There are also other issues, among which the essential issue of participation. Eventually we will have to address it. First what do we really mean by participation? We also need the analysis of human and social sciences on this particular issue. I personally include respect for people. I do wish that we turned the page of a type of consultation by which people *who know* pass on explanations to addressees who are meant to come out slightly better educated. This is a caricature of course, but this is no longer possible. People have such a level of knowledge that they have real scientific questions to which we must give real answers. This is our duty and a matter of respect. It is also necessary if we want to produce something governable. Participation is also an issue for agencies in charge of expertise in present circumstances. For the Afsset, the first point of rendezvous is clearly mobile telephony. We need to further our works, to foster scientific debates with activists wishing this exchange, and not only a single way debate informing on what the others thought. We need human and social sciences to help us in this quantum jump, this technologic jump in the way we operate.

Alain GEST

You have referred to what I said earlier about the importance of not closing yourself off to technological advances. If we had gone down the path of a systematic impact assessment of pretty much everything, a lot of developments may not have been made possible. You will probably admit that a number of advances have emerged and are perceived as progress by humanity. I am not to believe that the emergence of mobile telephony is not technological progress. We have 60 million users that believe otherwise, so we need to take their opinions into account and that is what we do as elected representatives. We take into account the opinion of respectable people with a high level of knowledge as opposed to skills. We need to specify that. We are also entitled to take into account the opinions of everybody else and those opinions may be very different.

As part of the Grenelle environmental talks, one measure was neglected even though it was based upon a consensus. I am sorry if this stirs up outcry, but I would like to remind you that this is representative democracy. In other words, the choices that are being made in this country are based on the final say of Parliament. At the end of the discussion, we weigh up the pros and cons and if every decision is made outside of Parliament then what is the point in Parliament being involved? I am not being pejorative here in saying that we need civil servants to implement decisions or we need to have Grenelle-type environmental talks etc, or even have surveys.

At some point in time there are no scientific explanations whatsoever and I am pretty sad to observe that the media are more interested in reporting the risk of cancer before it has been proven. This is pretty bad. Saying it and writing it down is even worse, which raises the issue of how far you can go when there are no more answers. This is where we need proposals. I want proposals more than I want conclusions because we need to look forward on this. Let me tell you, we are dealing with a very complex subject.

Claude GILBERT

Now we have heard what the expectations towards social sciences are, I would like the reporters of the workshops to respond or to comment on these expectations.

Danielle SALOMON

First of all I would like to thank the Chair for allowing this discussion to happen. There is something absolutely fascinating that I see here about expectations. When you are taking stock of what society looks like, everybody has a message to convey, a message that reflects the various components of society. As sociologists, this is our job, this is what we do. We listen, we analyse and we report on the various states of society. The various components in society have conveyed a number of expectations which I thought were absolutely colossal, even crazy. How could social scientists cope with these expectations? In my opinion, social scientists cannot do anything else but their job. They are just one of the many components, one of the many links in the chain and cannot do everything. They cannot speak on behalf of society. Of course we can analyse the data, reflect on the situation and report on it, but we certainly cannot speak on behalf of society. Social scientists may be part of expert communities, but that does not prevent us from looking at the problem from other angles. Secondly, and I apologise for being blunt, but what you are saying, dear congressmen – searching help from social sciences for better communication purposes- is quite a stereotypical view.

Alain GEST

Social scientists and communication: I am sorry, that is not at all what I meant. I apologise. What I am saying is that social scientists should be involved in conveying this message from a general point of view. We are dealing with an unsolvable problem, obviously.

Danielle SALOMON

Communication is a job on its own. Communication can be included in social and human sciences, but from a general point of view, economics, psychological, sociological analyses cannot be boiled down to communication. It is another line of work. Or perhaps it is just a small component of social and human sciences.

However, I think there is something really important we need to do. We need to be involved in improving the knowledge and understanding of processes. Let me take one example. You have talked about irrationality within certain social groups. Raymond Boudon, a major author in sociology, explains that people have always very good reasons to do what they do. He explains that there are different forms, different formats, different concepts about rationality. There is always a kind of a causal link -you can always put it back together- to explain people's behaviour. There is no irrationality but different forms of rationality.

In promoting the understanding of processes etc we have made a lot of progress in terms of our understanding of phenomena. Which means that there are different levels at which we can operate. At which social and human scientists can operate. This will be my conclusion. We need society to respond to the expectations people have vis-a-vis social and human sciences. In the long and interesting list of issues mentioned by David Gee, a lot of them are already identified. Take assessment for example. Assessment is something that was worked upon and voted upon many years ago by Parliament, but it is not being used. It is all well and good to have laws and a fantastic legislative framework, but in order to implement it, you need sheer determination and this does not happen overnight. There is always going to be a trial of strength, a balance of power.

