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Generating post-modernity: nuclear energy opponents and the future in the 1970s

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ABSTRACT

During the 1970s, industrialized society seemed to be on the cusp of sweeping change, moving away from the Fordist 'modern' era and into an undefined 'post-modern' future. To contemporaries in France and West Germany, arguably nothing symbolized this uncertainty more clearly than nuclear energy. This article examines, from the perspectives of three sets of actors, perceptions of the present and visions of the future connected with anti-nuclear protest. Anti-nuclear *activists* critically re-evaluated narratives of 'progress', deploying both backward-looking and forward-looking references to emphasize the importance of action against nuclear technology in the present moment. Movement-aligned *counter-experts* from the natural sciences came to question their own professional commitment to scientific progress as they argued that risky technologies were being rushed to commercial use for prestige and profit. Finally, *social scientists* sympathetic to protesters situated the anti-nuclear movement in relation to a 'new' era or a new phase of modernity: not nuclear technology, but opposition to it seemed to reveal where society was headed. In different but overlapping ways, each of these actors contributed to contemporaries' sense of living at a historic turning point defined by decisions about nuclear power.

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The 1970s were a period of sweeping change in Western Europe, perceived by contemporaries as a moment of enduring 'crisis'. For many historians looking back on that decade, *the* crisis was the oil crisis, which ended the *trente glorieuses* by calling into question an important segment of the energy supply on which highly developed societies depended.[1] The ensuing economic 'crisis' consolidated on-going changes to work and industry, supposedly giving birth to a 'post-industrial' society that valorized the knowledge-based work of the highly educated while rendering unskilled labour redundant. New 'post-Fordist' work patterns were to be the norm – at least for those who remained unaffected by the growing unemployment crisis.[2] Industrial society, which had thus far presented itself as the teleological endpoint of modernization, was seen to be disintegrating into a new 'post-modern' world characterized by rupture, precarity and uncertainty.[3]

Arguably no issue encapsulated contemporaries' sense of crisis and change as clearly as nuclear energy. Though plans for large-scale recourse to nuclear energy were already well developed, the oil crisis gave them new prominence and urgency.[4] Proponents

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presented nuclear power as a technological solution for economic ills, capable of providing the knowledge-based economy with fuel and jobs for decades to come; it was, in some sense, the pinnacle of high modern aspirations towards 'progress', with even its more problematic aspects to be kept in check by rational, scientific and technocratic management. Opponents, on the other hand, saw civilian nuclear technology – based in part on its military past – as foreclosing on other, more desirable possibilities for the future. Nuclear power stations, usually sited in peripheral, supposedly underdeveloped areas, were seen as harbingers of a vastly accelerated form of industrialization, with all the associated social and environmental ills. Debates about nuclear energy were thus also debates about what kind of future society was approaching – and at what speed.

The anti-nuclear movement was present in countries across the capitalist, industrialized world, from Austria to Australia by way of Japan and the United States. It was, however, in Western Europe that it most fiercely seized hold, with neighbouring France and West Germany standing out in terms of the frequency, intensity and interconnectedness of protest. Demonstrations in both countries in the late 1970s routinely attracted thousands of participants, and authorities in West Germany's federal states and France's centralist administration alike struggled to contain a movement that they made little effort to placate.[5] Though the energy policies of each country have diverged greatly since the 1980s (with France now heavily reliant on nuclear power even as Germany phases it out), the history of anti-nuclear energy protest in the 1970s was in many respects a shared French–German one. While opposition everywhere arose primarily around specific sites where nuclear facilities were planned, some of the earliest among them were in the Upper Rhine Valley along the French–German border. Many of the arguments and strategies activists deployed there subsequently circulated transnationally as well as nationally.[6] The links connecting particular protest sites were entangled with activism on other issues involving traditional environmental concerns (e.g. a chemical plant in Marckolsheim, Alsace), peace and non-violence (such as the Larzac military base in southern France), workers (e.g. the Lip watch factory in Besançon and Maoist organizing in Hamburg), or even issues that were, on the surface at least, apparently unrelated (feminism, autonomy). As a result, the movement brought local nuclear opponents concerned about their jobs, environment and quality of life into contact with a wide range of outside supporters motivated by principled opposition, indirect issue linkage, and their own, geographically diffuse sense of being 'affected' (*concerné* or *betroffen*) by nuclear technology.

This article will address the time-related arguments of the anti-nuclear movement from three perspectives, showing how each contributed to contemporaries' sense of living at a historic turning point defined by decisions about nuclear power. For anti-nuclear *activists*, the issue was intimately connected with time: their concerns about nuclear energy used both backward-looking and forward-looking references to emphasize the importance of action in the present moment. In doing so, they interrogated notions of 'progress' itself. Movement-aligned *counter-experts* from the natural sciences shared concerns about nuclear technology despite their professional commitment to 'progress'. A key element of their argumentation was the idea that risky technologies were being rushed to commercial use for reasons of national prestige and private profit. Contemporary *social scientists* who sympathized with anti-nuclear protesters situated this social movement in relation to a 'new' era or a new phase of modernity: not so much the technology, but the opposition to it seemed to reveal where society was headed.

For all three sets of actors, nuclear power was both symbol and catalyst of what Hartmut Rosa has termed 'social acceleration', a self-propelling process by which quantitative changes in speed within different domains lead to 'a silent but sweeping qualitative social revolution'.[7] Already at the time, the 1970s appeared to contemporaries to mark a threshold moment in which the apparent certainties of modernity had become destabilized and were giving way to a new and less predictable future. Because decisions about nuclear technology were practically 'irreversible',[8] they implied a pressing need for contemporaries to think about the future, a fast-approaching moment that no longer appeared to conform to modernist expectations of 'progress'. Drawing on a range of sources including movement ephemera, the activist press, published material, and oral history interviews with (former) activists, this article will show that, taken together, the arguments of activists, counter-experts and social scientists all served to stress the urgency of action on this issue of very long-term importance – and simultaneously to confer historic importance on the movement opposing nuclear energy.

Activists: dystopian futures and present pasts

The opposition to nuclear energy that formed in the 1970s sometimes portrayed the technology's large-scale adoption as a decisive step towards a dystopian future. These visions of the future were, however, rooted primarily in protesters' own 'space of experience',[9] namely, the living memory of the Second World War. At the same time, activists ascribed long-term significance to their own actions, linking protest to both the deep past and to generations far in the future. Frequently accused of rejecting 'progress', some activists embraced the charge and argued that scientific rationality itself was part of the problem.

Anti-nuclear, environmentalist and Green movements of 'the '68 years' sometimes imagined nuclear energy in relation to apocalyptic disaster scenarios.[10] These imaginings were based on the only widely known experiences with nuclear technology at the time, the bombings of Hiroshima and Nagasaki. Activists thus 'quantified' perceived dangers in relation to the number of 'Hiroshima bombs' they might represent. Prior to the start of Fessenheim nuclear reactor in Alsace – the first of a new wave of French and West German reactors – activists claimed that within 'a few months of operation, it will contain the equivalent of several hundred Hiroshima bombs . . . . If Fessenheim I starts, nothing will be the same as before.'[11] Describing the process by which electricity was generated from nuclear sources, a leading Parisian activist stated: 'We've now found a new means to boil water. Unfortunately at the same time we've also found a way to produce, for each nuclear power station, the equivalent of a thousand Hiroshima bombs of radioactive waste.'[12] In West Germany, references to Hiroshima and to the Second World War had arguably even greater resonance, not least because they recalled the air war against Nazi Germany.[13] Some Germans even invoked idioms of National Socialism in arguing about the importance of 'the healthy maintenance of living space [*die Gesunderhaltung des Lebensraumes*]' that nuclear power stations supposedly threatened.[14] Even those with more convincing anti-fascist credentials, such as the Communist Party member and anti-nuclear activist Balthasar Ehret, connected opposition to nuclear power with wartime experiences: 'In 1945 the Americans dropped their A-bombs on Hiroshima and Nagasaki. The thought tormented me, because I knew that my village, my family was

evacuated in war three times.'[15] By the same token, some activists specifically used anti-fascist references to assert the moral righteousness of anti-nuclear protest. One group, styling itself a 're-founded White Rose' (in the mode of anti-Nazi martyrs Sophie and Hans Scholl), proclaimed its resistance to the construction of the 'nuclear concentration camp Brokdorf'.[16] A similarly minded French group responded to the arrests of Germans at a French demonstration by writing that France too had 'its collaborators' and that 'the German anti-nuclear activists would have been with us in the concentration camps'.[17] The Second World War was thus a key point of reference for activists seeking to define debates over nuclear energy in moral terms.

