JANUS†—Reflections on DATAFAIR 69

F. J. M. Laver*

* *Director, National Data Processing Service, Docos House, 62–82 Commercial Road, London E1*

This paper reproduces the address given by the author at the close of DATAFAIR, The British Computer Society's Conference held in Manchester, 25–29 August 1969. It contains a number of points meriting more attention and of importance to the professional image of 'computer people', particularly in the sphere of business applications and software.

Introduction

Anyone who has to speak on the last day of a conference such as this faces something of a problem because, being, as I must assume, a well-run event, everything that the organisers wanted to have said will have been said: what has been said is everything, or even more than the speakers themselves wanted to say; and you will have heard, if not all that you hoped to hear, possibly all that you can bear to listen to.

However, I am shown in the programme as due to review Datafair 69 in all its aspects. You will be relieved to know that I have no intention of doing any such thing. How could I expect to inflict on you an oral report on so concentrated a week as the dedicated majority among you must have been having. You will have been dividing your morning between the 100 presentations made each day, and your afternoons between nearly 90 formal papers. Somehow, you will have found the time and mustered the energy to take part in the discussion sessions and to call at the booths of 46 exhibitors. You will have joined 17 of the 90 parties of works visits—if you joined more, you must have seen something twice, although you may not have noticed it at the time. The non-stop performance of 15 films will have absorbed the equivalent of one man day. There surely can be none among you who does not now know at first hand what it feels like to be a central processor time sharing—and remember *you* had proven software to do it with.

I decided, therefore, not to embark on any kind of revision course in the papers that have been presented; nor to uncover and re-display their highlights—nor would it benefit either of us to attempt to trace a conference theme.

Again, it would not be appropriate for me to propose any major thesis at this late point of the conference; the session is too privileged. The absence of discussion in fact prompts the thought that the occasion invites a kind of lay sermon; so this is what I now propose to deliver. (The difference between lay and clerical sermons is that the lay one is longer.)

My intention is to draw forth two topics that have occurred to me while reflecting on some of the papers, and then to draw them together with particular reference to The British Computer Society. The first concerns computers and people: the second, computers and systems.

Computers and people

Computers, like sulphuric acid and student power, tend to produce powerful reactions whenever they come into contact with ordinary men and women. Their use by the applied mathematicians and scientists, by whom and for whom they were invented, has produced no particularly adverse comment—but here they were affecting people accustomed to novelty and anxious to use them. Their use in business has attracted more criticism. An increasingly popular excuse for being out-of-stock wrongly supplied, or overcharging, is to say in a deplorably conspiratorial tone 'Well, you see, since head office put in that computer none of us knows where we are'. I sometimes think that when, in due course, the Society comes to apply for its coat of arms, this should consist of a scapegoat rampant on a field of variable length.

The Press, moulding as well as expressing the public mind, delights to catch our electronic miracle-machines in seemingly stupid errors. This is doubly less than fair, because it was the Press that made them into wonder-workers in the first place, and the errors are more often human than electronic. Lady Lovelace with her accustomed foresight commented on this phenomenon. Thus, in one of her splendid notes on Menabrae she wrote:

> 'In considering any new subject, there is frequently a tendency first, to overrate what we find to be interesting or remarkable; and secondly, by a sort of natural reaction, to undervalue the true state of the case, when we discover that our notions have surpassed those that were really tenable.'

Our prose style has deteriorated, but the situation has not otherwise changed with the passage of a century and a quarter.

† *In Roman mythology, an aboriginal spirit of the doorway; developed into a double-headed deity.* Ed.

It would, of course, be quite ingenuous of us to reproach the Press for dealing with computers in ways that search out some human interest, isolate some comprehensible fact, in order to appeal to the widest possible readership. It would be futile to expect to apply the canons of scientific literature to journalism: we should rather recall Oscar Wilde's remark that 'journalism is unreadable and literature is unread', and be ourselves ready to seek the larger, and I suggest the more important, lay audience. This will not be to everyone's taste, for in seeking to interest lay readers and secure their attention, it will usually be necessary to over-simplify outrageously, to select arbitrarily, to generalise without reservation and to deal in terms of personalities and problems. This is what journalists have to do, and we should not criticise them for misunderstanding our trade if we are not prepared to understand theirs.

