Knowledge Politics

The Paradox of Regulating Knowledge Dynamics

Science has not only led to the mass production of knowledge but also has it invaded society with multifarious effects: Consequently, today one talks about knowledge in the plural, for whereever knowlege is produced counter-knowledges occur. Therefore science studies has put a novel issue called knowledge society on the agenda: Scholars inquire into its texture (Böhme, Stehr 1986; Stehr 1994) as well as into its type of knowledge production (Gibbons et al. 1994; Willke 1998, 1999). While it is not as yet decided what a society based on knowledge will eventually look like it seems to be certain that we face up to some fundamental dilemmata of knowledge: Implementing knowledge inevitably means to adapt it to local conditions, thereby changing it. What is more, knowledge may prove not only useful and profitable but also risky. While societies promote systematic production of knowledge so as to improve individual well-being and collective standards of prosperity, health, and freedom, neither the quality of knowledge thus produced nor its effects once it has become implemented can be adequately foreseen. At issue is nothing less but the control of the unforeseeable.

Since technology and science, far more than economy, have become the real motor of societal change, institutions became established that debate and assess their potential or real effects before or while implementing them. So-called technology assessments, mediations, hearings or round-tables are designed to control or police knowledge, the main strategies being to minimize dangerous effects and to maximize public acceptance. Whereas two decades before nuclear energy or military research has been the primary concern of such interventions, today the attention has shifted to the biological and environmental research: Medicine, food, and nature are conceived as key issues deeply affecting individual lifes and societies at large. In the light of 'genetic engineering,' for instance, the issue is about making individual choices, privatize knowledge, and legislate its accessability. Thus, what is at stake today is the intricate relationship between the individual, economy, and the state: If anything, they share a common interest in regulating knowledge so as to keep the ideological, cultural, and moral effect of science and technol-

ogy under control. While Merton's norms are still part of the game named quality-control of knowledge, its regulation from within science does no longer seem sufficient. External regulation are sought to highten the efficacy of policing it: Drug regulation, intellectual property, and copyright protection are examples of the ways in which the distribution and implementation of knowledge becomes a domain of explicit legislation and a target of political and economic decisions. To be sure, regulating knowledge is not about 'reducing' it (though shortage of availability and accessability are forms of policing knowledge). On the contrary: Regulating knowledge will enforce the significance of knowledge, thereby disseminating the places where knowledge becomes implemented, disputed and adapted. Policing knowledge, thus Stehr as well as Weingart (2001), inevitably increases the dynamics of a knowledge-based society.

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Policing Knowledge

Nico Stehr

Early one morning in late July of 1999, Lord Melchett, the head of Greenpeace in Britain, was detained for questioning by the police after he and about 30 Greenpeace members raided a field of genetically modified maize near Norfolk. The protest came to an abrupt end after the farmer called the police and they arrested the protesters. According to *The Times* (July 27, 1999) the raid left government trials of seed crops that had been genetically modified in disarray. The farm on which the protest took place was one of seven test sites damaged or destroyed within months. The protest by Greenpeace followed a recommendation by the Association of Local Governments to its 170 members in England and Wales to phase out genetically manipulated foods (or GM food) until they are proven safe. A number of councils followed the recommendation. Major food manufacturers and supermarket chains as well as fast-food chains in Britain had already announced that they will not carry any products that contain genetically modified ingredients. A poll in the summer of 1999 found that 79 percent of the British public agrees that GM crop testing should be stopped. In Canada and the United States, genetic modification of foodstuff has hardly been questioned by the public. A major political battle on this front between North America and Europe is likely.

In January of 1999, the *Daily Telegraph* (January 22, 1999: 9) reported that the British Medical Association warns, in a report entitled *Biotechnology Weapons and Humanity*, that rapid advances in genetics will "soon transform biological weapons into potent tools of ethnic cleansing and terrorism." The British Medical Association urged that the regulations of the 1972 International Biological and Toxic Weapons Convention should be tightened and improved, anticipating the possibility of genetic warfare which is a practical possibility today.

The so-called 'genetic protection initiative' (the petition for a referendum 'for the protection of life and environment from genetic manipulation') in Switzerland was clearly rejected in June 1998 in a plebiscite in all the cantons, to the great 'relief of the pharmaceutical industry' (*Neue Zürcher Zeitung*, June 8, 1998). With a voter turnout of 40.6 percent, 66.6 percent of voters opposed the petition, which

according to its advocates would have declared Switzerland to be a great, unified 'genetic protection area'. The petition demanded, among other things, changes to the Swiss constitution forbidding the production, purchase and sale of genetically modified animals, the release of genetically modified organisms into the environment and the granting of patents for genetically modified animals and plants.

The fact that all of my examples of recent attempts to regulate the application of knowledge deal with genetic research – and the list could easily be extended – is, of course, a result of the fears and/or nightmares which have lately been prompted by just this area of research.

Knowledge Politics

In this contribution I plan to discuss what may well become one of the most significant and contentious issues for intellectual, legal, public, scientific and political discourse in the coming century: the growing pressure to police *novel* knowledge – or in other words, the emergence of a new field of political activity, namely knowledge politics.[1] In democratically organized societies, it is a legitimate role of political discourse and action to contribute to and take part in decisions that effect the ways in which scientific knowledge and possible technological artifacts are deployed in society or not.

During the early post-war decades of rapid economic growth, the application of scientific and technical knowledge in developed societies was not necessarily unanimously and uncritically advocated, to be sure, but there was a considerable degree of silent assent.

Such headlines of recent times as 'We know too much' and 'How much genetic self-knowledge is good for us?', or keywords from ever more vehement disputes, such as 'We dare not make use of everything we know', are part of the background and the environment of the current increasingly urgent demands for the regulation of knowledge in modern societies.[2] These science and technology controversies open a window on modern struggles over meaning and morality, economic benefits and damages, as well as the emerging and shifting locations of social power and control in knowledge societies.[3]

More specifically, it is the shift from regulating and policing normality or identity (Foucault) to the growing concern in knowledge societies with efforts to police novelty and differences. As I have

indicated, the examples that come to mind, and that have captured the attention of the media and the public recently, are numerous and growing.[4] For example, the United Nations, provoked by advances in ocean exploration, is drafting a treaty that attempts to regulate marine archeology and commercial efforts to hunt for and reclaim lost cultural treasures – and therefore the knowledge about ancient civilizations, such as the empire of the Phoenicians, that may come with their discovery (cf. *New York Times*, October 12, 1998).

