Risky Transformations: Nuclear Power, the Communist Future, and Changing Images of the Public

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Abstract

The object of this study is the public image of nuclear power as represented in Soviet and post-Soviet print media. Focusing on the concepts of risk, scientific-technical expertise and the public, changes and continuities affecting these concepts are identified in an attempt to understand how the technological culture of nuclear power and the Soviet state were mutually constitutive. Articles taken from three selected journals were analysed following a historical version of linguistic discourse analysis. The general expectation was to find distinct discursive shifts against the backdrop of the technical rupture of the 1986 Chernobyl disaster, and the political and economic collapse of the Soviet Union in 1991.

The three journals performed different roles in the late Soviet media system. While the popular journal provided emerging environmental groups with a current forum for discussion, the popular-scientific and the scholarly journal sustained a crucial discursive continuity by keeping the expert discourse stable. The rhetorical move of interpreting and integrating Chernobyl within this discourse as a 'lesson' or 'teething problems' contributed to the normalisation and stabilisation of the official discourse on nuclear energy in a fundamentally changed political context.

Introduction

My research project deals with the representations and transformations of the 'public image' of nuclear power. Through an analysis of selected articles that were published in Soviet journals since the 1950s I reconstruct how this public image of nuclear power was discursively constructed. I focus on representations of risk, scientific-technical expertise and the public. By identifying changes and continuities affecting these concepts I aim to understand how the technological culture of nuclear power and the Soviet state were mutually constitutive.

Nuclear power is often considered a paradigmatic case for negotiations about acceptable and unacceptable risks, for disagreement between experts and a lay public, but also for controversies among experts. Furthermore, the long duration of the nuclear power discussion notwithstanding, the persistence of incompatible communication models in this area is both unique and exemplary. It was in the context of nuclear power that traditional risk assessment strategies were fundamentally challenged. In the United States and Western Europe, anti-nuclear and other environmental groups deconstructed the dominant risk discourse and often successfully fought for more transparent and democratic decision making processes.

During Gorbachev's *perestroika*, the Soviet Union witnessed similar discussions, especially after the Chernobyl disaster. However, there are important differences in timing, scale and content, according to the particular context of a planned economy, a censored media and a one-party state. My fundamental assumption was that popularisation discourses anywhere resonated with changing technical, social and political contexts. I thus expected the Chernobyl accident of 1986 and the disintegration of the Soviet Union 1991 to modify the public representation of nuclear power in Soviet print media. I expected, in particular, challenges of expert definitions of risk and thus of scientific and technological expertise in general. I also anticipated shifts and reconfigurations in terms of trust in experts or political officials, in terms of the legitimacy to represent society as a whole, and in terms of accountability and responsibility.

Throughout, I was interested in the specifics of the Soviet context: how can we read, interpret, and analyse scientific discourse—almost by definition *objective*—in a deliberately *ideological* discursive environment like that of dialectical materialism? Where are the boundaries between scientific and popular (or popular-scientific) discourse—boundaries that have been challenged in the west? (see, e. g., Hilgartner 1990) What are the dominant models of popularisation in the Soviet context? And finally, what role did science and technology play to legitimise the political and economic system, and vice versa ('co-construction')? Although the current study is not explicitly comparative, my own western background renders it in many ways implicitly comparative.

In this essay, I give an overview of some preliminary findings. In the interest of brevity and readability, I did not include direct quotes from the texts analysed. The more interested reader is referred to the respective part of my dissertation (to be completed). Here, I first give a brief introduction to the specifics of the Soviet context: a one-party political system, a planned economy and a state ideology that claimed political authority by virtue of its scientific character. In particular, I attempt to show the role that nuclear physics played within the Soviet system of science and technology, and how this affected the status and significance of the civilian use of nuclear power. This includes a synopsis of the development of nuclear power engineering. The second part outlines the specific structure and functioning of the Soviet media system. I focus on the role of science popularisation, and on its proponents. I then go on to address methodical issues and the theoretical framework I rely on. The selection of journals and articles will also be explained in some detail in this section of the paper. The final part deals with the analysis of selected articles. As mentioned above, I pay attention to the topics of risk, expertise and the public. My goal is to show how these concepts evolve over time, and in different types of articles and journals.

For understanding the notion of risk, I trace the Soviet versions of this concept (or their absence) and compare them with risk theories developed in the west. As for expertise, I lay out the nature of expert-lay interactions in the selected journals and concentrate on credibility management, i. e. concealing disputes within science, as well as between science and politics, and maintaining boundaries between spheres of accountability and legitimacy. At last, the public in my analysis is not so much the 'actual public' that has been described by sociologists and policy researchers (e. g., Babcock 1997; Dawson 1996; Mickiewicz 1981). It is rather the 'imagined public', the audience or stakeholders envisioned and discursively represented in the journal texts. The purpose of this distinction, however, is mostly analytical: after the Chernobyl disaster, emerging environmental groups impacted on these (often naive and paternalistic) images. And vice versa, the official representations of the public had to a certain extent at least, a normative character, i. e., the public was expected to conform to these publicised images. The concepts of 'actual' and 'imagined'

public are therefore complexly intertwined. After having analytically taken apart the selected texts, in a final step I try to link the three concepts anew by asking how authors discursively construct, maintain and modify the relationships between experts and the public, and between expert and 'partisan' definitions of risk.

Specificity of contexts

The Soviet context of science and technology, and their popularisation, is simultaneously distinct from and similar to that of liberal democracies. Similar, in that scientists faced the same technological challenges, and policy makers had to make decisions facing the same uncertainties. Distinct, because scientists—albeit subject to party control and at the political leader's disposal—were freed from tedious negotiations with a potentially recalcitrant public.

Soviet nuclear power can be traced back to two origins. One is, of course, the military nuclear program. In order to explode an atomic bomb, the Soviet Union created a nuclear industry that provided the basis for later civilian applications of nuclear energy. There are now numerous publications on the Soviet nuclear bomb project, ranging from straightforward editions of archival documents (Riabov 1998, 1999, 2000, 2002a, 2002b), to analytical work (Holloway 1994; Vizgin 1998, 2002), conference proceedings (Velikhov 1997, 1999), and even documentary novels (Grabovskii 2000, 2001).

