Chapter 14
The Power of Scientific Knowledge and its Limits

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With few exceptions classical and contemporary sociological discourses have assumed that scientific knowledge will inevitably replace traditional forms of knowledge.[1] These latter forms of knowledge are portrayed as incapable of resisting the progressive dissemination of scientific knowledge. Traditional forms of knowledge are defined as institutionally based while scientific knowledge knows no time and place. It is further assumed that the carriers of conventional types of knowledge are not sufficiently powerful to slow or prevent their demise. Despite the broad consensus, thriving traditional forms of knowledge in modern society suggest distinct limits of scientific knowledge. This essay outlines the case made for the force of scientific knowledge in much of sociological theory but also examines the limits of the power of scientific knowledge, limits which are constitutive of scientific forms of knowledge rather than merely the outcome of resistance to the spread and dominance of such knowledge in contemporary society.

For decades it was the contagious optimism and, more rarely, the skeptical fascination with the apparently relentless success of modern science and technology that prompted social scientists to ignore the systematic practical limits of scientific knowledge as a theoretical issue. The present period, however, is seeing an apparently growing conviction that the widespread criticism of the practice of modern science and technology is both meaningful and pertinent. But whatever the intellectual grounds for the belief that practical limits of scientific knowledge do *not* represent a serious theoretical issue, the outcome is a rather elementary

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misunderstanding of the nature of and constraints to the social power of scientific knowledge.

An intensive examination of the interplay of scientific knowledge and social relations clearly ought to have priority. As Hübner ([1978] 1983: 214), reflecting the widespread agreement among social scientists now and in prior decades, recently observed: "the way in which present-day human society, as an industrialized society, understands itself rests, to a very great extent, on genuine technological-scientific forms and ideas". In spite of some exceptions,[2] earlier generations of social scientists shared this conviction[3] and anticipated either with fear or in disillusionment, an "age of science and technology", and an increasing rationalization of irrational forces.[4]

In a sense, this essay seeks to complicate a matter which has often been rendered increasingly simpler in the history of *sociological* thought. Proponents and opponents of modern science alike agree that scientific knowledge transcends traditional knowledge and, in modern society, tends to take its place (for example, Marcuse 1964; Schelsky [1961] 1964; Roszak 1972; Richta 1969; Bell 1972). Social scientists favour this assertion, despite the growing strength and acceptance of the *philosophical* thesis that common-sense concepts about things, persons, agency or

[2] The paradoxical condition, formulated less radically, that social action is necessary in contexts (still) unaffected by scientific knowledge, was already noted by Kant. The antirationalist then converts such a 'dilemma' into necessity: "Zu den Dingen, welche einen Denker zur Verzweiflung bringen können, gehört die Erkenntnis, dass das Unlogische für den Menschen nötig ist." (Nietzsche, *Menschliches, Allzumenschliches* 1,1)

[3] Max Weber's views about the vital omnipotence of modern science for instance are well-know. They can be found in the *Zwischenbetrachtung* in his *Gesammelte Aufsätze zur Religionssoziologie* (Weber 1978: 564). For Parsons (1937: 752), Weber's work culminates precisely in his "conception of a law of increasing rationality as a fundamental generalization about systems of action". This law constitutes the most fundamental generalization that emerges from Weber's work. Scheler ([1926] 1960: 207), for example, asserts essentially the same fateful development. Emile Durkheim's discussion, in *Elementary Forms of Religious Life,* of the conflict or reciprocal relations between science and religion also proceeds from the premise that science will displace religion, although Durkheim (1965: 574–7) is prepared to grant a continual though limited role to religious knowledge in modern society. Of course, not all sociological classics assign culture of modern society. Vilfredo Pareto celebrates and justifies the societal function of illogicality (as a capacity for action), though he attempts to do so on the basis of strictly logical reasoning.

[4] Compare, for example, Jaspers' ([1932] 1979) description in his *Spiritual Condition of the Age*, of the effect of technology on the nature of everyday life, on work, politics, the family, leisure, sports, language, education, the psychology of the modern individual etc. and the corresponding crisis of traditional forms of life. The crisis which affects science is not, for Jaspers, linked somehow to its ability to radically transform and alter the entire spectrum of modern life. He takes it for granted that this is in fact the case. But it rather lies in the extent to which science continues to be able to provide meaning to and for these profound changes (cf. Jaspers [1932] 1979: 125). The ability of science to offer meaning is not threatened, according to Jaspers, because science, in the broad sense of the term, is incapable of providing meaning in principle, but because the practice of science and scientists are subject to the same forces which make science more and more a reflection of the culture and of the structure of social relations it produces in modern society.

intention may have an immovable character as well as evidence of thriving forms of non-scientific knowledge in modern society. In general, I agree with the methodological and theoretical strategy for science which Geertz (1973: 33) succinctly states as follows: "Scientific advancement commonly consists in a progressive complication of what once seemed a beautifully simple set of notions but now seems an unbearably simplistic one."

The question about the limits of the power of scientific knowledge does not have any narrow boundaries. On the contrary, it raises a multitude of pertinent concerns which may be examined, moreover, from a variety of legitimate perspectives. Thus, some care, patience and space has to be devoted—more at any rate than is usual in essays of this sort—to *situate* the specific issue chosen for examination.

