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Hiding the Risks

or

How to Govern Technological Conflicts?

Introduction

Ever since Ulrich Beck's Risk Society was published in 1992, claiming that technological development is the source of social conflicts is quite a trivial statement in social sciences. Over the last few years we've had the chance to watch quite a few technology-related conflicts, such as the GMO issue, the BSE crisis or the bird flu.

What is more, some„classical" technological conflicts which could seem no longer current at present turn out to be still at stake: discussions concerning nuclear energy seem to be even more lively, especially since the debate over global warming made some governments of states look more closely into the atomic problem. New conflicts are still to come as we keep developing more innovative technologies, such as nanotechnologies or reproductive medicine.

The scale of technological conflicts shows that modern societies still have a problem with solving them and controlling their course. It seems that we could not find many examples of technological conflicts in the past which have been solved, or at least ended peacefully, as the social tension caused by technological development has been effectively cooled down. This is why it is so important to understand the nature of present conflicts caused by modern technologies and to analyse their dynamics from the sociological point of view.

The purpose of this article is to present a model describing the defining strategies taken by the participants of technological conflicts in order to solve them. We have called it a reductive model as it is based on reduction procedures such as reducing conflict complexity, reducing risk and reducing ignorance.

The first step will be to introduce some basic ideas concerning technological conflicts and the reductive conflict-solving model. Then, we will refer to the sociology of scientific ignorance which offers theoretical background for analyzing reduction processes. The next stage will be to introduce two risk-reduction degrees and three conflict redefining stategies used in our model. Finally, we will present a catalog of reduction techniques within each strategy.

Technological conflict

A „technological conflict" will be defined here as a kind of social conflict originating from a social debate over the consequences of using a certain technology. Using (or ceasing to use) it is perceived as threatening the interests of at least one actor of the conflict. Some examples of technological conflicts are presented in Table 1.

Issue at stake	Conflicted parties	Examples
Using nuclear energy	Ecologists, local communities, some political parties vs. energy industry, governments of states, scientists	Dispute over the construction of new nuclear power plants Power plant waste transport through Germany Local protests concerning the construction of nuclear waste disposals
Development of biotechnology	Part of the public and the media, religious groups, some governments of states vs. biotechnological concerns, scientists	Prohibiting the cloning procedure and certain kinds of genetic research
Genetically modified organisms (GMO's)	Farmers, ecologists, part of the public vs. biotechnological concerns, governments of states UE vs. USA and WTO	GMO-free region campaign in Europe Attempts to prevent the cultivation of GMO in the UE
Regulating water systems	Ecologists, part of the public and the media vs. governments of states	Constructing dams and artificial water reservoirs
Global warming	UE, ecologists, the public vs. USA, Russia, China, India, the industrial sector	The Kyoto protocol
Mobile phones	Part of the public, local communities, some scientists vs. telecommunication companies, state administration and scientists	Local disputes over the construction of telephone masts
BSE	Great Britain vs. UE, UE vs. USA, the public and the media vs. governments of states and cattle breeders	BSE disease in Europe in the 90's
Cure for AIDS	Governments of some African states vs. WHO and medical concerns	Doubts concerning the usage of AIDS medicines. Patent issue

Table 1. Some examples of technological conflicts

The model presented in this article is based on the assumption that the complexity of technological conflicts is one of the reasons why they are so difficult to solve. The complexity results from the fact that many modern technologies, and especially ”converging technologies”, interfere with our social life and transform it in quite a new way. As a result, technological conflicts are not (as the deficit model of Public Understanding of Science Model would like to see it) simple conflicts stemming from the fears shared by parts of the society, afraid of possible negative effects (real or imagined) of introducing certain new technologies, such as genetic engineering or using stem cells to generate organs. Technological conflicts concern the very nature of social change caused by the technological innovations (cf. Felt, Wynne 2007). We could say that they start when people become aware of the fact that the products of technological progress are not innocent tools, used in order to make our life easier and more pleasant, but an important factor stimulating social change and influencing both social life, the choices we make for the future, the types of human relationships and the relationship between human beings and nature.

According to Ulrike Felt et al., 2007, innovations generated by science are never purely technological. Their nature is always both social and technical. On one hand, they can be implemented effectively only when the structure and organization of the society are “compatible” with the very nature of each innovation. On the other hand, through their implementation and development, innovations always cause a change in the social context. As a result, as Felt et al. point out, describing modern fears caused by technological progress cannot be reduced to the notion of risk. These fears concern the nature and the consequences of each implemented innovation.

The fact that technological conflicts go beyond the pure notion of risk makes them become even more complex and multi-dimensional, as we are dealing simultaneously with many different issues (their harmfulness, moral and ethical issues, political and economic problems, group interests, individual rights, etc.). Their complexity makes them difficult to solve, which is why we can assume that one of the basic strategies of each conflicted party will be to reduce the technological conflict according to their interests. The present paper is an attempt to look at the dynamics of technological debates using a reductive conflict-solving model, which should be helpful in describing and understanding their nature.

The theoretical background for the model will be based on some elements of Pierre Bourdieu’s symbolic fields theory. Reducing conflict complexity consists on attempting to validate the definition of the technology at stake, formulated by each participant of the conflict. These definitions include technology’s mechanisms, its consequences, its risks, but also the postulated hierarchy of goals and values, the types of human relations, development projects, visions of the future, desired forms of social structure and visions of “good life”. In other words, participants of technological conflicts present wholesome definitions of reality resulting from the implementation of each socio-technological innovation, and try to validate them.

At this point, we could refer to Ulrich Beck’s theory of „ structures of defining” which he compared to the functioning of production relations in the industrial societies.