The second origin of Soviet civilian nuclear power lies in Lenin's famous slogan, 'Communism equals Soviet power plus the electrification of the entire country', and the ensuing efforts undertaken to create an electricity grid spanning the entire country. The electrification of the Soviet Union proceeded with high intensity and at great speed. It relied on fossil fuel and huge hydropower plants that were sometimes built in cooperation with western engineers (see, e. g., Graham 1993, 1998; Josephson 1995). The official historical narrative presents nuclear power plants as a logical consequence of technical progress, as addition, and eventual replacement to hydropower and fossil fuel power plants. This does not do justice to the

difficulties and dilemmas surrounding the early phase of nuclear power, when questions of technical reliability and economic effectiveness were being debated. The specific historical period from the late 1950s to the early 1970s has only recently become the object of scholarly research, and any systematic archival documentation comparable to the military project is still lacking (for an overview see Josephson 1999; Russian accounts include Sidorenko 1997, 2001, 2002a, 2002b).

It is beyond the scope of this essay to go into a detailed history of Soviet science and technology. In the following, I will therefore merely highlight a few aspects of the early period of Soviet reactor development. Nuclear physicists in the early 1950s had acquired influential positions within Soviet society due to the success of the Soviet A and H bomb programme. They had received awards, both ideological and financial ones, and were aware of their prestige and their clout as science managers (Grabovskii 2000, 2001). The suggestion of using nuclear energy for electricity production had been around from an early date, but time and resources to follow up on the idea became available only later, once the bomb had been exploded. The world's first nuclear power plant at Obninsk (near Moscow) was modelled upon the design of military reactors, which had the exclusive purpose of producing plutonium. The Obninsk plant, by contrast, was the prototype of an electricity producing nuclear power plant, and as such not only became the symbol for the 'peaceful atom', but also proved the feasibility of a civilian nuclear industry. Nuclear scientists and engineers had ambitious plans; they saw the share of nuclear power in the country's electricity production growing rapidly in the near future.

However, further development of a civilian nuclear industry was hampered. First, there was the state of the national economy, which was still recovering from the war and the disproportionate funding of the military nuclear program. And secondly, the economic and technical feasibility of a large-scale commercial nuclear power industry was still open to question. It was understood that the development of a civilian nuclear industry would require enormous investment, and there was no consensus among political decision makers as to setting priorities. Igor V. Kurchatov used all his political clout to prevent a stalemate. He personally supervised and promoted the development of various types of research reactors and successfully managed

to procure resources for the advancement of prototypes (Josephson 1990; Sidorenko 2001). Thanks to his skilful lobbying, nuclear scientists and engineers were able to develop and implement industrial-scale reactors. The idea of commercial nuclear power plants gradually began to take shape.

The historian of technology Paul Josephson has shown in detail the rhetorical repertoire nuclear scientists used to convince political decision makers that nuclear power was in fact a feasible, economical alternative to conventional power plants (e. g., Josephson 1990, 1996). He has also argued convincingly that political leaders, especially Nikita Khrushchev, drew political authority and legitimacy from the successes of the civilian applications of nuclear energy, which in turn gave nuclear physics unprecedented prestige and political influence. Science and technology thus functioned a as legitimising means for political leadership; political leaders in turn rendered science prestigious, which again facilitated the political influence of scientists.

This mechanism of science and technology functioning as a legitimatory source of political authority has been described by the political scientist Yaron Ezrahi (Ezrahi 1990). Although he focuses on the United States, as a matter of contrast he often refers to Soviet practices. In his opinion, the distinctive trait of liberal democracies is that their legitimatory processes rely on *public performances* that draw upon scientific knowledge. Ezrahi maintains that these legitimatory performances force political actors to publicly defend their actions against the potential criticisms, and thus significantly constrains arbitrary action. I will return to this concept when I discuss the roles I found being assigned to experts and the public.

From the series of reactor design suggestions, two main types were chosen for standardised production and implementation: a pressurised water reactor (VVER), and a channel type graphite-water reactor (RBMK). Fast breeder reactors were supposed to be developed at a later stage, and initially remained limited to prototypes (Sidorenko 2001). The industrial-scale implementation of nuclear reactors for energy production set in during the early 1970s, and within the ensuing two decades, nuclear power plants were being built all over the territory of the Soviet Union and went critical with up to four reactor units each.

Today, nuclear scientists often divide the nuclear power era in two phases: before and after Chernobyl. Chernobyl happened at a critical

stage in the development of commercial nuclear power. Civilian dual use nuclear reactors producing electricity and heat had been designed, and were already under construction in the immediate vicinity of Nizhnii Novgorod (the former Gorkii), and Voronezh. The fact that it was possible for the accident at the Chernobyl nuclear power plant to happen caught even some reactor designers by surprise: they had been operating with a notion of a maximum credible accident that had not included a scenario in any way comparable with this.[1] The recognition of Chernobyl being a watershed in terms of safety culture is a rationalisation with hindsight. It has to be seen whether this technical rupture found immediate reflections in the scholarly and popular-scientific media discourse.

The Soviet media system

Mass media in the Soviet Union were assigned two major tasks: to influence the formation of political attitudes, and to mobilise people to contribute to the economic goals of the leadership (cf. Inkeles 1950; Mickiewicz 1988). Soviet print media were a highly specialised apparatus designed to reach precisely defined audiences (Hollander 1972). Structurally, the Soviet media landscape was divided horizontally into several levels, reaching from all-union newspapers (like *Pravda*) to regional and local papers, as well as bulletin boards or newspapers that were posted on the wall of a particular factory or *kolkhoz*. The corresponding vertical categories represented functional distinctions, such as general, party, governmental, trade union, agricultural, and industrial press (cf. Inkeles 1950, 149).

A prerequisite for the functioning of that system was the existence of a central control apparatus, an instrument to watch over the uniform reproduction of media output. Censorship was primarily used as a means to centralise media messages. Every article that was to be published had to be authorised by the respective agencies. The administration of censorship from above, however, was supplemented early on by self-control of the actors involved: authors and editors developed a fine sense of what was likely to get authorisation for publication (cf. Hollander 1972; Mickiewicz 1988).