Activists also referred to conflicts much further in the past to frame contemporary protest in a positive light. Especially along the French-German border, the historic animosity between the two countries presented a useful foil. The protest singer Walter Mossmann borrowed the title of a nineteenth-century anti-French anthem, *Die Wacht am Rhein*, to tell a different story: instead of a 'watch on the Rhine' to repel the French, this was a joint watch by French and West German citizens to ward off the shared environmental dangers of a nuclear power station in Wyhl (Germany) and a chemical plant in Marckolsheim (France).[18] The song invoked regional history and linked it to recent biochemical threats, such as DDT (dichlorodiphenyltrichloroethane, a carcinogenic pesticide) and Contergan (thalidomide, which caused birth deformities); a local woman added a verse about Hiroshima and the need to 'protect our children'.[19] Activists at this corner of France, Germany and Switzerland could also dig much deeper for usable pasts, such as when they claimed the Peasants' War of 1525 as a precedent for their own supposedly borderless uprising against illegitimate authority.[20] Even in Northern German areas with fewer revolutionary bona fides, activists framed present protest as the revival of ancient traditions: near Brokdorf nuclear power station, activists constructed a past reaching back to 1140 in which the local marshland farmers had always fought for their survival amid wars initiated by distant rulers: 'Through the construction of nuclear facilities, the marsh population faces today like never before the problem of securing its existence.'[21] Such references to the distant past conferred a sense of longevity and historic importance to an issue specific to the post-war period.

For most activists, protesting nuclear energy was more about shaping an uncertain, potentially threatening future than about reviving the past. They insisted on claiming responsibility for a problem that would persist for generations and foregrounded children as symbols of the future.[22] In 1972, the first issue of the satirical, environmentalist journal *La Gueule Ouverte* – which billed itself at the time as 'the journal that announces the end of the world' – opened with a title page depicting a crying baby. The accompanying 'First and Last Editorial' described anti-nuclear protests in Fessenheim and Bugey as examples of the 'irrepressible need TO CHANGE LIFE' in order to avert an ecological 'catastrophe' that was 'much closer than you think'.[23] In 1973, the first ecological candidates in France, Henri Jenn and his deputy Solange Fernex, ran on a platform calling 'For quality of life and the future of our children'.[24] The same appeal was made repeatedly by groups of local women opposing the chemical factory in Marckolsheim and the nuclear power station in Wyhl. In one of several flyers entitled 'Women sound the alarm!', they expressed the desire for 'an environment in which our children can grow up healthy'. Referring again to the thalidomide scandal a decade earlier, they emphasized that lead poisoning and radioactivity posed health threats to (unborn) children, perhaps

resulting in deformities and birth defects. As one flyer bluntly put it, 'WE DON'T WANT ANY LEAD CRIPPLES OR ANY HIROSHIMA CHILDREN!' (The use of the term 'cripples' may also have resonated with the previous half-century of eugenicist thinking.[25]) The same flyer invoked women's concern for a 'healthy future', arguing that 'we women understand something different by "progress"': namely a healthy environment for children, jobs, environmentally friendly industry and the preservation of agriculture.[26]

Historian Frank Biess notes that this emphasis on 'feminine' roles related to children and health led to nuclear-related fears being coded as 'female', in contrast to an optimistic narrative of progress that was coded as male.[27] Especially in conservative, rural areas, women mobilized against nuclear energy in the name of their roles as mothers and with explicit reference to 'future generations'.[28] In July 1980, for example, a group of pregnant women and mothers (reportedly including 'old, young, city and country women, farm women, housewives, and "intellectuals"') stormed the parliament of the federal state of Baden-Württemberg to express concern about French and West German reactors along the Rhine. In a press statement afterwards, they explained that 'We do not want to have to sheepishly remain silent or lie when our children and grandchildren one day ask us, "Why didn't you do anything back then?"'[29] The implied reference to anti-fascist resistance again underscores the weight that the recent past had on imaginings of the future. Opponents of a nuclear waste site in Gorleben made a similar appeal on a poster that is, according to one historian, 'representative of the entire anti-nuclear movement': underneath 'motifs of struggle, salvation, solidarity, concern, and destruction', the poster asked, '"When they ask you how it could happen, can you tell them that you didn't know?"'[30] Concern for future generations was thus another frame by which activists made moral claims in the nuclear energy debate.

This focus on generations to come also resonated with certain religious arguments against nuclear energy. A group of German Catholics in the Upper Rhine Valley called for opposition to Fessenheim power plant in order to 'Protect unborn life!' According to them, abortion was wrong, but genetic mutations were precisely the sort of thing that might lead a woman to seek an abortion.[31] A Lutheran priest from the region, Günter Richter, focused his ire on nuclear waste, which he described as an 'atomic mortgage [*Hypothek*]' that present-day decisions would leave 'for the many generations after us, even after nuclear energy production has long since ceased'.[32] His religiously inspired lament that 'Man has become a subject of his [own] history' echoes claims about the Anthropocene.[33] As some religious leaders pointed out, nuclear power posed problems on such a timescale that modern institutions themselves were incapable of controlling or perhaps even grasping them. Söhnke Wandschneider from Hamburg was one of several Lutheran pastors who held church services in full clerical garb at demonstrations against Brokdorf nuclear power plant. When interviewed, he recalled a 1984 study for the US Department of Energy by the semiotician Thomas Sebeok, who concluded that no sign or language would be enduring enough to warn populations about radioactive waste tens of thousands of years later: Sebeok suggested that an 'atomic priesthood' of physicists, doctors and other experts might be established that would enact rituals to encode, adapt and re-encode a message of warning around nuclear waste sites, 'with perhaps the veiled threat that to ignore the mandate would be tantamount to inviting some sort of supernatural retribution'.[34] As Wandschneider pointed out in his interview, religion was one of the only forces durable enough to last for such an 'inconceivably long' period of time.[35] In the debate over nuclear power,

religion was not a source of apocalyptic visions, but an institution with a much longer vision of time than the nuclear industry.

