Vol. 24(1) 1978 pp. 65-70

Can Scientific Development be Stopped?

Brian Martin

The idea that scientific development cannot be stopped is not only inadequately posed and historically incorrect, but serves as a cover for a commitment to particular social and political values.

"We cannot stop scientific development." (Messerle, 1977)

"An attempt to stop the development of a proven scientific advance has never succeeded." (Marffy, 1977)

"Progress cannot be and will not be stopped, and I know that Plowshare [use of nuclear explosives for natural gas production, canal digging, etc.] will proceed." (Teller, 1970)

". . . the growth of knowledge and know-how has no intrinsic limit." (Medawar, 1969)

Statements similar to these are often heard in conversation or found in non-research publications. Usually they are made in support of some controversial technological development, such as supersonic transport aircraft or nuclear power production. What is the significance of such statements?

Superficially, the statements represent a belief in the autonomous development of science and technology. This belief is more widespread than the existence of such quotes would indicate. It represents a fundamental premise underlying the study of the history, philosophy and sociology of science, at least until recently. This 'internalist' school of thought is represented by such scholars as A. R. Hall, Karl Poper and Joseph Ben-David. It is only in recent years, when belief in the inevitability of scientific and technological progress has become increasingly eroded, that it has even been necessary for scientists to state explicitly this assumption. And because the eroding of this belief has proceeded most rapidly as a result of controversial technological developments such as nuclear power, it is also in these areas where explicit statements supporting the traditional belief are most common.

Here I shall argue that the idea of the autonomous development of science and technology is historically incorrect. Furthermore, this idea is often used to support a commitment to particular social and political values, values which are as a consequence hidden under the guise of scientific 'neutrality'. The basic approach used here will be to consider the idea of the autonomous development of science and technology in the light of actual and potential scientific discoveries and technological developments.

Science and technology

The idea of the autonomous development of science and technology is that scientific and technological development inevitably follows a particular path in the long run, independent of the subjective desires of individual scientists or the pressures of social, political and economic circumstances

(though such pressures may lead to temporary delays or detours in progress along this path). Of course, the path of scientific and technological development is not usually predictable beforehand; the idea is that the objective truth associated with nature – whatever it may turn out to be – will lead eventually to the same end result in terms of scientific knowledge and technological innovation.

Concern over scientific and technological development is almost always to do with *applications* or *implications* for the wider society. Those concerned about Darwinism in the 1800's were worried about its impact on religious belief or its contribution to social policy-making. Those involved with 'scientific management' in the early 1900's were interested in changing the organisation of the production process. In practice, when reference is made to the "development of a proven scientific advance", "development" refers to a social or economic impact, which is more usually called an "application". Indeed, the idea of 'technological development' is generally associated with application of the technology that is developed. Automobiles, rockets and bottle openers are built to be used, and not out of an abstract mechanical interest. Therefore, it is worth expanding somewhat on the relation of scientific development and technological application.

First, not all scientific discoveries have immediate or obvious implications in terms of applications. Examples are the general theory of relativity and plate tectonics. More accurately, major applications on a societal scale of such discoveries are out of the question, given current knowledge and technical capabilities. Therefore it is trivial to stop the application of such scientific discoveries, since few people desire the enormous commitment of resources required to apply the discovery, only to attain minimal benefits.

Second, technological developments often are not based on scientific knowledge but instead on observation and experimentation. Examples are the steam engine (which predated thermodynamics) and animal breeding (which predated genetic theory). Indeed, until roughly the middle of the last century, practical developments usually preceded, and often inspired, the scientific discoveries which explained them (see, for example, Mason, 1956). Scientific knowledge and technological development today are much more closely linked, with each providing a stimulus for the other. So rather than speak of "scientific development" it would be somewhat more accurate to speak of "scientific and technological development".

The belief in autonomous science and technology, in terms of its normal implications, could be formulated in this way: "An attempt to stop the (widespread) application of an applicable scientific and technological development has never succeeded." But is this true?