Olivier BORRAZ

I would like to make three comments.

First, social scientists still have a lot work ahead! We have done a lot of work in the past two days, but there are a lot of things that are still confusing and require more efforts in the future.

Second, many things that were said this afternoon are classic requests addressed to the social sciences: help us come up with solutions that are acceptable, help us communicate better with the general public, help us make people more rational, etc. These expectations are traditional, and we have been fighting for many years to demonstrate that the social sciences provide more than these limited requests.

My third and last point is in line with what I raised earlier, which is that institutions who want to work with social scientists are taking a risk. And that is scary for many of them. At the European Environment Agency, they have taken that risk openly, are being brave about it and are raising issues that I found fascinating. AFSSET is doing it too, more moderately, but it is a start. Mobile telephony shows how difficult it is to bring in social scientists. I continue to feel that bringing in social scientists is a risk and that is what is holding back a variety of institutions. M. Guespereau, I was very interested and a little curious about the idea of purifying or cleansing social sciences. What did you mean by that? I heard two things: rid the social sciences of their more critical or radical dimensions; make them more operational in expert procedures. Which of these options did you refer to?

Matthieu FINTZ

The first thing I would like to say is that we have been talking quite a bit about social and human sciences, but there are multiple social and human sciences and the subjects of their research is very different. We need to draw distinctions between the potential contributions which can be made from each social or human science.

It seems to me that economics, as part of social and human sciences, may fall within the broader efforts designed to make things public and this has been well documented by historians. It is important to make everything public in order to facilitate collective

decision-making. This was an important point that was raised by Nicolas Treich in terms of the importance and usefulness of CBA, cost benefit assessment. Decisions should not be made in a confined environment. On the contrary, decisions should be subject to discussion so that individuals can express their preferences, in a more democratic way. Against the backdrop of scientific knowledge being produced, natural or human sciences do play a role.

Secondly I think that social and human sciences can help epidemiologists look for and describe inequalities in terms of exposure. Epidemiology, in a historical context, was always social. Social epidemiology has a long-standing tradition, but I think that there is a potential today for interaction between sociology on the one hand and epidemiology on the other.

My third point is one that emerged rather clearly in the course of our discussions about the risks of risk based governance. How "risk society" generates its own risks. This is something we need to discuss in an open minded discussion bringing together sociologists, philosophers, politicians. I had an opportunity for discussion with a philosopher of techniques at the CEA, Vincent Bontemps. He is trying to explore the whole area of health risk, toxicological risk and socio-political risk. I think there is something we can put together here. I do not have an answer to the problem, but I do think it is an avenue worth exploring.

Yannick BARTHE

I was the reporter for Workshop 5. I am happy because change is happening in institutions in France in terms of their relationship with social scientists. We have heard a lot of things this afternoon, things that would have been absolutely unheard of ten years ago.

There is a true demand here for social sciences. It is up to us to get organised so we can meet this need and the questions that are being asked of us. We may need to work harder to reformulate them.

We have talked quite a bit about risk and uncertainty, but we have not talked much about decisions. I am delighted to have a Member of Parliament with us today, but the question that springs to mind is that there is a paradox. Everyone is saying that we need social sciences; everybody is underlining the importance of the contribution of social sciences. However, when we organise a two day seminar such as this one, only near the end, during the round table, decision-makers barge in and say: "We need social sciences". Why did this not happen yesterday? This is just a short remark and not at all hostile.

Claude GILBERT

Now let us wrap up the round table because we don't have much time.

David GEE

One issue is technological pathways. The reason why several people at the conference have called for responsible innovation is because innovation is not determined by democracies or by parliaments. Parliaments have virtually no say on technological pathways. They are determined by large concentrations of economic power out in the so-called marketplace which decide whether you will get mobile 'phones, lead in petrol, plastic buckets or whatever it is. Of course they meet real needs otherwise they would not sell in the medium to long-term, but the pathways are not chosen by democracies and we make big mistakes as a result.

Here is a quotation from the Chief Medical Inspector of Factories in the UK in 1934: 'It is impossible not to conclude that opportunities for the discoveries and prevention of asbestos disease were badly missed in the past.' Even then choices were available.

In 1925, when lead in petrol was introduced there was a one day trial of lead in petrol. They suspended its use because it killed workers. At the one day trial the best brains in public health in America said: 'This stuff will get into the public domain so slowly and so insidiously and is quite likely to damage people, particularly vulnerable people like pregnant people and children that it is not worth it.' General Motors stood up and said: 'This is a gift of God. It will propel American industry into the forefront of progress. We cannot afford to have these speculations stand in the way.' Here there was a choice, what could have been said on the basis of the public health view was: 'ok, we'll give you a ten year phase-out time to find the substitute for lead in petrol because we know that lead is going to be damaging'. The result would have been a different technological pathway. We do need more democratic control of technological pathways.