The power to define and say what is harmful and what is not, to what extent and beginning from what amounts, how to behave in the face of possible dangers, and how to control and regulate them, is one of the most fundamental political resources. This is because of the nature of the dangers themselves which are always symbolically mediated and can therefore only be cognised indirectly. As Beck wrote in *Risk Society: Towards a New Modernity* (1992: 27):

> That which impairs health or destroys nature is not recognizable to one’s own feeling or eye, and even where it is seemingly in plain view, qualified expert judgment is still required to determine it ‘objectively’. Many of the newer risks (nuclear or chemical contaminations, pollutants in foodstuffs, diseases of civilization) completely escape human powers of direct perception. The focus is more and more on hazards which are neither visible nor perceptible to the victims; hazards that in some cases may not even take effect within the lifespan of those affected, but instead during those of their children; hazard in any case that require the ‘sensory organs’ of science – theories, experiments, measuring instruments – in order to become visible or interpretable as hazards at all.

It seems, though, that Beck’s concept of defining risk does not allow to see the complexity of technological conflicts and concentrates too much on the harmfulness of each technology (see also Lau 1991).

According to Bourdieu’s theory, technological conflicts can be seen as struggling to validate the definitions of reality presented by each conflicted party. The struggle concerns different domains, depending on the nature of each conflict, and may include an attempt to prevent validating a certain definition of reality within one domain and shift it into another. It is the case of so-called “medicalisation” processes, when the definition of life, its beginning and its end is no longer an ethical, moral or religious issue and becomes a purely medical problem (which actually means that it has been shifted from one domain into another).

Struggling to validate one’s definition of reality often concerns the right to define some new phenomena resulting from technological progress. Several questions arise that could serve as examples, such as: how to interpret the transplant technologies?; which domain to use for describing nanotechnologies?; is growing GMO’s an economic, political, scientific or rather ethical issue?, etc.

The objective of each definition of reality presented by conflicted parties is to cover all controversial phenomena and to gain exquisite rights to define them. As a result, the complexity of the problem is being reduced in a way that suits the needs of each actor. This is why developing countries will view the global warming dispute as a purely economic problem, putting aside its ecological aspect. Some African countries will tend to perceive propagating condoms and the anti-HIV campaign as a reflection of political relations between the North and the South, ignoring the health problem (and, therefore, defining AIDS as nothing but an illusionary threat). The Catholic church will perceive abortion as breaking religious rules, ignoring the social aspect of the problem.

Struggling for the right to define requires specific defining strategies which aspire to influence the form of the conflict and the way it is solved. As a result, the conflict is being redefined in a way that reflects the interests of the actor: technological conflict now becomes economic, ecological or scientific. The diagram below presents the reductive conflict-solving model presented in this article.