Proponents of nuclear power challenged the views of their opponents chiefly by arguing that the technology represented a desirable advance in an inevitable forward march of progress. In a 1975 policy statement, premier Hans Filbinger of the West German federal state of Baden-Württemberg argued that 'there is no realistic alternative to nuclear energy' and that 'grave consequences for energy provision' would be 'unavoidable' if dozens of nuclear power stations were not built: 'Without the Wyhl nuclear power station, the first lights will start going out in Baden-Württemberg at the end of the [this] decade.' Protesters in Wyhl, who had occupied the site of a planned reactor and forced a pause in construction, were ruining Baden-Württemberg's bright future: 'If the example of Wyhl catches on [*Schule macht*], a sensible development of this state towards a good future will no longer be possible'; continued protest would make the state 'ungovernable'.[36] French proponents of nuclear energy levelled similar accusations against activists, claiming they would reverse progress and return to using candles. These included the Moscow-aligned Parti Communiste Français (PCF), which (unlike its West German counterpart) was a significant electoral force and a co-architect (with the Gaullists) of the country's post-war nuclear programme.[37] On the day of a major international demonstration in Creys-Malville in 1977, the PCF's daily newspaper, *L'Humanité,* published a cartoon showing figures shrouded in darkness holding up a candle to a sign reading 'Malville: 15 km'.[38]

Anti-nuclear activists, though, insisted that opposing nuclear power was not about longing for a pre-industrial past. It was about what nuclear energy represented: namely, a future of unfettered consumption, with accompanying environmental degradation. Odile Wieder, one of the organizers of the 1977 Malville demonstration, summarized her views as follows:

> For me, nuclear [power] is the symbol of something that does not [lead] toward individual autonomy. [It leads] to a society that resolves all problems and incites us to consume ever more. I don't say that we have to go back to the candle – that was not my perspective at all – but it's the symbolic side.[39]

Other activists argued that nuclear energy was a symbol of the modern world slipping out of control through concentration of power within a system that was complex beyond mastery. Mireille Caselli, a Frenchwoman who has lived in (West) Germany since 1971, recalled her motivations for protesting in an interview conducted shortly after the financial crisis of 2008. Interestingly, she explained her opposition to nuclear power in terms of science turning back the clock:

> It's really the refusal of what is done on too great a scale – whatever it is … The greater the scale at which something is done, the less it becomes tangible and the less possibility there is to act upon it, the greater the danger politically. And it's happening now with all these stories of virtual money for example …. You fall back into a system where you're as dependent on a level of decision as back in the Middle Ages, when there were the people at the top who decided everything. We no longer really have means of action.[40]

According to anti-nuclear activists, technological advances of this kind were the very antithesis of 'progress'.

Indeed, anti-nuclear activists explicitly rejected the teleological narrative of progress that the nuclear industry claimed for itself. The organizers of a demonstration in July 1977 ironically appropriated this very charge of anti-modernism, declaring that, on the

day of the demonstration, 'we are going to stop progress.'[41] Another cartoon (reprinted on a 1984 flyer) depicted a farming couple chatting to the heavily armed guards of a nuclear power station; referring to the supersonic aircraft France helped develop at immense cost, the farmer says, 'So it's like the Concorde then! It's going to bring us happiness.'[42] For many, nuclear power seemed to be a more extreme form of the industrialization processes that had already wrecked entire regions of post-war Europe (such as West Germany's *Ruhrgebiet*). In Alsace, activists concerned about Fessenheim nuclear power station criticized the broader industrialization plans of which it was a part, asking 'Where will our children play? In a true countryside or between concrete and asphalt?'[43] Almost a decade later, environmentalists mobilized by the anti-nuclear movement investigated the industrialization of the area near Brunsbüttel power station in two brochures. One, entitled 'Everything as Planned', focused on how conscious planning decisions had led to environmental devastation; the other, 'Different from Plan', emphasized how the very shortcomings of such planning had to be addressed through repeated, 'piecemeal' changes and 'permanent crisis management'.[44] From the questioning of nuclear technology specifically, some activists arrived at a fundamental questioning of industrialization, state planning and rational, technocratic forms of 'progress'.

Nuclear technology implied a permanence and an irreversibility that made it a symbol of broader societal debate. French activists thus spoke of a 'choice of society' that nuclear technology represented – the future that they did or did not want to have. West Germans spoke of a dystopian 'nuclear state' of technocracy: undemocratic, dangerous and shrouded in secrecy. In these formulations, activists in both countries were supported by a raft of critical scientific literature produced by sympathetic 'counter-experts'.

Counter-experts: questioning the rush towards 'progress'

In both France and West Germany, 'counter-experts' leant credibility to activists' critiques of nuclear energy: they argued that nuclear technology was too risky, too expensive and too untested to be an appropriate source of electricity generation for entire societies. Most counter-experts had training in the natural or applied sciences and were thus professionally inclined to subscribe to a high modern faith in rationality. They sometimes participated in protest alongside other activists, but framed their arguments first and foremost in scientific terms. Their initial critiques thus focused not on 'progress' itself as a problem, but on the politicization of science and the *tempo* with which nuclear energy programmes were being adopted or expanded. As a result of their criticisms of the technology, many would come to elaborate a larger critique about the kind of society that nuclear technology would create.

These 'counter-experts' were drawn from a range of backgrounds and fields. Those with arguably the greatest authority to speak were physicists engaged directly in nuclear research, though many critical voices among them were associated with universities and research institutes rather than the commercial nuclear energy industry. They were joined by colleagues from other natural science disciplines, especially biology and chemistry.[45] Borrowing from the repertoire of 'concerned scientists' and public intellectuals in the early post-war era, they expressed their views publicly through petitions and publications, of which the February 1975 'Appel des 400' was one of the first highly visible examples.[46] Ultimately signed by 4000 scientists – including 'almost half of the

community of nuclear physicists at the time' in France – the appeal emphasized that the French government's nuclear programme had been too rashly 'accelerated' for a technology that was still 'poorly understood' at the intensities demanded for industrial use (1000 Megawatts and more) .[47] This was not a fundamental critique of nuclear technology, but of the massive scale on which it was suddenly to be implemented.[48] The rush to embrace the technology meant that 'systematically, risks are minimised, possible consequences hidden'.[49]

Some francophone signatories went on to elaborate a more detailed critique of the 'Risks and Dangers of the Nuclear Programme' (March 1975) and to found the Scientific Group for Information on Nuclear Energy (Groupement des Scientifiques pour l'Information sur l'Energie Nucléaire, GSIEN). The group published a regular newsletter, *La Gazette nucléaire*, and members like GSIEN president Monique Sené explained the technology to local citizens' groups at information sessions across France. No such central organization existed in West Germany, but numerous formal and ad hoc university groups involving professors and students played a similar role there.[50] Scientists at the University of Bremen formed a working group on Pollution in the Workplace and the Unterweser Industrial Region (Schadstoffbelastung am Arbeitsplatz und in der Industrieregion Unterweser, SAIU). They tasked themselves with refuting the claims of a pro-nuclear pamphlet entitled '66 Questions, 66 Answers: For a Better Understanding of Nuclear Power'.[51] In response to this 'propaganda text', SAIU offered '66 retorts [*Erwiderungen*]' of its own 'for a *correct* understanding of nuclear power'.[52] Like their French colleagues, they criticized the 'accelerated expansion' of nuclear power and the claim that it was somehow necessary to cover (grossly overestimated) 'future energy needs'.[53] Critical scientists thus exposed divisions within the scientific community about nuclear energy, pointing out the potentially far-reaching consequences of an arguably rushed political decision to deploy the technology on a massive scale.

For some critical nuclear physicists, these arguments became part of a broader political reflection on science and its progress-orientated narrative. Jens Scheer, a nuclear physicist who became a professor in Bremen in 1971, was one of the most vocal members of the SAIU group. In his unpublished memoirs, he wrote of the 1955 'Atoms for Peace' conference in Geneva, describing how he and others 'naively … believed it was all happening for the progress of science for its own sake'.[54] He initially felt that there was 'absolutely nothing to criticize about our physics, except perhaps … the lacking societal relevance'.[55] As a result of his engagement with the radical-left Kommunistische Partei Deutschlands/Aufbauorganisation (an unorthodox Marxist group critical of Soviet communism), he later came to reject this view. When protests against the nearby Esenshamm nuclear power station started, he was able to connect his scientific knowledge with his politics by discussing problems of nuclear technology with concerned citizens. These commitments also had professional consequences: in 1977, Scheer was suspended from his university position and subjected to a ban on further work in public service (*Berufsverbot*), ostensibly for his communism. Sympathetic students, however, were convinced that the real reason for the suspension was that Scheer 'uses his scientific qualifications not in the service of the inhuman nuclear programme … but against [it] in the service of the population'.[56] They thus launched an international campaign against this anti-nuclear *Berufsverbot* until Scheer was reinstated in May 1980.[57] Critical

scientists like Scheer used their academic credentials to demonstrate that scientific and social progress were not automatically linked.