It is perhaps self-evident and comes as no surprise to anticipate that 'knowing' will be seen in knowledge societies as a domain in urgent need of policing and as a site to study the functioning of power in modern society.[5] Inasmuch as the widespread dissemination of knowledge increases the fragility of modern societies (cf. Stehr 2000) efforts designed to control knowledge may be interpreted as strategic attempts to reduce or manage their fragility. Whether such attempts are likely to be successful is therefore an important issue.

But the issue of the control of knowledge becomes significant for another reason as well. Insofar as knowledge, especially 'additional' knowledge, assumes growing importance within the economic system and becomes subject to economic interests, efforts to control, restrict or privatize its use will grow as well. A prominent example comes from genetic research and the Human Genome Project in particular. In light of the intensive competition among hundreds of researchers worldwide in the Human Genome Project, the concern intensifies that findings that might 'alter the world economy' will be monopolized, at last temporarily, if they can be protected by patents or other forms of intervention by the state. And since it is not only knowledge about genes that may turn into a valuable raw material, the fear of a progressive privatization of science grows.

Finally, demands to cope with the growth of knowledge refer to the attendant extension in capacities to act. Actors increasingly find themselves in situations in which the need for novel decisions emerges; and with it, of course, new apprehended dangers and risks. The potential openness, and not the self-evident traditional closure, of situations calls for, it seems, regulation and policing of knowledge now that knowledge is seen as the motor of new possibilities to 'manipulate' elements of a situation that in the past had been apprehended as beyond the control of all participants. The role and the prominence of references to fate, nature or the design of some higher

being that symbolized the closure of conditions of action lose their relevance. What was seen as forever beyond the control of everyone now becomes – initially in the thought experiments of a few individuals, at least – subject to control and manipulation. And what was in the past seen as an exceptional moral dilemma, or the need to arrive at a decision in an extreme situation or under rare circumstances, now becomes increasingly common.

Regulating Knowledge

Efforts to police knowledge are not new. The notorious and ongoing struggle in some parts of the United States, for example, to ban the teaching of evolution in schools is therefore a relevant case in point. The vote of the Kansas Board of Education to delete virtually any mention of evolution from the state's science curriculum[6] is one of the more recent examples of successful efforts of creationists to ban mention not only of biological evolution but also of the big bang theory from the curricular guidelines of schools in the United States. But most of the efforts to regulate and police the possible ideological and cultural effects of science that have been and continue to be undertaken from time to time in different societies have not been overly successful.[7] In addition, there is a distinctive shift in the kinds of concerns and consequences that may prompt efforts directed toward the regulation of knowledge. In the last couple of decades, there is a noticeable shift from concerns that revolve around security, to concerns with risk and now more and more to questions of uncertainty (cf. Bechmann / Stehr 2000).[8]

A transformation in public sentiment in favor of policing knowledge signals a basic change in the legitimacy of science,[9] in particular a shift away from a preoccupation with the 'ideological' or cultural implications of basic knowledge claims generated by science and possible conflicts with established world views, and toward an increasing preoccupation with its practical application and consequences. What I have in mind is perhaps best described as an attempt to directly control or regulate the immediate use or anticipated consequences of incremental knowledge but not the '*secondary*' implications of knowledge.[10] Attempts to police the secondary consequences of knowledge claims could refer, for instance, to action in the form of regulations prompted by the claim that passive smoking increases blood pressure. Efforts to curtail smoking in certain spaces or by

certain individuals may be based on and justified by this claim. But in such a context the claim itself is not the subject of any regulation.

The now widely discussed public demystification of experts may be seen not only as a prime example of a fundamental change in the nature of the relations between knowledge-based occupations and clients, consumers, patients, students, trainees, customers, etc., but also as a profound transformation in the public image of scientific knowledge. This change considerably enlarges the number and range of individuals who relinquish their traditional subordinate role in such expert/client relations as recipients of advice that rests on an *a priori* suspension of doubt. Helen Lopata has described the process I have in mind as the 'sophistication and the rebelliousness of the client' in contexts in which expert knowledge is dispensed (Lopata 1976: 437). Lopata notes that several social changes are responsible for the difficulty in monopolizing knowledge, by the professions for instance, and for the refusal of consumers and clients to remain passive and conforming recipients of expert advice. There is, first of all, the very increase in the volume of knowledge-based occupations, which reduces the ability to strictly enforce and control the boundaries and the nature of discourse and increases the fragmentation of fields of expertise. The fragmentation of expertise becomes public knowledge. Secondly, the astuteness and cognitive skills of the public increases. New organizations and pressure groups emerge, reinforcing the decline in the authority of experts.

Efforts to regulate and police knowledge are typically undertaken and/or initiated as well as legitimated outside the boundaries of the scientific community (naturally with repercussions for the production of knowledge within the science system). For the purposes at hand, 'regulating' refers, in the most general sense, to the conscious, strategic use of political and legal power, as well as economic resources and cultural authority, to shape – whatever the specific objective – the utilization of scientific-technical knowledge.[11] It involves a complex set of mainly formal ventures designed to encourage, restrict, shape, or banish knowledge claims and set standards for their use through pressure, the creation of institutions, and the deployment of norms and beliefs to make certain that knowledge evolves along a desired path and has only sanctioned consequences.

The source of the standards chosen to police knowledge, the regulatory procedures put in place, and the intellectual systems legitimi-

zing the cultural dismissal of certain uses of knowledge typically also do not originate in science and technology itself. For example, in the face of demands to preserve and defend the nature of human nature in response to developments in scientific and technical capacities to alter the *status quo* of human reproduction, scientific 'notions of nature do not provide us with unambiguous standards of naturalness to which we can appeal for normative orientation' (van den Daele 1992: 549). Since scientific notions of naturalness allow for the construction of a range of possible natures, regulation efforts advancing the cause of abstaining from practical steps intervening into human nature have to appeal to moral claims and political action that may or may not succeed in arresting human nature. The anchoring of standards and justifications outside of science does not mean that individuals who are scientists may not be found among those who vigorously support attempts to regulate knowledge.

My list of the available measures to control knowledge may at first leave the impression that I include science and technology policies as primary examples of such efforts. Strategies designed to regulate knowledge are mostly responses to changed and novel knowledge, not vice versa. Science and technology policies aim to encourage the development of knowledge, but they generally do so in highly ambivalent and open-ended fashion. Many decades of experience demonstrate, furthermore, that it is difficult or even impossible to steer and control the dynamics of developments in science and technology by way of political standards (cf. van den Daele 1992: 553–555). In contrast to strategic efforts designed to plan and encourage future knowledge, attempts to 'police' knowledge cover a much wider social field than science and technology policies, including more informal control processes. The controls knowledge politics may impose could extend to the ways in which knowledge is disseminated and travels, is dispensed, made accessible, employed and interpreted.