Another distinctive feature of the Soviet media was its highly planned character. Like any factory, farm or scientific institution, Soviet newspapers and journals had to submit plans that were checked, confirmed and sometimes modified by various agencies. There was a 'long-term development plan (estimated on five years), a shorter-term plan of a year or eighteen months, a still shorter-term quarterly plan (called 'operational plan') and, of course, the plan for the given […] issue' (Mickiewicz 1988, 24). These plans were not equally tight at all times and for all periodicals, but they impacted on the concept of newsworthiness by making it difficult if not impossible for journalists to spontaneously react and to report 'hard news'.

But reporting on current events was not the main function of Soviet mass media. Instead, the educational mission of the mass media took centre stage. Just like schools, courts of law or the family, the media were intended primarily as an educational device for the 'socialisation of the person receiving the message' (Mickiewicz 1988, 26). Thus, the 'official discourse' of Soviet print media not only mirrored political doctrines, but also crafted an image of the Soviet reader, thus envisioning an ideal member of society (and this was true even for scholarly and fairly technical periodicals). The central news item was the construction of a future socialist society. Only events that could be related to this general theme were considered relevant. It was of secondary significance when exactly an event got picked up, immediately or somewhat belated, for the most important process was going on all the time. Monthly journals belonged to the slowly changing part of the media. Changes occurring in journal reporting were also less visible than in the world of daily and weekly periodicals, and of radio and TV programs.

Theoretical framework and methods

For a theoretical framework I relied on research in a number of fields. First, this was the sociology of risk, which guided my conceptual approach to the phenomenon of risk, to risk perception, and to the significance of trust and experience in expert/lay interactions (some classics are Beck 1986; Douglas & Wildavsky 1982; Perrow 1984; Starr 1969; Turner &

Pidgeon 1997; collections of important articles are Krimsky & Golding 1992; Schwing & Albers 1980). For the options and varieties of representing risk in the media, the complex interaction of informing, concealing and defining what ought to be made 'public', as well as for the idea of communication models and models of agency I relied on work in public understanding of science and in risk communication research (e. g., Bucchi 1996; Irwin 1995, 2001; Lash et al. 1996; Michael 1998; Nelkin 1987; Wynne 1982, 1995, 1996). Another research tradition that has shaped my approach is the so-called 'New Rhetoric' with its emphasis on recipients of oral and written texts (Ashmore et al. 1995; Gross 1990, 1994; Gross & Keith 1997; Perelman 1982; Perelman & Olbrechts-Tyteca 1969; Selzer 1993; Taylor 1996).

A note on demarcation seems to be appropriate here: I am not conducting any semantic or content analysis. That is, I am not counting and drawing conclusions from how often 'accident' appears as opposed to 'disaster', or 'risk' as opposed to 'safety' as this might be done within a quantitative content analysis. The textual material I study does not suggest that such an analysis would answer the questions outlined above. Instead, the method I found most appropriate is a specific version of discourse analysis. Since *discourse analysis* has become a household term it needs some clarification. My initial idea had been to apply a strictly linguistic interpretation of discourse analysis to scientific and popular-scientific texts, until I discovered that in the mid-1980s, there had already been attempts within the Sociology of Scientific Knowledge (SSK) to draw the attention of sociologists and historians of science and technology to the linguistic representations of science and technology themselves (Gilbert & Mulkay 1984; Mulkay et al. 1983; for a polemical response cf. Shapin 1984). So although my approach proved to be less than original, I will use a different type of discourse analysis than Gilbert and Mulkay, namely, the historical version of Critical Discourse Analysis developed by Vienna based linguists Ruth Wodak and colleagues (Fairclough & Wodak 1997; Matouschek et al. 1995; Wodak 1989, 1990). Wodak's interdisciplinary teams have significantly modified their approach over the years (Wodak et al. 1998; Wodak 2000), but the version I use is an earlier one that I consider useful as a starting point for structuring my analysis.

They distinguish three levels of analysis:

(1) topics and themes (macro-level)

(2) argumentative strategies

(3) linguistic microstructure (micro-level).

On the level of content, topics and lines of argumentation are related to the historical and political context. Against this background, argumentation strategies can be identified regarding the use of generalisations, comparisons, contrasts, the demarcation of 'us' versus 'them', etc. Finally, on the linguistic micro-level, there is a variety of genuinely linguistic features like rhetorical questions, imperatives, active and passive voice, qualitative adjectives, etc. to be scrutinised. After having analysed a text according to these three levels, the next step is to describe connections that can be observed. For example, whether certain themes can be linked with distinct argumentative strategies, or whether certain repertoires of micro-linguistic mechanisms underlie these argumentative strategies.

In my case study, I focused on changes and shifts on these three levels, and on changes in the links between them. My initial hypothesis was that the Chernobyl accident in 1986 and the collapse of the communist government in 1991 would have prompted major changes within the discourse on nuclear power. I have not found such changes at the thematic level: danger from ionising radiation, radioactive contamination of soil, water and air, as well as individual and general radiation protection had been topics all along. And even the noticeable shifts at the thematic level are not unique to the Soviet Union: scientific cooperation and exchange at international conferences seem to have mostly levelled out national specifics before they found their way into print. However, there are differences between the West and the Soviet Union at the argumentative and especially at the micro-linguistic level. These are also the levels where subtle transformations within the Soviet discourse on nuclear power can be detected.

The selection of the journals I use was guided by Hilgartner's 'continuum' of popular-scientific discourse (Hilgartner 1990). In a nutshell, Hilgartner argues in this classic article that the clear-cut distinction between objective, neutral scientific text and simplified, popularised

versions of the same content does not hold out against closer scrutiny and that the line that is nevertheless being drawn to demarcate science from popularisation of science is in fact a political act. Comparing articles on the results of one and the same scientific research across various distinct publication media, he found that even scholarly discourse contained simplifications and other elements usually attributed to popular discourse, and that the best distinction one could make was a gradual one, a continuum.

Following this idea, I chose one scholarly, one popular-scientific, and one popular journal. The scholarly journal represents the field of nuclear science. The other two journals were immensely popular, with a wide audience and a high circulation, which allows the assumption that their 'envisioned readership' was determined by certain normative considerations, as described above.

