

Modernity, Technology and the Forms of Rationality

Andrew Feenberg*

Simon Fraser University

Abstract

Modern societies are shaped to a significant extent by socially rational institutions, arrangements, and technologies. A purely functional understanding of these rationalized structures eliminates the element of meaning from social life. Ellul, Heidegger and the Frankfurt School focused on this impoverishment and associate it with the spread of technology. But recent technology studies offer a different perspective which can be joined to the formulation of the social critique in the writings of Herbert Marcuse.

We are accustomed to thinking of rationality as a feature of modern societies. Modernity has been accompanied by an unprecedented growth of political freedom and science and the breakdown of many taboos. We are able, as our ancestors were not, to question everything, choose our leaders, and build on reliable knowledge accumulated over the past few centuries. This is why modernity appears to us as a value that must be preserved.

But progress in rationality has not only favoured human rights and freed the pursuit of knowledge. More and more of social life and technical activity are structured by what I call “social rationality.” By this term I do not mean an instrumental outlook, the sort of thing one finds wherever there are human beings, and indeed, even among animals. There is that, but also specific aspects which belong exclusively to modernity.

Social rationality bears a certain resemblance to the rational procedures we associate with mathematics and science. For example, markets are organized around a principle of mathematical equivalence: money purchases an equal value in goods. Similarly, bureaucracies operate through systematic classification and the application of universal rules. In this they resemble a science that applies laws to objects according to their type. Business and engineering seek optimum efficiency in the relation between means and ends. This requires precise quantitative measurement of the sort characteristic of science as well. I call this form of rationality “social” because it is applied by organizations to society. Even technology can be considered social in this sense given its powerful shaping effects on social life.

In this paper I will discuss many different approaches to understanding the significance of the rise of social rationality in modern life. Some of these approaches are philosophical, others sociological. They frame most contemporary discussions of science and technology. I hope to find in them the elements of a new theory of democracy in technologically advanced societies.

The phenomena I have grouped under the designation social rationality were called “reification” by Georg Lukács in his famous Marxist work *History and Class Consciousness* (Lukács, 1971). But reification involves much more than these phenomena. It crystallizes the fluid process of social relations in the form of “thinghood,” that is, as independent objects such as institutions and commodities. Individual features of human situations are

effaced in the application of general concepts. Time and space are rendered uniform and measurable. Reification thus separates the rational form of social objects from their human contents. The social world is conceptualized as a “second nature,” a realm of facts and laws similar to the first nature studied by natural science and like it controlled by technology. But unlike in the case of natural science, reification actually shapes the relations and objects it conceptualizes. Where science simply observes, reification is not merely a theory, but also a systematic practical relationship to the world. Reified practice constructs the world in the form of a collection of things governed by laws specific to the different domains into which society is fragmented.

Reification depends on a peculiar attitude toward social processes that is unique to modern societies. The subject of action in reified institutions limits its understanding and behaviour to technical manipulation. The buyer on the market abstracts from the human relation to the seller and simply seeks his own advantage. The bureaucrat and businessman too relate to the human objects of their activity in a strictly objective manner, applying rules impersonally and hiring and firing with indifference. Habermas calls this an “objectivating attitude” toward the social world (Habermas, 1984). A similar objectivating attitude toward technology strips away the dimension of meaning artifacts acquire in the course of use in favour of a purely functional approach. This reduction to function is exemplified in the architect Le Corbusier’s famous definition of a home as a “machine for living.” So much for “home, sweet home!”

“Meaning” in this context denotes the significance and associations objects possess within the way of life to which they belong. For example, food is not merely calories – its functional aspect – but is the occasion for the pleasures of the table, good taste, etiquette and conversation. It is edible according to culturally established rules and is eaten in a specific order with some items beginning the meal and others ending it, accompanied by appropriate drinks, and so on. The family gathers around the table.

All these complex cultural associations with food are as much a part of its experienced reality as its caloric content. Much of the richness of this cultural dimension is lost in the functional abstractions of dietary manuals and the barren setting of fast food restaurants. This example could be matched by others from every area of social life. In each case cultural interpretation reveals the hermeneutic complexity of the world from which functions are abstracted by reified thought.

