A tale of two cultures

Robert Kuttner

America's Struggle for Leadership in Technology. By Jean-Claude Derian. *MIT: 1990. Pp 309. £26.95, $29.95.*

JEAN-Claude Derian is in the distinguished tradition of Tocqueville — a French visitor who grasps US institutions better than most natives. Derian wrote this succinct book while he was science counsellor at the French Embassy in Washington during the mid-1980s. His subjects are the confused objectives of US technology policy, and its mixed effect on the competitive standing of industry. In part, the book is an efficient tour of the usual horizon: the role of NASA, the Pentagon and such "big science" projects as the Strategic Defence Initiative (Star Wars) in incubating and channelling new technologies; the distinct subculture of Silicon valley; a comparison of technology policy in the United States, Japan and France, and so on. This, of course, is well-worn territory, yet Derian manages to work it better than most.

But Derian's original contribution, which makes the book especially worth reading, is his analysis of the two cultures of high-technology industry — a 'sheltered' culture of large companies either with close linkages to government or dwelling within regulated or cartelized industries, and which compete mainly on the basis of technical advance; and an entrepreneurial 'exposed' culture of companies and industries competing openly (and fiercely) on the basis of price. "The sheltered culture", writes Derian, "has resulted from what seems to be an accident of history: the involvement of the federal government in the generation of advanced military technology in the aftermath of World War II." Most military contractors fit into this category, though regulation can be as efficient a basis for shelter as government procurement.

AT&T was perhaps the epitome of the US sheltered company. Although privately owned, it was a regulated monopoly. It could divert earnings to Bell Labs, the crown jewel of industrial laboratories, and pass the cost on to its captive customers. AT&T was superb at big technical innovations like digital switching, which its captive regional telephone companies were compelled to buy and which drove down the cost of basic phone calls and expanded its market. But as computing and telecommunications converged into a single digital technology, AT&T's sheltered culture made it very slow to compete for the new markets in the thousands of devices that could fit on the end of a telephone wire. These devices are highly price competitive, and successful purveyors are necessarily entrepreneurial. After deregulation, AT&T fell on its face attempting to sell personal computers, though it has been highly successful marketing its UNIX system, the fruit of Bell Labs.

IBM, by contrast, is the quintessential 'exposed' company — entrepreneurial, market driven, and innovative in a different fashion. "Big Blue", despite its market power, sides with supporters of open systems, allowing its machines both to be cloned and to remain the industry standard, as a strategy for keeping itself on its toes.

Although defence firms tend to epitomize the sheltered firms, the correlation is far from perfect. Some companies, Boeing for example, began as almost exclusively suppliers to the US Air Force, yet made the transition to commercial markets while still drawing on the benefits of close research and procurement links to government, and the oligopolistic character of the aircraft industry.

What is refreshing about Derian's version of this analysis is his catholicity. In an era of government-bashers versus mercantilists, he is in neither category. His message is not that government involvement is a millstone — or that it is a salvation. Nor does he discern a simple correlation between government linkage and entrepreneurial failure. His point is that one must get down to cases, which he does brilliantly. In the heyday of Dwight Eisenhower's "military–industrial complex", the linkage of sheltered firms to the Pentagon and NASA produced great technical advance, and commercial benefit for big US companies, but this era is over. Derian nominally classifies Japanese industry as mostly exposed rather than sheltered, but in reality (as he seems to agree), what Japan really manages is a more competitive blend of the two cultures. Firms are partners in interlocked industrial groups: the state subsidizes targeted breakthroughs frankly aimed at commercial advantage; it relies on cartelization and market closure when that serves its purposes, yet its companies are fiercely price-competitive in world markets. Japan seems sheltered *vis a vis* imports, but highly open in export markets.

America's problem today is that it no longer has the military basis for incubating commercial technologies, whereas its 40-year reliance on shelter has sapped the entrepreneurial vitality of its firms that must compete in an increasingly exposed global culture. The country is also hobbled by peculiar ideological blinders. So long as the ostensible goal is basic research or military supremacy, the prevailing ideology allows government subsidy of technology. But in a nation that believes deeply in Adam Smith and David Ricardo, deliberately using government to help create commercial advantage is considered sinful. Aid to the semiconductor industry could be channelled only through the Pentagon, disdaining commercial spillovers. Aid to high-definition television (HDTV) was rejected by the Bush White House as a form of the loathed industrial policy. Neither Japan nor France nor the EC commission has this Anglo-Saxon neurosis (which is currently

Mountain melody — Nepalese monks blow their long brass horns, producing "a low primitive sound that rolled across the valley to the mountains". Mike Harding, British entertainer and keen conservationist, trekked through the Himalayas of India and Nepal while making a film about the effects of deforestation. The photographs he took together with his affectionately written account of the journey combine to provide a superb portrayal of this breathtakingly beautiful corner of the world. Published by Viking, price £16.95, $29.95.

shared only with Mrs Thatcher). As a result, the United States ends up with a less efficient blend of the exposed and sheltered cultures than most of its trading partners.