Atomnaia Energiia (Atomic Energy) is a scientific periodical that has been published in Moscow since 1956. It is the 'theoretical and scientific-technical monthly journal of the Soviet Academy of Sciences and the Soviet State Committee for the use of nuclear energy' (imprint).[2] It mainly contains specialised technical and theoretical articles in nuclear physics and engineering. Articles of a more general character are quite rare, thus the journal clearly addresses a narrow audience of specialists. Researchers submit articles (sometimes individuals, but usually research teams), which are then reviewed by the editorial board which includes leading scientists in the field. I have not found references to external peer review, but every article had to go through an approval procedure that involved expert certificates regarding its content. *Atomnaia Energiia* was never printed in big numbers, although the current number of printed issues is a fraction of its former circulation. The journal was accessible to the public in general and specialised libraries.

Nauka i zhizn' (Science and Life) is a 'Monthly popular-scientific journal' (imprint), edited since 1934 in Moscow. It reached a circulation of 3.45 million in 1987. The journal was very popular among quite different social groups, partly because its contributions ranged from scientific papers written by members of the Soviet Academy of Sciences to crosswords, chess, and sewing instructions. In 1997, *Nauka i zhizn'* still featured

Soviet symbols on the front page, and the most noticeable change since Soviet times was the inclusion of regular advertisements and the shift from hand-drawn maps and charts to colour photographs.

And finally, *Ogonek (Little Fire)* is a Moscow-based weekly journal that originally featured liberal arts. Founded in 1923, *Ogonek* became very popular among a wide spectrum of Soviet as well as foreign readers for its open coverage of topics that had been strictly censored before (e. g. the Afghan war). After Gorbachev became General Secretary in 1985, the share of social and political contributions in the journal reached a peak. To cover special topics like Chernobyl, the editors recruited independent guest authors. *Ogonek* has been referred to as 'the flagship of *perestroika*'. Its popularity increased to the point that no copies were no longer available for sale, and people resorted to sharing circulating copies. In 1986, 1.5 million copies were printed and distributed, in 1989 more than 3 million.

I compare articles from these different types of periodicals, over a period of roughly fifty years, with the Chernobyl accident of 1986 and the disintegration of the Soviet Union 1991 as two major turning points. I have found that the position and character of these journals is a crucial aspect of my research project that I have yet to consider fully. While comparing the concepts of risk, expertise and the public across the specifics of the individual journals is an explicit goal of my analysis, I have also found it worth paying attention to the distinctiveness of each journal's discourse.

As for the sampling of articles, I proceeded differently for each journal, due to their specific character. In *Nauka i zhizn'*, I checked the annual indices for articles on nuclear energy, and then decided whether they were close enough to my topic; i. e., I excluded articles on military applications of nuclear energy, most articles on the theory of nuclear physics, and articles with an explicit focus on the nuclear fleet, or on nuclear applications in agriculture, medicine and industry. In the scholarly journal *Atomnaia Energiia*, I excluded very technical articles (i. e. ones that consisted mostly of mathematical formulas). However, if the introduction and/or conclusion of such articles suggested that the topic was highly relevant, I included the introduction and conclusion.[3] Since *Ogonek* started to publish articles on nuclear power on a regular basis

only in the mid-1980s (and even then, they were still rare), I have tried to find and use all of them. The texts I selected are reports, commentaries, programmatic articles and, in rare cases, letters to the editor, or answers to such letters. I tried to balance the overall number of articles (approx. 100, the three journals combined) according to year of publication, type of article and author.

Changing concepts: textual analysis

The articles I selected according to the criteria described above were analysed from three points of view: first, how the notion of risk emerged in the text and whether it in fact appeared; second, how expertise was framed and how experts were presented; and third, how 'the public' was envisioned, or again, whether it came into view at all. These three themes are, of course, mutually related, and after having isolated them the ensuing step was to tackle and understand how they illuminate and even constitute each other.

Risk

For a theoretical framework, I relied on theories of risk that had been developed mainly in the west. In particular, my approach was guided by Douglas and Wildavsky's cultural approach to risk and risk perception (Douglas & Wildavsky 1982), by Beck's idea of modern industrialised nations being 'risk societies' (Beck 1986), and by suggestions to view our notions of risk in a historical light (e. g., Krohn & Krücken 1993). While the cultural approach intimately ties risk to the structure and identity of social groups, Beck's 'risk society' deals with qualitatively new risks that have the potential to undermine traditional social stratification. Beck's risks are often invisible, and they systematically release irreversible damages. They pose a danger to everyone, disregarding traditional class inequality and subverting the framework of nation states. Douglas and Wildavsky focus on risk *perception* and argue, in contrast to Beck, that what people perceive as risk depends on their general worldview.

They view risks as collective, social constructs, depending on the institutional type an individual relates to (market individualism, hierarchy, or sectarianism), and as structured by social organisation.

Both approaches have been criticised as 'relativistic' and 'objectivistic', respectively. I find it helpful to take a historical perspective to understand the evolution of our understanding of risk. Krohn and Krücken, e. g., try to contextualise and reconstruct the 'objective risk'-perspective that became dominant during the second half of the 20th century. However, they find it hard to completely reject the idea that contemporary risks involve novel characteristics, so they introduce the term 'evolutionary risks'. These risks are defined as significantly altering the specific context they appear in by influencing the very conditions that made them possible. Similar to Beck, Krohn and Krücken argue that evolutionary risks are not comparable with other risks, in that the only way to find out about the nature and scope of evolutionary risks is to take them.

I suspect that the suggested dualism between 'risk objectivism' and the 'constructivist approach' is itself a simplification. There are many passages in Beck where he relativises a blunt risk objectivism, e. g. when he talks about contemporary risks being especially open for processes of social definition. Also, his emphasis on the definitional authority of scientific experts contradicts a purely objective notion of risk. On the other hand, the cultural, or constructivist approach rests on the assumption that there is in fact 'something out there' which then acquires a particular significance (or does not) for respectively organised social groups. Therefore, rather than positioning my project in terms of this dichotomy, I followed Soviet concepts over time, over different types of articles and journals, and tried to bring out how risk was *presented* to Soviet (and international) readers by scientists and engineers, and how these (re)presentations changed, or did not change. For this, the term risk did not necessarily have to appear explicitly. Media discourse may address the issue of risk implicitly, e. g. in terms of modality, evaluative language, and the projection of more or less undesirable scenarios.