Nevertheless, some loss of richness is essential to modernity. It has made possible tremendous progress in the power and effectiveness of markets, institutions and technologies. The result is the emergence of large scale social organization and enterprise. The building of nation states and cities depends on the generalization of social rationality. The progress of knowledge and the emergence of the modern form of rational individuality depend on the transformation of daily life through ease of movement in space and transmission of intellectual resources on an ever widening scale. Better education and relatively greater security of life erode religious traditions and customs inherited from the past and open individuals onto the future to an unprecedented extent. These are the foundations of modern life.

But the results of all this progress in rationality are mixed. Every advance in the power of reason seems to have been accompanied by devastating setbacks. The 20th century, which should have seen a triumphant justification of reason, instead saw both triumph and disaster. Wars, nuclear weapons, concentration camps, and environmental crisis are a part of its heritage, along with greatly increased wealth, the spread of democracy, medical advances, decolonization, and progress in racial and gender equality.

There are two commonplace interpretations of these mixed results. Many, perhaps most, people conceive of reason as in itself innocent, neutral, employed for ends either good or bad depending on human will. This is the obvious answer to the question of the failures of modernity: bad people made a bad use of the neutral instruments supplied by reason.

But many important philosophers have proposed a different answer in the context of a critique of technology, understood as the signal achievement of modernity. Jacques Ellul, Martin Heidegger, several of the thinkers of the early Frankfurt School, and many others argue that there is a fundamental flaw in rationality as we in the modern world understand it (Ellul, 1964; Heidegger, 1977; Adorno and Horkheimer, 1972; Horkheimer, 1947). They do not claim that irrationality would be an improvement. They reject the old romantic opposition of reason and emotion that would lead to such a conclusion. The argument is more subtle and focuses on historically specific distinctions between our way of being rational and that of earlier societies.

Those earlier societies relied primarily on what we think of as “common sense” rather than a formalized mode of thought such as we associate with scientific and technical disciplines. This everyday or “informal” rationality is less systematic but richer in content than our formal rationality. It takes into account meanings and valuative dimensions of objects from which scientific-technical rationality abstracts in identifying objects with their functions and affordances. It plays with timing and ambiguity in ways excluded by systematic thinking. It opens up the psychic space of self-reflection and critique. Still today humanistic disciplines, like most other non-technical thinking, build their reflections on the basis of everyday modes of thought rather than on the reified abstractions and quantifications of the technical disciplines.

Although informal rationality structured premodern societies, it cannot and does not structure modern societies based on socially rational systems and procedures. The hope of the critics, insofar as they have any hope, is not that we get rid of technical rationality and go back to the past, but rather that we learn from the past what we are missing and on that basis reconstruct modern society in a more humane pattern. However, these thinkers have little confidence in the future.

Ellul explains that modern societies are ruled by efficiency. This purely instrumental value replaces all others and guides the development of technology. On this basis he argues that technology has become “autonomous.” He does not mean that technology is self-generating but rather that modern decision makers all solve the technical problems they face in the same way under the rule of efficiency. The personal element is thus eliminated. This has implications for how the world is understood and experienced by modern human beings. We think we are free and that technology has enhanced our powers when actually we are dominated by technology and increasingly channelled into the paths the pursuit of efficiency opens for us.

Heidegger argues that we moderns see the world as a sum of resources, raw materials and system components. Nothing any longer has its own inner principle of movement, its own essential core of being, but rather everything serves a role in the technical system. Objects are ripped from their contexts and reduced to their useful properties. These decontextualizations and reductions are inherently one-sided and violent. In this respect modern technology differs from craft work in which a pre-existing essential form embracing a wide range of values and meanings is realized by the craftsman in materials conceived as predestined for the work. The ancient silversmith, in Heidegger’s example, gathers traditional ideas about the form and purpose of the chalice and combines them with silver to make an appropriate product. Instead, modern societies impose arbitrary

and changing plans on passive materials. Heidegger calls this the “enframing” of reality by the “technological revealing.”

The first generation of the Frankfurt School holds similar views, but interprets the modern “dialectic of Enlightenment” politically. Max Horkheimer, for example, distinguishes premodern “substantive” rationality, encompassing both means and ends, from the purely instrumental rationality of modern technological society. The incorporation of human beings into the technical system as deskilled producers and passive consumers of media and commodities suppresses resistance to social injustice and so perpetuates a competitive and destructive social pattern. Common sense itself is corrupted as adjustment to the facts of life becomes conformity to the exploitative system which establishes those facts. The system prevails not only in the reified organization of society but it is lived by the individuals as the necessary form of their own experience.