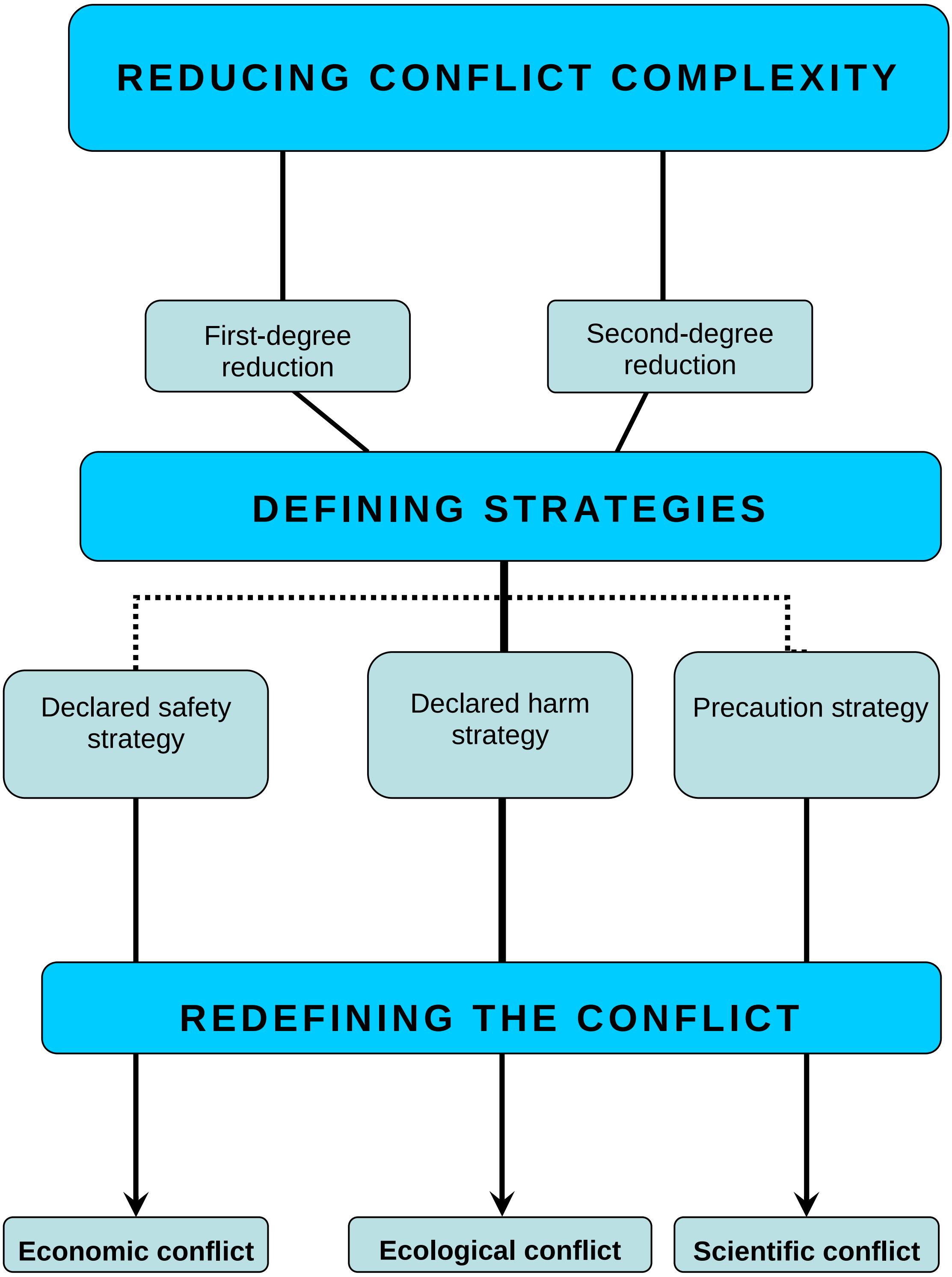

Fig. 1 Reductive model of solving technological conflicts

The sociology of scientific ignorance

The sociology of scientific ignorance (SSI) sprouted from the sociology of scientific knowledge (SSK) in the early nineteen-eighties (Stocking 1998). It did not aspire to replace the existing research tradition. What it wanted to do was expand this tradition and complement it with a previously ignored dimension, the “shadow-side of knowledge” (Stocking), i.e., what science did not know. Rather than being a new sub-discipline of the sociology of knowledge, it was a redirection. Several works emerged within this new current, most of them theoretical (cf. Smithson 1985, 1989, 1993; Ravetz 1986, 1987, 1990; Funtowicz & Ravetz 1991; Stocking & Holstein 1993; Beck 1996; Michael 1996; Walton 1996; Japp 1997; Stocking 1998; Böschen 2000; Wehling 2001, 2004).[1]

This idea is based on the observation that ignorance has lost its natural “innocence”, both epistemological and social: ignorance is no longer a natural state, a shadow zone dissipated by scientific discovery and a mere starting point for scientific endeavour, it is now problematised as a social construct, a product of knowledge-generating processes which serves specific political functions (Wehling 2004: 36). This is how Peter Wehling describes the new approach to ignorance (2004: 36-37):

> Whoever reduces ignorance to the incognisability of natural relations is also reaching for a specific figure of argumentation and placing it in either the public or the scientific debate on the reasons for the lack of scientific knowledge. And by so doing he evokes the question of the meaning of “incognisability” (fundamentally incognisable? incognisable at this particular moment? incognisable due to insufficient scientific and technological advancement?) and the factors leading to this incognisability.

The reasons for incognisability are sought not in the nature of reality itself but in the institutional and methodological barriers within science and its environment. As in the sociology of scientific knowledge, where scientific knowledge is not viewed as something which is objectively given in nature and merely discovered by scientists but as the outcome of specific social, knowledge-generating processes, so too scientific ignorance is viewed as the product of social relations. It is subject to negotiation among scientists and between scientists and other actors (sponsors, regulating and controlling institutions, consumers); as something which is moulded by specific interests and either modified and accepted or rejected. Placing ignorance on

[1] For a discussion of ignorance from a different research perspective see: Luhman 1992; Merton 1987; Proctor 1995; Sojak & Wicenty 2005.

the same analytic plane as scientific knowledge meant extension of the famous symmetry principle of the so-called strong program of sociology of knowledge.

Knowledge is not just the reverse of lack of knowledge, the realm of the yet unknown, reduced by scientific progress. On the contrary, researchers have coined the term “science-based ignorance” (Ravetz 1986), conceived as the realm of relevant ignorance generated by scientific and technological advancement. “Now we face the paradox that while our knowledge continues to increase exponentially, our relevant ignorance does so even more rapidly. And this is ignorance generated by science!” (Ravetz 1986: 423, after Wehling 2004: 44). This is how Ravetz specified his concept of ignorance generated by science: “This is an absence of necessary knowledge concerning systems and cycles that exist out there in the natural world, but exist only because of human activities. Were it not for our intervention, those things and events would not exist, and so our lamentable and dangerous ignorance of them is man-made as much as the systems themselves.” (1990: 217, after Wehling 2004: 44).

Here the sociology of scientific ignorance touches a problem which is also important for the study of technology where the focus is on the fact that, as science and technology are developing, the range of technological interventions is becoming increasingly wider; hence on the one hand, their possible consequences are becoming more and more far-reaching and on the other hand, they are becoming more and more difficult to foresee.

To summarise the most salient aspects of the sociology of scientific ignorance from the point of view of the study of technological conflicts, we should draw attention to the fact that this is not sociology of ignorance in the strict sense but sociology of scientific ignorance.[2] This observation seems to be based on the tacit assumption that once science has described and explained a phenomenon, this phenomenon is automatically known and passes from the realm of ignorance to the realm of knowledge. Meanwhile, as far as many features of today’s technologies are concerned, they remain within the domain of scientific ignorance despite the fact that they have been scientifically cognised (more on this later). In other words, they are

[2] This is why Wehling is reluctant to identify ignorance with risk. He thinks that risk, i.e., the probability that certain consequences will take place, is situated within the cognitive horizon of science because science must first identify these possible consequences; ignorance, meanwhile, also involves lack of knowledge concerning the possible consequences of actions. Hence risk is scientifically founded and although it involves a considerable amount of uncertainty, this is not pure ignorance (Wehling 2004: 70-71).

invisible not because they continue to elude scientific cognisance but because they are subject to extra-scientific processes and phenomena. These processes and phenomena must be described if we want to gain a comprehensive view of the mechanisms of conflict reduction.

This aspect of the sociology of scientific ignorance goes hand in hand with its epistemological attitude: the focus here is on the nature of scientific cognisance and the reasons why certain phenomena escape it whereas it seems to be only one of the many important questions concerning the development of areas of uncertainty, risk and ignorance in society.

A third major aspect of the research paradigm we are discussing here is its focus on unintended and unconscious mechanisms of ignorance generation and lack of interest in the role of specific social actors and their interests in the social construction of ignorance (Wehling 2004: 55). A pertinent illustration of this approach is Wehling's analysis of the history of Freon and its effect on the ozone layer. In his attempt to discover how it happened that for half a century nobody noticed that Freon was destroying the ozone layer Wehling completely ignores the interests of the producers of this substance. Even when he writes about the most controversial period, lasting more than a decade (from 1974 when it was first hypothesised that Freon might be harmful to publication of the Montreal protocol in 1987), he fails to see that one of the determinants of the prolonged questioning of the detrimental effect of Freon on the ozone layer was the strategy adopted by Freon's main producer, DuPont concern, who consistently refused to accept this hypothesis until 1986 (cf. Smith 1998).

