THE PURPOSE OF THE FORUM

B. C. Brookes

By the end of the NATO Advanced Study Institute at Aberystwyth (1973) it seemed to at least one of its members that at information science was beginning to emerge. The main purpose of this Forum is to reconsider that emergence. We therefore invited a limited number of those who are known to have contributed to research in information to discuss related problems and included a higher proportion of Europeans than the NATO meeting attracted.

In its present state, information science is almost wholly a field of application. There is great activity in the extension of information networks and the establishment of new kinds of service. More and more governments are modernizing and diversifying their economies and feel it necessary to adopt information services, both for industrial and social purposes, similar to those which have already been established in the most advanced industrial countries. Networks spread around the Earth.

The industrial revolution; an analogy

The *industrial* revolution was founded on the intimate interaction of three technologies - of coal, iron and steam. The first steam-engines were pumps for clearing mines of water (1699). Then followed steam-engines as sources of rotary power to supersede mills drawn by wind or water. The new rotary engines were applied to new types of machine for boring and machining iron so that steam-engines of higher power and efficiency could be steadily developed. By the year 1800, after 100 years of development, the trend towards larger machines was also being accompanied by a search for steam engines of a higher power/weight ratio, to drive carriages and ships. These steam-engines needed to be compact, economical and reliable so that the vehicles they powered could also carry a pay-load over long distances away from their maintenance bases.

Development steadily continued so that by 1850 steam engines were pulling trains along the embryo railway networks of Europe and North America and steam-powered ships were crossing the Atlantic.

One remarkable aspect of this immense technological achievement over the period 1700-1850 was that it had needed no application of scientific theory whatever. All the main contributors had been men of practical skills who were able to translate their insights directly into working hardware, though only the successful machines are now remembered. The second remarkable aspect was that these intensely practical engineers and craftsmen, wholly devoted to the task of 'harnessing the forces of Nature for the benefit of mankind', unwittingly precipitated a *social* revolution which transformed mainly agrarian into mainly industrial economies. The social impact of the new technology was enormous.

The first *theoretical* contribution to the development of engines which converted heat into power was published by Sadi Carnot in 1824. It was ignored because of its abstractness. The missing quantification did not emerge until the 1840's when the exact relationship between heat and mechanical work was experimentally determined by Joule *et al*. Fairly quickly thereafter, thermodynamics, the theory of the 'heat-engine', was developed and its laws were formulated. By 1880 it was at last possible to design heat-engines on scientific principles with due regard to efficiency and economy. The first of these engines was the Diesel, named after its inventor. The new theory was *general*, ie it applied to all machines which converted fuel into power. The new theory also indicated how machines of still higher performance might be achieved and so led to new lines of theoretical and applied research in engineering, metallurgy and many other fields.

The information revolution

The impending *information* revolution is also based on three technologies - of computers, telecommunications and (in its widest sense) reprography. These three well-established technologies already attract much scientificially-based

research so that we can expect continued developments of possible application to information systems to be derived from them. I have no doubt that information science can ride comfortably on the products of these other technologies for years to come.

The main scientific problem of the *industrial* revolution was to understand exactly how heat can be transformed into mechanical work, a problem which took about 80 years to solve even though it is a purely physical and familiar process. The main scientific problem of the *information* revolution is to understand the information process in humans, a problem which is much more complex and which is partly physical but mainly biological and social. And, significant as was the *industrial* revolution on society, the impact of the *information* revolution is likely to be even greater.

The *industrial* revolution gave man control over *mechanical* power on a wholly new scale. The *information* revolution offers man control over a *social* power on a wholly new scale.

Even though we do not fully understand them, present information systems seem to work well enough for most purposes. There seems to be no reason why development should not continue, indefinitely, much as the development of the steam-engine did, without a theory. So why call a Forum to discuss the *theoretical* aspects of information science?

Responsibilities

Any attempt to understand information 'needs' and users in any fundamental sense brings us up against one of the major areas of enquiry which have so far resisted scientific analysis - the human mind in all its variety, complexity and stages of development. So any fundamental theory will take many years to generate. Yet the design of more effective, efficient and economic systems will increasingly depend on a more fundamental analysis of user needs than purely statistical studies can ever hope to give us.

There are also *social* responsibilities to consider. Those who are aware of the possible social implications of universal information systems need to begin thinking. Who should control inputs to the systems and access to them? And how can this control best be exercised? What is it all for?

Some of us have *academic* responsibilities also. We need to make the study of information science more attractive to young people of high intelligence. For some years the professional needs of information services have been met by training young people as practitioners for work in a relatively stable environment. But there is likely to be a growing concern with social, technological and scientific issues which will become increasingly interdependent and complex. It is time we began to consider what we as academics should prepare for.

The main objective

The long-term task is to begin the search for a fundamental theory of information analogous to the theory of thermodynamics in the industrial revolution. What *short*-term tasks would it be reasonable to set ourselves?

Looking around the information scene I see few who have already contributed some of the theoretical elements which offer hope of synthesis into a coherent body of knowledge. But at present they cling rather desperately to their individual bits of flotsam, splashing about in all directions in the dark waters. Perhaps, though we are very widely scattered about the world, some of us might work in closer cooperation towards one or more of the short-term targets. If we could, an exciting opportunity to begin the founding of a new science lies before us.

---oOo---