residential subscribers. They also consider the issue of information inequality, which is a crucial issue totally ignored by the Committee. A 'band-aid' approach of providing a few crumbs to disadvantaged rural and low income groups, a strategy which is advocated by the Davidson Inquiry, is unlikely to provide **all** Australians with the means of coping with change in the new information society.

In many respects the Davidson Inquiry into the merits of public versus private ownership has been unfortunate in that it has focussed debate on a small part of the plethora of issues raised by our shift into an information society. The government has virtually ignored the questions of how telecommunications might be used to assist the delivery of welfare, health and education services. Very little debate has taken place as to how improved telecommunications services could be developed as a part of an industrial strategy. Once again we have been willing to accept the agenda for debate as presented by our 'great and powerful' friends. The *Phone Book* goes part of the way towards countering this trend; it deserves to be widely read.

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Revolution in Miniature. The History and Impact of Semiconductor Electronics Second Edition *by Ernest Braun and Stuart Macdonald* (Cambridge University Press, Cambridge, 1982) pp. viii + 247, $A15.50 (pb), ISBN: 0-521-24701-2 (hb), 0-521-28903-3 (pb).

For the past several years, when students and colleagues in the field of industrial economics have asked me where to start reading about the semiconductor industry, I have had a ready answer. The publication of the second edition of Braun and Macdonald's *Revolution in Miniature* assures that I will continue to give the same answer from some years to come.

The usefulness of this book for economists is upon first consideration rather surprising, since it is not a traditional 'industry study.' *Revolution in Miniature* is instead the history of a technology and its consequences — one of which happens to be the development of an industry. But the history of technology is the appropriate place to begin study of the semiconductor industry, which has been and remains an industry defined and propelled by its technological accomplishments. These accomplishments, their internal logic of development, and their consequences for market growth and performance are presented with great clarity and good judgment by Braun and Macdonald.

The first edition of *Revolution in Miniature* recounted the history of semiconductor technology from its intellectual roots in the work of Faraday and Maxwell to the invention of the microprocessor, surveyed the state of the American and worldwide semiconductor industries as of the early 1970s, and assessed the impact of microelectronics on the broader economy and society. The second edition brings the technological history through the decade of the 1970s into the early 1980s in an excellent new chapter on the era of large scale integrated circuits. Chapters on the condition of the industry in the United States and worldwide have been thoroughly revised and updated.

Particular episodes of the technological history — such as the invention of the transistor, the growth of single crystal silicon, and the invention of the integrated circuit — are related in more detail elsewhere. But Braun and Macdonald's is the only study which narrates the entire history with both thoroughness and insight. The main themes of the story emerge clearly. The transistor, to a degree unusual in the history of technology, was in a very real sense an invention based on science. But the succeeding technical accomplishments largely followed an inner logic of product design and production process engineering directed toward manufacture of faster, smaller, cheaper, and more reliable semiconductor devices. Through it all, the market grew at an astounding rate, encouraged initially by the appetite of the US military for computers and communications equipment, and eventually by the versatility of the technology itself, as microelectronics found an ever-widening array of useful applications.

For the historian of technology with an inclination to theorise, this book provides a rich mine of examples. Miniaturisation is as striking an example of a 'natural trajectory' (in the language of Nelson and Winter) as one is likely to find in modern technology. From the beginning, a major thrust of technical effort, driven initially by military requirements, was to make devices smaller, economising on the scarce space available for early missile guidance systems. 'Making it smaller' continues to be a fruitful trajectory in the design of modern semiconductor devices, though now, as before, technical obstacles confront each successive step along the path. These obstacles frequently take the form of 'compulsive sequences' (in the language of Nathan Rosenberg), wherein an innovation in one element of a technological system focuses subsequent effort upon another element. Thus, the pursuit of miniaturisation led to the invention of the integrated circuit, but the solution — packing multiple transistors on a single chip — led to a new problem: a compounded probability of device failure. This led in turn to an intensive effort to make early integrated circuits more reliable. Similarly, recent advances in lithographic techniques have enabled the achievement of increased circuit densities, but the effort required to design a circuit has increased disproportionately. Innovation in lithography has thus focused current effort on design innovation.

A distinctive strength of Braun and Macdonald's book is the skillful and judicious use of industry sources. The text is dotted with quotations from industry leaders; usually these remarks are pithy and cogent, amplifying and driving home the argument of the authors. Occasionally, however, the authors succumb to the temptation of giving industry executives the last word on a controversial issue. Indeed, they sometimes give the last words to two executives with opposing views. For example, they take this approach on an issue so important as that of assessing the efficacy of US military R&D support programs. This practice can be irritating to the reader, who, after digesting the narrative details, may reasonably expect from the authors some guidance in interpreting the material.

One significant shortcoming of the revised edition is the inadequate treatment of the development of the Japanese semiconductor industry. The treatment of Japan contrasts sharply with the discussion of the European industry, where the authors provide a rather detailed and astute assessment of

the failure of various public policies to elevate national capabilities to parity with the Americans. The authors provide little explanation of whether or why public policy has fared better in Japan. Indeed, public policy is not even very clearly described. For example, the authors cite, without appropriate qualification, "the decision of the Japanese government in 1974 to allow American-owned companies to operate in Japan" (p. 171). The implication in the accompanying text that American companies have since enjoyed open access to Japanese markets would be hotly disputed by any randomly selected US semiconductor executive.

Quibbles aside, Braun and Macdonald's study remains our most complete and well-documented treatment of an important chapter in the history of modern technology.

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Videotex in Australia: Interactive Information Services *A report to the Prime Minister by ASTEC, prepared by the Technological Change Committee* (AGPS, Canberra, 1983) pp. 91, ISBN: 0-644-02691-X.

The term 'videotex' describes a service whereby the user, via the telephone and a display terminal (which can be a modified television set), can interact with a remote computer data base. Since most households in developed countries already have the necessary basic equipment, it has been widely suggested that videotex could become a new 'mass medium' for the diffusion of information. This report attempts to describe the potential impact of videotex and to suggest how the Australian government might best ensure that the benefits of videotex are achieved.

A study of this kind, which is directed at policy makers, has a responsibility to look objectively at all available evidence before making recommendations. In dealing with a new and complex technology with which policy makers are unlikely to be wholly familiar, the need for critical analysis of potential benefits and costs is even more important. The ASTEC study, while it does a good job of describing the potential benefits of videotex, is less successful in analysing whether these benefits will really materialise. As a result, policy recommendations are based on an incomplete and one-sided analysis.

The first question to be asked, then, is what are the potential benefits of videotex? The ASTEC study describes in some detail the many services which could be offered on a videotex system. First, it can offer nearly universal availability of a very wide range of information. Basic economic theory asserts that markets do not function properly unless all of the players are well-informed; as the economy becomes more complex, the diffusion of information becomes more important. Economic efficiency is not the only side-effect of readily-accessible information — democracy too is strengthened. If videotex could indeed ensure equal access to information, it would bring substantial social and economic benefits.

Secondly, videotex can make many existing activites more efficient, both for the customer and the provider. Banking transactions, for example, can be carried out from home, saving time for the client and saving the cost of