The literature relevant to my topic employs a great variety of notions to establish meaning for the concept of 'knowledge', for example. For the purpose of this discussion, knowledge can best be defined as constituting a *capacity for social action*.[5] And, in this broad sense, different forms of knowledge may indeed be seen as functional equivalents. In fact, much of the literature on the role of scientific knowledge in modern society clearly assumes that *it* can be a substitute for other forms of 'knowledge'. But the question then becomes, why and how one form of knowledge, for example, traditional knowledge, is replaced by or fails to yield to knowledge generated by science. The ability of scientific knowledge to dislodge other forms of knowledge is almost taken-for-granted and is seen to be linked primarily to superior cognitive attributes of scientific knowledge. I will inquire into this assertion. The power or the limits of scientific knowledge at issue here are consequently primarily intellectual or 'ideological' limits, that is, the limits built into scientific knowledge itself.[6]

Almost all social science studies of science are governed by the conviction, at least until very recently, that modern scientific knowledge is increasingly replacing traditional collective beliefs—as well as labor and property—as the dominant media of social organization (cf. Weingart 1981). The strategic theoretical resource which produces such agreement in social science discourse is an *institutionally-based definition of non-scientific forms of knowledge*—for example, of religious knowledge—and the concurrent classification of scientific knowledge as unaffected by time and place. As the functioned differentiation of society increases, it is argued, the net loss in the influence of institutionally-based knowledge grows while

[5] According to this conception, knowledge is a condition for the possibility of action. Obviously, scientific and technical knowledge are such capacities for action. And, in this regard, social and natural scientific knowledge do not differ. The definition of knowledge as a capacity for action does not prejudice scientific knowledge as a 'superior' form of knowledge. The term capacity signals also that knowledge may be left unused or may be employed for 'irrational' ends. Moreover, it indicates that the *use* of knowledge is related to the *local* conditions of action. For a much more extensive discussion of these notions cf. Stehr (1991).

[6] The term 'built into' intends to convey the sense to which a non-essentialist, contingent thesis will be pursued in the essay. The limits at issue are not somehow 'essential' to scientific knowledge as scientific knowledge.

scientific knowledge, not bound by any institutional limits, fills the void and deals with emergent problems.

The dissemination and social implementation of the knowledge generated in science, and in particular the transformation of discoveries and inventions into technical forms, are indeed undoubtedly the most important elements of modern societal development. However, this does not necessarily imply that displacement and elimination of traditional forms of knowledge follow on the heels of the successful implementation of scientific knowledge; nor is it permissible to conclude with certainty that scientific knowledge represents a precise functional equivalent or even replacement for non-scientific knowledge; or that the dissemination of objectified science as technology is linked to a rationalization of world-views.

I will discuss the social and cognitive conditions which limit the dissemination of scientific knowledge and, conversely, the conditions which foster the persistence of 'traditional' or everyday knowledge[7] (where such knowledge has not been transformed by science)[8] in contemporary society insofar as such persistence is the outcome of specific attributes of scientific discourse and its cognitive products. I begin with a critical examination of a couple of exemplary macrosociological theories of social change which consider scientific knowledge one of the crucial principles of social organization. This examination focusses on how these theories deal with the 'nature' of scientific knowledge and its unique position in modern society.

Theories pertinent to the question of the power and authority of scientific knowledge in modern society, although most in fact limit their analysis to the broad assertion of the salience of science in and for modern society, are varied. One of the purposes of the following section is to show the extent to which past and present theories in fact converge. The theoretical conceptions to which these remarks pertain, for example, are the Weberian thesis of the increasing rationalization of society; Georg Simmel's notion of a cultural tragedy; the dichotomy of civilization and culture, first explicated in Alfred Weber's cultural sociology; Ogburn's theory of cultural lag; the assertion of a professionalization of culture; and, finally, the theory of postindustrial society. However, I will limit my discussion to a brief description of Max Weber's and Daniel Bell's influential theories of modern and postmodern society.

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[7] This means that knowledge which is explicitly constructed to operate as a substitute (as competing knowledge) for scientific knowledge is not at issue here. The account of the origin of the universe offered by creationists as direct challenge to the account accepted in the scientific community would be such a form of knowledge (La Follette 1983; Montagu 1984).

[8] However, I do not intend to argue that non-scientific knowledge is somehow static; of course, everyday knowledge is affected by attempts to popularize scientific knowledge. A most incisive study by the historian Burnham (1987) demonstrates such effects on everyday knowledge: he shows how everyday 'superstitions' were transformed by efforts to decisively popularize science in the last one hundred years. The result is the emergence of something akin to a functional equivalent of traditional superstition, in direct response to attempts to popularize science.

14.1 Calculability and Power

Among the theoretical accounts in sociology of the overwhelming role of modern scientific knowledge, none has been more influential than Max Weber's world historical perspective of the practical impact of science on a rationalization and demystification process affecting ultimately all social relations. Weber ([1922] 1989: 13) describes this process and the special role of knowledge in his lecture "Science as a Vocation" in the following terms: "The knowledge or the belief that, *if one only wanted to*, one *could* find out at any time; that there are in principle no *mysterious, incalculable powers at work*, but rather that one could in principle master everything through *calculation.*" The profound transformation in ways of living implies a destruction of traditional forms of life and principles of organization but also of conventional beliefs as obsolete. Weber's views are representative for the prevailing theoretical reflections in sociology concerned with, in this instance, methodical approaches to life and social relations as well as bureaucratic forms of organization. The destruction of traditional social structures and ideologies is the other side of the coin of the irresistible advance of modernity. Shortly after Weber, Mannheim ([1929] 1940: 101) formulated the same idea more skeptically: "The chief characteristic of modern culture [perhaps][9] is the tendency to include as much as possible in the realm of the rational and to bring it under administrative control—and, on the other hand, to reduce the 'irrational' element to the vanishing point." The chances of a survival of non-scientific knowledge in modern society are evidently minimal.[10] The reliability of the kind of everyday knowledge dominant up to this juncture in time disintegrates as a result of the increasing complexity of social and physical systems (Boulding 1967: 690).

[9] The qualifying term '*womöglich*' here translated as 'perhaps' (or, alternatively, as 'possibly'), is missing from the translation of *Ideologie und Utopie* into English. This term represents a 'skeptical' qualification by Mannheim of the Weberian thesis about irresistible rationalization of modern social life. For further discussion of the differences in the English and German editions of Mannheim's *Ideology and Utopia,* see Kettler et al. (1983).