This is why it seems that, in a larger perspective and without contradicting the very nature of SSI, we could talk about the social construction of ignorance. Socially-constructed ignorance will concern, for example, some diseases such as malaria, tuberculosis or cholera, which are called "neglected diseases[3]". Their existence in today's world is often explained by the fact that medical industry has no interest in doing any research on a cure or vaccine that could eliminate them. This situation results from the fact that these diseases concern mainly Third World countries which are not a target group for pharmaceutical concerns. Among all new medicines introduced on the market over the last decade, only 1% are supposed to cure tropical

[3] See *Public Library of Science (PLoS) Neglected Tropical Diseases*, www.plosntds.org.

diseases. The persisting ignorance of the effective ways of fighting malaria turns out to be a social construct determined not only by the objective nature of reality (i.e. the complexity of the problem), but mainly be the interests of particular social groups.

Reducing conflict complexity

Definitions of reality formulated by the conflicted parties who are trying to validate them are based on a two-stage reduction:

1. First-degree reduction: reducing conflict complexity to physical risk This stage consists on reducing the conflict to fears concerning the possible physical and biological hazards (a technology carries certain risks for human life and health and threatens the nature)
2. Second-degree reduction: reducing ignorance which is part of the risk

It may appear on two levels:

- reducing uncertainty concerning the probability of certain damage
- reducing ignorance concerning the nature and scale of possible damage.

Second-degree reduction is based on the classical model of evaluating risk, where risk is the probability of certain damage: R (risk) = P (probability) x S (damage scale).

Reducing ignorance consists on hiding the ignorance of one or two sides of the equation: the probability of damage (P) or its scale (S).

As a result of first-degree reduction, the consequences of introducing a controversial technology are reduced to physical and biological phenomena. It is now possible to reduce a complex technological conflict to a debate over the harmfulness of each technology – a debate that can be solved by experts.

Reducing conflict complexity, being the result of this operation, consists of refusing to acknowledge any issue that doesn't concern physical risks or harmfulness and risk in general. One of the most important among the excluded issues is the innovative nature of a technology (in a broad, technical and social perspective).

Second-degree reduction, performed after the conflict has been reduced to a debate over risk, excludes the risk itself from the definition of reality. It follows a zero-one logic: the risk is presented using opposite pairs of “harmful”-“unharmful”. When ignorance of the probability of damage (P) and/or of their scale (S) is reduced to zero, we can be 100% sure that the phenomenon in question is unharmful. On the other hand, reducing ignorance by transforming the probability of damage into the certainty of damage (P=1) and assuming a proper damage scale, we end up defining the phenomenon as clearly harmful.

This procedure allows to reduce ignorance which was an obstacle in risk assessment. On the same time, though, the very notion of “risk” is being eliminated and reduced to “safety” or “danger”. As risk always involves at least some dose of ignorance, eliminating risk leads to reducing conflict complexity through minimizing ignorance.

As a result of reducing the complexity of the conflict, certain aspects of the technology in question are simply being excluded, which leads to constructing ignorance. If a conflicted party manages to validate their definition of reality based on a reduced image of the conflict, then the elements which had been excluded from the conflict discourse (and definitions of reality based on these elements) are shifted into what Bourdieu calls “social unconsciousness” and enlarge the domain of social ignorance.

Defining strategies

Reducing conflict complexity may be performed using one of three defining strategies: the strategy of declared safety, the strategy of declared harm and the precaution strategy. Each of these strategies is supposed to help a conflicted party validate their definition of reality, and therefore redefine the conflict in a way that suits their needs. The winning strategy will determine not only the final definition of a controversial phenomenon in the public discourse, but also the very nature of the conflict and the way it is solved.

The strategy of declared safety and the strategy of declared harm perform the first-degree reduction in a similar way and reduce the conflict to physical risk. That way, all arguments which do not concern the physical harmfulness of the technology in question are simply not considered as valid. What is excluded is mainly the game of interests connected with the technology at stake, as well as the structural changes which could be caused by its implementation.

Excluding the game of interests makes it possible to consider that the definitions of risk presented by conflicted parties reflect (more or less) the objective reality and do not depend on non-scientific factors. In other words, excluding the game of interests concerns hiding the social character of scientific knowledge.

However, ignoring the conflict of interests is not only connected with defining, but concerns structural consequences as well. Not talking about possible interests which could be supported or disturbed by a particular technological decision may have structural effects. For example, presenting the cultivation of GMO's as a purely ecological problem, without taking into consideration the political and economic context (both local and international) leads to ignoring the major impact this technology has on agricultural production structure and on the balance of power in the society (see Seifert 2005).

Apart from reducing the conflict to physical risk, the strategy of declared safety aimes at redefining the technology in question as safe, with the use of certain procedures of second-degree reduction (reducing ignorance). The objective here is to validate a definition of reality which considers the technology to be safe, and therefore, risk-free.

The aim of the declared harm strategy is to redefine technological conflict as an economic conflict. The conflict is presented as a market game with its specific rules which concern consumer choice, freedom of market competition, calculating gains and losses, economic progress, etc. As risk has been excluded from discourse, every debate over the possible harmfulness of the technology seems useless. Profitability becomes the main criterion in making technological decisions. A technology is presented in the perspective of products entering the market whose fate should be decided by the consumers. A classic example of an economic conflict is the competition between technological solutions, each trying to set the global standards, e.g. the nearly finished competition between Blu-Ray and HD DVD systems, or the historical debate over VHS, Betamax and video 2000. The competition between Windows and Linux systems is also following the logic of an economic conflict. A conflict on the market doesn't really involve any regulative state institutions whose only function is to ensure the freedom of competition.