The non-inevitability of scientific and technological development

The basic and simple reason why scientific and technological development does not follow a pre-ordained path is that any particular scientific and technological development can be applied in many different ways in society. In practice the development will be applied in only a few certain ways; some applications will never be implemented, while others become a major aspect of the operation of human society.

Simple genetics provides one useful example. Animal breeding has been a successful technique for centuries, so its application to humans could be considered "the development of a proven scientific advance". However, in spite of the efforts of eugenicists, the application of breeding principles to humans has found only the most narrow acceptance. The attempt to stop, or the lack of support for, this development has been most effective. In the case of plants and animals, the *selective* application of breeding techniques is most noticeable. While major efforts have been made to produce tomatoes that are hard enough to be undamaged by mechanical pickers (or even to produce square tomatoes!), there has been virtually no effort made to produce more nutritious tomatoes (Hightower, 1976). Not only can technological development be stopped, but it can be quite delicately channelled into particular directions (Rose, 1972).

Electronics provides another example. Telephone and television are accepted parts of our daily lives. But there are other areas of electronics whose widespread application has been stopped, at least until now. For example, it is quite feasible to emplant a transmitter in a person's body so that a central control station can continually monitor the person's location. This may serve a few potentially beneficial medical purposes, but could also serve the interests of a totalitarian state. So far this application of "a proven scientific advance" has been successfully resisted.

Finally, there is the case of the internal combustion engine. While the automobile forms the basis for transportation in industrialised countries, the reason for this does not lie in the inevitability of scientific and technological developments. Clearly there are other developments – electric trains, bicycles, different approaches to town planning – which were quite successfully stopped by the automobile industry, oil companies, and highway builders (Commoner, 1976). Because the widespread introduction of a technological development necessarily precludes a similar introduction of alternative developments, it is clearly false to say that scientific and technological development (with widespread societal application) follows an inevitable path.

At this stage it is worth returning to the relation of science and technology. Technological development, and the normally associated application of the technology, is not inevitable because there are potentially many different types of technology which might be developed and applied, and only a few which are actually developed and applied. So the appropriate perspective is not one of stopping or fostering technological development per se, but rather of choosing the direction in which the development should follow. Rather than being like a train on a track which can be either speeded up or stopped, technology is potentially like a multipurpose vehicle with a multitude of possible destinations.

But if technological development reflects social and political choices, what of science? As noted earlier, scientific development is often as much a consequence as a cause of technological development. Therefore, to this extent, scientific development will also reflect social and political choices. For example, much more fundamental scientific research is stimulated by the interests of agribusiness than by consumer interests, and hence there exists more scientific knowledge relevant to producing genetic strains of vegetables and fruits that are machine pickable than to those which are of

high nutritional value. Furthermore, most fundamental scientific research these days is funded by government and industry in areas where applications are hoped for, and even 'independent' research takes place in a general societal context in which some sorts of discoveries have a higher prestige than others. Scientific knowledge in the area of molecular biology has been more sought after than scientific knowledge about the effects of heavy metals on health; scientific knowledge concerning nuclear fusion has been more sought after than scientific knowledge about local collection of solar energy. So scientific development, though in a less direct manner than technological development, also follows to some extent the dictates of social and political pressures.

Value-laden assumptions

In defence of the statement that, "We cannot stop scientific development", it might be argued that widespread societal application is not a necessary part of the claim. This would raise the question of whether it were inevitable that scientific and technological developments were always brought to the point of application, whether or not they were actually applied. This would be a rather academic question, since this is not what actually happens in practice. But in any case this is not the meaning of most statements about the inevitability of scientific and technological development, since such statements are presented in the context of justifying a particular widespread application of technology – in the case of the first three quotes, it refers to the widespread use of nuclear power as a source of energy.

The actual introduction of technology into society is promoted by particular groups, to achieve particular aims (Dickson, 1974; Melman, 1972; Elliott and Elliott, 1976). This can range from profit-making in the case of machine-pickable tomatoes to social control in the case of electronic monitoring of individuals. In a particular controversy, some groups will support a certain technological innovation and others will oppose it (and perhaps support other technologies). In the case of the Concorde, aircraft manufacturers, committed governments and some unions supported the new technology, while environmentalists and others (such as those arguing on grounds of economics or equity) opposed it. Still other groups advocated electric cars, or less travel, or bicycles, or any of a host of alternatives both for transport and for investment.