The ideal-typical concepts of research and knowledge policies and their separate strategic functions for the development of knowledge and its societal deployment may increasingly be blurred in knowledge societies as the boundaries of science and society become more fluid and porous. Efforts to regulate knowledge will influence science policies and sciences policies will have an impact on attempts to police knowledge.

Shifting boundaries between science and politics for example may

be manifest with respect to the process of the fabrication of knowledge; in particular, the emergence of cognitive closure, consensus formation or the evolution of uncontested facts in scientific fields increasingly may incorporate non-scientific actors and non-systemic groups. The more or less direct intervention into cognitive processes in science perhaps is most evident in the case of problem-oriented research such as environmental research, risk and technology assessment. Some fields of medical research may serve as another example. In France, the involvement and support of patient groups for the treatment of muscular dystrophy has lead to considerable investments by their organisation into molecular biology and the human genome (cf. Latour 1998: 208).

The Social Control of Knowledge Claims in Science

In yet another sense, the social control of knowledge claims *in* knowledge-rich and knowledge-based social systems is not a novel phenomenon. What makes science unique among social systems, for example, is the way in which and the extent to which the social task of maintaining the 'quality of the products' of science is accomplished 'with so little difficulty that the problem of quality control has received no more than passing mention in any systematic discussion of science' (Ravetz 1971: 273). Assessment of 'quality' is constitutive of much of the work done in science.

For Karl Popper, as is well known, the willingness to submit ideas to critical scrutiny and commitment, and not to accept knowledge claims at face value, constitutes the demarcation criterion between science and other social systems, including systems driven by ideas. Whether or not such a demarcation criterion linked to the motives of individual scientists and the institutional norms allows us to distinguish in an unambivalent manner between science and other increasingly knowledge-based social institutions is not at issue in this context. Nor do I intend to inquire into the functions of quality control, how the standards of the quality control may be elaborated, the precise mechanisms and enforcement of the social control of knowledge in science, whether these processes are effective in weeding out 'shoddy science', and how science may be stratified with respect to the policing of knowledge. Much has been written about these matters in recent years. Quality control in present-day science is clearly no longer as invisible and taken-for-granted as in the past. However, a

more extensive discussion of the internal control mechanisms of science is accompanied by skepticism about the efficacy of self-policing, and therefore by demands that control within the scientific community must become a strictly formalized undertaking. In a society that is itself knowledge-based, the problem of the social control of knowledge both within and outside of science inevitably becomes a central social and political problem

The social regulation *of* science-in-progress is a highly difficult and perhaps impossible undertaking that, furthermore, has the unintended consequence of reducing the authority of science as an asset to politics. Perhaps the most significant barrier in the way of extensive external social control mechanisms on science-in-progress is the size and organization of the scientific enterprise today, as well as its competitive and its international texture.[12] The politics of science must not be conflated with the politics of society. The politics of knowledge cannot simply be reduced to political power, and science generates many kinds of knowledge, not only knowledge that is essentially political and therefore of immediate practical use.

The Societal Regulation of Knowledge

It seems highly likely that not only the state and major social institutions, but also social movements and groups of affected 'laypersons', will demand and organize to implement measures to increasingly regulate knowledge. In the past two decades, for example, AIDS research in the United States has been marked 'by a sustained lay invasion of the domain of scientific fact-making' (Epstein 1996: 330) breaking down some of the entrenched barriers between science and society.[13] The experience of AIDS research signals that efforts to control the application of knowledge – in this case prominently the aspects of who is to benefit, when and for what 'price' – has repercussions for the development of knowledge in academic science and for research and development in corporations.

It is perhaps self-evident that the growing efforts to police knowledge signal that claims about the inevitability of a self-propelled domination of society by science are simply unsupportable. The specific issue I will therefore discuss is not what I consider almost beyond dispute, namely that the deployment of control and regulation measures will increasingly be aimed at knowledge, but rather the

entirely unresolved issue of the likely efficacy of all efforts to police knowledge. There is a yawning gulf between approaches that stress the ease with which knowledge is monopolized and controlled by an elite and the very different perspective advanced here, which emphasizes the extent to which the expanded role of knowledge significantly diminishes the ability of either major societal institutions or small groups to harness without serious challenge the gains that result from the growth of knowledge.

During the evolution of industrial society, liberal democracies successively instituted increasingly elaborate legal frames pertaining to the social status and use of property and labor. Thus the freedom of economic actors to exercise power and authority by virtue of their individual or collective ownership over labor power or the means of production is increasingly constrained and circumscribed by a host of legal norms, as well as organizations and political programs that emerge around these factors. Ownership is restrained not only spontaneously by the market, for example, but also by the state. Deliberate and anticipatory legal constraints on the use of property and labor are not neutral. Legal norms convey, from the point of view of certain actors, especially those who feel impotent in acquiring ownership and in affecting the legal rules pertaining to their disposition, privileges; while they signal (natural) rights to those who control property and labor. Unequal access to ownership, and therefore any stratification of effective influence on the construction of the legal restraints and rights, is in turn typically – but not always exclusively – based on an unequal distribution of labor and property in industrial society, elements that are constitutive for its social and economic existence.

It is almost self-evident that *legal* efforts and legislation in knowledge societies will be increasingly directed toward ways of controlling the employment, and indirectly the development, of knowledge. I emphasize political and legislative efforts to control the implementation of scientific knowledge rather than more tenuous forms of informal or spontaneous social control because the latter are simply part and parcel of the conventional state of affairs of science and its relation to society, namely the standard selectivity with which knowledge develops and is utilized. Vigorous opposition to political ventures to limit the considerable autonomy of the modern scientific community and to control knowledge will be as common as was opposition to

efforts to control the use of property or the ways in which labor power might be utilized by the owners of the means of production.

One question that must be examined in the face of demands for the regulation of scientific findings has to do with the problem (which is not merely a new problem) of the extent of the social independence of science, its origins, its foundation and development; as well as the demand, which under certain circumstances opposes such independence, for some kind of control over scientific development, the communication of scientific findings and/or the consequences of scientific knowledge, whether through a kind of voluntary self-control by scientists or by means of externally implemented measures.