Some of the failures of computers in commercial work, and I am told that there have been some, have been due in part to difficulties of communication between computer men and their clients—a matter which has been the subject of papers to this conference. Computer men tend to be young hawks, who soar with great panache to breathtaking heights of theory in regions where more elderly managerial doves have learned to flap along with pragmatism and hope. Again, some computer men and women, like some scientists, have personality traits that hinder their communication with lay managers. They are introverts who are happiest in a world of machines or theoretical systems, where everything is predictable and can be brought under complete control, and are rather ill at ease in the buzzing, blooming confusion of the world of people and personalities, saturated with irrationality and charged with emotion.

This problem of developing good communications between computer specialists and laymen, is hampered by our use of a terminology that has taken such ordinary words as program, instruction, word, dedicated, gate and bit and used them in highly esoteric ways; nor is it helped by the fatal fascination that acronyms have for computer men. My title is not one. *We* know that these acronyms—like puns—are only harmless fun, ingenious when they are ours and tedious when they are other people's; but outsiders see in them a deliberate attempt to evolve a mystique. I am not suggesting that we should, or that we could, invent a new terminology, but only that when talking to laymen we must remain continually on guard against the very real risks of mutual misunderstanding.

Again, it requires no more than an instant of sympathetic thought to appreciate that the managers working in a business that is installing a computer will have worries about its possible effects upon their jobs—will they be replaced? or displaced? will they be able to cope with all this complexity? will they be given time to do so? Even quite senior managers fear that they are marked down as victims in a take-over campaign by the computer specialists; they do not see computers as tools for them to use, they see them as devices for usurping functions that they previously and properly performed. This problem is no new one. The same questions must have arisen with the rise of earlier specialist groups, for example accountants; although when you consider just how many senior managers came up through the accountancy route, it is perhaps, understandable that they have the best of reasons to be worried by what later invaders may do. Here, again, the answer must lie in more communication and fuller participation; all affected staff must be brought into the picture at the earliest practicable stage, and be consulted and kept informed as the project develops. To be a completely successful computer in a business, line managers must see it as a 'we' thing not a 'they' thing —something that we managers want to use to help us in our work, that will increase our status and our effectiveness, and that we have had a share in designing: not something that they are putting upon us; and for their good, not for our comfort.

Failure to consult and failure to communicate are not, of course, the only causes of failure in business computer systems. Some unsuccessful systems have suffered from ill defined requirements, from ignorance of the difficulties, from sloppy systems work, from underestimated costs, from overreaching ambition and from faulty conception. Computers can never be a substitute for thought, nor are they reliable harbingers of improvement. A decision to use a computer may, briefly, give a management the reassurance that they are (after all) more progressive than they feel—but we know that what lies ahead is no royal road, but rather the steep and stony path of the pilgrim.

Experience and sweat have by now driven most of the bad ideas out of batch processing; but devils cast out are reputed to find other abodes, and I have been wondering whether this lot haven't moved over into management information systems. Thus, it is not yet universally understood that in these the real need is not real-time but real information that bears on the real problems of real managers. MIS systems are currently the area of computer activity in which there are the greater gaps between what is possible in principle, what is achievable in practice and what users in fact require. Like Joshua, computer enthusiasts have gone on and spied out a promised land, but like the Israelites the great mass of managers hearing of the heroic times and great rewards that lie ahead raise loud cries that they would rather be left as they are. They find management quite difficult enough without being helped by young men whose competence manifestly lies elsewhere, and whose interest seems to them to lie more in the opportunity to develop their own skills and advance their own careers, than in understanding the needs of management and of business. These are hard words, and much too censorious of some; but it is important that we should recognise that the upward spiral of computer salaries, and the consequent rapid movement of systems analysts and programmers between employers, have generated a somewhat cynical attitude in those who are left behind to make the systems work—and if we are honest we must admit that their jaundice is not entirely attributable to sour grapes.