In the 1950s, nuclear risk appeared in my articles as 'danger', or 'safety', and as such is in fact a big issue. For any such risk that the authors identified, there was either a 'technical fix' on the horizon, or it was

connected to military applications of nuclear energy (to nuclear bombs, nuclear war, and the competition between the superpowers; e. g., Emel'ianov 1958). Risk in terms of nuclear power engineering was absent from the discussion: the lack of containment was seen as an advantage facilitating a greater frequency of testing parts, the unlimited potential in principle to expand the size of the reactor and the avoidance of manufacturing technically sophisticated containment structures (Dollezhal' & Krasin 1959).

Scientists were, however, very aware of the risks of radiation. But they were convinced that diligent testing would help them understand the new phenomena involved and thus increase radiation safety (Aleksandrov 1969, 118). *Safety* was something that had to be considered, but something that scientists were keeping under control, something that could be ensured, even guaranteed. Whatever the design, all nuclear power plants were supposed to fulfil the criteria of 'reliability of operation' and of 'safety for the operators and the population of neighbouring areas' (Dollezhal' & Krasin 1959, 9).

Explicitly, 'danger' appeared in the context of radioactive waste. Also, there was explicit reference to the danger of radioactive substances entering the food chain (Emel'ianov 1961, 306), and an awareness of the necessity to prevent this by introducing special safety measures. Even the concept of a 'maximum credible accident' was discussed in detail early on, also with reference to the international context. After the Chernobyl accident, several expert authors asked how it was possible that this 'maximum credible accident' could be surpassed.

But there was one other thing that was clearly perceived as risk: the risk of *economic* failure was at least as prominent and feared as the risk of radiation leaking. Even after the world's first commercial reactor at Obninsk went critical in 1954, there were serious doubts about whether nuclear energy was going to become a branch of the national economy (Sidorenko 2001), whether it could be used for non-military purposes in any efficient way (Dollezhal' & Krasin 1959). As early as 1959, safety was measured up against economic profitability.

After the Chernobyl disaster, the representation of risks and dangers changed, just as they did after the collapse of the Soviet Union. It was

only then that the journal *Atomnaia Energiia* started discussing risk as a concept that involved more aspects than guaranteed safety, i. e. one that involved certain uncertainties. Starting with the accident, the journal gave space to risk issues. Different methods of risk assessment were discussed, in very general terms as well as with concrete examples. The 'human factor' prominently entered the discussion of uncertainty, which also prompted authors to suggest different ways of excluding or controlling this variable, e. g. by designing redundant technical systems that prevented human mistakes, but also by designing simulators to enhance operator training, and by introducing regular exams and updates for nuclear power plant operators etc. As these examples illustrate, the belief in technical solutions was unshattered.

While I had originally expected the popular-scientific journal *Nauka i zhizn'* to be more reader-oriented, and thus to represent more of the public concerns that were raised all over the country, I found quite the opposite to be the case. The articles published in *Nauka i zhizn'* were aimed at politically moderating and psychologically easing the journal's readership. *Atomnaia Energiia* published its first reaction to the Chernobyl accident in June 1986, a quite timely reaction given the clumsy planning that organised the Soviet media. The article was clearly aimed at readers turning to the scholarly press for information, for its style was generally accessible and less technical than the journal's usual articles. It invoked the safety of Soviet nuclear reactors and called for discipline, but it provided a minimum of actual information. By contrast, *Nauka i zhizn'* published two small articles on 'Man and radiation' and 'What is radiation and why can it harm the human organism?' as late as September (Anon. 1986; Buldakov 1986), with hardly any reference to Chernobyl.

After Chernobyl, the risk of a nuclear accident was presented as being less than ever. The Chernobyl accident was called a 'teething problem', or a 'lesson' that had to be learned. In the end, it made nuclear power plants safer than they had ever been before, because now much more attention was paid to their safety systems, and to their correct operation. Also, there were new, less secret regulatory agencies, even though these were not (yet) publicly accountable.

Expertise

The relationship and interactions between scientific experts and a lay public have always been an issue, probably since the time science became defined as such (Shapin & Schaffer 1985). Scientists have always perceived this relationship as a problematic one that needed special attention and popularisation efforts. During much of the 20th century, an optimistic technological enthusiasm sustained a clear hierarchy between scientists and the lay public, where path breaking achievements were expected from science and technology, which in turn provided scientists with high social and political authority. Scientific and technological progress was long considered to be beyond question, right until the wake of environmentalist mass movements.

The increasing gap between a self-confident scientific-technological elite and a public that had come to see progress in a more critical light prompted new political initiatives like the 'public understanding of science'. These initiatives started from the assumption that the public had an information and knowledge deficit that prevented them from understanding fully the benefits of scientific and technological progress. Much of the literature in this area still deals with attempts to obtain quantitative measurements of people's scientific literacy (e. g., the European Union carries out 'Eurobarometer' polls, the U.S. National Science Foundation conducts annual 'Science Indicator' studies, etc.).

Criticism of such approaches has accompanied these efforts from the start. Within the Sociology of Scientific Knowledge (SSK), and more generally within Social Studies of Science, researchers have identified communication models underlying the interactions between scientific experts and the public that are often incompatible (Gross 1994; Irwin & Wynne 1996; Limoges 1993; Michael 1992, 1996; Wynne 1982, 1995). Rather than putting the burden exclusively on the public as lacking information and rationality, these scholars have suggested that successful communication also involves reflexivity on the part of scientists and scientific institutions. They have pointed out that the character of rationality is relative and that apart from the scientific worldview, other, fully logical and rational systems of thought and action could be identified (Perrow 1984; Wynne 1993, 1996; Yearley 2000). They have shown

that our understanding of expertise is dependent on certain schemes, cognitive as well as institutional, that assign and deny expertise. These schemes are sustained by boundary work (Gieryn 1995), credibility management (Hilgartner 2000; Shapin 1995), and trust.

In my analysis, I focused on representations of nuclear scientists and engineers, and on the status attributed to them. I tried to tackle the strategies of boundary work and credibility management, in particular with regard to the specifics of the Soviet context. I attempted to get at the expert-lay interactions underlying an article, and at the ways expert identity was discursively established and maintained. In more limited terms, I also looked for discussions of trust in experts among the public, e. g. in the form of letters to the editor. However, there are some fundamental reservations with regard to analysing letters to the editor.[4] They must be understood as being resonant with the official line, as part of a harmonised, orchestrated whole, and not necessarily as reflecting the feelings or opinions of actual readers. Nevertheless, by being published, these letters fuelled the dynamic relationship between the journal's editors, its authors and readers.

