implications, we need to know whether NASCO's problems are distinctively Egyptian or not. For example, similar problems of government interference through regulation and direct control affect public sector enterprises in most other types of economy. Which other sources of uncertainty are common elsewhere? I want to ask how like Egypt is India, or Romania, or China, or West Germany, and on what dimensions? Without some discussion of these questions, the case analysis remains parochial. Indeed, we have no way of knowing whether it is distinctively a development study or, as I suspect, merely a specially obvious case of the tensions that exist between formalised systems and human organisation in its social setting.

Lind might also have asked, are the problems arising from Egyptian organisational culture present or not in the developed world? We are given very little idea of what constitutes culture in Lind's view. One example given is the limited autonomy of managers, but as this is associated with skill shortage, it is not clear that it is a cultural rather than a structural phenomenon.

A further valuable addition to this book would have been some account of how the existing MRP system actually works. It is one thing to analyse structural deficiencies *a priori*: it is another thing to see what really happens. This would be particularly important if we wished to assess Lind's suggestion of using computers at NASCO for low level operational control of production, such as event reporting and tracking, because external uncertainties should be negligible. Yet, unless we know that there are no other internal sources of uncertainty that would undermine even an unsophisticated system, we cannot say whether such a suggestion is any more likely to work than COPICS. Given that NASCO's inventory data is rarely correct, why should we suppose that event reporting would be kept up to date?

Finally, Lind makes what he sees as a radical suggestion, that computers might be used to match the rationality of Egyptian organisation. He suggests a system that plans what products could be made on the basis of the availability of parts, thereby reversing the existing situation. Is it rationality that is matched here? Rationality is a frequently occurring motif in the book, but it is little explained or explored. Perhaps what is rationally demanded of a computer system in this context is that it be a symbol of industrial progress.

Just as the bumper sticker reads, 'One nuclear bomb can ruin your whole day', so the slogan of this book should read, 'Environmental uncertainty can ruin your computer system'. This is a message for managers the world over, developed and less developed. It is a pity that the message is not very accessible in its present form. Let us hope that Lind will continue to research in this area to provide the basis for a more mature book.

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The Tragedy of Technology: Human Liberation Versus Domination in the Late Twentieth Century *by Stephen Hill*
(London, Pluto Press, 1988) pp. 294, ISBN 1-853-05-009-1

The basis of classical Greek tragedy lies in the contradiction between destiny and free will. Individual protagonists *appear* to have the power to control their

lives, and assert that power with eloquence and passion, but the more they try to demonstrate their freedom, the more firmly they enmesh themselves in a fate already ordained for them by forces outside the landscape of the visible drama. It is in this sense that Stephen Hill presents the course of modern technological development as a 'tragedy' — a story in which the invisible technological order shapes not only human lives, but even human attempts to escape from its control.

The problem addressed by Hill, in other words, is very similar to that considered by Langdon Winner in his study *Autonomous Technology* (Cambridge Mass., MIT Press, 1977): the paradox of a technological system which is out of the control of its human creators. Hill's approach to the problem, however, is quite different from Winner's. The central theme of *The Tragedy of Technology* is the relationship between technology and culture. Modern technology, according to Hill, has so penetrated and transformed our culture that the very symbols and concepts by which we now understand the world are ones which have grown out of this technology. It is the transformation — or perhaps we should say subversion — of culture which makes it hard for us to envisage alternatives to the current path of technological change.

Hill likens the technological system to a written text, consisting of a mass of objects and symbols laid down over past decades, but reinterpreted afresh by each generation. Its permanently inscribed form, however, limits the range of possible interpretations, and so makes it more rigid than the oral cultural texts of less technologically sophisticated societies. At the same time it is also a non-phonetic script, one whose complex symbols can only be interpreted by a small and highly-trained elite.

These ideas are original and arresting ones, and they are ideas which Hill proceeds to apply to a long sweep of technological development from the Industrial Revolution onwards. The first controllers of industrial technology, the early factory masters (we are told) imposed the new technology upon their workers by force, recruiting employees from the sections of society least capable of resistance (women and children). In the long term, however, such brutal imposition of technology could not continue to be effective. What was necessary was to develop a culture in which the workers would acquiesce in their own subordination to the technological system. This was achieved by the development of new workplace ideologies, and above all by educational programmes which moulded the minds of the young for their place in the industrial order.

A second transformation occurred in the 1920s and 1930s. By then the expansion of the technological system demanded the existence of a mass consumer market. This in turn called for cultural changes which would create psychological cravings for a wide range of new commodities. Drawing on the ideas of David Riesman and Herbert Marcuse (among others), Hill suggests that the rise of consumer culture involved the destruction of existing social relationships. Individuals ceased to relate to the world by means of direct human contact, and instead related to it by means of objects such as cars and televisions. The objects, however, like addictive drugs, never succeeded in filling the social emptiness which had prompted their purchase: consumer demand became at once insatiable and inherently unsatisfying.

Hill is always careful to avoid the assertion that technology directly determines culture. Instead he talks of alignment between technology and culture. If technological and cultural systems are not aligned, either the momentum of technological change falters (as was the case in Britain after the mid-nineteenth century), or culture itself is undermined (as in Third World countries in recent

times). Despite the choice of words, however, the underlying message of the book is frequently both deterministic and profoundly pessimistic.