Underlying all these diagnoses of the ills of modernity is nostalgia for a world in which the essence of things is secured by a stable culture. All premodern societies believe in such essences, understood as an internal principle of form and development. Essence limits human technical activity to means that favour the unfolding of potentialities slumbering in nature which nature unaided cannot realize. This interpretation of premodern making is reminiscent of Michelangelo’s answer to the question of how he made the statue of David: “I simply cut away all that was not David.”

Only modern societies free instrumental activity from all concern with the essential and conceive a total technical system that embraces human beings as well as things in accordance with arbitrary plans. This is the condition for rapid technical advance but it also has disastrous consequences since so many aspects of reality are ignored by the reified systems that serve in the race for power and wealth modernity unleashes.

Since it is impossible to return to the closed cultural worlds of premodernity, we must innovate unprecedented solutions. At best premodern forms of technical practice hint at possibilities foreclosed by modernity. Some critics of technological rationality take refuge in spiritual transformation but this is no solution. It leaves the realm of technology unchanged while holding out hope that a better attitude can somehow address the problems technology causes.

Unsatisfactory as is this approach, it seems preferable to the suggestion that we regress from industry to craft. One imagines with difficulty the preservation of the achievements of modernity such as individual freedom in a society based on medieval technology. Even more unsatisfactory is the solution Heidegger proposed at one time in his life in which the challenge of technology is met through some sort of collective heroism which he associated with Nazism.

Jürgen Habermas and Herbert Marcuse represent two alternatives to these various diagnoses and prescriptions. They are both associated with the Frankfurt School, Marcuse with the first generation and Habermas with the second. A comparison of their views enables us to get beyond the systematic pessimism of the thinkers we have considered so far.

Habermas argues that the concept of rationality is not exhausted by science and technology. We must make room for a second concept of “communicative rationality” that refers to the process of reaching understanding in the intersubjective relations of human beings. The world is similarly divided into a realm of “systems” organized for the rational control of nature and resources, and a “lifeworld” in which shared meanings – culture – direct thought and action. These two worlds intermingle to some extent in every society, but in modern times they tend to be more and more “differentiated,” that is to say, they tend to form separate institutional spheres. For example, economic life is separated from religious life, scientific research from ethics, and so on.

Modern “rationalization” processes are correspondingly twofold. Communicative rationality advances in parallel with scientific and technical rationality. Its advance is measured by the degree to which barriers to free communication are overcome. Institutions such as political democracy arise on the basis of a communicative rationalization that also affects private life and enhances individual freedom. Ideally system rationality and communicative rationality would achieve higher degrees of rationalization in their separate spheres without interfering with each other. In reality, under the impact of capitalism, the rationalized pursuit of power and wealth outstrips communicative rationalization and invades the terrain of the lifeworld. For example, politics, which ought to be governed by the results of free public debate, is corrupted by propaganda. Family relations come under the increasing control of the legal apparatus. These and other changes result in social pathologies. They can be overcome through restoring the independent role of communication and establishing a better balance between the two forms of rationality.

Habermas’s solution to the dilemma of modernity is ingenious and his notion of communicative rationalization fruitful, but I have a reservation concerning his concept of differentiation. It seems to me that he greatly exaggerates the degree to which differentiation is possible and has actually occurred. Of course he is right that science and technology are today far more independent of religion, politics and customary beliefs than in the premodern past, but he overlooks the extent to which interests now shape their problems and solutions. As a result, he treats science, technology and other systems such as the market as neutral in their own sphere and regrets their impact on society only where they over-reach and invade the lifeworld. This view has conservative implications. It discourages attempts to reform systems and focuses reform efforts exclusively on their boundaries.

But a generation of environmentalism has shown that science and especially technology are quite flexible and can be changed through constructive political interventions without loss of rationality. Such changes are not dedifferentiating but in fact orient the rationalization of systems at a deeper level than Habermas envisages. The continued imbrication of system and lifeworld must be analyzed with other instruments than those he supplies.

The Frankfurt School philosopher Herbert Marcuse offered another interesting alternative to the philosophies of despair. He did not assimilate Habermas’s advances but attempted to develop the argument of the first generation Frankfurt School, to which he belonged, in contact with the new historical experiences of the 1960s and 1970s. Although politically questionable, this approach has advantages over Habermas’s excessive respect for the autonomy of science and technology.