Critical scientists in France also changed their views of nuclear technology as they analysed the politics behind it. Dominique Lalanne was a founding member of GSIEN and one of the first signatories of the 'Appel des 400', which explicitly criticized the French nuclear programme for labelling as 'scientific' a choice which was in fact 'political'.[58] He was attuned to such questions in part due to his proximity to the Christian Left and his membership in the Parti Socialiste Unifié (PSU), which positioned itself as an ecological, anti-nuclear alternative to both the PCF and the Parti Socialiste (PS).[59] Much like Scheer, he remembers being initially drawn to the study of nuclear physics as part of 'the generation that saw in nuclear energy something extraordinary that had to be discovered and was very promising for humanity'.[60] However, that initial fascination gave way to critique as Lalanne discussed the French nuclear programme with colleagues in his particle accelerator lab – as well as within GSIEN, the CFDT trade union and the PSU. Historian of technology Sezin Topçu describes GSIEN's arguments as proceeding from a questioning of government policy to a critique of technocracy, in line with calls for *autogestion* (literally workers' 'self-management') like those made by CFDT and PSU.[61] Lalanne and GSIEN thus criticized, for example, the 'economic and political concentration' represented by the nuclear industry's grandiose plans for a Fast Breeder Reactor in Creys-Malville, as well as the specific risks presented by the technology itself.[62] Lalanne especially opposed the military use of nuclear technology, which he and others argued was inseparable from 'civil' nuclear energy.[63] He eventually became a spokesperson for the French branch of the International Campaign to Abolish Nuclear Weapons (ICAN), which was awarded the Nobel Peace Prize in 2017. For Lalanne as for Scheer, social progress thus involved limiting the proliferation of dangerous scientific developments.

Most critical scientists had little to do with the nuclear energy industry directly. A significant exception was constituted by the engineers and workers of France's CFDT trade union, who criticized the industry from the perspective of their own work conditions (and often under the banner of *autogestion*). They were decisive not only for bringing the problems of the nuclear industry to public attention from a different position of authority, but also for framing the debate in terms of a broader societal choice. The union published a book in 1975, *L'électronucléaire en France*, which provided an overview of technical aspects of nuclear energy, the economics of its industrial use, and its implications for security, the environment and work conditions.[64] The book also criticized the 'acceleration' of a nuclear programme that would dramatically restructure future possibilities: France's nuclear programme, the book explained, was framed as 'an apparently technical decision … in order to subsequently lock in [*enchaîner*] a series of other decisions and so-called constraints which are none other than the consequences of prior choices'.[65] Decisions being made in the then-present moment would thus have very long-term consequences: the 'colossal development [of nuclear energy] in a small number of years to come is certainly one of the key choices for the future [*choix clefs du devenir*] of our society'.[66]

This 'acceleration' was particularly palpable at the nuclear waste reprocessing centre in La Hague, originally built for military use in the 1960s but privatized, rapidly expanded and retrofitted in the 1970s to handle the much larger volumes of waste that new French and foreign nuclear reactors were expected to produce.[67] The result, according to both

workers inside the plant and environmentalists outside it, was an increase in accidents and radioactive contaminations owing to cost-cutting and the use of untested or even improvised equipment. A 1976 documentary, 'Condemned to Succeed', reported on problems at the plant as well as the medical issues of its employees, who went on strike from September to December of the same year for better working conditions.[68] Like scientific experts, nuclear employees stopped short of condemning science and technology full stop, but they argued that the rapid expansion of nuclear power in the interest of private profit was setting an unsustainable and dangerous course for society as a whole.

Critical scientists and popular science authors sometimes framed nuclear power in 'apocalyptic' terms.[69] One of the best-known books in West Germany on nuclear power was entitled *Friedlich in die Katastrophe* ('Peacefully into catastrophe'). Its author, Holger Strohm, was not a nuclear scientist or industry employee, but rather an engineer. According to historian Dolores Augustine, Strohm had 'enough of a grasp of the technological issues' to dissect with confidence many of the problems identified by others, but he was 'not always able to distinguish between reasonable hypotheses and untenable theories that found no support among scientists'.[70] His text, dedicated to 'all people of coming generations' and extending to over 1200 pages by its fourth edition in 1981, provided an encompassing critique of nuclear energy that touched on its economic aspects, including employment, financing and corruption within the industry; potential risks associated with pressure tanks, cooling systems, other accidents and possible sabotage; the transport, storage and reprocessing of nuclear waste; and the effects of radioactivity, especially on genes.[71] A chapter on secrecy, surveillance, policing, and the criminalization of anti-nuclear protest borrowed for its title a term popularized by science journalist Robert Jungk: the 'nuclear state' (*Atomstaat*) concisely communicated the dystopia that nuclear energy opponents envisaged if society chose nuclear energy.

In *The Nuclear State* (orig. 1977), Jungk framed the choice facing society in the 1970s in terms of two paths forward: the 'hard' path of a 'plutonium future' that necessitated concentration of power and a 'strong state' in perpetuity,[72] which contrasted with the 'soft' or 'gentle' path of anti-nuclear citizens' initiatives pursuing 'modesty, justice, connection to nature, love of beauty, affirmation of feelings, participation, and the liberation of fantasy'.[73] Jungk coined the term *Atomstaat* with the 'SS state' of National Socialism in mind, the implied comparison referring to the increasingly militarized appearance of West German police at successive protests against Brokdorf nuclear power station in 1976–77.[74] This 'apocalyptic' framing, with its past referents and anxious concern for the future, was typical of the emotional politics of the period in West Germany.[75] However, its resonance there and elsewhere (the book was translated into several languages) was also tied into Jungk's personal biography. Born in Berlin to a Jewish German family in 1913, he had fled Nazi Germany for Switzerland, becoming a journalist there during the War. He later moved to Austria and came to specialize in science journalism. While not an academic with formal qualifications, he was invited to teach regular seminars at West Berlin's universities in the 1960s and, in 1970, was given an honorary professorship at the TU Berlin. Jungk was thus not a classic academic, but his biography gave him the moral authority to make bold claims about the 'nuclear state' that appealed to both mainstream and radical anti-nuclear activists.[76]

Jungk's concern with nuclear technology was closely tied to his lifelong preoccupation with 'the future'. His first book, *The Future is Already Here* (1952; literally 'the future has

already begun' in the original German), had expressed a mixture of trepidation and fascination with the technical 'progress' of the post-war United States; its lengthiest chapter was devoted to nuclear technology. A follow-up, *Brighter than a Thousand Suns* (1956), told the story of atomic research during the Second World War. The later *Big Machine* (1966) examined the proto-Europe of transnational science through the lens of the CERN particle physics research centre.[77] By the 1970s, Jungk saw himself as a contributor to the popular, semi-academic field of 'futurology'.[78] He met regularly with other leading 'futurists', including public intellectuals of varied calibre such as Johan Galtung, Alvin Toffler and Bertrand de Jouvenel.[79] Jungk also conceived and implemented 'future workshops' designed to anticipate challenges and their possible solutions. For him, nuclear power was not only about 'the future form of energy provision, but also of domination'.[80] Robert Jungk's prolific journalism did much to cement the impression that nuclear energy presented a fundamental choice about the future, with wide-ranging social, economic and political repercussions.