The type of control over science that is chiefly of interest here is therefore not related to the (primary) social control of scientific findings, that is to say, to forms of control that arise from the existence of such social constructs as the 'scientific community' itself. The system-specific regulation of knowledge has already been mentioned. Robert K. Merton, in one of the most influential treatments of this topic, has attempted to describe the peculiar form of primary or system-immanent social control in the modern scientific community by drawing attention to the existence of a number of special social norms that regulate the social relations among scientists. The presence of a particular social convention, such as for example the demand for unimpeded access of all scientists to all research findings, which also simultaneously means a ban on any form of secrecy or selective communication of scientific results, represents, no matter what attitude one takes to the concrete rules of conduct, a form of social control that influences or regulates, for example, the possible content, extent, goals and methods of communication. In summary, only a limited palette of possibilities from a multitude of other possibilities in the relevant context can be realized. In terms of primary social control, it is therefore a matter of a control taken for granted by scientists, and of a form of constraint on their social and intellectual life that is largely regarded as legitimate and necessary. Whenever the control and/or the freedom of science are under discussion, this taken-for-granted social control cannot be at issue. This control, which certainly must vary in its extent and manner and in the degree to which it is accepted, is, if you like, one of the indispensable resources of the social cohesion or solidarity of any institution, and thus of the scientific community as well.

Against the background of system specific social control within science, therefore, those discussions that lead to a revision or extension of the already existing forms of control in the scientific community are of interest. With mounting efforts outside of science to regulate new knowledge produced by science, the nature of social control within science is bound to be effected and changed. I do not merely mean to refer to what constitutes a kind of anticipatory regulation of research efforts and the informal or formal acceptance of zones that constitute investigatory matters and methods that are off limits, for instance, in the form of ethical certification requirements. In fact, what can and likely may increasingly occur is a convergence or mixture of regulatory practices.

Appended to the United States Human Genome Project is an NIH/DOE Committee to Evaluate the Ethical, Legal, and Social Implications Program of the Human Genome Project (ELSI). The committee has a short but contested history. The National Institute of Health (NIH) has proposed to attach ELSI units to its other institutes and research endeavors (cf. Murray 2000). Such a program, though peer-review based but not in the usual sense since assessments of research proposals are interdisciplinary, represents at least an enlargement of traditional system specific mechanisms of social control in science if not, in this instance, an intrusion of the state and the public concerns into the regulation of the development of knowledge and obviously difficult anticipatory judgments about its social implications. Such committees also raise the general question of the role of democratic order and the influence civic society ought to have on the ways in which the results of scientific research are deployed if at all.

The Public and Science

And in this context, the 'loss of contact' (Holton 1986: 92) between science and the larger public is today emerging as a salient attribute of the interrelation between knowledge and society. Large segments of the public have become disenfranchised, at least in the view of the scientific community. This loss of contact is not only the result of a growing cognitive distance between science and everyday knowledge; it is also affected by the ever increasing speed of knowledge expansion and by the deployment of knowledge as a productive capacity. The decreasing cognitive proximity increases the political distance from science, for example by restricting public reflection on both anticipat-

ed and unanticipated transformations of knowledge resulting from the application of knowledge.[14] The scientific community shares responsibility for this diminishing intellectual proximity, since the preferred self-image of science as a consensual, even monolithic and monologic, enterprise is increasingly in conflict with both its public role and its own internal struggles about research priorities, as well as the generation of data and their interpretation.

However, on political and moral grounds many groups, constituencies and institutions must be consulted before decisions are made about issues that affect the regulation of knowledge and indirectly the development of science and technology. It would be misleading to think that the distance from and the loss of contact with science, or the considerable scientific illiteracy in modern societies, is somehow a 'potentially fatal flaw in the self-conception of the people today' (Holton 1992: 105) and/or signals the possibility of a dramatic collapse in public support for science. It is more accurate, perhaps, to speak of a state of precarious balance affecting the autonomy and dependence of science in modern society. A loss of close intellectual contact between science and the public is perfectly compatible with both a diffuse support for science in modern society and an assent to legal and political efforts to control the impact of science and technology. In another sense, however, the loss of cognitive contact is almost irrelevant, and highly controversial; for example, when 'contact' is meant to refer to close cognitive proximity as a prerequisite of public participation in decisions affecting scientific and technological knowledge. Such a claim is practically meaningless because it almost requires public engagement in science-in-progress (cf. Collins 1987: 691).

From the point of view of the scientific community, the lack of cognitive proximity to the general public has advantages and disadvantages. The loss of contact between science and the public can perhaps explain, at least in part, why the scientific community, in view of its attractiveness and usefulness for corporations, the military and the state, has been able to preserve a considerable degree of intellectual autonomy (cf. Gilbert/Mulkay 1984). Such autonomy, however, is contingent on a host of factors within and without the scientific community. The loss of contact is a resource for the scientific community. It signals a symbolic detachment and independence that can be translated into an asset vis-à-vis the state and other societal agencies. Science becomes an authoritative voice in policy matters; or it

represents, in ideological and material struggles with other political systems, the openness of society (cf. Mukerji 1989: 190–203). But the cognitive distance also limits the immediate effectiveness of the 'voice of science' in policy matters,[15] and extensive autonomy and independence of science may result in an excessive celebration of 'normal' scientific activity and lead to a lack of innovativeness.

From the point of view of the non-scientific institutions, the lack of intellectual proximity of the public to scientific knowledge in general and research fronts in particular also has both advantages and drawbacks. Selected disaffection with science and technology has always accompanied its development; strong demands and efforts to legislate selectivity in the ways in which knowledge is implemented and deployed can lead to even stronger disaffections with science, although such a response may be dismissed as part of an anti-science crusade or movement. But the term 'anti-science' is vague and brings together a broad range of things that typically 'have in common only that they tend to annoy or threaten those who regard themselves as more enlightened' (Holton 1992: 104).

The Developments of Social Controls

The social control and regulation of scientific knowledge that has moved from the stage of being-in-progress to some form of completion and desires to be implemented outside of the scientific community is already quite extensive. In all modern societies, we now find elaborate drug regulations and corresponding agencies that register, test, control or permit pharmaceutical substances to enter the market as legalized drugs. Until a few decades ago, decisions about the production and marketing of chemicals as drugs were typically made by corporations, by individual pharmacists or by physicians (cf. Bodewitz et al. 1987). As scientific knowledge is 'applied', it becomes embedded in social contexts external to science. As a part of such embeddedness, knowledge is subject to the kinds of control mechanisms and social constraints found in these contexts. It simply cannot escape the selectivity that issues from such external contexts, even if only in efforts designed to generate trust toward a certain artifact or solution offered by novel knowledge.

The whole area of national and international intellectual property and copyright protection is another arena in which legislation to control the deployment of scientific and technical knowledge is

already extensive. In many ways, such controls date back at least to the 1883 Paris Convention for patents and related industrial matters and to the 1886 Berne Convention for copyrights. The acceleration in the speed with which inventions reach the market, their shortened economic life-span and the extent to which recent inventions, for example in the field of microelectronics, the organization of production, medical treatments and biotechnology, are difficult to protect from copying efforts will increase pressures to enact further protective legislation (cf. Vaitsos 1989).