The strategy of declared harm goes in an opposite direction: after the conflict has been reduced to physical risk, the technology in question is being defined as clearly harmful, i.e. having inevitable and disastrous ecological consequences. That way, the conflict is being redefined and becomes an ecological one. It is now a conflict reduced to physical risk, concentrating mainly on possible hazards for human life and health and for the nature. No non-technical arguments are being taken into consideration. The criterion which is supposed to clear the controversies and solve the conflict is the physico-biological harmfulness of the technology. Some examples of this type of defining strategies include the debates over localising waste disposals, power plants or factories polluting the environment, disputes over mobile phone industry and building telephone masts, or over the harmfulness of certain medicines.

The third strategy is the precaution strategy, based on the precautionary principle. It states that, if there is doubt as to the possible harmfulness or serious change caused by the technology, we must continue to undertake actions aiming to prevent the destruction of natural environment, regardless of the cost and of the fact that the harmfulness is not yet a verified scientific fact (Levidow, Murphy 2003: 54).

The precautionary principle is a direct answer to risks connected with technological innovations which has not yet been properly investigated. It is, therefore, a result of acknowledging our ignorance while introducing a new technology. Unlike the strategy of declared safety or declared harm, the precaution strategy does not reduce ignorance but makes it a starting point. The solution presented within this strategy is to refrain from using the technology in question until we obtain precise scientific data concerning its harmfulness or unharmfulness. Ignorance is not considered to be an immanent feature of modern technologies, but a transitory state which can be overcome with scientific progress.

By referring to scientific judgement, the precaution strategy performs a first-degree reduction, reducing social risk to physical risk (as scientific investigation can only concern what is physical). It leads to redefining technological conflict as a scientific conflict, which can be characterized as a conflict taking place within the domain of science and solved according to validation strategies typical for the scientific field. The precaution strategy shifts the controversial issue at stake into the domain of scientific judgement, removing the core of the conflict from the public discourse. As all actions concerning the use of the technology in question are being suspended, the technological conflict is being suspended as well, temporarily, until science provides a solution.

Techniques and ways of reducing conflict complexity

This part will present the most important techniques and ways of reducing conflict complexity used within each defining strategy. They will be treated altogether, as most of them are applicable for all three strategies.

Risk naturalisation

As we have stated before, the basic strategy of reducing conflict complexity is to reduce it to physical risk. This operation, which can be called naturalisation, is part of the risk-assessment process.

One of the first steps in risk assessment is delineation of the area of occurrence of potential risk. In practice, risk is usually evaluated by representatives of the mathematical and natural sciences and within the frameworks of these sciences and therefore risk is usually reduced to the biological/physical dimension: possible harmfulness for the environment and human health is assessed but the social, political and economic consequences of implementation of a specific technology are not (cf. Seifert 2005). As Ulrich Beck (1992: 24) wrote:

> The debate on pollutant and toxic elements in air, water and foodstuffs, as well as on the destruction of nature and the environment in general, is still being conducted exclusively or dominantly in the terms and formulas of *natural* science. It remains unrecognized that a social, cultural and political meaning is inherent in such scientific ‘immerisation formulas’.

We find a similar idea in Dorothy Nelkin’s work (1995: 453):

> Quality of life issue are discussed in terms of the physical requirements for a disputed facility or the accuracy of risk calculations rather than the needs or concerns of a community. Concerns about the morality of fetal research are reduced to debates about the precise point which life begins.

Franz Seifert (2005) shows how the “hegemony” of physical risk has shaped the debate on the acceptability of producing genetically modified plants and this in turn has influenced the course of the conflict between the United States of America and the European Union on the World Trade Organisation Panel. According to Seifert, physical risk “becomes decisive in any kind of restrictive regulation, at national, supranational or international level. (…) As a consequence of physical risk hegemony scientific debates become the crucial conflict arenas” (*ibid*.: 367).

We find a similar idea in Les Levidow et al., according to whom the conflict over GMO result from the fact that EU’s regulation policy concentrates on physical risk: „EU policy has defined agribiotechnology as an expert scientific issue, involving precaution, though kept separate from socio-ethical issues” (Levidow i in. 2005: 266). It contributes to the growing distrust and uneasiness of some part of the society, and, as a result, inflames the conflict.

Methodological rigour

Another mechanism connected with scientific practice is used for reducing uncertainty, which is part of the second-degree reduction. The mechanism consists of expecting that science will provide clear evidence of the harmfulness or harmlessness of a technology or its products. Thus, we are facing the problem of interpreting results of scientific research which is very often not capable of determining whether the technology is harmful or safe, and can do nothing but point out the possibility of safety or damage.

Scientific results can therefore be interpreted as insufficient, inexact, uncertain, and therefore, unable to confirm the harmfulness of a technology (which is the strategy of declared safety). Expecting that scientific research will provide clear evidence of harmfulness may lead to questioning any non-100% evidence and to claiming that, due to lack of sufficient proof, the technology at stake can be considered as harmless.

On the other hand, the lack of proof of harmfulness can be interpreted within the strategy of declared harm in quite a different way, according to the principle stating that “lack of proof of harmfulness is not a proof of harmlessness”. This is why conflicted parties acting according to the strategy of declared harm will demand a scientific proof of harmlessness. However, the methodology of science clearly states that there is no such thing as a proof of harmlessness. Science may not observe any possible hazards, but it cannot proof their inexistence (or, as a matter of fact, the inexistence of anything).

The strategy of precaution proposes quite a different solution to this problem. Instead of being reduced, ignorance is being accepted and made a starting point. The precaution strategy assumes, however, that sooner or later science will be able to overcome its limitations and provide sufficient knowledge for making proper decisions concerning the technology in question.

Defining acceptable level of risk

In order to determine whether something is harmful, we must first define the critical level which cannot be exceeded, otherwise the influence of a technology (e.g. the consequences of using a certain chemical substance or the electromagnetic radiation) can no longer be perceived as harmless. On the other hand, it also means that we determine the critical level of acceptable risk. We must remember that it is being determined not only based on scientific criteria, but also on the way people judge the phenomenon in question. In other words, defining the critical level of acceptable risk depends on the price that the society is willing to pay in order to ensure the desired level of safety.