We need to recognise, and not just pay lip-service, to the fact that business computer systems do alter the patterns of information flow and thus do tilt the balance of power in an organisation. The growing use of computer bureaux will re-present this problem in new ways. Thus, the customers of a bureau are invited to hand over large and often vital parts of their work to an outside agent, and some of them doubt whether they are safe in thus putting their jobs into commission? How long they wonder will the agency be content to remain neutral and docile, serving its customer's interest? How soon will the logic of vertical integration lead it to extend its

boundaries to embrace his business? The use of bureaux raises with special acuteness the problems of communication between customers uninstructed in computers, and the bureau's computer specialists, uninstructed in the customer's affairs. Each speaks a different jargon, and each takes for granted a thousand things well known to those steeped in his trade, but mysterious and occasionally significant to the other, had he only suspected their existence. Sometimes our troubles flow not from the things we forget to say, but from those we never thought of saying, because they were so obvious to us.

I have so far been considering the troubles that may arise when computers come up against people in their working lives. These are important, but there have recently been various signs of a wider public concern at the prospect of the extension of computer control over individuals. Clive Jenkins expressed this concern in his opening address. Bills have been introduced in the Commons and the Lords on Data Surveillance and Personal Records in computers. Some see a threat to our cherished human rights not to be found out—and not to be found in either. The conjoint use of computers and communications for information services and for data processing will certainly transform our society in ways that will pose difficult problems; of élitism and of political responsibility for example, as well as offering opportunities to counteract urban over-concentration. Remote access computers are anti-city and anti-campus. Rather than attempt to enlarge on these problems let me commend to your attention the sardonic wit of Hans Alfven, who, writing as Olof Johannesson, produced 'The Great Computer'. Let me also agree with Marshall McLuhan that changes in our environment change us—indeed as the animals who head the evolutionary league table it would be surprising if this were not so. Hence, because the use of computers tends to be impersonal, rational and efficient, we need to be on our guard to make sure that computer systems take sufficient account of human frailty and human dignity; and do not merely treat us as rather low-priority peripherals yielding somewhat suspect data in singularly ill-disciplined formats.

It is worth remarking that some of the effects that are feared may come, not because they have been planned deliberately, but rather accidentally as an unforeseen and unwanted by-product—somewhat like the case of the man who loved the fat girl, who, as you will no doubt recall, lamented 'she's all my fancy painted her, but so much more besides'. A member of the Congressional committee concerned with the threat to privacy, commented that Big Brother was less likely to come to America through the action of a power seeker, than by the action of a bureaucrat obsessed by efficiency.

We, who take computers and the advantages they bring very much for granted, need to accept that there is here a genuine and a troublesome problem. The simple lifer's solution is to ban the use of computers where they touch on human beings, but this is too simple for these crowded non-desert British islands. To do so would deny us the opportunity of winning substantial social and economic benefits—or at the very least, delay them. I expect that most of us would want to argue that there is great scope, and even greater need, for a more explicitly rational approach to our affairs and that the use of computers for analysis and for simulation offers the best hope of gaining first insight into, and eventually control over, the complex systems of economics and of society. George Orwell, however, has reminded us that rationalisation of the administrative and economic system does not imply that the increased power will be used for humanitarian ends, and we must agree that nothing in computer technology guarantees that it will promote human good. All technology is neutral. The discovery of fire made it possible to burn a heretic—or the Sunday joint. We must recognise and accept that we are challenged to live dangerously. No other choice is open to us. This I believe to be realism, not fatalism: disaster is not inevitable, but like the good Boy Scout we should 'Be Prepared'.

Computers and systems

Notable among recent trends in computing is the lush—some would say the rank—growth of software. Indeed, this conference has itself illustrated this fact by the relative numbers of papers dealing with hardware and with software. It is interesting to speculate whether the use of software is an established trend which will be with us for some time yet, or whether we are approaching the extreme of a swing about to reverse in the direction of hardware, as might happen should the use of large-scale-integration in micro-circuits slash hardware costs and boost hardware reliability. Some time ago, impressed by a quip of Lord Bowden's about it taking the united efforts of the staff to keep the machine on the verge of operation, I ventured to define a 'Bowden Limit', towards which system design inevitably tends, and which is reached when the system becomes so large and so complex that it just does not work for long enough between failures to find out if it is working. This is the primary Bowden Limit, the secondary is reached when simulation on existing machines extends beyond the obsolescence date of the new system. Whether there is a tertiary is left as an exercise for the reader.