Like Habermas Marcuse distinguished two domains of rationality. He recognized the significance of modern science and technology but argued that they truncate the lived experience of nature on which they are based, reducing it to those aspects through which it can be controlled. We also have access to “existential truths” that reflect the intrinsic potentialities of things. Experience reveals norms of peace, harmony, and flourishing that have been preserved and developed by philosophy and art throughout the history of class society, even as the repressive structure of that society prevented their realization. According to Marcuse, modern societies are so rich and their technologies so powerful that they can at last realize the potentialities revealed in experience. But only a socialist society that democratically administers technology will be able to break the “continuity of domination” and initiate a new era (Marcuse, 1970).

This solution depends on the notion that there are truths to be found in our everyday experience of the world. There is a trivial sense in which this is obvious. We know all sorts of facts about our environment with certainty. But Marcuse intends something more

complex: we also “know” many normative “truths” such as the difference between beautiful and ugly, healthy and sick, tasteful and vulgar. But unless these “truths” have a better claim to rational universality than particular prejudices the word is simply misused. Marcuse argued that there are certain normative assumptions built into human experience as such. The Western cultural tradition articulates these assumptions in works and concepts that have validity beyond the vagaries of personal opinion. He believed that categories such as beauty and health belong to our nature and have equivalents in all cultures even if their referents differ somewhat from place to place.

The differences surface as disagreements in large scale modern societies. They may never be resolved in a singular universal but that is unnecessary in a democratic context. Public debate and voting can give an operative content to normative categories and that content can guide the transformation of technology in accordance with a renewed notion of essential potentialities. This is how Marcuse interpreted the environmental movement, the beginnings of which he witnessed toward the end of his life. Demands for respect for nature expressed politically eventually prevail and lead to technological changes. The point is that design and development are no longer guided exclusively by the pursuit of profit and power but respond also to a vision of the good. Marcuse extrapolated this tendency into a socialist future. In that future technological rationality would incorporate values once again but in a modern way, that is, on the basis of rational reflection on experience (Marcuse, 1992).

Marcuse avoids the vacuity of an appeal to a mere change in attitude which leaves technology as it is, as well as the regressive notion of a return to premodern craft. He also escapes from the logic of Habermas’s too rigid distinction between system and lifeworld. All these positions imply that technology cannot be changed, only approached in a different spirit, bounded in its application or simply abandoned. Marcuse’s position is unique among critics of modernity in that he recognizes the flexibility of technology, its potential for reconfiguration under different social conditions. His position is also original in posing the problem at the level of the form of rationality and its relation to meaning. As we will see next, this opens a possible connection to recent technology studies which incorporates a sociology of meaning. But this connection has been ignored, overshadowed by the very radical political argument within which Marcuse locates his contribution to understanding technology.

The key insight of the new field of technology studies is the role of social actors in the design of technologies and technical systems. The notion of “actors” dereifies technical practice by restoring human decision in the technical sphere. Where previously it was generally assumed that technologies were designed in response to purely technical considerations – Ellul’s “efficiency” – more recent research demonstrates that many technical decisions are made in response to ideologies, visions of life and interests. Technology studies shows this concretely through research on particular cases of all sorts, from missile accuracy to the history of bicycles, refrigerators, plastics, and vaccines. The old technological determinism that so influenced modern sociology and philosophy is effectively refuted. Technology, it turns out, is “underdetermined” by technical constraints. There is always room for alternative designs with different social consequences.

According to technology studies, technology is a hybrid of knowledge about nature, conserved in the technical disciplines, and the many concerns of non-technical actors who intervene in design in a variety of ways. Several concepts have been introduced to signify the hybrid character of technology and the technical disciplines that create it. Wiebe Bijker proposes the concept of “technological frame,” a kind of paradigm or model that guides the actions and interactions of the many individuals and groups who

cluster around the process of development. The similar notion of the “technological regime” has been developed by Arie Rip in a constructivist approach to technology assessment. I have suggested the term “technical code” to refer to the translation of social demands into technical specifications. Technical choices that depend on a social criterion of some sort bear a social content in technical form (Bijker 1995; Rip et al. 1995; Feenberg, 2010).