Until *glasnost'* and Chernobyl, there was literally no questioning of technical and scientific experts' competence to safely handle potentially dangerous technologies. On the contrary, the scientific establishment and the political authority supported and sanctioned one another. *Atomnaia Energiia* is quite an interesting forum with regard to expert opinions. Even before Chernobyl, discussions of differing points of view took place, and not always in highly technical terms. For example, in 1977, a group of authors around Nikolai Dollezhal' (a prominent engineer, the chief constructor of the channel type reactor design) published an article about the siting of nuclear power plants far away from urban centres, advocating what they called 'nuclear energy complexes', large accumulations of industrial facilities connected to nuclear energy (Dollezhal' et al. 1977). A modified version of this article was published two years later in the party monthly *Kommunist* (Dollezhal' & Koriakin 1979). There, it caused an uproar among the scientific and political elite, for it was perceived as questioning the safety of Soviet nuclear power plants:

> They questioned the current siting policies for Soviet nuclear power plants and urged that future power plants be placed in remote areas, far from large cities. […] their fears about safety were soon repudiated in the Soviet press. Members of the scientific, engineering, and managerial elite published articles reiterating the importance of nuclear power to economic expansion; and dismissing safety concerns. (Graham 1993, 91 f.)

The demonstration of the norms guiding Soviet journalism (unconditional loyalty to the party, high ideological content, patriotism, truthfulness to Leninist theory, a popular character, accessibility to the masses, and criticism and self-criticism)[5] were not equally important in the three journals. *Atomnaia Energiia* provided technical information, thus addressing specialists, but hardly ever lay audiences. An exception are the articles published after Chernobyl, and a few generally accessible texts that were usually opening articles. The authors writing for *Atomnaia Energiia* were generally certified scientists, whose legitimacy was provided by their institutional affiliation or cooperation with renowned scientists. For *Nauka i zhizn'*, the author had to be a very visible scientist, or, if the journal used its own correspondents, they truthfully represented the official party line. *Ogonek* was the only journal granting 'partisan sources' an immediate, direct voice.

Scientific authority was established and maintained through an explicitly scientific style, formulas, abstract references to 'publications in the mass media' *(Atomnaia Energiia)*, by references to renowned research institutions, scientists' awards, and devout interviews *(Nauka i zhizn'),* while *Ogonek's* authors based their legitimacy on having been eye witnesses, or even participants. In fact, *Ogonek* was building on its partisan image in *perestroika* times that it had established earlier, as a vehicle of the *intelligentsia*. It derived its authenticity and credibility precisely from the fact that is was not true to the party line. *Nauka i zhizn'* did publish articles that were not entirely optimistic, but that still 'explained' the connection between scientific and technological progress and political development toward communism. *Atomnaia Energiia*, as a small-scale, expert forum, limited its engagement with political doctrines to a few opening articles and stereotypical quotes that scientists had learned to deploy earlier.

> Scientists employed all kinds of appropriate terms, such as 'Marxist', 'practical', and 'patriotic', to display their conformity to the 'party line'. They invented a symbolic rhetorical device, the 'founding father', whose image became an embodiment of the party line in particular disciplines. They developed new styles of scientific writing—decorative prefaces, forewords and afterwords, filled with 'nomadic quotations'. They created a new genre of scientific literature—'jubilee papers', glorifying Soviet power. (Krementsov 1997, 45 f.)

Soviet science popularisation had a long and glorious tradition. In the area of science exhibitions, Soviet popularisers had an excellent reputation (see, e. g., Schroeder-Gudehus & Cloutier 1994). Their efforts to 'enlighten' the public with scientific knowledge and truth was driven by the Marxist worldview that itself claimed scientificity, and was ultimately aimed at the scientifically founded establishment of a rationally planned economy and (therefore) just society. The more visible a Soviet scientist, the greater was his duty to take part in the process of engaging the minds of those who would never work as scientists, of conquering their imagination and enrolling them in the common project of constructing communism.

Expertise also meant different things at different times. In the 1950s, the number of experts in the field of nuclear sciences was still small and cadres were recruited from regular engineering departments all over the country. The training of nuclear specialists was only beginning. Later on, the field became more defined, the faculties and credentials of its representatives more explicit. The establishment of professional journals like *Atomnaia Energiia* testifies to this process of discipline-building.

As far as the public is concerned, in both *Atomnaia Energiia* and *Nauka i zhizn'*, the 'deficit model' clearly reigned: scientific information was flowing in one direction, it had a clearly defined origin and a clearly defined target. Disagreement with or resistance to expert opinion were understood as irrational and deviant. *Ogonek* was more ambivalent as it featured the public's views more prominently and less condescendingly, but it also worked with a fairly narrow definition of expertise, or, for that matter, counter-expertise. Not everyone could stand up against the country's nuclear bosses, the author had to have some kind of scientific or *intelligentsia* credentials. By and large, *Nauka i zhizn'* was the most consistent journal of the three in its representations of scientific expertise.

(It is another question whether this kind of representation was the right choice for maintaining the journal's credibility.) *Atomnaia Energiia* simply had less to worry about credibility management as far as the public was concerned; it did have to deal with the opinions of partisan experts after Chernobyl, however. As a rule, differing expert opinions were not published when they deviated from earlier published points of view, unless they were framed extremely carefully, or with significant delays in time. *Ogonek's* reporting credibility skyrocketed during the *perestroika* years precisely because it published the opinions of counter experts.

The Soviet press had in general been very successful at concealing disputes within science, as well as between science and politics. The maintenance of clear boundaries between science and politics that has been described as fundamental for western science and technology management (Hilgartner 2000; Jasanoff 1990) played a slightly different role in the Soviet media system: it was precisely the blurring of these boundaries that was central to the Soviet context. Scientific experts were always also politicians, and political leaders were always also scientific experts (i. e., expert ideologues). The Chernobyl accident and especially the collapse of the Soviet political order shattered this peculiar constellation. Given the need to assign responsibility for the accident, and in the face of an increased and increasingly public accountability for nuclear safety, the choice between scientific *or* political affiliation became crucial, signifying options with clearly distinct meanings and consequences.