In this context, the ideological implications of statements such as, "We cannot stop scientific development" are fairly apparent. Such a statement relies on the still common, though declining, perception of science as a neutral and objective search for truth. It relies on the esoteric nature of scientific knowledge and the forms of modern technology which are inaccessible to the public. It relies on a common feeling of helplessness and resignation in the face of technological change. And it uses these connotations and characteristics of science to support a particular technological innovation in society, which will be controlled by and serve the interests of particular groups in that society.

In practice, the idea of the inevitability of scientific and technological development is almost always used to support innovations which are backed by large government and business interests, and which are opposed (if at all) by citizens' movements – as in the cases of fluoridation, the supersonic

transport, and nuclear power. This cast of adversaries is not surprising, considering that the overwhelming majority of research and development money is allocated and spent by government and industry (Rose and Rose, 1969; Sklair, 1973).

Finally, it may be asked, if scientific and technological development were really so unstoppable, would anyone feel it to be necessary to warn citizens that their efforts to effect the course of technological innovation and application are futile?

Implications

It is still common for academic scientists to teach, and to write textbooks, in a way based on the assumption that social, political and economic factors do not influence the development of science and technology. This approach may have (or may once have had) some validity in a limited domain, but it is increasingly out of touch with the ongoing politicalisation of the activities of scientists, due to the source of funding for science and technology and the uses to which science and technology are put (Rose and Rose, 1976, 1976a). Some initiatives have been taken in terms of courses on the history and philosophy of science, but relatively little has been done to change the content or style of most science courses in terms of bringing awareness of the social and political aspects of science and technology. One set of possibilities is suggested by some of the examples used here: to study an area of controversy in which scientific and technological judgements are thrown into question by social and political considerations, such as nuclear power, food additives, transport policy, genetic engineering, or automation. It is in such areas that conflicts between 'experts' and concerned citizens most often occur, and hence where the interactions between the technical and the social are most easily studied.

References

Commoner, Barry
1976 **The poverty of power: energy and the economic crisis,** London, Jonathan Cape.

Dickson, David
1974 **Alternative technology and the politics of technical change,** London, Fontana.

Elliott, David and Elliott, Ruth
1976 **The control of technology** London and Winchester, Wykeham.

Hightower, Jim
1976 "Hard tomatoes, hard times: the failure of the land grant college complex", in Richard Merrill (ed.), **Radical agriculture** New York: New York University Press, 87–110.

Marffy, Wilmer C.
1977 letter to the editor, **The Gazette** The University of Sydney, 3, September 1977, p. 19.

Mason, S. F.
1956 **Main currents of scientific thought: a history of the sciences** New York: Abelard-Schuman.

Medawar, Peter
1969 "On 'The effecting of all things possible' ", **New scientist,** 43, 465–467.

Melman, Seymour, in Charles A. Thrall and Jerold M. Starr (eds.)
1972 **Technology, power and social change** Lexington, Mass.: D. C. Heath and Company, 49–54.

Messerle, H. K.
1977 letter to the editor, **The Gazette** The University of Sydney, 3, September 1977, 19.

Rose, Steven
1972 "The real significance of CBW", in Jonathan Benthall (ed.), **Ecology, the shaping enquiry** London: Longman, 303–316.

Rose, Hilary and Rose, Steven
1969 **Science and society** London: Allen Lane,

Rose, Hilary and Rose, Steven (eds.)
1976 **The political economy of science: ideology of/in the natural sciences** London: Macmillan.

Rose, Hilary and Rose, Steven (eds.)
1976a **The radicalisation of science: ideology of/in the natural sciences** London: Macmillan.

Sklair, Leslie
1973 **Organized knowledge: a sociological view of science and technology** St. Albans: Paladin.

Teller, Edward
1970 "Can a progressive be a conservationist?", **New scientist**, 45, 346–349.

About the Contributor

Brian Martin is a lecturer in the Department of Applied Mathematics at the Australian National University.