In social theory, the institution generating knowledge and the institution contemplating and executing political action were once regarded as entirely unrelated domains. At the beginning of the twentieth century, the dilemma of the indispensable separation of science and politics found perhaps its most influential expression in Max Weber's ([1921] 1948: 77–128; [1922] 1948: 129–156) essays on science and politics as a vocation. Today, the intellectual foundations that allowed Weber to legitimize the fundamental division between the practices of knowledge and politics have fallen into disrepute. Confidence in the neutrality, instrumentality and political neutrality of science has been thoroughly eroded. Reference to the politics of knowledge therefore no longer constitutes a profound break or a violation of the norms of scientific action and the essentially means-like attributes of scientific knowledge. Science is deeply implicated in social action and political agendas hold sway over science. Precisely how dependent or interdependent science and politics are is a matter of ongoing debate and empirical analysis. But the widespread disenchantment with science and the extensive material dependence of the scientific community on the state do not justify the equally unrealistic proposition that the boundaries between politics and science have altogether vanished. Science remains embedded in particular political realities, and as long as it is situated in a form of civil and political society free of totalitarian strains, scientific activity tends to benefit. By the same token, as long as traffic across the boundaries of science remains widely unimpeded and subject to negotiation, both science and society gain.

In as much as knowledge becomes the constitutive principle of modern society, the production, distribution and especially the application of knowledge can avoid political struggles and conflicts less than ever. The distribution and implementation (and with it the

fabrication) of knowledge increasingly becomes a domain of explicit legislation and a target of political and economic decisions. Such a development is inevitable, because 'as the institutions of knowledge lay claim to public resources, some public claim on these institutions' (Bell 1968: 238) and their results are unavoidable. Even more significant is that, as the importance of knowledge as a central societal resource increases, its social, economic and political consequences for social relations grow rapidly, together with demands to regulate the specific utilization and access to knowledge.

The dissemination and application of knowledge does not occur in the imaginary world of perfect competition and equality of opportunities. As a result, a politics of knowledge must confront the consequences of the social distribution of knowledge, especially the stratified access to and utilization of knowledge. It remains an open question, for example, to what extent dispossession of knowledge generates social conflicts and in what specific ways such struggles manifest themselves. Daniel Bell (1964: 49) warned several decades ago that right-wing extremism may 'benefit' from any exclusion of social groups from access to and acquisition of technical expertise.

However, such predictions about the intellectual, social and economic gaps sustained by knowledge overestimate the extent to which knowledge and its use can in fact be controlled. It will be increasingly difficult to control knowledge, in spite of the many efforts that will undoubtedly be made. Efforts to control knowledge encounter contradictions. Sustaining economic growth, for example, requires an expansion of knowledge. And knowledge that expands rapidly is difficult to control. The expansion of knowledge enlarges the segment of knowledge-based occupations. Knowledge expansion and knowledge dissemination rely on conditions that are themselves inimical to control. Nonetheless, as I have observed, the typically expressed fear that an inevitable outcome of such developments is the greater ease with which knowledge (and information) can be monopolized and effectively employed for repressive (even totalitarian) purposes, or even as a tool of maintaining the benign status quo, had been a widely accepted premise of discussion of the social control of knowledge even before Orwell's classic book on the subject. What exactly nourishes this point of view? What is the basis for the widespread conviction that knowledge and technical artifacts are relatively easy to control and that access to knowledge can be easily denied?

Knowledge Hierarchies and Monopolies

One of the ways to understand the various means by which knowledge is seen to be controlled, perhaps even monopolized, and its gains – following the Matthew principle – primarily allocated to the rich and powerful, is to examine the literature that has incessantly informed us that precisely such outcomes are built into the very logic of scientific and technological development. What exactly is it, in the view of these critics, that gives technology and scientific knowledge such potency and discriminatory power? And what kinds of *mundane encounters* with modern science and technology may have prompted or at least reinforced the critics' theoretical conceptions of science and technology? Typical encounters with science and technology in everyday life must have left their mark and strengthened otherwise rather abstract assessments of the technical artifacts and scientific knowledge. I will suggest that these essential and affirming encounters are experiences with 'frozen' or arrested technical artifacts and knowledge forms.

My aim is not an exegesis of the epistemological or theoretical ancestry of such views. I presuppose that the critique of modernity, insofar as it touches upon the rationality of science and technology, represents a form of civilizational critique that has accompanied the emergence of modern societies from the beginning. The critics of modern civilization flatly reject the claim that science and technology, as celebrated by its proponents, are socially and politically neutral. As Marcuse pointedly asserts: "Science, *by virtue of its own method* and concepts, has projected and promoted a universe in which the domination of nature has remained linked to the domination of man" (Marcuse [1964] 1989: 166). For illustrative purposes, I refer in some detail to two representative philosophical and sociological critiques of the interrelations between the social and intellectual fabric of society, knowledge and technology; namely, the analysis of modern science and technology by Herbert Marcuse and Helmut Schelsky.[16]

Marcuse's views of the role of modern science and technology gained considerable public resonance with the publication in 1964 of his *One-Dimensional Man*, subtitled 'Studies in the Ideology of Advanced Industrial Society'; but they can be traced back to his writings and those of both Adorno and Horkheimer in the early 1940s. Critical theory, in effect, abandons Marx for Weber on the issue of the emancipatory potential of modern reason. Marcuse observes at the time,

'National Socialism is a striking example of the ways in which a highly rationalized and mechanized economy with the utmost efficiency in production can operate in the interest of a totalitarian oppression and continued scarcity. The Third Reich is indeed a form of "technocracy" (Marcuse 1941: 414). In the case of National Socialism, politics is still a decisive force; yet technical knowledge is already seen as an indispensable instrument of political control.

A quarter of a century later, Marcuse assails the scientific mind and the transformation of knowledge into a form of scientific-technical rationality that has perverted the project of emancipation and has led to the human domination of nature. Marcuse (1964: 146) argues that such outcomes are inherent in science, that 'scientific-technical rationality and manipulation are welded together into new forms of social control' resulting in a kind of epistemic enslavement of modern individuals. Modern individuals become incapable of seeing and dealing with the world in any other manner, hence their entrapment.