'ThePublic'

The concept of the public is itself inextricably linked to that of expertise, and to the idea of performance (Hilgartner 2000). Although the texts I analysed can more easily be understood in terms of stage management, any performance also needs an audience. And in contrast to the 'actual public(s)' that have been described elsewhere I focus on the 'imagined' or 'envisioned public(s)' as they are manifest in the text. This also means that I did not rely on opinion polls, or on surveys on public attitudes or public perceptions of technological risks.[6]

'The public' is a tricky notion to begin with. The 'general public' as we perceive it in the west was not only excluded from any scientific or technical decision, it simply did not exist in the minds of Soviet decision-makers other than as 'mass(es)' to be managed, to supply with the basic necessities of life, and to keep under control politically and ideologically. Over the course of this project, I have been repeatedly challenged for applying the term 'public' to the Soviet context. In Marxist terms, I have been told, there is no public, only 'society': one society striving towards communism, toward a just social order. I acknowledge that 'the public' means different things in different contexts. Nevertheless, I want to continue crossing boundaries with concepts, and see how (and if) they work in a new environment. Using the term 'public' and the distinction I make between active and imagined public appears to be a way to interpret my primary sources without imposing too much of a western bias. For even in a totalitarian, top-down ruled state, there were those governed, those affected by state policies, those 'moulded into ideal Soviet citizens' (or punished for not becoming them). Some kind of 'imagined public' has always been there.

I tried to trace the historical transformations in the discursive representations of this 'imagined public', especially transformations that coincided with (or can be put into a causal relationship with) the technical and political ruptures of Chernobyl and e. g. the *perestroika*. I looked at the ways my authors discursively constructed, maintained, changed and varied the relationships between the public and scientific experts, between the public and the state, as well as between the masses and political doctrines embodied by the party.

Starting in the late 1980s, the Soviet Union witnessed a massive uprise of social groups that formed as a consequence of the Chernobyl accident. These groups articulated their concerns and opposition to state plans by taking advantage of Gorbachev's policies of *glasnost'* and the abolition of censorship. For a brief period they effectively managed to halt any activity in the sphere of nuclear power engineering: the construction of new reactor blocks, the scheduled start of recently completed ones, etc. These groups managed to distinguish themselves as serious challengers of nuclear energy officials and their plans for the country's

technological future. And yet, within a few years, such groups ceased to be a crucial factor in the discussion: people were busy surviving economically.

An 'active public' also appeared on the pages of *Ogonek:* from the three journals analysed, it was the only one that granted dissident views the opportunity to have their views published. Although *Atomnaia Energiia* did not provide members of the public groups a voice as authors, they appeared as actors that had to be taken seriously. A fairly patronising tone vis-à-vis the public made room for a more sophisticated discussion. But my main question sets in even before this 'actual' public came into view, before Soviet citizens started to experiment with their options to disagree, to dissent, to protest, or even to resist. This question is: had the public been assigned any role at all, and if so, which one? I found Brian Wynne's concept of 'models of agency' useful since in my articles, 'the public' emerges mostly implicitly, as imagined, ideal readership, or as envisioned, ideal 'Soviet citizens', sometimes in an intricate combination of both.

Wynne criticises the artificial separation of cognitive and social dimensions in dominant approaches to public understanding of science, which ignore underlying tacit models of agency: 'tacit models of social agency underlie assumptions about what people can or should understand about science' (Wynne 1995, 378). Wynne is well aware that any communication involves ideas and perceptions of an audience, or a public, and that it is therefore unavoidable to impose models of agency on one's listeners, readers, or spectators. Instead of the unidirectional, homogenous deficit model, however, he proposes models that envision a public with various and sophisticated forms of expertise of their own, a public that is not irrational but a resource for different rationalities that can affect initial risk assessments in meaningful ways.

The articles I chose were consciously prepared with specific audiences in mind, they were written and edited with a clear idea of how readers were supposed to understand them. The journals' discourse before Gorbachev (that is, for *Nauka i zhizn'* and *Atomnaia Energiia*) provides a good background for studying the turbulent *glasnost'* period, and the early post-Soviet years. In *Atomnaia Energiia*, I found remarkably direct comments on how the readers would perceive what was being written on

nuclear energy in the 1950s. In the ensuing decades, the public—be it the readers, the potentially affected population, or the nuclear power plant operators—more or less disappeared. This might have had to do with the specific audience the journal addressed, namely, nuclear energy specialists, and it went hand in hand with the identification of the auctorial 'we' with scientists in general, or nuclear energy cadres in particular. The public returned to the pages of the journal only after Chernobyl. *Nauka i zhizn'* was very consistent with regard to its readers. The journal's readers continued to be in need of education and even 'enlightenment' along objective scientific truths.[7]

It was part of the job of Soviet nuclear physicists and engineers to popularise scientific findings and technical achievements, but also to perform as science journalists. Publishing texts in journals that targeted different audiences, they had to frame their readers in specific ways—as students, colleagues, or fellow combatants in the struggle for a bright communist future. By representing the relationship between experts, the state, the party, and the public, the masses, etc., they assigned specific subject positions to these envisioned actors. The predominant model of agency for the 'imagined public' was the image of an ignorant, passive mass, in need of enlightenment by experts, whose paramount task was to credulously absorb what was being presented to them. In the late 1980s, the environmental protest movement contested these images, and as a result the imagined public came to be conceptualised as not manageable, and potentially resistant and rebellious. This new public was still imagined as uninformed, but their irrationality had taken on a more aggressive expression, they were seen as troublemakers who potentially posed a threat to the planned development of the nuclear industry. As it was to be expected, this resulted in old and new strategies to keep the public at bay—the latest example being President Putin's media legislation (Belin 2002). The dilemma that Russian decision-makers and nuclear officials face today seems to be (a) to distinguish themselves from the Soviet past, but (b) also from western science and technology policy, which is seen as paying exaggerated attention to public opinion.

Conclusion

As a way of linking the concepts of risk, expertise, and the public, I suggest the use of Yaron Ezrahi's notion of public performance that I have introduced above (Ezrahi 1990). To reiterate, Ezrahi argues that science and technology function as a legitimatory source of political authority. Such processes of establishing legitimacy need a public performance, which supposedly makes political actors publicly accountable and thus significantly constrains arbitrary action, even when such performances have taken on a habitual character. However, any public performance—and this notion may include media representations—involves 'stage management' (Hilgartner 2000), i. e. the attempt to control the performance itself, as well as its publicly conveyed representations. Ezrahi locates the key distinctions between the liberal democratic and the totalitarian state model in the *possibility of failure*, that is supposedly present in the democratic model, but absent in the totalitarian one and in the role that is assigned to the public. Also, according to Ezrahi, the *options available to the public* in these two models are distinct: while in liberal democracies, the public is envisioned as attestive spectators, a totalitarian model merely allows its spectators to celebrate the official presentation.