How can determining the acceptable level of risk contribute to the symbolic reduction of risk? According to our hypothesis, if risk level is being sanctioned, the society tends to treat anything below that level as harmless, and anything above it as harmful. As a result, we would be dealing with the social constructing of safety and danger described above, which excludes and reduces uncertainty (and also, risk).

Let us look more closely into the elements of the process of determining the acceptable risk level. This practice has been so fiercely criticised in risk theory (cf. e.g., Beck 1998, 1992; Wolf 1991; Scheer 1987; Conrad 1987) that here we will only list the most important factors which may contribute to the situation where risk becomes invisible.

According to Jens Scheer (1987), the very idea that “thresholds” can be established below which a substance is harmless and above which it suddenly becomes harmful was borrowed from radiation research. In this case it has actually been confirmed that radiation in excess of a specific limit will destroy protein particles and have toxic effects on living organisms. Thresholds marking the point of qualitative change are not universal, however. The relation between substance dose and its effect on the organism is often not linear. Yet it has become accepted practice to set threshold values for many substances, just as it is done for radiation (Scheer 1987: 447).

Ignoring the process of accumulation of various substances is the next way of symbolically neutralising risk. Acceptable levels are defined for one factor only. Meanwhile, substances are deposited in the human or animal organism and their effects accumulate. Add to this the practice of a single exposure to large doses and a single measurement of their effects instead of long-term exposure to small doses, often a much better model of what actually happens in real life (Wolf 1991: 396).

Other things that have been subject to criticism are reliance on animal studies and transference of their findings to humans and the brevity of the studies which makes it impossible to identify all the effects of a substance. The latter is often forced on researchers by the logic of patent-based market competition which puts a premium on original substance discoverers only. Concerns try to shorten the interval between the discovery and its introduction to the market as far as possible.

Risk assessment is also often unable to take account of the delayed consequences of many technologies. Some of the adverse effects of nuclear radiation due to the bombing of Hiroshima and Nagasaki were not apparent until the nineteen-sixties (Sheer 1987: 449). This delayed effect is one of the reasons why some pharmaceuticals are withdrawn from the market despite previous approval. Their adverse effects sometimes do not show up until the next generations (cf. Wehling 2004: 79-82).

Some dangers are completely overlooked in risk evaluations because the number of known cases of adverse effects is too small. This could be the case, for example, with certain diseases which may be caused by in vitro fertilisation (cf. Schuh 2004).

The conflict of interests

Peter Weingart (2005) wrote that the changing status of science as an institution is one of the constitutive features of contemporary societies (information societies, knowledge societies). He thinks that we are witnessing the increasing overlapping or mutual dependency of science on the one hand and politics, the economy and the media on the other hand. This is leading to the development of new phenomena and processes at the science – politics – economy – media interface which are affecting the way things are done. Risk reduction is one of these new phenomena.

One of the major determinants of the process whereby risk is reduced is the overlapping of science and big business. Science, both pure and applied, is becoming increasingly privatised and dominated by private concerns. Obviously, private economic agents who reap profit from new technologies are loathe to advertise the inherent risk. This is leading to conflict and tension between businessmen, public regulative institutions and public opinion. Scientists are the intermediaries in these conflicts. Unfortunately they are not always neutral although that is what is expected of them. Sheldon Krimsky gives many examples of the large scale of conflict of interest at the science – business – politics interface in his book *Science in the Private Interest* (2003).

Krimsky draws attention to the role which advisory committees, appointed by governmental agencies, play. In the North American legal system they have very considerable influence on legislation and decision making processes. Naturally, they should be objective, detached and, above all, not personally involved in the issues on which they are passing opinions. They should also be extremely highly qualified. In practice, however – Krimsky argues – these demands are often difficult to reconcile because highly qualified scientists usually also work for industry. Conflict of interests is therefore very common among governmental experts and advisors.

Risk channelling and appropriation

Risk is channelled, i.e., it is reduced to a selected fragment which can be submitted to political and/or economic, preferably monopolistic, control. This method diverts attention from other threats and gives the impression that the risk in question is under control. The so-called international emission trade, advertised as a way to limit global warming, may be an example. In this method, economic advantage is taken of a technological controversy so that the present technological progress can be left relatively intact while economic profit is gleaned from the situation. At the same time, public opinion receives the signal that the situation is under control and so is the risk, as attested to by the data on the development of the emission trade.

A good illustration of this mechanism can be found in the famous analysis conducted by the French sociologist, Philippe Roqueplo, who took interest in the debate on forest death in Germany and its relation to introduction of compulsory equipment of cars with catalysers which took place in the early nineteen-eighties (Roqueplo 1986). Roqueplo demonstrated that, thanks to the way the political debate in the European Union was channelled, Germany managed to enforce a beneficial interpretation of the reasons for forest death and gain economic advantage. Only private cars were "accused" and other possible causes, such as SO_2 emission caused by industry, electric power plants and trucks and lorries were rejected. By channelling the problem this way, Germany, the world's leading producer of catalysers, could take advantage of the obligation to install them in cars.[4]

Withholding information about risk

The next type of methods adopted to make risk invisible is withholding information in the strict sense. This is an example of conscious and deliberate action whose purpose is to prevent information about the dangers of a particular technology

[4] A similar case persisted in Poland for many years thanks to Kazimierz Grabek, the monopolist in the production of gelatin who successfully lobbied for bans on import or higher customs duty on gelatin or its components under the pretext of the risk of mad cow disease.

leaking out. As Dortohy Nelkin states, „Secrecy can be a way to divert criticism, reduce the intrusion of burdensome regulations, prevent panic, and avoid costly delays. (1995: 455). She refers to the situation, when after the Chernobyl accident federal agencies in the United Stated prohibited the energy agencies officials and some thousands of scientists working in state laboratories to comment on that case. „They feared that disclosure of information to the press would result in hasty and inappropriate public responses to the controversial American nuclear power program" (1995: 455).