The technical presumption of science becomes a political presumption and has consequences for human social organization because the transformation of nature, according to the logic of technology, also involves changes in the social relations of individuals. Whatever claims may be made on behalf of the essential political neutrality and potential of technology, Marcuse stresses emphatically, even against Marx, that a technology that has become the *universal* form of material production, "circumscribes an entire culture; it projects a historical totality – a 'world'" (Marcuse 1964: 154). In other words, the relation and respective implication of science and its technical application, and of the nature of the society that is thereby created, can in the final analysis only be viewed as an intimate connection that operates under the same logic. Technological reason and its universals, namely the discipline and control of production resulting in regimentation, the pursuit of narrow goals or specialization and the absolute uniformity of regimented and specialized labor or standardization, are bound to predominate throughout society.[17]

The same inherent force, the rationality of domination, soon propels the universes of scientific and ordinary discourse. All sectors of society, all social activities and all subjectivities are brought under the control of technical forms of discourse. The domination of nature and society go hand in hand. Science and society become reflections of the logic of technical rationality. Marcuse therefore concludes that the

"scientific method which led to the ever-more-effective domination of nature thus came to provide the pure concepts as well as the instrumentalities for the ever-more-effective domination of man by man *through* the domination of nature … Today domination perpetuates and extends itself not only through technology but *as* technology, and the latter provides the great legitimation of the expanding political power, which absorbs all spheres of culture" (Marcuse 1964: 158).[18] The resulting lack of freedom and autonomy appears neither as irrational nor as the result of political forces but as a 'rational' submission to the technical necessities of existence. In the final instance, therefore, instrumental reason becomes ubiquitous and turns life in society into a 'totalitarian' existence. The sphere of the political becomes, as in Schelsky's scientific civilization, the sphere ('the incessant dynamic of technical progress has become permeated with political content' [Marcuse 1964: 159]) and rationality becomes irrationality. The state becomes merely an expression of the technical base and is depoliticized. Social change will be arrested for the most part, especially by virtue of the power and the primacy of the society's administrative apparatus, and this containment of social transformations is perhaps the most singular achievement of advanced industrial society.

Marcuse's analysis of scientific rationality is highly abstract and lacks congruence with social reality, especially with the ways in which and the extent to which many modern individuals experience spheres of autonomy and responsibility. He provides no examples of how technological means are turned into mere means of social control and domination; for example, how the telephone or television invariably become instruments of domination. The reluctance of dictators to promote a modern telephone system in the early part of this century would indicate that they feared its subversive possibilities. To this very day, differences in economic and demographic factors do not satisfactorily account for the large disparities in the dissemination of the telephone in state socialist and capitalist societies after the Second World War (cf. Buchner 1988). But even more to the point is Alain Touraine's observation that Marcuse's theory of modern society lacks reality congruence: "The image of a totally unified society, in which there is a perfect correspondence between technology, firms, the State, and the behavior of consumers and even citizens could not be further removed from observable reality" (Touraine [1992] 1995: 159).

Helmut Schelsky's thesis that advanced industrial society is evolv-

ing into 'scientific civilization' was first expounded by him in a lecture in 1961 entitled 'Humans in scientific civilization'. For Schelsky, *modern* technology represents not merely an adaptive capacity to the constraints of nature, but a reconstruction of nature by society, and therefore of society. In the context of modern technology, humans no longer confront nature with the assistance of organs aided, improved and developed in their capacity by technology, but on the basis of a 'detour' via the brain, or the application of theoretical knowledge in practical contexts. The outcome is that, using the language Schelsky employs, an 'artificial' nature as well as an 'artificial' change of humankind itself. The result therefore is a "re-construction and re-creation of man … in his corporal, psychological and social existence" (Schelsky [1961] 1965: 16). We produce, as Schelsky observes, "the scientific civilization not only as technology but necessarily also in a much broader sense continually as 'society' and as 'soul'" (Schelsky [1961] 1965: 17).

Modern technology changes the relations of humans to nature, to themselves and to others. The result of this dual transformation is the 'circulation of self-determined production' (Schelsky [1961] 1965: 16) representing the real foundation of scientific civilization. The self-regulated and self-propelled nature of this process, the constant production and reproduction, evolves into a self-steering process which does not appear to allow for any escape:

> Every technical problem and every technical solution invariably becomes also a social, a psychological issue because the self-propelled nature of this process, created by man, confronts humans as a social and psychological dictate which in turn requires nothing but a technical solution, a solution planned and executed by man since this is the nature of the condition to be tackled (Schelsky [1961] 1965: 16–17).

Modern technology constitutes a particular logic, and this logic necessarily becomes the dominant logic of human life. One of the significant consequences of such a conception of technology is that the traditional 'logic' of technology reverses itself. That is, technology as a producer of mere means of human action becomes a producer of ends or meaning, or in other words, 'means' of action determine its ends and prefigure the direction of social change. Schelsky describes technology as an intellectual process which dissects varied natural objects into

their elementary parts in order to re-assemble them according to the principle of the least effort or maximum efficiency. The result of modern technological construction, therefore, is a novel product or process with *artificial* features and, in analogy, an *artificial* human being.

Schelsky's and Marcuse's theories evidently converge. They share the thesis that there is the distinct danger that technology in modern society will increasingly displace spontaneous social and political action and significantly reduce individual spheres of responsibility and autonomy, resulting, in the end, in the 'death of the self'.

Marcuse and Schelsky are by no means alone in their assessment of the trajectory of the social, political and economic development of advanced industrialized societies. Nor are they alone in attributing the societal changes they describe to intrinsic and enslaving 'laws' of science and technology. On the contrary, their observations and warnings resonate with a broad intellectual trend that actually began to take on its peculiar characteristic in the 1950s, when social theorists first noted distinctive and presumably irreversible trends in industry and production.[19] Social scientists asserted a tendency in industry toward increasing technological progress, manifesting itself in the rapid mechanization or *automation* of production. While the increased automation of production that is, as Marcuse (1964: 35) observes, inherent in technological progress itself enormously enlarges the output of commodities, it does not, as many observers then noted, make work more meaningful, demanding and challenging. The result is summed up by David Riesman and his collaborators in *The Lonely Crowd* (1950): Industry is now producing bored workers through simplified work routines, and the central meaning of life is increasingly shifting away from work toward a search for creative expressions in leisure activities.

Schelsky's and Marcuse's observations resonate with Bell's (1960) thesis about the end of ideology, as well as with the prognosis by Robert Lane (1966) that we are about to enter an age in which scientific knowledge increasingly dislodges the political element from politics. By the same token, the futurists Herman Kahn and B. Bruce-Briggs (1972: 8–29) in the early 1970s discern multi-trends within modern society that have been widely noticed by 'macro-historians', including the 'centralization and concentration of economic and political power' as well as 'innovative and manipulative social engineering'. The growing rationality that comes with the rapid ac-

cumulation of scientific and technical knowledge, according to Kahn and Bruce-Biggs, is increasingly applied to "social, political, cultural, and economic worlds" (Kahn/Bruce-Biggs 1972: 9). Although this trend may not accelerate, the desirability of social engineering is widely supported and an "almost universal belief among the educated" (Kahn/Bruce-Biggs 1972: 29).