[10] As a result, Seyfarth (1972: 354), for example, demands "a greater emphasis of de-structuralized processes which attached themselves to emerging structures" as an important addition and qualification of the Weberian thesis of the one-sided emphasis of the broad structural transformation of modern life resulting from the increasing application of the calculability of social action. However, such a qualification does not necessarily revoke the thesis of the irreversible and irresistible success of a methodic form of life or the importance of examining the limits of rationalization beyond those Weber himself was prepared to recognize.

14.2 Post-Industrial Society

Among the present-day macro-sociological theories, Bell's (1972) theory of post-industrial society stands out. It is of particular interest in our context because Bell explicitly designates scientific knowledge as the ultimate source and engine of societal transformations. Bell's theory of society, which deals primarily with changes in the social structures of advanced (Western) society, has won more critical acclaim and attention than similar designs (e.g., Touraine 1969; Richta 1969). According to Bell, the spheres of social structure, the polity, and culture form the order of society. These three realms of society are not assumed to be strongly linked. Bell does not proclaim that changes in the social structure determine all other spheres (cf. Bell 1987: 1). His theory lacks, as a result, a deterministic center,[11] his conceptual framework, especially the differentiation of social structure, on the one hand, and polity and culture, on the other hand, are strongly reminiscent of the dichotomies between civilization and culture or material and adaptive culture (see also Bell 1975). The social structure can be differentiated into the economic, technological and occupational systems. The developmental logic which Bell considers to be the "axial principle" of his theory of society, is the centrality of *theoretical knowledge* as the source of innovation and the basis of policy formations. The importance of theoretical knowledge can perhaps be measured by indicating that Bell (1972: 344) is convinced that many if not all decisions in production and business, as well as in politics, will be increasingly based on the fruits of research and development. The decision-making process becomes ever more a technical process, although the role of science and technology is not given quite the same prominent role as in the context of the "end of ideology" debate (cf. Bell 1969; Lipset 1962). It was thought (Lane 1966: 659) that political criteria were about to vanish completely and give way to universalistic conventions produced by science (see also Vidich/Lyman 1985: 289–94).[12]

[11] Bell (1972: 119) elaborates on the consequences of his decision to examine primarily axial changes in the social structure by indicating that the analysis of such changes does not mean a "specific determinism between a 'base' and a 'superstructure'; on the contrary, the initiative in organizing a society these days comes largely from the political system. Just as various industrial societies—the United States, Great Britain, Nazi Germany, the Soviet Union, post-World War II Japan—have distinctively different political and cultural features, so it is likely that the various societies that are entering a post-industrial phase will have different political and cultural configurations".

[12] In contrast to Alfred Weber and William Fielding Ogburg, Bell (1972: 20) attempts to specify certain attributes of modern theoretical (scientific) knowledge and indicates that knowledge has always played a role in the functioning of society. But what is "distinctive about post-industrial society is the change in the character of knowledge itself. What has become decisive for the organization of decisions and the direction of change is the centrality of *theoretical* knowledge—the primacy of theory over empiricism and the codification of knowledge into abstract systems of symbols that, as any axiomatic system, can be used to illustrate many different and varied areas of experience. Every modern society now lives by innovation and the social control of change, and tries to anticipate the future in order to plan ahead. This commitment to social control introduces the need for planning and forecasting into society. It is the altered awareness of the nature of innovation that makes theoretical knowledge so crucial".

According to Bell, the post-industrial society is no longer organized around the axis of man and machine but around scientific knowledge. The transformation is reflected in a shift away from the importance of manufacturing to the service sector of the economy. This change is accompanied by a reduction in workers employed in manufacturing. The occupational structure witnesses a noticeable growth in the number of "professional and technical" employees. The new kind of work increasingly requires theoretical knowledge. Scientific workers are the most significant resource of post-industrial society. The privileged position of this "new class' or stratum,[13] implies that the ethos of society will increasingly derive from the ethos of science (cf. Bell 1972: 386; see also Lane 1966; Gouldner 1979). On the basis of what Bell optimistically calls new possibilities and modes of technological forecasting, post-industrial society will be capable of planning and controlling its technological growth, thus reducing the indeterminacies of economic development. An increasingly complex society develops a new intellectual technology, which emerges as a result of the necessity to replace intuitive problem-solving and judgments with algorithms and formalized decision-making rules. The greater dependence of social institutions on theoretical knowledge increases the societal and political significance of universities, research institutes and other intellectual institutions as producers and codifiers of such knowledge.

In his theory of post-industrial society, Bell draws a rather optimistic portrait of Western society (see also Dahrendorf 1977: 79–82). Some of the oldest dreams of mankind are close to reality. It will be possible, for example, to control social change. Progress and change in virtually all spheres of society, as well as different forms of knowledge, are dependent on the centrality and primacy of theoretical knowledge. While Bell does not explicitly take up the issue of the displacement of traditional forms of knowledge, it appears that he simply assumes that the dilution and replacement of traditional knowledge may be taken for granted (cf. Bell 1976: 4).

A much more explicit commitment in this respect may be found in the analysis of the distribution of forms of knowledge in post-industrial society by Holzner/Marx (1977). They assert that the structure of everyday knowledge in post-industrial society will change qualitatively and take on characteristics of scientific knowledge: "Common sense in post-modern, knowledge-based societies is much more flexible and open since it requires acceptance of varied, differentiated frames of reference and confidence that rules exist or can be discovered for their translation into each other. It also requires a fairly complex understanding of, and faith in, rationality as an encompassing code that admits of differential specifications and modes of expressions, but also provides for their ultimate mutual intel-

[13] However, one ought to keep in mind that Bell (1979) expresses severe doubts that the notion of a "new class" itself is of great theoretical value.

ligibility" (Holzner/Marx 1977: 20).[14] Significant aspects of everyday knowledge function as "an orientation to sources of needed information and procedures for gaining access to specialized bodies of knowledge and their expert practitioners" (Holzner/Marx 1977: 25).