Another good illustration is the court battle waged in 2004-2006 between Greenpeace, the French group CRIIGEN (Committee for Independent Research and Genetic Engineering) and the Monsanto biotechnological concern. This last organisation refused to disclose the results of research which was the basis for applying for permission to import MON863, a genetically modified variety of maize produced by this concern. Everything began when a group of *Le Monde* journalists managed to gain access to data demonstrating that rats fed with this maize, which contained a toxic insecticide, developed severe blood and organ anomalies. The German branch of Greenpeace demanded that the concern reveal its research findings but Monsanto refused on the grounds of commercial confidentiality. In 2005 the German court adjudged that the data must be disclosed, however (Greenpeace 2007).

Apparently such practices are frequent when publishing data on verified risk might threaten the actor's economic interests. Another striking example is the history of the DuPont concern. In 2005 the Environmental Protection Agency accused DuPont of withholding information on the risk of using perfluorooctane acid (popularly called Teflon) for over 20 years. The company agreed to pay a 10 million dollar fine and allocate over 6 million dollars for environmental protection programs. This was the largest administrative fine the EPA had ever adjudged. That same year, *Business Week* magazine awarded DuPont the No. 1 of 'the Top Green Companies" title (DuPont, Wikipedia).

Discourse and risk exclusion

The third area in which risk is made invisible is discourse which we shall now discuss. Radosław Sojak and Daniel Wicenty write in their book *Lost reality. On the social construction of ignorance* (2005: 69-84) that knowledge may be both an instrument and an object of exclusion. This is why risk marginalisation or exclusion from legitimate discourse plays a crucial role in the process of conflict reduction and the number of mechanisms which operate in this area is so large that their discussion would exceed the confines of this article. Hence we shall focus on the most important ones.

We propose to look at the problem of reducing risk in discourse through the perspective of three „exclusion procedures” presented in Michel Foucault's *Discourse on Language* (1972). The first one is prohibition, based on the subject taboo (things we cannot talk about), the ritual (what can be said in which circumstances) and on the privileged position of certain speakers. It concerns both the content and the possible forms of discourse.

The other procedure is the opposition of madness and reason, the rational and the irrational. In case of technological conflicts, we will be dealing with the separation of the scientific from the non-scientific and with setting standards of methodological accuracy. In a broader perspective, this opposition will also concern non-scientific rationality and manifest itself in statements such as “you cannot act against progress” or “progress cannot be stopped”.

The third procedure presented by Foucault is the opposition of true and false, used as a rhetorical strategy and a tool in fighting to control discourse (and define risk). In the context of technological conflicts, it is based on scientific discourse and can be used for the purposes of methodological rigour strategy.

Discourse framing

In her article *Biotechnology and the Politics of Truth* (2005) Sally Brookes analyses biotechnology from the perspective of various discourse frameworks which function within a given discourse formation. Discourse formation is understood as a historically originated system of discourse institutions and practices which define the discourse rules; situation within a specific fragment of the discourse formation says which cognitive perspectives, approaches and conceptualisations are acceptable and will give the ultimate meaning to specific statements and contents (Brookes 2005: 363).

In this perspective, the theory of discourse frameworks seems to be in accordance with Foucault's exclusion procedure based on the opposition of reason and madness. Placing a particular discourse framework depends on the commonly accepted criteria of determining what is reasonable and what is insane.

Specific frames and practices are responsible for content inclusion/exclusion and framing. These frames integrate facts, theories, values and interests into cohesive structures. They say which discourse assumptions will be accepted as obvious and unquestionable. Brookes analyses the frames of the discourse on application of biotechnology in agriculture and points out their consequences for legitimisation of the GM food-based "green revolution".

As far as risk reduction is concerned, two frames are most crucial: the frame based on the assumption that "technology has its own trajectory" (*ibid*.: 363) and the assumption that "biotechnology is natural" (*ibid*.: 365).

The first of these two assumptions views scientific and technological development as something inadvertent which progresses according to its own intrinsic logic and also as a politically neutral phenomenon which leads to more advantages than disadvantages. This frame ignores the aforementioned contemporary links between science, politics, the economy and the media. Possible adverse effects of technological development are excluded from this frame by relegating them (as "unscientific") to the realm of political practice.

The second frame, which declares biotechnological neutrality, habituates public opinion to the futuristic associations which bioengineering evokes by stressing that it is "really" simply a continuation of earlier technologies ("people always manipulated genes, e.g., by crossing animals or plants in order to obtain adequate varieties").

Maarten Hajer uses the concept of emblems to analyse ecological discourse. Emblems serve as a metaphor which helps to orient cognition and frame the problem (Hajer 1995: 19-21; cf. Lakoff & Johnson 1980). They symbolise the problem, attract most of the public opinion and concentrate discourse on themselves. Hajer gives examples of global warming and the ozone hole (the nineteen-eighties) which substituted the earlier nuclear power emblem (the nineteen-seventies) or the pesticide problem (the nineteen-sixties), the mainstays of ecological discourse in each consecutive period (Hajer 1995: 20).

It seems, therefore, that the emblem concept may be viewed as an attempt to specify the theory of discourse frames: emblems function within discourse frames according to a given discourse formation's super-ordinate rules of discourse. By concentrating the main body of discourse on itself, it helps to divert attention from other issues. Hence the peculiar struggle to make a problem an emblem as attested to by the years-long attempts to pay more attention to the problem of global warming.