As can be seen from this brief description, technology studies arrives at conclusions similar in important respects to Marcuse’s from a completely different starting point. Technology studies validates Marcuse’s hypothesis that technological design is responsive to society and embodies a way of life, although it usually abstains from political references and philosophical reflection on the nature of rationality.

This partial confirmation suggests a strategy for reconstructing Marcuse’s theory in a politically modest but still normatively interesting form. Instead of linking the transformation of technology to a future socialist revolution, it can be conceived as an ongoing process that is gathering strength as technology causes a wide variety of problems to which solutions must be found in the present. And in fact solutions are being pursued actively around issues in environmental, medical, and information technology today. Technology studies explain why and how these public interventions into technology are not simply ignorant meddling but significant for the future (Wynne, 2011).

Marcuse’s conception of that future was shaped by his Marxist assumptions. He argued that the environmental movement confirmed his critique of capitalism. Environmentalism invoked a value based on the evidence of experience – the affirmation of life – as a guide to the reform of technology. It thus opposed the rights of the living to the destructive dynamic of capitalist development. But whether social movements such as environmentalism will prove incompatible with capitalism as Marcuse believed need not be decided in advance.

Despite the controversy over Marcuse’s Marxism, his methodological contribution is undoubtedly important. He related environmental politics simultaneously to the overarching structure of modern rationality and the particulars of technological design. That is the important connection that is so far missing from technology studies.

A new picture of technical politics can be drawn on the basis of Marcuse’s philosophy of technology and research in technology studies. This picture has two sides, a negative side and a positive side. The negative side is revealed by the environmental movement. The dominant technological rationality is based on a simplified understanding of its objects. Reduced to raw materials and disconnected from their natural background, the materials incorporated into technical system have unanticipated side effects that become fatally significant as the system develops. Eventually these side effects cause such destruction and disease that ordinary people are affected and protest. The protests feed back into technological design and result in modifications that reflect a more realistic understanding of nature’s complexity. This overall dynamic leads to awareness of the hybrid character of technology and a weakening of technocratic and determinist ideology. Predictably, technical politics will become part of mainstream political life as this process unfolds.

The positive side of the new picture is at work in other domains such as information technology. There technologies introduced in the context of military and business enterprise have been colonized by users in pursuit of personal fulfilment. The communicative opportunities opened by the technologies have a role parallel to that of side effects in environmentalism, revealing complex potentials of the systems unsuspected by their original designers. These potentials are benign rather than threatening and deserving of independent development. They enable new forms of sociability and multiply creative

possibilities for ordinary people. The democratic implications of these technologies emerge as resistance grows to commercial exploitation and political suppression. This is one of the most active interfaces today between system and communicative rationality.

What are the values that preside over these processes of technological change and what is their relation to the technical disciplines involved in the redesign of technology? In each particular case of environmental protest the arguments are different but it is possible to generalize to a notion of respect for nature within limits set by human flourishing. The reconciliation of these requirements is usually possible and even economically viable in the long run if not in the short run time spans of capitalist investment decisions. Similarly, the value of human flourishing underlies the transformations of information technology. These are precisely the values Marcuse celebrates in his reflections on the lived experience of nature and the “existential truths” we can learn from it.

The technical disciplines respond to these public interventions by gradually incorporating a broader range of considerations in their concept of the object and their practices. The increased complexity of the disciplines corresponds to the real complexity of the world on which they operate. Values do not appear within the disciplines directly and immediately, but indirectly through mediations that address side effects and opportunities identified in protest, hacking and innovation. The results are improved technical disciplines and technologies as judged from both a technical and a normative standpoint.

The dynamic interaction of technical disciplines and public interventions is a consequence of the differentiations that make modernity possible. Until technology achieved a certain autonomy it was constrained by craft traditions and religious, ethical and aesthetic conceptions. Modernity unleashes technology by creating the conditions for the development of independent formal rational systems. Social rationality is thus a productive feature of modern societies despite the problems it brings in its wake. But the rapid development of modern technology has such vast and threatening impacts that it can no longer conserve its autonomy.