14.3 Knowledge as a Natural Force

I have limited my discussion to two representative theories of macrosocial change which assign particular importance to scientific knowledge, in order to demonstrate that the notion of knowledge, despite its apparent theoretical centrality, is treated as a black box, as a kind of mysterious natural force beyond the control of individual and corporate actors. Scientific knowledge does not constitute, according to these theories, a specific form of life nor a principle of social organization. Scientific knowledge is treated as a universalistic category, not as a varied cultural resource. As a means of organizing activities within the economy and the state it becomes the dominant resource, yet, in the final analysis, it is viewed as a medium beyond the control of actors. Equally clear, at least as an implicit assertion, is the thesis that these means of organizing social life must penetrate and affect traditional ways of life and displace these obsolete expressions and processes. However, in the context of these theories, neither the origins of modern science and modern scientific knowledge, the peculiar qualities of scientific knowledge claims, nor the ways in which and the reasons why such knowledge travels well, are examined sociologically in any serious sense. And in this neglect, virtually all theories of societies have many surprising communalities. For example, when Habermas ([1981] 1983: 159) observes that Max Weber considers the history of science and technology a central aspect of the development of Western culture "but in his *sociological* attempt to *explain* the origins of modern society", Weber treats it rather as a boundary condition, then this observation is actually self-exemplifying because much of critical theory is similarly based on an equally simplified version of scientific knowledge.[15]

The scientistic conception which underlies the theories of Max Weber and Daniel Bell reflects the still dominant view of the development of science and scientific knowledge as a semi-automatic process. The theory of science adopted by these authors asserts that neither the expansion of scientific knowledge nor its wide application is, in any serious sense, affected by local socio-historical circumstances. Scientific labor, scientific discourse and the practical use of scientific knowledge

[14] But Holzner/Marx (1977: 23) observe, at the same time, that the *contents* of everyday knowledge will be affected much less by scientific-technical knowledge because "the consequence of modern science and technology has not been to overwhelm common sense views and render them insignificant, but to modify them somewhat and increase their cultural significance to the point where they represent the unique and distinguishing characteristic of post-modern society". But his assertion is clearly quite abstract and, perhaps by design, ambivalent.

[15] Cf. Habermas (1982: 274).

are, according to this conception of the nature of science, generally homogeneous and ahistorical processes. The technical successes of science develop in unison with the expansion of scientific rationality into social conduct. In particular, the penetration of social relations by scientific rationality in the form of increasing planning, control, systematization of decisions and even the "formation of drives or impulses", as Mannheim (1935: 41) speculated, is judged to be a realistic outcome of an extensive employment of science in society. It is entirely possible and part of the logic of these theories that saturation with scientific rationality, and, with technology, is a gradual and uneven process. In principle, however, it is not felt necessary to distinguish between them. On the contrary, the two processes melt into each other and their consequences become a unity. As a result, the notion of 'scientificity' (*Wissenschaftlichkeit*) is treated within the theoretical frame of reference, on the one hand, as a natural component and, on the other hand, as immune to any sociological analysis. A sociological analysis of the development of scientific knowledge and technology is considered to be impossible in principle because its evolution is subject to entirely separate regularities.[16] The separation between scientific and non-scientific knowledge is, moreover, viewed as an impenetrable boundary and not as the expression of an historical process (Böhme 1978: 44–47; van den Daele 1975). Error and ignorance are considered, in so far as these theories of macrochange address the question of everyday knowledge and non-scientific knowledge at all, as static elements. Once scientific knowledge expands, its practical realization is virtually unproblematic. No loss of identity occurs in the process. Finally, a frequent and implicit assumption is that scientific knowledge is the most authoritative form of knowing (and doing) and is obligatory.

These scientistic conceptions which inform most of our understanding of the role of scientific knowledge in society have, however, been questioned and replaced by a more socio-historical conception of the development of science and scientific discourse.[17] This change enables me to consider the continued presence of non-scientific convictions not merely as an expression of delayed backwardness but to justify the question, to what extent are sociologically relevant features of scientific knowledge itself responsible for the apparent limits of the power of such knowledge in contemporary society?

[16] It is not surprising, therefore, to encounter many theories of society which advance and defend an understanding of science and technology which is linked to a prohibition of a sociology of scientific knowledge, in as much as such a position is reinforced by the classical sociology of knowledge and science which is animated by and faithful to the same conviction about its own limits (see Mulkay 1979; Stehr/Meja 1981, 1984).

[17] The literature which deals with the origins and the nature of this cognitive change in the philosophy, history and sociology of science has, in the meantime, grown considerably; an overview may be found in Brown (1984).

14.4 The Limits of the Power of Scientific Knowledge

There are a number of theoretical positions worth brief examination, though they do not directly address the issue of the possible limits of scientific knowledge from the point of view of such knowledge. However, these positions are, for the most part, the outcome of theoretical or empirical work concerned with other matters; moreover, despite suggestions about possible limits of scientific knowledge, such restrictions to its power are considered to be marginal at best, especially in the long run. It is rather difficult to separate, as will be seen, an examination of the nature of scientific knowledge from certain important features of social practice to which such knowledge is seen to apply and where it is widely expected to command considerable assent. In the final analysis, however, I would like to highlight those limits to scientific knowledge which are constitutive of such forms of knowledge.

14.4.1 Thinking Against Knowledge

Scientific knowledge has always had its opponents. Social strata and groups which have resisted scientific knowledge, may have developed a style of thought which has articulated opposition quite effectively and has contributed to a slowing in the pace of the dissemination of scientific knowledge.