Despite the specifically German-language context in which the term 'nuclear state' was formulated, French counter-experts shared much of the same analysis. GSIEN, for example, wrote of nuclear power's grave 'consequences for individual and collective liberties', which would entail 'a secret network' of surveillance alongside heavy-handed, visible policing, all of which could and likely would be deployed against political movements as well.[81] This dystopian vision of nuclear society in France and West Germany was formulated in tandem, as activists and experts circulated between contexts. The first chapter of Jungk's book was a long reportage describing his visit to La Hague and discussions with CFDT workers there. When the federal state of Lower Saxony held public hearings to discuss the construction of a similar reprocessing centre in Gorleben (on the border with East Germany), authorities also called upon counter-experts such as Yves Lenoir, an engineer at the Écoles des Mines in France, who testified about the dangers of vitrification methods for temporary storage of nuclear waste. In particular, Lenoir criticized the carelessness and rush with which experimental technologies were being applied. Vitrification of nuclear waste in glass containers, for example, had been tried in France and was already being sold as 'fundamentally viable' (*grundsätzlich realisierbar*) in West Germany even though the technology was not fully developed: 'Glass is hardly a satisfying solution that justifies vitrification on an industrial scale . . . . They want [*man will*] to make people believe that there is an almost a priori guarantee [*Berechtigungsgrundlage*], even though they know that it will [only] perhaps someday later work.'[82] The problem, according to Lenoir, was one of tempo: workers were under such 'time pressure' that they could not even dispose of contaminated equipment properly. 'This rush', Lenoir argued, had 'nothing to do with mankind's hunger for energy' and far more to do with economic competition among powerful states to develop high-tech industry.[83]

Anti-nuclear 'counter-experts' came from a variety of backgrounds and emphasized different aspects of a shared critique depending on their own disciplinary, national and political backgrounds. However, their arguments converged around the idea that nuclear power represented a major decision about the future of society, and one technocratic decision-makers were forcing through in a hurry before its implications could fully be

grasped. Society thus stood on the cusp of sweeping change, but the future that its decision would generate was unclear and hotly contested.

Social scientists: a 'new' era

If nuclear energy was understood in terms of what it implied about the future, the same was true of the opposition to it. Sympathetic observers from the fields of political science and sociology interpreted protest as a sign of the apparently epochal nature of contemporary change. Like the counter-experts discussed earlier, some of them participated in protest, but they generally framed their arguments in terms of academic analysis. Looking at the anti-nuclear movement, they became convinced that they were seeing a 'new' form of social organization, different from the workers' movements of the past. An entire field of 'New Social Movement' (NSM) theory developed, which sought to explain the dynamics of environmentalist, feminist, peace and other contemporary movements. While the alleged novelty of such movements quickly became a point of controversy, for a time these academic arguments further legitimized the idea that society was entering a fundamentally different, 'post-' something era.

Social scientists had already begun actively conceptualizing a technologically driven future only shortly after the Second World War ended. Herbert Marcuse famously wrote in 1964 that the 'advanced industrial society' of the post-war period was a 'one-dimensional' one, where consumer society created false needs that drew the working class into the 'comfortable, smooth, reasonable, democratic unfreedom' that was, in his view, 'a token of technical progress'.[84] Technological rationality was not 'neutral', but a force for containing and undermining change. Nuclear technology symbolized how this new society was foreclosing other, possible futures: 'Does not the threat of an atomic catastrophe which could wipe out the human race also serve to protect the very forces which perpetuate this danger?'[85] Others drew different conclusions from the same kinds of observations about the changes sweeping society.[86] Daniel Bell, for example, wrote of an emergent 'post-industrial society' in which technological change had eroded the traditional working class by shifting from an industrial to intellectual means of production, with a knowledge-based economy centred on services rather than goods. As a result, the nature of work and consumption, the class structure of society, and even 'consciousness about time and social change' were likewise being fundamentally altered.[87] For Bell, too, the atom bomb had created this society, though he more optimistically claimed that it had 'made the world dramatically aware of the power of science' – not least by creating the possibility of 'nuclear energy for human use'.[88] Social theorists in the 1960s and 1970s struggled to name this rapidly changing society: Bell called it 'post-industrial', but he also cited prior work on 'post-capitalist' society (Ralf Dahrendorf, 1959), a 'post-civilized' era (Kenneth Boulding, 1964), and 'post-modern' society (Amitai Etzioni, 1968).[89]

By the 1970s, several authors were starting to interpret contemporary protest movements like the opposition to nuclear energy as evidence of just this kind of underlying structural change. These movements were described as 'new' in terms of the actors they involved, the values they defended, the issues they contested, and/or the modes of action they employed.[90] Anti-nuclear protest, for example, was not carried out by workers contesting the order of society through class conflict, but by broader alliances anchored in segments of the middle class – specifically, a 'new middle class' of highly educated

individuals working in the public sector, social services and the professions, marked by higher levels of education and relative economic security.[91] According to political scientist Ronald Inglehart, this background partly explained the different values of these new movements: having grown up in the prosperity of the *trente glorieuses*, the middle-class adults of the 1970s looked beyond just their material well-being and instead held 'post-bourgeois' or 'post-materialist' values such as autonomy, authenticity and identity, which led them to focus on their quality of life.[92] Despite the clear material implications of accelerated industrialization and the life-and-death stakes of a nuclear accident, sociologists framed the anti-nuclear struggle as one of post-materialist 'quality of life'.[93] NSMs also appeared different from prior socialist movements and working-class trade unions in terms of their internal functioning (relatively flat hierarchies, grassroots democratic procedures) and their engagement with politics (largely anti- or non-institutional, relying on dramatic, symbolic actions to draw media attention).[94] For many sociologists, all of these characteristics pointed to the idea that the working class and its struggle for ownership of the means of production no longer constituted the central conflict of industrial society. However, if the contours of the new society were vaguely perceptible, its essence was still a matter of debate. Industrial society had once seemed to be approaching 'some sort of end state' of modernization; by the mid-1970s, it appeared that 'the industrialized world is actually undergoing change which is more rapid and more genuinely new' than in the supposedly developing world. This change was 'far harder to grasp, harder to conceptualize': it represented 'a leap into the unknown'.[95]

If protest was capable of pointing to the central conflicts of the new society, then the dramatic and highly adversarial anti-nuclear protests of the late 1970s in France, West Germany and elsewhere seemed to represent a promising field for analysis. The French sociologist Alain Touraine, for one, had written in the 1960s of an emergent 'post-industrial' society that might equally be characterized as 'technocratic' (in terms of political power) or 'programmed' society (in terms of economic organization).[96] If one conceived of the dawning society in terms of a knowledge-based economic system with the potential for an anti-democratic concentration of power among technicians, experts and managers, then in the late 1970s it would seem entirely logical to claim, as Touraine did, that the anti-nuclear movement 'might tomorrow take over the central role played by the working-class movement and the labour conflicts of industrial society'.[97] *The* (singular) 'new social movement' was for Touraine an intangible presence that might manifest in any of a number of different 'struggles' (*luttes*)[98]: Touraine and his collaborators sought to identify it in student activism, Occitan regionalism, feminism and others, but they briefly invested their greatest hopes in anti-nuclear protest as the struggle in which 'the popular social movement specific to [*propre à*] programmed society would manifest itself most clearly'.[99]

Touraine's research group began its 'sociological intervention' with existing groups in Malville and Paris in 1978, precisely when anti-nuclear protest in France especially experienced a rapid decline. (In West Germany, similar setbacks would prove only temporary.) Their method involved discussing the nuclear issue with activists in order to draw protesters towards a 'higher' understanding of their own actions, tied to fundamental contestation of the social structure (at least as the sociologists perceived it).[100] Touraine seems to have personally wanted anti-nuclear protesters to attack technocracy head-on, but he found their actions too timid: 'the distance between the potential social

movement and the real action was very great' – as was the distance between Touraine and the activists for whom he had such great ambitions.[101] Even if he was ultimately disappointed by anti-nuclear activism, Touraine still interpreted it as revelatory of things to come:

> The anti-nuclear struggle is helping us to build our future. On the threshold of programmed society, it brings first a strategy to escape from the crisis, in other words to enter the post-industrial society, and above all a prophecy which announces the new conflicts of that society.[102]

Though the almost mystical framing implied by the term 'prophecy' was unique to Touraine's study, the implication that the post-industrial future was both on the horizon and embedded in the present moment enjoyed wider resonance in the period: the future had indeed already *begun*.

