The editors at least seem to view technology as applied science. The emergence and appropriateness of priority areas that are based on the latest technologies (e.g. information technology and biotechnology) in the two countries is another issue which demands further investigation but this is not explored in the book. Likewise, various philosophies of science and the sociology of science appear to be used by different contributors to justify policy. For example, Waardenberg claims that it can be shown from recent research in the 'sociology of the sciences' that "attempts to steer the development of research areas by non-scientists are generally totally unsuccessful: scientific developments are nearly always determined by forces from within the scientific community" (p.119). Unfortunately, the various interpretations placed on science by the different contributors are not analysed in this book in a way which would help the reader get a better understanding of the social processes involved in science policy formulation.

In summary, I believe the book will be of interest to government officials and science policy researchers in various countries despite the fact that its contents are likely to date rather rapidly because of the dynamic nature of the field. However, what is lacking is an overall perspective that gives the reader a clue on how to read such official policy statements as against their content *per se.* Blume's contribution in Part I approaches this but the rest of the book is much less reflective and analytical. Contributions to the literature in this field must aim to do much more than simply assemble such official texts under the one cover if our understanding of science policy is to be improved. Having said this, I believe there is a need to start somewhere and this book can be seen as part of this initial step. Australia could do much worse than spending a fraction of its vote on international science and technology agreements on similar comparative studies and reports. To get best results, the exercise would need to focus on critical understanding, not purely 'mutual understanding'.

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The Papers of Thomas A. Edison, Vol. 1, The Making of an Inventor, February 1847-June 1873 *edited by Reese V. Jenkins et al.*
(John Hopkins University Press, Baltimore and London, 1989) pp.LXVIII + 708, $US65, ISBN 0 8018 3100 8

This volume is the first of a projected series of 15 to 20 volumes being jointly sponsored by Rutgers University, the New Jersey Historical Commission, the US National Park Service and the Smithsonian Institution in which it is intended to document all aspects of Edison's life, writings and inventive activity. It has set a fine standard of production and editorial expertise. Attractively bound, and extensively illustrated with reproductions of Edison's own drawings from his notebook, diagrams from patent applications, portraits, and photographs of patent models and telegraphic instruments produced in workshops with which Edison was associated, this volume provides a scholarly yet intimate view of

the personal characteristics and creative genius of America's greatest inventor. Altogether the complete series will make available in print only some 0.2 per cent of the 3.5 million pages of archival material held at the Edison National Historic Site in West Orange, New Jersey (about 10 per cent of this material will be available on microfilm). However, this first volume, with its 348 annotated documents, contains nearly 90 per cent of the known Edison related materials (50 per cent, if accounting records are included) from the period of Edison's life covered — from his birth, to his trip to England in April-June, 1873 to demonstrate his automatic telegraph system to the British Post office.

The illustrations, especially, are a delight; some of Edison's drawings (of which there are nearly 600) displaying considerable artistic skill. The latter, as the editors point out, provide critical evidence of the importance of visual-spatial thinking in technical creativity. At least they do in Edison's case: his early writing (reproduced) in this volume — sensibly, I believe — with all its original misspellings and alterations) seems painfully awkward, yet this was evidently little problem to the inventor (who took out his first patent in 1868). Such revelations provide a valuable counter to some of the nonsense written in history and philosophy of science which attaches so much importance to words — as if these were the totality of what goes on in a scientist's mind — or anybody else's, for that matter.