Alain GEST

I am very happy to be here because I made some remarks which may have been perceived as rather provocative. I am sorry if you misunderstood me, because in terms of communication what we are looking for, is another approach. What we are looking for are different approaches and that is most important contribution you can make. I will be ready to take your proposals with a view to including them in the report I am going to produce.

André CICOLLELA

We are at the turning point. The new borders for democratic society will be shared by technological developments and there is a space opening up. This was unthinkable decades ago and now it is part of public discussion and it is excellent. It is perfectly normal that this is a little difficult, because it is a dramatic change, but it should shed some light on the next decade.

There is a change in the concept and in the design of health. One issue that has not been addressed is why health policy is always governed by an approach combining health and care. This is extraordinary because we could say now that health is partially the consequence of health determinants, and if we act on those determinants, it will be as

noble as if we healed people. Hippocrates said 2,500 years ago that physicians have to take care of the health of the soul. Maybe we should rediscover this virtue and that is a major challenge.

The health law which was recently discussed at the Assembly put aside prevention. It is the right time to have a new foundation base for health policy so maybe they should shed some light on this topic. How is it that the health system is always not aware of that challenge?

Martin GUESPEREAU

Personally, I am full of hope. Five or six years ago, in 2003, I worked on development questions and the World Bank had just published a document at that time on the causes of the sub-development and the solutions it recommended. It reached a conclusion which amounted to two words: *responsiveness* and *accountability*, and I feel I have heard them throughout these two days. They still spring to my mind in this issue of the governance of uncertainty.

Claude GILBERT

Thank you. This brings us to the end of the Round Table. I would like to very warmly thank all those who took part in these exchanges. They have clarified expectations with regard to human and social sciences, and brought out some of the changes in relations between researchers and participants. The Conference is now coming to a close.

CLOSING

Pierre LIBREROS

**Technical Adviser, Ministry of Ecology, Energy, Sustainable Development and
Town and Country Planning
France, on behalf of Chantal Jouanno, Minister for Ecology**

The Minister for Ecology I represent today would have liked to come here to wind-up this symposium. The topic of governing uncertainty is one that she is confronted with every day. She would like you to be sure that she really pays attention to the contribution of the social sciences. That is very important, especially in terms of the health environmental risk she is in charge of today. This event is innovative in its theme and has been a real success, thanks to the fruitful co-operation between the R²S network and AFSSET.

During your discussions you mentioned topics which are the daily work of the ministries in charge of health and environment: mobile telephony, nanomaterials, air pollution and low dose effects, etc. When risks are to be identified, the decision-makers first response is to turn to the experts and try to follow a proven system, i.e. a scientific risk assessment. This is followed by the management of the identified risks with a balance between risks and benefits to establish a priority, and finally a conventional communication on actions.

We are confronted more and more with uncertainties. Scientific expertise is not able to reach conclusions in the short period of time required in order to keep pace with technological developments. The results concerning nanotechnologies will not necessarily be an operational or management tool. In relation to all of those uncertainties linked to technological development, the Government has two instruments available. These may be rudimentary but they are used to try to address those issues.

The first instrument is to give a central role to the consultation of the public opinion and to favour as much as possible, the expression of the stakeholders. Le Grenelle de L'Environnement here in France is the basic instrument for public discussion on the environment. Our Member of Parliament talked about the difficulties in conducting such a process.

The second instrument is the implementation of the precautionary principle. It is a cardinal rule that the implementation of the precautionary principle imposes a new way of organising decisions. Let me set out a few examples. The Government decided to embark upon a public discussion on nanotechnologies under the aegis of the National Commission on Public Debate. A debate in that format led by the State is a first. Its remit is to explore all facets of the topic: the applications, the risk and the priorities in terms of research; and some not so traditional dimensions such as ethics, social stakes, governance and regulation.

The second topic you addressed was the controversial matter of relay antenna. Mrs Jouanno, our Minister, has just set up an operational committee on experimentation around relay antennas for mobile telephony. We want to conduct experimentation openly on the possible drop in the emissions of relay antennas. This necessarily implies an agreement on protocol, the methods to follow, the measurements, the cities to choose and so it is a new format.

The third type of action we are trying to take is in implementing the second National Health Environmental Plan. Following a request made by the Grenelle Committee on Emerging Risks, we are going to create, probably in the autumn, a place for discussion which will be a forum with the stakeholders on emerging risks.

All this is to say to you that the State pays more and more attention to the way uncertainty is addressed and managed. The State associates upstream with the various stakeholders, the expertise agencies, and independent agencies in expressing their opinions. A cross-fertilisation between expert scientists and social sciences is essential and the outcome of your symposium will be very useful to us.