A number of West German sociologists agreed with the idea that 'new social movements' (not one, but several) pointed the way towards the future, but they also saw important backward-looking elements within them. In 1983, Karl-Werner Brand, Detlef Büsser and Dieter Rucht jointly authored a pioneering study of NSMs that argued such movements represented a response to a deep-rooted 'crisis of modern civilisation'.[103] However, in their interpretation, anti-nuclear and other movements had an explicitly 'anti-modern thrust [*Stoßrichtung*]' that actually made them not all that new: the environmental movement alone contained a range of tendencies, including '"conservative" or "nature-Romanticist", "ecological", "reformist", "democratic-" or "eco-socialist", "anti-capitalist/spontaneous" and "orthodox communist"' strands, some of which were more rooted in the pre-industrial past and might not offer solutions for the future.[104] The authors were optimistic, though, that the predominant 'post-materialist' groups would, in interaction with these other elements, provide the 'ferment' that might help the NSMs together elaborate 'a *shared* vision of the future' that would not be rooted in nostalgia for an imagined and inaccessible past.[105] After all, the ecological movement had already managed to develop a much more fundamental critique of society than prior movements: the mass opposition to nuclear weapons in West Germany during the 1950s had not challenged 'technical-industrial progress as such', nor had the student movement of the late 1960s called into question 'the necessity of economic growth'.[106] NSMs appeared to be capable of creating an alternate modernity that would constitute a utopian counterpoint to the dystopia of a 'nuclear state'.

The NSM paradigm enjoyed broad currency in the 1980s, and other sociologists, too, queried what form of 'modernity' anti-nuclear and other movements might represent. Claus Offe accepted certain aspects of the NSM framework, but argued that the allegedly shifted values of contemporary protesters were actually 'what is *least* new' about them. Their values were instead 'part and parcel of the repertory of dominant modern culture, which would obviously make it difficult to think of movements as flowing from either "premodern" or, for that matter, "postmodern" subcultures'.[107] As a result, Offe came to the conclusion that they should be 'understood as a *selective radicalization of "modern" values*' rather than a complete rejection of modernity itself.[108] When Brand, Büsser and Rucht issued an updated version of their book in 1986, they came to similar conclusions. Anti-nuclear and other 'new' social movements represented not so much an epochal step backwards or forwards, but were 'the midwives of a reflexive step of modernity. Perhaps

they are – consciously or unconsciously, willingly or not – the contemporary [*zeitgemäßen*] champions of the "project of modernity".'[109]

Brand, Büsser and Rucht also revised much of their optimistic speculation about the future of NSMs themselves. Their analysis in the 1983 edition had been influenced by the highly visible protests for environmentalism and peace that had drawn millions of West Germans and other Europeans onto the streets in the preceding three years. By 1986 though, mass demonstrations had trailed off precipitously after failing to halt the stationing of American nuclear warheads in Western Europe. Moreover, the grassroots anti-nuclear movement specifically – which had once seemed a 'model'[110] for other movements – had been absorbed by large membership organizations (such as Bund für Umwelt- und Naturschutz Deutschland, the German branch of Friends of the Earth International) and by the new Green Party (Die Grünen). The increasingly 'organised' environmental movement was no longer the broad-based 'negative coalition' that had brought together local concerned citizens, post-materialist youth and segments of the Left and Right; as a result, it was less likely 'to formulate a general [*übergreifenden*] alternative blueprint for politics', as it had previously seemed capable of doing.[111] The authors still insisted that environmentalism had 'swayed one of the pillars of the project of modernity' with its 'critique of "growth society"'.[112] The difficulty was in understanding what degree of change that represented:

> Consciousness of living in a situation of upheaval is widespread. Significantly, it is not so easy [*gelingt es jedoch nicht*] to conceptualize [*auf den Begriff zu bringen*] what is to come. Instead, farewells to the past pile up, such as is expressed in the talk about the 'postmodern'.[113]

The NSM paradigm came under increasing criticism as it spread from Europe to the United States later in the decade. Scholars systematically attacked the claim to novelty, arguing that the aims, tactics, structure and participants of such movements were not so much 'new' as simply re-framed by NSM theorists. The problem was exacerbated by the fact that different NSM theorists defined key terms (such as the 'new' middle class) 'in widely divergent ways'.[114] Indeed, while the anti-nuclear movement might be seen as addressing the cutting edge of a hyper-modern world, it could also be understood in terms of environmentalism and nature protection, which had much deeper roots. Craig Calhoun argued that 'new' social movements simply resembled any social movement at the time that it happened to be 'new': post-materialists of the 1970s thus had much in common with movements founded in the early nineteenth century.[115] Several authors argued that such movements were 'new' not in relation to modernity, but to Marxism – or, rather, a caricature thereof. Lorna Weir argued that the labour movement, portrayed as the paradigmatic 'old' social movement, was in fact a straw man, 'the reduction of socialism to the moment of orthodoxy'.[116] Socialism had historically taken many forms, not just the hierarchically organized, vanguard political parties that made grassroots activism on non-class-based issues seem so 'new' by comparison.[117] Indeed, socialist struggles had been embedded in prior movements for women's rights, peace and anti-racism, all of which had a rich history of their own before the industrialized, post-war period of high modernity. Moreover, the claim to novelty was, Weir argued,

'tautological: social movements are new by definition since the historical period is new'.[118]

Society does appear to have changed in important ways in the 1970s, but social scientists at the time, like historians since, have struggled to specify the nature of that change. For contemporaries experiencing social acceleration, 'new' social movements seemed to correspond to some of the identifiable (or imagined) differences between the recent past and the apparent future. Whether these movements actually signalled a departure from modernity and to what extent they were actually 'new' are almost beside the point: for a historian of time, the unceasing claims to novelty communicate the sense of upheaval that even academic observers perceived in connection with protests against nuclear energy.

Conclusion

In the 1970s, the anti-nuclear movement was seen by many as one of the defining social movements of a new era – perhaps even *the* definitive one. Activists framed nuclear energy as a question that would affect later generations so far into the future as to be almost inconceivable. At the same time, they presented their own resistance in relation to some of the most dramatic moments of the recent and not-so-recent past, from Hiroshima to the sixteenth-century Peasants' War and beyond. Counter-experts sympathetic to the movement likewise conferred historical importance on the anti-nuclear movement by emphasizing the present moment as decisive for the kind of future society French and West German citizens wanted to have. They brought 'high modern' scientific knowledge to bear in the debate, lending legitimacy to claims about the need to avoid a dystopian nuclear future. Finally, sympathetic observers in academia likewise strengthened anti-nuclear activists' claim to historic importance, arguing that they stood at the front line of conflict within society – whether that society was modern, post-modern or something else entirely. In this respect, anti-nuclear protesters and their allies actively constructed the movement's importance, framing it in historical terms that emphasized (and likely encouraged) their feelings of acceleration.

This self-constructed history has not necessarily stood the test of time. Anti-nuclear protest is today often regarded more narrowly as a 'single-issue movement' focused on concerns about radioactivity and the risks of explosion. Accidents in Harrisburg (1979), Chernobyl (1986) and Fukushima (2011) made real precisely these sorts of dangers (about which anti-nuclear activists had long warned), but they also encouraged the movement to focus intently and almost exclusively on these immediate threats.[119] Sociologists in the 1980s continued to accompany the movement and provide a 'first draft' of history that reflected its concerns: Ulrich Beck's analysis of 'risk society', published in the immediate aftermath of the Chernobyl disaster and popularized well beyond the academy, long coloured perceptions and analysis of the later anti-nuclear movement, much as 'new social movements' theorists previously had.[120] Since then, the new era that anti-nuclear protest once seemed to be creating has been replaced by other variations on the future that have come and, in some cases, already gone: the post-Cold War era, globalization, terrorism, financial capitalism, digitalization. Fragments of each were visible on the horizon in the 1970s and 1980s, but none seemed quite so important to contemporaries as nuclear energy.