Excluding people and information

The next technique of reducing risk through discourse also refers to Foucault's theory of „prohibition". This time, it is about not allowing certain speakers to take part in discourse. Radosław Sojak and Daniel Wicenty think that exclusion of people who proclaim certain information is a way of excluding information from discourse (2005: 69-84). "Exclusion of a person often leads to exclusion of certain information and the perspective on which it is founded" (*ibid*.: 78). Exclusion of people and information is based on the rule that "those whose values and norms have been defined as bad have no right to participate in the game which constructs social reality" (*ibid.*: 76). Sojak and Wicenty have analysed many works on social studies of science and the history of scientific controversies in search of examples of such exclusion mechanisms (cf. also Barnes, Bloor & Henry, 1996; Collins & Pinch, 1998). But examples of this method can also be found in the technology discourse. Two examples from Polish press are Zbigniew Wojtasiński's article under the telling title "The mad ecologist disease" (2003) and Włodzimierz Zagórski's article "The new food magic" (2006) beginning with the words: "The opponents of genetically modified food are a new tribe of savages who believe in magic rather than science". If someone is declared a savage in the very first sentence then how can we take what he says seriously? As Sojak and Wicenty say, "to control knowledge is to control people. The use of such control excludes people and their knowledge from the community's interpretative interplay and the process of creating social reality" (2005: 79).

The false symmetry strategy

Another discourse strategy for the marginalisation and trivialisation of risk is to emphasise the controversial and ambiguous nature of a problem. The debate on global warming is an example of this strategy. This mechanism is particularly obvious in the United States of America where global warming is a major political issue, on both the international plane (the Kyoto Protocol) and the domestic plane (Al Gore's campaign or Arnold Schwarzenegger's "conversion" to ecologism). No wonder, therefore, that the belief that global warming has yet to be explained and the effect of human activity on global climate change has still to be proven are upheld in public debate. One of the ways in which this is done is the media's practice of quoting voices for and against global warming in equal proportions. This way, under the guise of journalist reliability and objectivity, the public is given the impression that scientists are divided in half on this issue. Things sometimes get even worse than this as when attempts are made to count the proponents and adversaries of each theory. For example, this is what Gary S. Becker, winner of the Nobel Prize for Economics, wrote in an article tellingly entitled "Global hypocrites" (2007: 50):

> Human kind's responsibility for global warming is "very probable". That is what more than 2.5 thousand researchers, authors of the recent UN Intergovernmental Panel on Climate Change (IPCC) said. Not too few perhaps? At the same time 4 thousand other researchers signed the so-called Heidelberg Appeal protesting against the alleged connection between human activity and warming of the climate.

Sharon Begley argues that upholding controversy is a deliberate strategy adopted by PR specialists and conservative think tanks connected with the oil industry (2007).

Rhetorical procedures

Discursive reduction of conflict complexity includes a number of rhetorical procedures, such as „discourse-closing categories", imputing ignorance, individualization, attachment, hierarchization and legalizing risk.

"**Discourse-closing categories**" are incantations whose use by one of the adversaries causes discourse to reach its limits beyond which it cannot proceed any further. The aforementioned references to inadvertent or "no alternative" scientific progress, accusation of critics of certain technological solutions of the wish to "return to the caves", or talk of the "necessary costs of progress", all belong to this discourse-closure category. The side-effect category also serves a similar function: this category was used for a long time to tame the hazards of technological development. As long as they were viewed as potential side effects, they could be marginalised and treated as "necessary evil".

Imputing ignorance involves excluding people and knowledge from discourse. It is based on the assumption that resistance to technological progress results from the lack of understanding of its true nature, i.e. from scientific ignorance. In other words, this method claims that every critical attitude towards a technology is caused by ignorance. As a logical conclusion, everyone who is against is simply an ignorant – if their weren't ignorants, they wouldn't be against. Imputing ignorance is a method aiming to eliminate the opponents through claiming that „they are mistaken, as they do not know what they are doing" and that they are being manipulated by the ecologists or other demagogues.

Individualization involves reducing risk to the level of individual actions and decisions. It leads to ignoring the key aspect of modern risk: its non-individual (or even global, as Beck would say) character. Instead, risk is being presented within the classical model of personal risk undertaken by each individual responsible for their actions. Referring to the concept of the "responsible citizen" is, according to Beck, "nothing more than cynicism used by the institutions to make their failure look more beautiful" (2007: 107).

Hierarchization consists of creating a hierarchy of risks which suits the needs of each actor. In order to avoid a greater risk, it is possible to accept a less significant one. For example, introducing electronic monitoring systems in public places, as well as the implementation of advanced citizen-control systems is supposed to prevent a greater risk of crime and terrorism. Producing nuclear energy is explained by the need to stop the global warming, etc.

Attachment involves making a connection between the technology at stake and an important social problem it's supposed to solve. The development of one of the more controversial fields of biotechnology, so-called "green" biotechnology used in agriculture, is now being discussed together with the less controversial issues of "white" (industrial) and "red" (medical) biotechnology. It allows the GMO issue to be placed at the same level as the problem of fighting hunger in the world, producing a cure for cancer or transplanting organs. The attachment procedure is strictly connected with the hierarchization method and refers to the classical way of calculating risk which considered risks and chances. Using the attachment method is supposed to show that the risk in question is worth taking, as it will allow to avoid greater threats or will have a positive social effect. It also refers to the value of progress by presenting the technology as groundbreaking and very innovative. As a result, considering the possible gains, blocking the implementation of the technology at stake becomes irrational.

Legalisation, i.e. referring to the legal character of the technology in question is a very common procedure within the strategy of declared safety. It is based on the assumption that, once the technology has been put to all necessary investigation and obtained a positive evaluation from the agencies and institutions created to assess risk, it must, therefore, be harmless. This method involves ignoring any doubts concerning the effectiveness and reliability of risk-assessment procedures.

Conclusions

The reductive model of solving technological conflicts presented in this article is nothing but a theoretical construct, a tool for describing the dynamics of technological conflicts and attempting to understand it. Concentrating on the mechanisms of constructing ignorance (through conflict reduction), it highlights the problem of excluding certain aspects of technological progress from the public discourse, which is the result of using different strategies of defining by the conflicted parties. Adopting this model allows us to analyze which elements are being excluded as each participant of the conflict formulates their own solution to the problem. However, it is also possible to think of a non-reductive, normative model of solving technological conflicts which would allow to avoid reduction and exclusion and would make it possible to analyze the whole complexity and multi-level character of problems related to technological innovations.

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