As the capitalistic process of rationalization and the spread of rational conduct to many spheres of life go hand in hand with the development of modern science and technology, so does a critique of capitalism depend on criticism and opposition to modern technology and a rationalist style of thought. The critique of the capitalist economic system is inaugurated by an opposition to it from the conservative position of the political spectrum (cf. Mannheim [1925] 1986: 63–71).

Some of the basic features of the emerging conservative style of thinking and experiencing, in response to the Enlightenment and the capitalist economy, include, according to Mannheim ([1925] 1986: 100),

> […] its experience of the qualitative, its concrete rather than abstract ways of experiencing, its experiencing on the grounds of what is and not what ought to be, its experience of imaginary spatial relationships in contrast with the linear experience of historical development, its substitution of landed property for the individual as the substratum of history, its preference for 'organic' associations over '- classes', and others.

Modern science strives to generate experiences which are generally demonstrable and universally valid. As Mannheim ([1925] 1986: 60) explicates further, science constitutes a project which strives for "socializable knowledge" in stark contrast to the kind of cognitive insights emphasized by conservative thinking which are possible and accessible only to particular, more circumscribed "experiential communities" (*Erfahrungsgemeinschaften*). The conservative argues, therefore, against scientific knowing to the extent that it involves an indifference towards all specific and concrete elements in the object or can only be demonstrated to a

particular experiential community. For the conservative, scientific knowledge eliminates, to its own detriment and that of all human beings, "all *particular essential references* to man, nature, and things in which every piece of knowledge comes embedded" (Mannheim [1925] 1986: 61).

During the era of the Weimar Republic and the Nazi period, a rapprochement can be observed in the work of influential conservative intellectuals, especially Hans Freyer, Werner Sombart, Ernst Jünger, Carl Schmitt and Oswald Spengler, of 'culture' and technology. Herf (1983) has called the sympathetic connection between what used to be contradictory categories in conservative-romantic thought, an expression of "reactionary modernity". The genesis of this rapprochement may be traced to experiences of this generation of intellectuals during the First World War and the pragmatic political realization that certain national goals could only be reached in conjunction with an affirmative attitude toward modern technology. At the same time, intellectual resistance against the Enlightenment and its aims no longer required opposition to the manifestation of modern technology. The ideology of National Socialism in Germany represents the most radical manifestation of such a connection between *Innerlichkeit* and technology (Benjamin 1961). The rapprochement between conservative thinking and technology affirms the fact that technical-industrial modernization does not need to go hand in hand with the modernization and rationalization of intellectual life.

The present-day critique of science and technology resembles, to some extent, the conservative assault on science in the 1920s, although conceptual similarities cannot disguise essential differences. Among the resemblances are the shared conviction about the potency of scientific knowledge and technical artifacts and the belief that scientific rationality may somehow be monopolized in the hands of a few, forming the basis for the exercise of power in social relations. How else is one to interpret the persistent warnings about an impending "imperialism of instrumental rationality" (Weizenbaum), the danger of an aggressive "colonialisation of the life world" (Habermas), or the unavoidable "Taylorisation of the world of work" (Volpert)?

14.4.2 The Compartmentalization of the Life-World

Not only explicit resistance against a particular style of thought may limit the success or channel the dissemination of scientific knowledge, but the differentiation or compartmentalization of the life-world into more or less separate spheres may impede the process of the dominance of scientific knowledge. Moreover, individuals and groups can hold scientific and non-scientific beliefs concurrently.

Mannheim ([1925] 1986) has pointed out that the capitalist-rationalist process may have limits or be capable only of partially supplanting existing views and social processes. While the realm of public social relations is rationalized, the sphere of private relations and convictions might be more immune to transformation. Even strata, Mannheim ([1925] 1986: 64) suggests, at the forefront of the

rationalizing process "did not entirely lose their original bearing towards life. It merely disappeared from what we may call the foreground of their *public* and *official* life. Their *intimate* relationships, insofar as they remained untouched by the capitalist process, proceeded in a non-calculating, non-rationalized manner. The relationship to life did not become abstract in these spheres". In fact, the phenomenon of gradual disappearance and recession into intimate spheres of certain public spheres, that is, into spheres of life in which personal and religious feelings prevail, complements the rationalization of work and exchange, among other realms (see also Elias [1939] 1978). But as Mannheim himself indicates, the spheres of life which retreat into intimacy are those left untouched by the process of rationalization. They do not remain unaffected, however: these intimate spheres evidently live a fragile and precarious existence.

Simmel's analysis of the limits of the 'intellect' are specific. He speaks about its averaging or levelling character and close proximity to the principles of individualism and egoism. In particular, in the *Philosophy of Money*, Simmel ([1907] 1978: 437) asserts that the nature of the (objective) contents of the intellect can be communicated universally and that, assuming its validity, everyone with a sufficiently predisposed mind will be persuaded by it. In this respect, there is no analogous function in the sphere of the will and the emotions. The basic antagonism of (individual) reason and inner feelings becomes evident further by virtue of the fact that the "contents of the intellect […] do not possess the jealous exclusiveness that is common in the practical contents of life". The distinction between intellect and emotions finds its analogy in the dichotomy between means and ends; both fulfill distinct functions and cannot be substituted for one another:

> Certain emotions, for example, involved in intimate personal relationships, would completely lose their significance and value if others were entitled to share them. It is also essential for certain objectives of the will that other people are excluded from both pursuing them as well as gaining them. It has been rightly suggested that theoretical notions, on the other hand, are like a torch whose light does not become dimmer by igniting innumerable others from it. In as much as their potential boundless dissemination has no influence whatsoever upon their importance, they elude private ownership more than any other contents of life. (Simmel [1907] 1978: 437–8)