If the anti-nuclear movement is no longer seen as contesting an issue at the very core of present-day society, it is also because of its successes – and partial successes – in challenging the technology. Several countries held referenda that led to the cessation of new construction (Sweden, 1980), phase-out of existing plants (Italy, 1987) or the outright rejection of nuclear power (Austria, 1978). Germany implemented its nuclear programme (in reduced form) despite ferocious opposition in the 1980s, but committed itself to a phase-out in 2000 (and again in 2011). The French state pushed hard to develop its nuclear energy programme and currently faces few direct challenges from protesters, but the industry has been plagued by financial difficulties and was fundamentally restructured in 2016–17. Everywhere, the ambitious nuclear programmes of the 1970s were subsequently scaled back in response to protest, rising costs associated with security concerns, and declining profitability. In no small part because of the work of anti-nuclear activists, nuclear power in the early 2020s no longer seems to have quite the same radiant future that it had 50 years earlier.

Notes

1. On the 1970s as a crisis or turning point, see the viewpoints gathered in Ferguson et al., *Shock of the Global* and Wirsching et al., '1970s and 1980s as Turning Point?' On the oil crisis specifically, see Painter, 'Oil and Geopolitics' and Graf, *Oil and Sovereignty*. For a critique of *trente glorieuses* narratives, see Bonneuil, Pessis and Topçu, *Pour en finir avec les « Trente Glorieuses »*.
2. Hartog, *Régimes d'historicité*, 155–6.
3. Other terms include 'late capitalism' or 'late modernity'. See Jameson, *Postmodernism*, xix.
4. On perceptions of nuclear technology (civil and military) prior to the 1970s, see Hasenöhrl, *Zivilgesellschaft und Protest*; Topçu, 'Atome, gloire et désenchantement'; and Augustine, *Taking on Technocracy*.
5. For a table showing the number of participants at key demonstrations from 1971 to 1981, see Tompkins, *Better Active than Radioactive!*, 15–16.
6. See Tompkins, 'Grassroots Transnationalism(s)' and Milder, *Greening Democracy*.
7. Rosa, 'Social Acceleration', 28.
8. Ibid., 23.
9. Koselleck, *Vergangene Zukunft*, 349–75.
10. On 'the '68 years', see Dreyfus-Armand et al., *Les années 68*. On the 'apocalyptic' imaginings of the early West German Green Party, see Gebauer, 'Apokalyptik und Eschatologie'.
11. Freiburg, Archiv der Sozialen Bewegungen in Baden (ASB), Bro 12.0.1.96: 'Seveso … et Fessenheim ?' (flyer, 4 pp.), 1976.
12. Brice Lalonde of Les Amis de la Terre in Otzenberger, *Les atomes*.
13. Oppenheimer, 'Air Wars'. For some, such references were part of a narrative of German victimhood aimed at deflecting responsibility for the war. See also Moeller, 'Politics of the Past in the 1950s', 33.
14. Meinrad Schwörer, 'Heimat an Kaiserstuhl und Rhein: Erbe und Verpflichtung', in Nössler and de Witt, *Kein KKW in Wyhl*, 14–15.
15. Balthasar Ehret, 'Wasser: Schatz der Erde – Lebensmittel des Menschen', in Nössler and de Witt, *Kein KKW in Wyhl*, 134–44 (134). The Moscow-aligned Deutsche Kommunistische Partei (DKP) was founded in 1968 as a successor to the previously banned KPD. It took a position against West Germany's nuclear energy programme but was neither the 'driving force' behind protest on the issue nor a significant factor electorally. See Nehring and Ziemann, 'Do All Paths Lead to Moscow?' 4.
16. Berlin, APO-Archiv, S37–38: Weiße Rose, '1984 – verhindert den totalen Staat!' (brochure, 8 pp.), undated, p. 4.

17. 'J'au eu honte …', *Casse-noix*, August 1977, 6.
18. Moßmann's version, however, used a different melody. See Milder, *Greening Democracy*, 51.
19. Walter Moßmann, *Die Wacht am Rhein*, reprinted in Nössler and de Witt, *Kein KKW in Wyhl*, 204–5.
20. An image of sixteenth-century peasant leader Joß Fritz, for example, appears with text (in local dialect and gothic lettering) celebrating the anniversary of the site occupation at the Wyhl construction site in ibid., 11.
21. BUU, *Brokdorf – Bauplatz wieder zur Wiese!*, 20.
22. Depictions of healthy women and children were common to the safety-related discourses of proponents as well as opponents of nuclear energy. Augustine, *Taking on Technocracy*, 35–40.
23. 'Premier et dernier éditorial', *La Gueule Ouverte*, November 1972, 3–4.
24. Hamburg, Archiv Aktiv, 'Ökologiebewegung im Elsass' folder: Henri Jenn and Solange Fernex, 'Bewegung Oekologie und Ueberleben' (election flyer, 2 pp.), March 1973.
25. Dolores Augustine notes the eugenicist framework of science after 1945 in her discussion of nuclear experts and counter-experts: *Taking on Technocracy*, 75.
26. 'Frauen schlagen Alarm!' (flyer), reprinted in Amsterdam, International Institute of Social History (IISG), Bro 737/6 fol: Frauenkollektiv Freiburg, 'Frauen erklären Atom und Blei den Krieg' (brochure, 44 pp.), 1975, p. 37.
27. Biess, *Republik der Angst*, 381. On gendered representations of nuclear safety, see Augustine, *Taking on Technocracy*, 35–7.
28. See also Engels, 'Women of Wyhl'.
29. Amsterdam, IISG, World Information Service on Energy (WISE), Correspondentie West-Duitsland 80: Ulla Bonczek, 'Go-in im Landtag am 2.7.1980'.
30. Macduffin [pseud.], 'Plakatmotive der Anti-AKW-Bewegung', 180–1.
31. Freiburg, ASB, 12.1.7: 'Schützt das ungeborene Leben!' (flyer), undated 1976.
32. Günter Richter, 'Christen als Betroffene in einer bedrohten Umwelt', in Nössler and Witt, *Kein KKW in Wyhl*, 206–11 (211, 207).
33. Chakrabarty, 'Climate of History'.
34. Sebeok, *Communication Measures to Bridge Ten Millennia*.
35. Söhnke Wandschneider, interview with the author, Hamburg, August 26, 2010.
36. Hans Filbinger, 'Energie für Baden-Württemberg' (policy statement, reprinted as 4-pp. brochure), February 27, 1975.
37. See Hecht, *Radiance of France*, 58. On the PCF's difficulties engaging with the anti-nuclear movement, see Eisenhammer, 'French Communist Party and the Nuclear Debate' and Chesneaux, 'Du PCF à Greenpeace'. On other parties, see Nelkin and Pollak, 'Political Parties and the Nuclear Energy Debate'.
38. Title page cartoon by (Georges) Wolinski, *L'Humanité*, July 30, 1977.
39. Odile Wieder, interview with the author, Annecy, January 29, 2010.
40. Mireille Caselli, interview with the author, Freiburg, April 12, 2010.
41. Bourgoin-Jallieu, Private archives of Marie-Jo Putinier: Jean Caillon, illustration (on envelope advertising *Combat Non-Violent*), 1977. The same slogan appears in another illustration by Jean Caillon in 'Malville épopée', *La Gueule Ouverte*, July 28, 1977, 2–3.
42. Lyon, La Gryffe, 'Chooz/Super Pholix/Malville' folder: Campagne pour l'arrêt de Malville, 'Nucléaire – Impasse économique' (flyer, A5), August 4, 1984.
43. 'L'Alsace … terre d'équilibre ou de destruction', *Ionix*, January 1974.
44. Mohr, *Alles wie geplant* and Mohr, *Anders als geplant*.
45. Some of the best-known 'counter-experts' came from different fields entirely, including mathematics (Alexandre Grothendieck, Pierre Samuel), geology (Haroun Tazieff) and engineering (Yves Lenoir).
46. Nelkin and Pollak, *Atom Besieged*, 90–2.
47. Topçu, 'De l'engagement « savant »', 252.
48. Ibid., 252.

