would eventually be brought into modern functional form in 1970–71, and it still serves today as a vital part of the world-wide VLBI network. Sir Bernard tells an interesting story of how this rebuilding came about, when he was made chairman of the Astronomy, Space and Radio Board of the UK Science Research Council, as it was then called. The administration of the university was looking forward to the rich rewards that he could reap with his high post, but he chose to set aside his dreams of a far larger dish in favour of Martin Ryle's new one-mile aperture-synthesis telescope. The future development from that point moved inexorably away from the hands-on personal experience to large, professionally tended facilities. Radioastronomers, with Jodrell Bank in the lead, had made the old lifestyle redundant.

Sir Bernard's memoir is relatively brief, but it is beautifully written and easily understood by a lay reader. My wife greatly enjoyed his telling of how Joyce Lovell played a crucial role in improving the quality of her husband's 1958 Reith lectures. The title of the book is apt, and serves as a reminder for many of us how subject our decisions are to chance events. Without the fortunate timing of the Sputnik by the Soviet Union, Sir Bernard would have been in serious trouble, but in October 1957, he became a hero instead. He wears his laurels modestly, and gives credit to the talented young people who, under his leadership, made Jodrell Bank such an interesting place.

At the first reading, I wished for more description of the inside workings of the system, but that is not his style. The monumental clash between Ryle, Pawsey and the Cambridge cosmologists is not mentioned; in fact, there is no mention of the symposium itself, despite Jodrell's central role. In a more gossipy vein, it would have been fascinating to learn more about the dealings between Sir Martin and Sir Bernard over budget priorities, which must have been intense at times. In retrospect, these omissions are entirely in character. In the summer of 1955, solving the enormous financial and engineering problems were far more vital to Jodrell Bank's future than a prestige item like a symposium. Sir Bernard always attended to first things first. The lack of gossip is also consistent, because he is a gentleman, and gentlemen have no need of gossip. He credits Sir Martin with the same virtue; knocking the other man's project is no way to further one's own interests. Sir Bernard's consistency has served him well, and astronomy as a whole has been well-served at the same time. □

Bernard F. Burke is in the Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA.

Essential link

Geoffrey Tweedale

Early Scientific Computing in Britain. By Mary Croarken. *Oxford Science Publications: 1990. £25.*

UNTIL the 1950s, computing was regarded as a highly esoteric activity. Even the great von Neumann regarded powerful computers as the tool of applied scientists — quite exclusively. It was also believed that computing would be a highly centralized activity, with only a handful of centres providing the faculity for solving complex calculations for scientists, engineers and surveyors.

Croarken takes as her main theme the gradual centralization of computing power in the United Kingdom during the first half of the twentieth century. Although the development of desk calculating machines in the late nineteenth century made it theoretically possible to centralize some types of scientific computing, this trend only began to emerge in the late 1920s. A key figure was L. J. Comrie, a New Zealand-born astronomer, who joined the Nautical Almanac Office in 1925 and soon became its superintendent. Under Comrie, the NAO mechanized much of its computation and developed efficient numerical methods for use with mechanical computing aids, such as Hollerith punched-card machines. The NAO was thus transformed from rather a narrow institution, providing navigational data, to a world-renowned centre involved in astronomical societies, tablemaking and mechanical computation generally. In other words, it had come close to becoming an unofficial computing centre. A driven and impatient man, Comrie eventually found the civil service environment of the Admiralty uncongenial and in 1937 he left to set up his own firm, the Scientific Computing Service. By the beginning of the Second World War Comrie's London-based business had become the only commercially run scientific and computing service to exist in Britain (and probably the world).

Meanwhile, mathematicians at Manchester and Cambridge universities, finding that Hollerith punched-card machinery and desk calculators were inadequate for their needs, began the construction of large-scale analogue machines. In 1934 Hartree, a professor of mathematics at Manchester University, constructed a differential analyser. Although useful for complex differential equations, such as those in ballistics, the analyser did not lead to the growth of a computing centre at Manchester University. However, Hartree's work did provide a springboard for later work on digital computers both at Manchester and at Cambridge, where another differential analyser was built and the Cambridge University Mathematical Laboratory was founded in 1937.

Nevertheless, when the Second World War broke out the only organization to which scientific workers, both within and outside government, could apply for computational advice or practical assistance was Comrie's Scientific Computing Service, The sudden upsurge in demand for computing services from the military thus created a problem. Initially, the expertise and resources of individuals such as Comrie and Hartree were used and computation within the government's service ministries was expanded. The Admiralty Computing Service was established in 1943, though its role as a central computing service was limited by its restriction to government work, its lack of equipment and failure to undertake new research. These deficiences were eventually recognized, leading to a proposal from the Department of Scientific and Industrial Research for the creation of a genuine national computing centre — the National Physical Laboratory Mathematics Division — which became operational by 1946. By then the electronic stored-program computer was about to make its entrance, leading first to the development of other computing centres in the 1950s, but eventually to the decentralization of computing services.

The author's investigation of scientific computation in the 1920s and 1930s is an important contribution to the history of computing, though the final sections of the book are something of a disappointment: the discussions of the work of the NPL and the post-war development of computing at Manchester and Cambridge add little to previous accounts. Croarken seems to avoid the wider implications of her work: there are no international comparisons and little analysis of the social and economic context. She argues that the "most important single factor which prompted the creation of computing centres was the work of far-sighted individuals" — yet the fact that the foundation of a centralized computing service was undertaken only through the pressure of war makes such a conclusion seem simplistic.

Nevertheless, Croarken reminds us that, despite the enormous strides of the past forty years, calculating machines and computers have had a long history. Though mostly using only published secondary sources, she sheds a clear and illuminating light on early pioneers such as Comrie and Hartree and provides an essential link between their work and that of their more famous heirs from the electronic digital era. □

Geoffrey Tweedale is at the National Archive for the History of Computing, Manchester University, Manchester M13 9PL, UK.