14.4.3 Mythological and Scientific Truths

In Durkheim's lectures on "Pragmatism and Sociology", delivered shortly before the First World War, a prominent place is reserved for consideration of the dichotomy of mythological and scientific knowledge. Mythological truths are accepted without further inquiry and testing, while scientific truths are always subject to verification and proof. The persuasive character of mythological knowledge, its constraining and objective nature, is linked to the fact that such knowledge is collective knowledge. But mythological knowledge is by no means unconnected to reality. The reality represented by mythological truths is the reality

of society. Mythological knowledge is erroneous with respect to things or objects but it is true in relation to the thinking subject (cf. Durkheim [1955] 1983: 87). Scientific knowledge is, for Durkheim, also a form of collective consciousness. However, scientific knowledge becomes possible only in a society which is differentiated. Mythological and scientific knowledge correspond in many ways to organic and mechanical solidarity. The function of scientific truth is therefore to mediate and strengthen the collective consciousness. The difference between mythological and scientific knowledge may be found, above all, in their respective relationship to collective beliefs and individual consciousness. In other words, scientific thought like mythological knowledge, can form the basis for social solidarity. But what are the preconditions for social communication? According to Durkheim ([1955] 1983: 88), "either by uniting to form a single collective mind, or by communicating in one object which is the same for all, with each however retaining his own personality; like Leibnitz's monads, each expressing the entirety of the universe while keeping its individuality. The first way is that of mythological thought, the second that of scientific thought". Scientific knowledge represents and expresses societal formations and their state of development, in which individual differences and individualism are the foundation for collective solidarity rather than a threat to it. Durkheim ([1955] 1983: 92) therefore concludes that "intellectual individualism, far from making for anarchy, as might be expected during the period of the domination of mythological truth, becomes a necessary factor in the establishment of scientific truth, so that the diversity of intellectual temperaments can serve the case of impersonal truth".[18]

However, Durkheim is not as certain as Comte that scientific truths will displace mythological claims rapidly and completely. Durkheim suggests that it must be assumed that the power of scientific knowledge is, for the time being, limited to the world of physical objects. Sociology is faced with a most complex domain and therefore at best able to produce frail and limited hypotheses. Moreover, these knowledge claims have not affected public consciousness to any great degree. Social action is subject to constraints, especially to the pressure to act, and cannot be postponed until a scientific solution of social issues is at hand. Society is forced to operate with certain images of itself. The relative backwardness of sociology and the uneven development of science assures the survival of mythological claims. Mythological knowledge does not lose its social relevance fully, even in societies in which natural scientific knowledge appears to dominate. Actors are constrained to orient themselves in specific ways and the kinds of orientations provided by mythological truths are capable of serving as orientation for action. More generally, Durkheim ([1955] 1983: 91) insists that scientific truths cannot govern or dominate orientations by themselves because "there is, and there always will be, room in social life for a form of truth which will perhaps be expressed in a very secular way, but will nevertheless have a mythological and religious basis". What Durkheim has concretely in mind, are ideas or taken-for-granted 'dogmas' such as 'democracy',

[18] I have changed the translation slightly to capture the original meaning.

'progress', "the class struggle" which continue to contain, since they are rarely questioned, mythological components. Although Durkheim by no means suggests that the co-existence of scientific and mythological truth is inevitable, or even a fate we must bear and cannot transcend, the elimination of mythological claims will require a considerable period of time.[19]

14.4.4 Organized Knowledge and Traditional Knowledge

In contrast to these conceptions, there are accounts within sociological discourse about knowledge which imply, in the final analysis, that scientific knowledge is limited in its social effectiveness, although these limits are fixed a priori. The most important perspective[20] in this respect is derived from linguistic rather than sociological theoretical themes. A main example holds that the language of science, as differentiated from everyday language, cannot be formalized fully. Related is the sociological thesis that scientific knowledge is ultimately based on other forms of knowledge and cannot entirely relinquish ties to them, in particular everyday knowledge, and that specialized scientific knowledge cannot replace everyday knowledge (Luckmann 1981). Cicourel (1986) maintains, for example, that medical knowledge is dependent on everyday knowledge (*declarative knowledge*). The sociological variant of this argument points, therefore, to structural differences among forms of knowledge which perform different functions. Related to this conception is the thesis that, under more or less stable social conditions, the demand for traditional knowledge does not decline decisively. Finally, to this context also belongs the idea of competition among carriers of knowledge (cf. Znaniecki 1940; Böhme 1981). I would like to pursue, in greater detail, the notion of how structural features of knowledge depend on the conditions and the context of their production.

A critical analysis of the limits of the social power of scientific knowledge must incorporate some understanding about the special nature *as well as* the similarities of scientific and non-scientific knowledge and action. It can be shown that, from a *sociological* perspective, the dominant basis for the classification of scientific knowledge as a unique form of human knowledge is of limited use for the purposes at hand. That is, the dominant classification and attributes of scientific knowledge are linked too closely to now obsolete epistemological conceptions of science—notions and ideals of scientificity such as universality, experience, rationality,

[19] For Durkheim, the co-existence of mythological and scientific truths constitutes also a significant hurdle for the progress of sociological knowledge. On the other hand, one expects sociology to serve a crucial function in the establishment of any future dominance of scientific truths in the collective consciousness of society.

[20] The linguistic conception about the limits to scientific knowledge are of particular importance because it tends to be taken seriously within science itself, especially among theoreticians of knowledge and science. Its attractiveness to epistemology could well be linked to the fact that it allows the invocation of *logical* or formal considerations (cf. Goedel's Theorem).

necessity, practicality. Conceptions of scientific knowledge which are based on these attributes deny that scientific knowledge is socially based and a collective enterprise. They also ignore the fact that science is an historical enterprise. Merton ([1942] 1973) has suggested that everyday knowledge has a greater measure of plausibility and comprehension than scientific knowledge for most people as well as considerable substantive affinity to existing cultural 'prejudices' and so constitutes a possible source of competition for scientific knowledge claims, at least in everyday practical circumstances. Merton's conception is useful and indicative of an early theoretical conception of the limits of scientific knowledge which has the merit of transcending considerations primarily driven by epistemological concerns. Toulmin's (1972: 378) characterization of specific organized human activities may be seen as an initial way of delineating the conditions for the possibility of (organized) scientific knowledge, a superior basis of classification: "[…] human activities and enterprises […] in which decisions are made, procedures followed, considerations taken into account, conclusions arrived at, new possibilities entertained, and 'reasons' given for the resulting conclusions or actions". But, as Toulmin indicates, not all human activities and decisions can be subjected to corresponding organized forms of scientific discourse.[21] Such limits are designed to stress, on the one hand, the special circumstances which prevail in the production of scientific knowledge, affecting the structure and the possibilities of reproducing such knowledge; and, on the other hand, that the special organizational form of scientific discourse does not extend to and incorporate the entire range of human problems, themes and issues. Toulmin's delineation of scientific discourse may serve, nonetheless, as a first approximation of the practical limits of scientific knowledge.