In my opinion, it is not the potential of an unsuccessful performance that can ultimately distinguish the two models. Both liberal democracies and totalitarian states tend to arrange public performances in such a way as to avoid failure; good stage management is vital in both contexts. Even if the goal of avoiding failure is not always made explicit, it becomes evident in cases where a public performance does fail, e. g. the Challenger explosion. On the other hand, any state's means to control the success of public performances are limited.[8] It seems that if the Soviet state and its leaders wanted to draw on science and technology as *publicly accessible* and *universally valid* rhetorical resources to legitimise their power, they needed (semi-)public performances. One could argue that to this end, the Soviet regime had developed sophisticated ritualised forms of attestive visual culture (Krementsov 1997). As a result, it becomes difficult to neatly set apart whether the public was assigned a celebratory or an attestive role, or whether such a distinction was consciously blurred.

In the name of 'constructing the bright communist future', 'the well-being of humankind', 'peace on earth', 'the obligation to defend the fatherland' etc., sacrifices along the way of technological progress were not only deemed acceptable, but necessary. The political change starting in the mid 1980s made it possible to criticise the system of a centrally planned economy, and thus of an exclusively economically driven analysis of technological risks. In the case of nuclear energy, the concepts of risk and expertise were intricately tied together, the consensus being that good Soviet scientists automatically stood for exciting advancements of science and technology in the interest of humanity, and for good, reliable, safe nuclear technology. Soviet experts had managed remarkably well to keep dissent between science and politics—and even the necessity of negotiations between the two—invisible to the public. No doubt had been cast on the faith in experts and the expert system, although the relationship between political leaders and scientists was not always one of mutual trust and benevolence (cf., e. g., Holloway 1994; Krementsov 1997).

Officially, science was marching hand in hand with the country's political leaders toward the communist future, on the direct road leading there: the promotion of scientific and technological progress. Chernobyl and the contemporaneous opening of society under Gorbachev shattered many assumptions that had been taken for granted: suddenly, conflicting expert opinions were discussed openly. *Perestroika* allowed alternative media to emerge and blossom, but from the nuclear experts' perspective, the process seemed to be getting out of control. I am unable tell from my data whether trust in experts had declined before the Chernobyl disaster, but I can safely say that the media discourse of this period presented a negative attitude among the public with regard to nuclear power as a new phenomenon.

To different extents, the journals I chose on the one hand provided the emerging environmental groups with a public voice (*Ogonek*), and on the other supported the scientific experts who found their own assumptions challenged—not so much by the Chernobyl accident, but by the apparent loss of trust in their expertise and authority in decision making processes *(Nauka i zhizn', Atomnaia Energiia)*. I would argue that especially the latter way of reacting to the new *perestroika* realities is important for the understanding of the changes and transformations of Soviet media dis-

course. Journals like *Nauka i zhizn'* and *Atomnaia Energiia* played a crucial role in providing the discursive continuity that post-Soviet nuclear energy programs rely upon until this very day—by keeping the expert discourse stable. Despite the changes in expert identity vis-à-vis the state after the collapse of the Soviet Union, *Atomnaia Energiia* as a highly specialised, scholarly periodical was able to present a clear boundary between science and non-science (i. e., politics, ideology), as if this were a historical continuity.

However, this boundary between the scientific and the political sphere had been redefined only after the Chernobyl disaster and the collapse of the Soviet order. It became a crucial element in defining expert identities under new circumstances. While nuclear power had been promoted as the ultimate progress toward communism, its later, post-Soviet representations invoked an objective, scientific rationality. A responsible handling of risks, and a transparent engagement with public opinion become part of this new identity of the nuclear power establishment. The rhetorical move of interpreting and integrating Chernobyl into this discourse as a 'lesson' or a 'teething problem' contributed to the normalisation and stabilisation of the official discourse on nuclear energy in a fundamentally changed political context.[9]

In a media system like the Soviet one, with its imposed political conformity, we do not generally expect a variety of discourses existing next to each other. However, this is exactly what I was finding: in the scholarly press in particular, critical comments had always been possible, as long as they followed certain conventions. The popular press changed the most during the *perestroika* period and after the collapse of the Soviet Union. The popular-scientific journal—supposedly in an ideal position to mediate between science and the public—proved to be the most conservative outlet, although in recent years the topic of nuclear energy has for the most part disappeared from its pages.

Notes

1 When the RBMK was developed, the opinion was common among nuclear engineers that the RBMK type was even safer than the VVER, because each channel could be controlled individually (e. g., Morokhov et al. 1974).

2 All translations, unless otherwise noted, are mine. S. S.

3 This strategy of using only key passages of a text for analysis is backed by linguistic findings: the overall structure of scientific articles prescribes a condensed summary of the research project in just these passages, the introduction and the conclusion.

4 Inkeles has argued that letters to the editor in the Soviet press functioned simultaneously as informal control—by providing the top Party officials with first-hand information from the public—and as a 'safety valve' for channeling social tension (Inkeles 1968, 266).

5 *Partiinost' ideinost', otechestvennost', pravdivost', narodnost', massovost',* and *kritika i samokritika* (Hollander 1972, 39).

6 First of all, opinion polls were not representative and inherently unreliable, and secondly, there still are serious access issues with the results of these polls (Babcock 1997).

7 It is no coincidence that the Soviet Ministry of Education in literal translation was the 'Ministry of Enlightenment' *(Ministerstvo prosveshcheniia)*.

8 Ezrahi argues that while the United States broadcast pioneering science and technology live, the Soviet Union chose to show funerals on television—a presumably 'safe bet'. However, there were public performances in the Soviet Union that spectacularly failed (Brezhnev's funeral was a case in point, cf. Hobsbawm 1994).

9 It is a bitter irony that this is not just a rhetorical move, but a technical fact: Soviet nuclear power plants did become safer after Chernobyl.

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