49. 'Appel des scientifiques français,' Feb. 1975, reprinted in: Orsay, Private archives of Dominique Lalanne, GSIEN, 'Le malentendu nucléaire ?' (brochure), October 25–27, 1977, p. 5.
50. Nelkin and Pollak, *Atom Besieged*, 92.
51. Hamburgische Electricitäts-Werke, *Zum besseren Verständnis*.
52. My emphasis. SAIU, *Zum richtigen Verständnis*, 9.
53. Ibid., 154. See also Nelkin and Pollak, *Atom Besieged*, 92.
54. Cited according to Storim, 'Erinnerungen an Jen Scheer', 175.
55. Ibid., 175, 177.
56. Hamburg, Rote Flora, 15.230: Studiengangsausschuss Biologie/Chemie, 'Jens Scheer Info' (flyer, A4), November 20, 1977.
57. Amsterdam, IISG, WISE, Correspondentie West-Duitsland 79–80: Letter from Jens Scheer to WISE, May 1, 1980.
58. GSIEN, 'Le malentendu nucléaire?' October 25–27, 1977, p. 6.
59. See Hatzfeld, *Faire de la politique autrement*; Ravenel, *Quand la gauche se réinventait*; and Soulage, 'L'engagement politique des chrétiens de gauche'.
60. Dominique Lalanne, interview with the author, Orsay, February 25, 2010.
61. Topçu, 'De l'engagement « savant »', 253.
62. 'Non à Super-Phénix' (paid advertisement), *Le Monde*, July 3, 1976.
63. 'La prolifération de l'arme nucléaire', *La Gazette nucléaire*, March 1977.
64. CFDT de l'Énergie atomique, *L'électronucléaire*.
65. Ibid., 7.
66. Ibid., 9.
67. As one of the only such sites in the world, La Hague processed waste for countries as close as West Germany and as far away as Japan.
68. Jacquemain, *Condamnés*.
69. Nelkin and Pollak, *Atom Besieged*, 97.
70. Augustine, *Taking on Technocracy*, 83.
71. Strohm, *Friedlich in die Katastrophe*. A further revised edition was published in 2011 and a documentary film about the book appeared in 2013. However, they faced a more tepid reception as a result of Strohm's embrace of conspiracy theories and far-right politics.
72. Jungk, *Atomstaat*, 9–15.
73. Ibid., 152. Jungk borrowed this 'hard'/'soft' distinction from Lovins, *Soft Energy Paths*.
74. Jungk, *Trotzdem*, 463. On the violent demonstrations in Brokdorf, see Tompkins, *Better Active than Radioactive!* 161–5.
75. Biess, *Republik der Angst*, 365–91, esp. 376–8. So too was the 'hard'/'soft' dichotomy, which is reminiscent of other binaries (e.g. 'cold'/'warm') in the emotional history of the period. See Reichardt, 'Authentizität und Gemeinschaftsbindung'.
76. 'Interview mit Robert Jungk', *Radikal* 41, June 9, 1978 and *Radikal* 43, July 6, 1978.
77. Each of these appeared in numerous translations. The original titles were: Jungk, *Die Zukunft hat schon begonnen; Heller als tausend Sonnen; Die große Maschine*.
78. See Andersson, *Future of the World*.
79. See, for example, Galtung, 'On the Future'; Toffler, *Future Shock* and Jouvenel, *Arcadie*. See also M. Connelly, 'Future Shock: The End of the World as They Knew It', Ferguson et al. (eds.), *The Shock of the Global*, 337–50.
80. Jungk, *Atomstaat*, 147.
81. GSIEN, *Électronucléaire, danger*, 80–2.
82. Original emphasis. Hamburg, HIS Sbe 731: Informationszentrum Kritische Wissenschaft, 'Gorleben-Hearing' (brochure), 1979, pp. 17–18.
83. Ibid.
84. Marcuse, *One-Dimensional Man*, 1.
85. Ibid., xvi, ix.
86. Harrington, review of Birnbaum.
87. Bell, *Coming of Post-Industrial Society*, 346.

88. Ibid., 346–7.
89. Ibid., 51–4.
90. The points here and in subsequent body paragraphs are drawn from Brand, Büsser and Rucht, *Aufbruch*; Offe, 'New Social Movements'; Weir, 'Limitations'; and Pichardo, 'Critical Review'.
91. Offe, 'New Social Movements', 851–3.
92. Inglehart, 'Silent Revolution in Europe' and Inglehart, *Silent Revolution*. See also Doering-Manteuffel and Raphael, *Nach dem Boom*, 61–6.
93. For a critique, see Milder, *Greening Democracy*, 14–15, 49–50.
94. For a summary of characteristics of 'old' and 'new' paradigms of politics, see Offe, 'New Social Movements', 832.
95. Inglehart, *Silent Revolution*, 6–7.
96. Touraine, *La société post-industrielle*, 7.
97. Touraine, *La prophétie anti-nucléaire*, 11. Where possible, I have borrowed English translations from Touraine, *Anti-Nuclear Protest*, here p. 3.
98. This distinction between *lutte* and *mouvement* was typical of Touraine but not of the wider literature.
99. My translation. The section in question is not included in the abridged English version. Touraine, *La prophétie anti-nucléaire*, 297.
100. Ibid., 343. This method was criticized for its 'condescending tone' towards activists and compared with 'missionary work'. See Barkan, review of Touraine. Michel Wieviorka, one of Touraine's collaborators at the time and now a leading scholar in his own right, defends sociological intervention as a method for researchers and the actors they study 'to co-produce knowledge' about social movements and society. See Wieviorka, 'Sociology's Interventions'.
101. Touraine, *Anti-Nuclear Protest*, 181.
102. Ibid., 193.
103. Brand, Büsser and Rucht, *Aufbruch*, 17–35.
104. Ibid., 243–5. This was independent of the question of whether the New Age spirituality of some activists represented a meaningful answer to a hyper-rational modernity (p. 261).
105. Ibid., 270–1.
106. Ibid., 249.
107. Offe, 'New Social Movements', 850, 848.
108. Original emphasis. Ibid., 853.
109. Brand, Büsser and Rucht, *Aufbruch* [1986], 283.
110. Radkau, *Aufstieg und Krise*, 474, cited in Brand, Büsser and Rucht, *Aufbruch* [1986], 248.
111. Brand, Büsser and Rucht, *Aufbruch* [1986], 251.
112. Ibid., 271.
113. Ibid., 241.
114. Pichardo, 'Critical Review', 422.
115. Calhoun, '"New Social Movements" of the Early Nineteenth Century'.
116. Weir, 'Limitations', 96.
117. See, for example, Wright, *Socialism and the Experience of Time*.
118. See Weir, 'Limitations', 81.
119. See Biess, *Republik der Angst*, 380–1; Bösch, 'Taming Nuclear Power'; Kalmbach, 'Radiation and Borders'; and Tompkins, *Better Active than Radioactive!* 29.
120. Beck, *Risikogesellschaft*. See Doering-Manteuffel and Raphael, *Nach dem Boom*, 67–72.

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