Toulmin's reference to scientific discourse as differentiated spheres of social action (see also Lepsius 1983) with special attributes, especially in the case of scientific laboratories, isolated from other social contexts, makes it evident that the structure of knowledge produced under these circumstances affects its reproduction in other social contexts. The specific attributes assumed by scientific knowledge under these conditions may be thought of as 'material' and cognitive attributes, but both sets of features impinge upon the conditions under which scientific knowledge may be reproduced.

First, I will consider what may be called the material attributes assumed by scientific knowledge as a result of the conditions of its production. Knowledge claims or knowledge effects produced under special conditions in scientific laboratories can undoubtedly only be reproduced outside the laboratory if the special conditions which allowed such outcomes are also reproduced outside the laboratory. That is, the special circumstances which allowed for the original observation

[21] Toulmin (1972: 405) stresses that "the boundary between disciplinable and non-disciplinable activities runs where it does because, in the course of their practical experience, men have discovered that it is both functionally possible and humanly desirable to isolate certain classes of issues, and make them the concern of specialized bodies of inquiries; while with issues of other kinds this turns out to be either impossible, or undesirable, or both at once".

of the effect must be extended to the context in which a successful transfer is to be made (Rouse 1987: 227). Thus, the notion that scientific knowledge, unlike other forms of knowledge, is not bound or limited institutionally, has to be questioned in light of the conditions necessary for the reproduction of scientific knowledge claims outside the circumstances of their initial discovery. It is by no means certain, in other words, that it is only the influence of conventional forms of knowledge that contracts as the functional differentiation of society progresses and once powerful institutions such as religion as well as institutionally-based knowledge in general diminishes in importance.

Secondly, knowledge claims not only take on features derived from the material conditions of their production but also reflect institutionally bound cognitive attributes. These attributes include a *suspension* of the pressure to act as constitutive of scientific discourse. Knowledge produced within the scientific community is released from the tasks it must perform outside of science. One of the most salient attributes of everyday life situations is, in contrast, the persistent constraint to act, the pressure to reach a decision, to observe a specific rule, to follow a particular course of action by discarding alternative possibilities or to provide an account of completed action ex post facto. This suspension of the constraint to act within scientific discourse may be described, on the one hand, as a virtue of intellectual activity taking place under privileged conditions which moderates the effect that the pressing interests, rapidly passing opportunities and ambiguous dependencies of everyday contexts can have on the production of scientific knowledge claims. On the other hand, the result of this suspension of the pressure to act is that scientific knowledge takes on qualities of incompleteness, provisionality, fragmentariness or expansiveness, which reduce its effectiveness as knowledge in circumstances in which action is the foremost requirement. For as Durkheim ([1912] 1965: 479) observed so well: "Life cannot wait" (cf. also Gehlen [1950] 1988: 296–7).[22] In most social contexts the need to act takes precedent over the need to know. Perhaps there is, as Simmel (1890: 1) surmises, a kind of anthropological constant in the form of a general and widespread preference among humans, namely to 'do' something rather than to know about something and knowing, in turn, may flow or require prior doing.[23] In his lectures on "Pragmatism and Sociology", Durkheim ([1955] 1983), discussing the scientific status of the discipline of sociology, refers to the same set of issues when he attempts to enumerate some of the reasons for the relative scientific backwardness of sociological knowledge. He underlines, for example, that the fragmentary and uncertain knowledge of sociology cannot but produce skepticism or doubt about the contingencies of practical action in the social

[22] Incompleteness or the lack of any impetus to action is constitutive for scientific knowledge: "Faith is before all else an impetus to action, while science, no matter how far it may be pushed, always remains at a distance from this. Science is fragmentary, and incomplete; it advances but slowly and is never finished." (Durkheim [1912] 1965: 479, compare also Luhmann 1983: 154–9).

[23] Though there is no direct textual evidence, Simmel's early observations may have been prompted by Goethe's dictum *Im Anfang war die Tat* ("in beginning was the deed") since Goethe's sentiments about the priority of doing over knowing were no doubt well-known to Simmel.

world. This might be appropriate with respect to natural science knowledge, but we have to live in the social world, and to live means to act. "[S]ociety cannot wait for its problems to be solved scientifically. It has to make decisions about what action to take, and in order to make these decisions it has to have an idea of what it is" (Durkheim [1955] 1983: 90). As a rule, scientific knowledge is, however, produced under conditions which consider 'waiting', distancing, careful reflection, the elimination of time-bound constraints to reach a decision or even the deliberate abstention from a judgment until the 'evidence' is in, a distinct attribute of the validity and the virtue of such knowledge claims. By reducing, and at times even eliminating, urgency as a part of the production process of scientific knowledge, gains for the point of view of epistemological ideals contrast with deficiencies from the perspective of everyday life in which urgency to act becomes a constitutive characteristic of action impossible to neutralize.