The influence of ideological and, more generally, of political factors on scientific and technical developments remains unanalyzed, however. This suggests that the conventional central theoretical categories employed in the analysis of modern society, partly inherited by present-day social science from the past century, such as class or economy but also such notions as capitalist or socialist, have lost their crucial role in social theory. Observers were increasingly convinced that the distinction between capitalist and state socialist economic orders was becoming obsolete. At the same time, however, confidence in the power and the uniqueness of scientific knowledge remained strong. Raymond Aron ([1962] 1967: 42) embraced and highlighted these assumptions in his theory of 'progressive' industrial society. At the same time, questions about the motor of 'social change' or the centrality of the economic system for societal transformations were raised anew. It is at this time that theorists began to advance the thesis that technology and science, rather than the economy, are the real motor of societal change in modern social systems (cf. Parsons 1970: 619).

More generally, however, Schelsky's and Marcuse's accounts of the social and political force of modern science and technology suffer from an unintended but nonetheless misplaced confidence in the practical efficacy of scientific reasoning and quantification. Knowledge and technology are for the most part treated as a black box. The concern with technical artifacts is primarily functionalist. The major question posed concerns the psychological, social and political consequences of objects in the sphere of social relations. What exactly confers such power on objects is never examined. Marcuse and Schelsky presuppose an image of science and technology that then gives them reason to despair. One perceived consequence of technology and science, the extent to which the world of objects begins to dominate the world of subjects, paradoxically rests on an acceptance by both Marcuse and Schelsky of the positivist image of science as a most efficient, rational enterprise that produces highly useful devices

and knowledge claims. As a result, we must return to our initial question: what nourishes such a view of science and technology, in spite of Marcuse's and Schelsky's otherwise deep misgivings about such a science and such efficient technical objects?

At this point, we must take cognizance of some kind of phenomenological analysis of everyday experience and common sense understanding of science, especially regarding technical matters, that are not further investigated by Marcuse and Schelsky, even though they serve as starting point and as affirmation of their observations. The primary experience in everyday contact with technology is the *finished* product. The everyday experience of technology is not rooted in an understanding of the conception and fabrication, in short: The decisions that constitute the nearly always invisible 'technical code' of a matter and that co-determine the ways of using such technologies in everyday contexts are not manifest to the user.

Feenberg has provided us with a fruitful explication of the concept of the technical code: The technical code refers to those attributes of an object that

> reflect the hegemonic values and beliefs that prevail in the design process. Such codes are usually invisible because, like culture itself, they appear self-evident. For example, tools and workplaces are designed for adult hands and heights not because workers are necessarily adults, but because our society expelled children from the work process at a certain point in history with design consequences we now take for granted. Technical codes also include the basic definition of many technical objects insofar as they become universal, culturally accepted features of daily life. The telephone, the automobile, the refrigerator, and a hundred other everyday devices have clear and unambiguous definitions in the dominant culture (Feenberg 1995: 4).

While the technical code of an object originates or is provided in the context of its production, it is thus not yet necessarily decided how ultimately to handle an object – in the context of its use – as if it were natural. For this, the 'cultural code' is a further requirement, since it contributes to the decision of which possibilities for use are connected with an object. Technical and cultural codes may overlap, but they can also diverge. Ultimately, the cultural code can also change. In any case, technical and cultural codes more or less definitively limit the imaginative possibilities for use, and have as a consequence the fact

that everyday experiences with objects are primarily 'successful' experiences. And this counters the disappointments that naturally also continually occur, nonetheless probably basically confirming the confidence in the predetermined technical and cultural process of the object. The technical and cultural code endow the object with a specific process or even a purpose which will be fulfilled by it. The codes stabilize usage. Objects confer certainty. The degree of security that allows these coded processes to be reproduced again and again is then associated primarily with an image of reliability – although the goals that can be realized with this reliability can be of various different kinds. In any case, in the process an emotional connection with the object takes form. This certainty, security and reliability in principle in everyday dealings with technical objects at the same time induces, according to my thesis, a high degree of confidence in the efficiency of objects. The fact that connected with this efficiency there might at the same time be a feeling of helplessness or of the 'power of objects over us' is understandable. The limited technical and cultural code of an object, even if 'the radical constraints on possible integration of objects are in the interest of those integrations that serve to satisfy the needs of powerful individuals or groups' (Joerges [1979] 1996: 25) obstructs alternative possibilities for use and confirms one's helplessness in handling objects. This is, to be sure, nothing other than a reification of the dominant code.

A phenomenology of technology underlines some general observations by Alain Touraine about the actual role of technology in a society that is increasingly based on technology:

> We live in a society in which means were completely divorced from ends. Far from determining or absorbing ends, the same means could therefore be used for both good and evil ends, for both reducing inequality and exterminating minorities. The increasingly dense networks of technologies and signs in which we now live, and which orient and govern the ways in which we behave, by no means imprison us in a technological world and by no means destroy social actors. They impose neither a logic of efficacy and production nor a logic of control and reproduction. The image of technocracy triumphant is pathetically inadequate if we contrast it with the increase in consumption, the rise of nationalisms and the might of transnational companies (Touraine [1992] 1995: 148–149).

Prospects

In my view, efforts to police knowledge and to defend society against some of the anticipated but also uncertain effects of the utilization of recent gains in knowledge ultimately will do little to seriously limit its application, in one way or the other. But this will not keep various societal agents from trying.

One of the most immediate and controversial questions that awaits regulation and resolution as the result of evolving knowledge about the susceptibility to certain health risks in relation to specific genes is the question of how insurance companies (and other organizations and institutions), in particular health insurance companies, will use such information.

Private *health* insurance companies in Germany have announced (*Frankfurter Allgemeine Zeitung*, July 21, 2000: 17) that they plan to continue to use established procedures when it comes to a determination of calculating the risks individual applicants represent (also Murray 2000: 242–245; *Task Force on Genetic Information and Health Insurance*, 1993). That is, full disclosure of all relevant information is required. The applicant is under no obligation to disclose information she/he does not happen to have. A genome analysis will not, the insurer's indicate, become a prerequisite in issuing a policy. However, individuals who happen to such information, for example, as the result of taking part in a research study, are expected to divulge the genetic information.

But how is one to insure that insurance companies limit their usage of such information voluntarily? What exactly is genetic information? How broad or narrow can or should one define genetic information? And, how does one treat the interaction between genetic and non-genetic 'causes'? How does one attribute responsibility? Can an insurer acquire genetic information indirectly, for example, on the basis of a family history? Are special legal norms required? Genetic tests are bound to become more common, more accessible, and less and less expensive. Policing knowledge looks like work that Sisyphus might know.