The ultimate reality test for technology is public acceptance since the public must deal not only with each particular technology in its ideal setting but all of them together in the chaotic world of daily life. The informal common sense rationality arising from everyday experience can evolve to become adequate to making judgements about this world. It is not simply inferior to technical rationality but encounters the world differently. Rather than abstracting toward a limited explanatory register consisting of causes and functions, informal rationality connects ideas by association. It operates on the surface of the phenomena where values and meanings circulate freely. This may lead to confusion and error but it is also open to the unforeseeable complexity of the world. That openness can be essential where the narrow scope of the values and connections built into technology leads to disaster or blocks progress.

Feedback from “reality” as it is experienced by ordinary people under these conditions is thus not extraneous to technology but essential to its successful development. In a differentiated society that feedback takes place through a sometimes conflictual circulation of information and products between technical experts and their technical disciplines and society at large. In sum, neither social rationality nor everyday rationality are complete in themselves; they form halves of a fragmented whole.

Reification cannot be abolished once and for all by joining the heterogeneous fragments but its effects can be mitigated by their interaction. Struggles in which formal and informal modes of thought encounter each other bring the human basis of the society to the surface. Concrete issues involving technology and other rationalized institutions are the occasions for these struggles. Anything that promotes the interaction of these

divergent ways of understanding the world is progressive. Obstacles to communication between technical specialists and those affected by their activities should be removed as quickly and as effectively as possible. That is the new task of the democratic process that has been unfolding in the modern world since the 18th century in parallel with technical advance.

Short Biography

Andrew Feenberg's research in philosophy of technology is located at the intersection of Frankfurt School Critical Theory and Science and Technology Studies. He has published books in his field with Oxford University Press, University of California Press, MIT Press, and Routledge, among others. His books have been translated into Italian, French, Portuguese, Chinese and Japanese. His most recent book is entitled *Between Reason and Experience: Essays in Technology and Modernity*. His current research focuses on the social and political impact of the Internet. He also studies the history of Western Marxism. Dr Feenberg was a pioneer in the field of online education. He continues to do research in this field and to work on Marginalia, a program designed to enhance interaction in online forums. Dr Feenberg taught for many years in the Philosophy Department at San Diego State University, and at Duke University, the State University of New York at Buffalo, the Universities of California, San Diego and Irvine, the Sorbonne, the University of Paris-Dauphine, the Ecole des Hautes Etudes en Sciences Sociales, and the University of Tokyo. He holds a BA in Philosophy from The Johns Hopkins University and a doctorate in philosophy from the University of California, San Diego. He is currently Canada Research Chair in Philosophy of Technology in the School of Communication, Simon Fraser University, where he directs the Applied Communication and Technology Lab.

Note

* Correspondence: School of Communication, Simon Fraser University, 515 W. Hastings St., Room 3598, Vancouver, BC, Canada V6B 5K3. Email: feenberg@sfu.ca.

Works Cited

- Adorno, Theodor and Max Horkheimer. *Dialectic of Enlightenment*. Trans J. Cummings. New York: Herder and Herder, 1972.
- Bijker, Wiebe. *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change*. Cambridge, MA: MIT Press, 1995.
- Ellul, Jacques. *The Technological Society*. Trans. J. Wilkinson. New York: Vintage, 1964.
- Feenberg, Andrew. *Between Reason and Experience: Essays in Technology and Modernity*. Cambridge, MA: MIT Press, 2010.
- Habermas, Jürgen. *The Theory of Communicative Action* (2 Vols.). Boston: Beacon Press, 1984.
- Heidegger, Martin. *The Question Concerning Technology*. Trans. W. Lovitt. New York: Harper and Row, 1977.
- Horkheimer, Marx. *Eclipse of Reason*. New York: Seabury Press, 1947.
- Lukács, Georg. *History and Class Consciousness*. Trans. R. Livingstone. Cambridge, MA: MIT Press, 1971.
- Marcuse, Herbert. 'Re-Examination of the Concept of Revolution.' *All We Are Saying*. Ed. A. Lothstein. New York: Capricorn Books, 1970.
- . 'Ecology and the Critique of Modern Society.' *Capitalism, Nature, Socialism* 3,3 (1992): 29–38.
- Rip, Arie, Thomas Misa, and Johan Schot, eds. *Managing Technology in Society: The Approach of Constructive Technology Assessment*. London/New York: Pinter, 1995.
- Wynne, Brian. *Rationality and Ritual: Participation and Exclusion in Nuclear Decision-Making*. London: Earthscan, 2011.