Laboratory studies of the production of scientific knowledge (e.g., Latour/Woolgar 1979; Knorr-Cetina 1981) show as well that the knowledge claims produced in science, which are neither based on nor an expression of an unique or special form of rationality or logic, result primarily in claims to non-local knowledge. Indeed, the site for the production of scientific knowledge does not differ much from the sites for the production of conventional or everyday knowledge. From this it follows that scientific rationality, once it appears outside the boundaries of the scientific community—for instance, in the form of expert knowledge in the determination of curricula, the allocation of public funds for research, or as expert witness or counsel—often is followed by severe disappointment in the eyes of the public because the scientific knowledge fails to display the expected reliability and consensus (cf. Barnes 1972).

In addition to these considerations following Bourdieu ([1980] 1987), for example, it is possible to assign to practical contexts a logic which is less stringent than the logic of logic. The social scientific analysis of everyday contexts reduces the urgency to act in such situations. The effect which is achieved might be called a depragmatization of everyday contexts or the elevation of practical circumstances to the level of theoretical contingencies. At the same time, the depragmatization of everyday contexts through social scientific discourse makes visible features of the former which offer resistance against theoretical transformation. Among them are aspects of a *practical* logic such as the ease of operation and control, subjective adequacy, economy and its practical persuasiveness represented in the union of a totality of judgments and their ambivalence. This opposition of practical and theoretical logic prompts Bourdieu to draw the radical conclusion that any theoretical reconstruction of practical situations amounts necessarily to a distortion of the 'truth' of praxis. The peculiar character of practical circumstances happens to be that it resists theoretical reconstruction because the truth of praxis resides in its blindness to its own truth. Scientific discourse and praxis have different purposes and attempt to realize different functions.

14.5 Science and Ignorance

I have already indicated that the assumption of the irreversible and forceful progress of scientific knowledge and the concomitant demise of traditional forms of knowledge, which cannot measure up, in its practical efficacy, to knowledge produced by science, includes the assertion, at least implicitly, that only scientific knowledge advances while non-scientific forms of knowledge are void of any transformational capacity. The same thesis of the inefficacy of conventional knowledge asserts, finally, that such knowledge is not really capable of defending itself. The conviction that traditional forms of knowledge are essentially helpless finds its parallel in the belief that scientific knowledge reduces the volume of conventional knowledge consistently rather than adding to it.

Is, however, the pool of conventional knowledge merely static knowledge? As a matter of fact, in an age of somewhat reduced enthusiasm for scientific knowledge, the idea that science might well be one of the important sources of the growth and the transformation of conventional knowledge becomes more plausible (cf. Brzezinski 1970: xii). When Ravetz (1986: 100) suggests, for instance, that "while our knowledge continues to increase exponentially, our relevant ignorance does so even more rapidly. And this is ignorance generated by science", he alerts us to the possibility that advances in scientific knowledge and their practical application are accompanied by a wide range of unsolved problems, often in the forms of risks, and by unanticipated consequences. From the point of view of scientific discourse, "scientific progress" produces immediately and incessantly non-knowledge or even ignorance (i.e. "certified ignorance"). In an indirect manner, therefore, the production of scientific knowledge and its realization—for example, in the responses of affected groups and individuals to unintended and unexplicated consequences, multiple risks and costs—contributes to the persistence and transformation, perhaps even expansion of conventional knowledge. Of course, these patterns occur in response to developments in science and their dissemination to and translation into practical contexts. But as a result science itself can be seen to represent a source for the perpetuation and the dynamics of traditional forms of knowledge in society.

14.6 Conclusions

The point of departure of my considerations was the widely-held view among sociologists, past and present, that, as Weingart (1981: 228) perceptively points out, our primary means of action orientation, are replaced "in more and more spheres of life, by the production *and* application of systematic knowledge" and that this process of replacement occurs as different aspects of life become successively the object of scientific scrutiny. Concretely, the displacement in dominant forms of knowledge implies that, on the basis of scientific knowledge, "different frames of reference and modes of attribution are established for social action and/or existing

orientations are proven to be irrational or erroneous with respect to accepted purposes". The result is, according to Weingart, that "reflective reasoning, in light of competing components of systematic knowledge, takes the place of the internalization—on which its taken-for-granted status depends in the first place—of norms and values".

I have tried to show that this assumption about the powerlessness of non-scientific knowledge represents one of the more important themes on which both classical sociologists and theorists of present-day society concur. These ideas are injected into sociological discussion, sometimes in the form of prophecies and dire warnings about the impending destruction or colonization of traditional ways of life, but mainly in the form of a black box thesis. The thesis about the power of scientific knowledge becomes, in an unreflective manner, a premise of theoretical work and assumes, for the most part, a taken-for-granted status.

I have critically examined the premise of the unlimited power of scientific knowledge by suggesting constitutive features of scientific knowledge itself which could be seen as co-determinants for the social and intellectual limits of such knowledge. The perspective adapted implies, of course, that I could also pursue the question of the unique 'functions' of conventional forms of knowledge in modern and highly differentiated societies. Undoubtedly, traditional knowledge too has specific constitutive features which assist in its resistance to competing knowledge claims and helps its survival even in societies which have achieved a high degree of scientification. While scientific knowledge becomes itself more and more differentiated and represents, without question, one of the motors of many social transformations, to the extent that contemporary society is a society built by and on scientific and technical knowledge, the same dynamism does not apply to traditional knowledge. Conventional knowledge is somehow an island of tranquility within the storm of functional differentiation. Such observations and the repeated complaint about the consequences of 'dilettantism' and extreme 'specialism' may in fact be taken as a point of departure for a more systematic inquiry into the peculiar role conventional forms of knowledge may play as media of social interaction and as social cement. Or one may assert with Mannheim ([1929] 1940: 170) that politics as politics remains possible only as long as the sphere of the irrational exists; where it tends to disappear, "administration takes its place". The theoretical and empirical challenge remaining is to bring into union the analysis of the interaction of those forms of knowledge which are characterized by changeability and recalcitrance.

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