Nearly all of this book is about the United States, though in a closing chapter Derian makes it clear that he favours both a more entrepreneurial, less sheltered European industry, particularly as the single market approaches, but also the benefits of efficient shelter such as the commission's technology research consortia (ESPRIT *et al.*). Europe has companies clearly in the exposed, entrepreneurial tradition (Philips, Olivetti), and it needs more. As a Frenchman, Derian possesses both an appropriate disdain for *etatisme* and an appreciation for the benefits of a soupcon of *dirigisme* if used in moderate amounts. "The omnipresence of the state and the state–company symbiosis, are at once sources of strength and weakness in France", he notes.

Like other European visitors to the United States, Derian occasionally throws up his hands in gallic bewilderment at the sheet perversity of much of the country's technology policy and its tendency to squander its remarkable legacy for the sake of geo-political and ideological goals. An American observer of science, military and economic policy must sadly concur with Derian's analysis. The book, incidentally, was originally written in French. The translation, by Severin Schaeffer, is a superb rendering in idiomatic and technically accurate English. □

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Rich material

B. F. Schutz

A Journey into Gravity and Spacetime By John Archibald Wheeler *W. H. Freeman: 1990. Pp 257. £16.95, $32.95.*

THE distinguished physicist John Archibald Wheeler's long-awaited 'popular' book on general relativity has finally appeared, and it is a tour-de-force. Aiming to give intelligent non-physicists the opportunity to gain real insight into gravity, Wheeler has written a gem of a book that will be required reading for the experts as well. For where most such books skirt around the parts of the theory that seem mathematically the most abstract, Wheeler tackles them head-on. He repeatedly finds beautifully lucid ways into the heart of the subject, using only a minimum of algebra and geometry. Helped by many high-quality illustrations, his fluent writing makes it all seem easy. The book demonstrates yet again Wheeler's lifelong message to physicists: what is deep is also simple.

Wheeler is known as both a creative scientist and a teacher. As Richard Feynman's mentor, he contributed enormously to the foundations of quantum electrodynamics. As one of the first 'mainstream' physicists to move into general relativity, he fathered a school of research from which has sprung some of the most important work on black holes, gravitational waves and cosmology — indeed, he coined the very name 'black hole'. His introductory textbooks on special relativity (with Edwin Taylor) and general relativity (with Charles Misner and Kip Thorne) have been very influential, and are widely used in university courses.

Wheeler's writings have a characteristic style, which is not to everyone's taste. He makes extensive use of analogies and of asides that explore byways along the main road of exposition. In the present example, I feel that this approach works very well. The asides, presented in text on a shaded background, typically present material that needs extra mathematics. The analogies are unusually well constructed: no mere similies, they usually give considerable insight into the point at hand.

Nothing better illustrates Wheeler's ambitious approach than his treatment of space-time curvature. Experts know that the components of the curvature tensor outside a black hole all have roughly equal magnitudes, but differ by signs and factors of two. This might not seem a point worth addressing in a 'popular' exposition, but for Wheeler it is absolutely central. The components have the relationships that they have to one another in order that the rule he has previously given us for the curvature of space-time — what the experts call Einstein's field equations but what in this book become a simple word-equation relating two-dimensional notions of curvature to the energy and momentum in space-time — should hold in spherical symmetry. Wheeler makes his point without ever needing the language of tensor analysis.

In a similarly simple and direct manner, Wheeler makes the principle of maximum proper time the foundation of his discussions of motion in space-time. Most popular accounts would, I suspect, refer to this only in passing, or as a consequence of other considerations. Wheeler's method is for him the simplest way into the subject, allowing him a straightforward generalization from the law of motion in flat space-time, and permitting him to explain planetary motion in the same breath as the twin paradox.

There are equally masterly discussions of gravitational waves — why they are transverse and quadrupolar — of the Penrose process, and of many other features of space-time and gravity that are usually considered too difficult to explain in simple ways. There are, of course, parts of the book I could criticize. Wheeler's style does sometimes confuse at least temporarily, such as the occasions on which he states an important result with no justification and neglects to mention that he will prove it in the next section or chapter. But shortcomings like this did nothing to inhibit the feeling that grew in me as I read through the book, that this is a masterpiece of explanation.

A reader with no background in general relativity who takes the time to think about Wheeler's arguments and explanations should find this the most satisfying of expositions on general relativity; to come away having understood and even (for the spherical case) essentially to have solved Einstein's field equations should more than reward the effort invested. For those who think of ourselves as expert in the theory, the book shows us that we still can learn things from the old master. And for those of us who also teach the subject, there is rich material here for our lectures. I think the book would do very well as auxillary reading in a lecture course to supplement one of the standard textbooks, because it fleshes out with words and explanations the abstractions of the equations. This is a book that should therefore be in every academic library as well as in quite a few personal ones. □

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■ Just published by Oxford is *General Relativity,* in which I. R. Kenyon reviews the field, including the general and special theories, black holes, cosmology and the search for a quantum theory of gravity. Price is £30 (hbk), £15 (pbk). □