Notes

1 By the same token, a report issued by the Rand Corporation (Fukuyama / Wagner 2000: 1) anticipates that in the early part "of the 21st century, the technologies emerging from the information and biotechnology revolutions will present unprecedented governance challenges to national and international political systems." The report deals with the governance of both research and knowledge policies.

2 The discussion and formulation of the novel moral principle for a "right to ignorance" by Hans Jonas (1974: 161–163) is germane in the context of this discussion.

3 The new political field I identify as 'knowledge politics' is, certainly, not immediately connected with the often-described ambivalent sense of crisis in modern societies, based on the over- and / or mass production of knowledge. The tension between the extent of knowledge production in advanced societies and the limited capability of the individual person to assimilate the huge amount of knowledge available, was already described by Georg Simmel ([1907] 1978) a hundred years ago in a theory of the current age in the final chapter of his *Philosophy of Money*. The tragedy of culture manifests itself in the cleavage between objective culture made independent and the obstinacy of subjective culture. The problem of the policing of knowledge is not related to the production of knowledge in total – even if it is related to overproduction, however that may be defined – but rather to the range of incremental knowledge, which is conceived as being capable of changing reality.

4 Dorothy Nelkin (1995: 447–456) has published an informative typological summary of the public controversies in which science has found itself embroiled in the United States in the past.

5 Steve Fuller (1993: 377) advances a similar assertion, as far as I can see. He indicates that 'in the world of tomorrow, breakthroughs in the natural sciences are regarded as triumphs of applied sociology and political economy, rather than of, say theoretical physics, chemistry, or biology'. It is better understood and presumed that the implementation of a specific knowledge claim can alter the social fabric of society and the anticipated transformation is no longer seen as mainly beneficial.

6 Cf. 'Kansas Votes to Delete Evolution from State's Science Curriculum', *New York Times*, National, August 12, 1999.

7 The regulation or the stratification of access to knowledge is nonetheless a constitutive component of everyday life. The world of adults, for example, is differentiated from that of children.These stratified worlds go hand in hand with the ability to impede or even to obstruct children's access to certain forms of knowledge. The quotidian forms of regulating access to knowledge are not under discussion here.

8 I am grateful to Günther Küppers for this observation.

9 Whether the public willingness to support the field of knowledge politics will intensify in connection with what some scientists have defined as a 'comprehension gap' among the population, or whether this willingness will have any significance at all, remains to be seen. In a lead article, the English Sunday paper *The Observer* (21 February 1999, p. 28) describes the perceived wide comprehension gap as follows: 'Between the scientific upper class, the latter-day Leonardos trekking into the brain or sketching the universe, and the majority of voters and politicians in all Western democracies, there is now a deep comprehension gap'. This deficit in comprehension, however, should not be underestimated in the sciences themselves either, given the growing division of labour among the disciplines.

10 A shift toward concerns with the externalities of science does not mean that contested efforts to regulate the conduct of 'scientific inquiry' (cf. Wulff 1979) and, for that matter, attempts to manage or plan scientific research (e.g., van den Daele/Krohn/Weingart 1979) will disappear. On the contrary, issues of ethics, accountability, and conflict, as they relate to the genesis and execution of inquiry, will of course remain highly significant. At the same time, discussions about the conduct of inquiry will be affected by anticipated outcomes of research.

11 My use of the concept of 'regulation' resonates with the way in which Steinmetz (1993) deploys the term to analyze the regulation of the emergence of the welfare state in Imperial Germany. This concept takes its distance from the economic literature on regulating the practices of capital accumulation (e.g., Jessop 1990) because that approach tends to rely on an overdetermined image of the ultimate efficacy of regulation practices.

12 The enlargement of the scientific community into an international or even global community is becoming a focus of reflection and research in science studies (e. g., Schott 1988; 1993).

13 Assessing the impact of the interventions by uncredentialed participants in biomedical research and in AIDS care, Epstein (1996: 346) concludes that 'the impact of the AIDS movement on biomedical institutions in the United States has been impressive and conspicuous [and] it has rapidly become something of a cliché to say that the doctor-patient relationship will never be the same in the wake of AIDS'.

14 As late as in the 1970s, confidence in the capacity of 'disinterested' scientists to resolve public issues in the area of space exploration, nuclear power or food additive regulation, etc., was still considerable and significantly exceeded confidence in other groups or agencies (cf. Miller 1983: 90–93; Jasanoff 1990: 12). The general decline in the last two or three decades among the public of developed societies of the trust in science and technology as a problem-solver, a trust that had hitherto been a core element of modernity, has been documented by Inglehart (1995: 391).

15 Chandra Mukerji (1989: 197) describes the trade-off: 'What reassures scientists the most when they face the power of the voice of science and their powerlessness to use the voice in the public arena is the idea of their autonomy. Scientists are not, in the end, politicians, and they suffer political defeats better than the loss of face among their peers. As long as they can conduct research with which they can advance science [both science itself and their positions in it], they can feel potent. But the cost is that scientists cultivate an expertise that empowers someone else'.

16 A more extensive description and analysis of both Schelsky's and Marcuse's critiques of the excessive power of modern science and technology in society may be found in Stehr 1994: 203–221.

17 The decisive outcome of these developments is that the workers are incapable of acquiring a critical view of the repressive social order. The 'masterly enslavement' is pervasive throughout society, affecting all individuals at all levels of production.

18 Theodor W. Adorno's ([1966] 1973: 320) image of the extension of the rule of nature to a rule over man by man is similar. Adorno warns that the "unity of the control over nature, progressing to

over man and finally to that over men's inner nature" is one of the enormous dangers of the present age.

19 The genealogy of Schelsky's and Marcuse's fears about the impact of modern science and technology is of course much longer. I will refer to Max Weber but could list many more observers who have expressed concerns about the fateful consequences of science and technology in the age of modernity. Marcuse's and Schelsky's diagnoses resonate closely with Max Weber's analysis of the modern age as a demystification of the world resulting from the growing rationalization of social relations through science and technology. Weber emphasizes the painful tension between rational, empirical knowledge and meaning systems found in the life-world. Moreover, Weber's intellectual 'grandchildren' often share an 'Exodus impulse', namely the attempt 'to explode the fatalistically closed "steel-hard casing" of the demystified world' (Bolz 1989: 7). Schelsky and Marcuse therefore also make use, although for the most part implicitly, of a long established radical as well as conservative (romantic) intellectual tradition that launched a highly critical and skeptical analysis of the impact of technology and science on culture and social relations.

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