Consider for example, the chapter on the Third World, succinctly entitled 'The extinction of cultures'. This contains a collection of fascinating and tragic (in the conventional sense) stories about the destructive effects of western technology on traditional societies in Asia and the Pacific. Perhaps the most devastating is the case of the Cook Islands, where the construction of an airport designed to encourage tourism led to a mass outflow of migrants, reducing the population by more than half in a little over a decade. The conclusion drawn from the stories is a stark one. As the alien artifacts of the western technological system are introduced into non-western societies, "the cultural pulse of prior technical knowledge dies, and the whole surrounding culture implodes. The culture stays stitched together, but only with dissolving thread. For the central heart of technique starts to beat to the cultural rhythm of the social and economic assumptions of the invading industrialised culture."

But for every case cited by Hill it would be possible to cite a case of non-western societies absorbing western technology without experiencing cultural extinction. Examples abound, from the introduction of western spinning equipment in Meiji Japan to the use of television by Aboriginal media organisations in Central Australia. Doubtless in each of these cases new technology brought with it change and disruption, but this does not mean that it resulted in a cultural void, or that the local culture simply dissolved into that of the wider industrialised world.

This points to a key weakness in Hill's thesis: an assumption that, before exposure to modern industrial technology, societies possessed a traditional culture which was holistic and, at least in the case of non-western societies, generally static. Traditional culture, moreover, is implicitly seen in a very rosy light. In the western world, for example, we are told that the rise of consumer culture deprived individuals of their "autonomy to decide on meanings for themselves" and promoted a "denial of love, caring and concern for others". It even undermined the most fundamental of human relationships, so that people now "fall in love when they feel that they have found the best object available on the market, considering the limitations of their own exchange value". All this leaves one wondering how much autonomy, caring and concern for others there was in, say, a sixteenth century English village, and whether the description of commodified love is not a perfect summary of the state of affairs described in the novels of Jane Austen.

Emphasis on the destructive and enframing power of the technological system also creates problems for Hill's conclusions. In the final chapter he tries to suggest some strategies by which we might free our consciousness from the cultural constraints of the technological system. Such strategies include creating greater freedom of access to information and developing a more critical and independent perspective in our education systems. Desirable as these would be, however, it is a little hard to be convinced they would be capable of altering a technological trajectory so powerful that (as we have earlier been told), it absorbs and co-opts protest itself, turning the symbols of protest into yet more commodities to be sold for profit.

The Tragedy of Technology is both a highly ambitious and an extremely thought-provoking book. It contains a wealth of interesting analogies and useful historical detail (although its style sometimes makes for hard reading). Its approach to the relationship between technology and culture is an original one, and large parts of its criticism of the destructive effects of modern technology are convincing.

Its explanatory power, however, is limited by the concept of culture on which it is based. Without a greater sensitivity to the dynamism, the diversity and the conflicts within "traditional cultures", it is impossible to understand why the cultural impact of modern technology has varied so greatly from one society to another; why some cultural systems have succeeded and others failed in aligning to its demands; and why the creative and destructive effects of technological change have been so unevenly distributed throughout the modern world. And without a greater emphasis on the liberating as well as the enslaving potential of contemporary technology, it is difficult to suggest a plausible means of escape from our destiny in a technologically-determined tragedy.

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Taming the Tyrant: The First 100 Years of Australia's International Telecommunications Services *by Edgar Harcourt*
(Allen and Unwin, Sydney, 1987) pp. xvi + 405, cloth $39.95, ISBN 0 04 994011 2

Inevitably, the history of Australia's telecommunications links with the outside world is, in part, a history of the entire international telecommunications network. As such, it is of interest to anyone concerned with telecommunications and with the application and organisation of new technology. There are seven principal themes of Harcourt's history: the origins of the first international telegraph connection, attempts to reduce perceived monopoly power of the private cable company, the advent of international wireless communication and the consequent reorganisation of Commonwealth telecommunications, nationalisation and division of the private system at the end of the Second World War, the arrival of submarine telephony in the 1950s, of satellites in the 1960s and the position of the Overseas Telecommunications Commission (OTC) itself in relation to the Post Office and competition in the home market.

A necessary condition for Australia's first international telecommunications connection was the experimentation with submarine telegraph cables that culminated in the Atlantic line of 1866. Additional preconditions were the British government's commitment to a telegraph link with India (encouraged by the Mutiny) and the conquest by telegraph of the vast expanses of Australia that separated the major population centres from the north, where a cable was most likely to be landed. Early in 1862, the British government formed in Bombay an Indo-European Telegraph department to join the Indian telegraph system with the European network, which by then extended as far east as Baghdad and Teheran. The Australian colonies were incapable of adopting a uniform international cable policy, for each hoped to gain revenue from international through-traffic and not itself have to pay Australian transit charges. Before the land line was completed, the Telegraph Construction and Maintenance Company's (Telcon) ships arrived at Darwin and on 7 November 1871 landed the shore end of the cable. Twelve days later the other end arrived at Banjuwangi in Java. Then the submarine connection failed and remained silent when, on 22 August, the South Australian overland cable was completed. At the beginning of 1880 a