Yes, this volume does lend support to those who wish to see Edison included among the greats of science, notwithstanding his later disparagement of much academic science of his time[1]. Certainly, just as his literary ability may have been limited (though this improved considerably with age — by 1873 he was even considering writing a book on telegraphy), so too was his mathematical knowledge. But then, so was Faraday's, and no one seems to think this diminishes his credentials as an original and creative scientist of the first rank. The artificial divide between 'science' and 'technology' — which some historians and philosophers of science make so much of — is little more than the legacy of a conservative educational tradition which drew a sharp distinction between 'brain' and 'hand' work, and its abandonment is long overdue. In this connection, it is interesting to note that *Scientific American,* which Edison read avidly and which is described by the editors as a "popular mechanics' magazine" of the time (p.676), was published by Munn and Company, a large patent agency with whom Edison had dealings. In any event, this volume should put to rest some of the myths about Edison — that he was a plodding, cut-and-try unscientific tinkerer, and so forth. On the contrary, we meet a sophisticated, imaginative thinker who was conversant with the writings of Faraday, Robert Sabine and others before he was twenty, from his reading in the Cincinnati Mechanics' Library and similar places while working as a telegraph operator. By that time he was already experimenting, and as the editors note, "consistently consulted the technical and scientific literature and let ideas guide his work" (p.xxxii).

The wealth of material in this book also documents the importance for Edison's later career of his long apprenticeship in the telegraph industry — then at the cutting edge of communications technology in America. What is revealed is the inventor's consistent employment of what may be described as the method of 'theme and variation', rather than trial and error. Thus an 1868 design for a receiver by Edison, for instance, utilised a revolving drum (with chemically prepared paper) and stylus, apparatus which was to reappear in his phonograph of 1877. Similarly, ratchet-and-pawl escapement mechanisms for printers devised by Edison in 1872-3 were later used in his motion-picture cameras.

But along with his technical genius, Edison is also renowned, of course, for his entrepreneurial abilities (an area in which we in Australia, today, still have a great deal to learn), and this side of his personality is well brought out in the present volume too. Thus we learn that within a few weeks of his first arrival in New York City in July 1869, the twenty-two year old inventor had teamed up with Franklin Pope and James Ashley, editors of *The Telegrapher,* the journal of the recently formed telegraphers union, in a business advertised as the Financial and Commercial Telegraphic Company, which operated a stock reporting service employing a compact printing telegraph designed by Edison and Pope. In October the following year, the partners, with the financial backing of George Harrington, a former Assistant Secretary in the US Treasury, had started the American Telegraph Works, manufacturing telegraphic equipment to be used in connection with Edison's improvements on the British invention, the automatic system of George Little, as well as other outside jobs. By May 1871, Edison had joined forces with William Unger, a Newark machinist, in manufacturing such equipment as Edison's 'cotton instrument', a telegraph printer employed by the Gold and Stock Telegraph Company to report prices from the New York cotton exchange; and by the end of the period covered in this volume, the inventor-entrepreneur was overseeing five workshops with 150 employees and had already formed the associations with whom he was to go on and make and market the inventions for which he is most well known.

Edison's successes might have been due in large measure to his personal qualities, but this is not the whole story, as this volume also convincingly shows. Before moving to New York, Edison spent some time in Boston, where, as the editors explain, he "entered a sophisticated technological and business environment that spurred the inventive talents and enterpreneurial activities he had honed during his youth and itinerant years in the Midwest" (p.19). The social and economic environment of science and technology is, of course, a growth area in academia, and books like this one are a welcome addition to a literature which is frequently somewhat lacking in historical perspective. However, *The Papers of Thomas A. Edison* should also appeal to many other people besides academics (and indeed, the editors indicate that they have in mind a wider audience). This first volume in the projected series has established a fine standard in scholarship and production, and it would be carping to find fault. Perhaps some of the information in footnotes to introductions to sections could have been incorporated in the main text (especially where these are short, and the footnotes are nearly equal in length); and with the editors' policy of reproducing Edison's writng verbatim, it is not possible to determine whether errors are original or typographical — perhaps they could be indicated with an asterisk (though admittedly, this could get cumbersome).

But, altogether, this volume will be a pleasure to pick up and browse through for anyone with the slightest interest in the history of science and technology — or indeed the man himself, a complex and many-sided genius no doubt, and an obsessive workaholic to whom a business associate (Daniel Craig) once wrote from Peekshill in the New York countryside: "[C]ome here Saturday, and be **happy** for one day in your life" (p.295).

REFERENCE

1. See David A. Hounshell, 'Edison and the pure science ideal in 19th-century America', Science, 207, 1980, pp.612-7.

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