As I see it, designers use the components and techniques available to them at a given time to press on towards the Bowden Limit, where they are held in check until new techniques appear. This process is illustrated by the sequence of computer generations, which can be regarded as a relaxation oscillation superimposed on a secular drift. It can also be regarded as an enormous nuisance to computer users. The advent of LSI may push the hardware Bowden Limit back to a point where it ceases to be troublesome, to users anyway, and for several years at least. In software on the other hand, I feel that we are at the Bowden Limit with our current techniques—indeed, some large-real-time systems may well have passed beyond it.

The history of science illustrates by many examples the fruitfulness of transferring concepts from one discipline to another, and perhaps I could usefully illustrate this thesis another way by borrowing the concept of 'critical mass' from physics. When a business, or a department, or a data-processing system, attains a certain critical mass, there occurs a sharp rise in its internal activity, and one which is not matched by its exchanges with the outside world. In the civil service this narcissistic phenomenon is recognised, without any pleasure, as red tape, and O & M units have been introduced to detect and prune back its growth. In our field, on the other hand, 'red tape operation', as a term, has been

blessed by its inclusion in the IFIP vocabulary. Some large real-time computer systems may already have exceeded their critical masses; but unlike the situation in nuclear physics the effect is not to release energy, but rather to absorb it. And in this way to reduce the effective work done by the computer for its users to a shamefully small fraction of its total activity.

There can be little room for doubt that users are more dissatisfied with manufacturer's software than with any other aspect of their relationship. The users view can be summed up by reversing Churchill's famous appeal to Roosevelt and saying that to users their suppliers' policy has often seemed to be: 'Give us the job and we will finish the tools'. But, to be fair, our suppliers are no more fools or knaves than we are, so what has gone wrong? In part, there has been a scarcity of first-class people with first-class ideas; and quantity cannot substitute for quality in the design and manufacture of system software. In part, we have fallen into the trap that caught Charles Babbage, for we too are always having better ideas. Indeed, because innovation is the essence of our business we are peculiarly susceptible to this siren's call of innovation. Have we—because computers are general-purpose instruments—tried to make our software too general-purpose also, so that it does everything rather badly and nothing very well? Should we specialise more, matching our executive software closely to the individual application's environment? Another way of putting this question is perhaps to ask whether we would not be better off with more limited executives, shifting more into the application programs—limited in range of facilities, not in power or efficiency? Unbundling might, I suppose, produce this result. Should more software functions be left to the hardware? LSI might produce that result—by reducing the costs and increasing the reliability of hardware at a time when software's costs are rising and its reliability is not.

The software problem has been complicated by the continual development of ever-more-powerful central processors, and the consequent need to provide them with complex executive systems to control their operation. In between the occasional big computation that extends and justifies their processing capacity, the use of these hulking great brutes has to be parcelled out between many concurrent users' programs. The software that supervises this sharing is itself time-consuming, and consuming extraordinarily expensive time at that. At the limit this approach may become self-defeating, for—as with cosmetics—at the limit the costs may all reside in distributing and packaging rather than in the product itself.

There is a tendency among some with-it chaps to regard batch-processing as dead, and superseded by the real-time on-line conversational stuff. This assumption merits examination. Conversation is often a time-wasting process. Conversation with a computer is no exception. It needs to be confined to those applications where it can be shown to be both necessary and effective. Heruistics and millisecond responses are all very well, but chatting up a computer can never be a substitute for thinking or for exercising common sense.

The convergence of computers and communications, at both the operation and the technological levels, is a matter of great current interest and one that requires us to look ahead—if not entirely forward—to moving on from computer systems to sytems of computers. As any system grows larger and includes more elements, its behaviour very rapidly becomes more complex, and a complete or even a sufficient understanding of its pathology very much harder to acquire. Some approaches appear to treat large systems of computers in terms of a single super-system, to be designed and implemented all in one, but this I believe to be most accident-prone; a surer approach is surely to move steadily towards the total system by building up a hierarchy of intercommunicating but individually self-supporting sub-systems. In this way we will achieve a more robust result and fault diagnosis and recovery will be easier—or, at any rate, possible.

As well as converging with communication systems, computers are converging on information systems. It is worth pausing to observe that term 'information' used differently by communication, computer and information men. Communicators are concerned only with economical and accurate transport of coded representations from A to B, without regard to their meaning—if any. In computing, we are concerned with the fast, accurate transformation of representations, without regard to the meaning of the transformations, or the input or output. Information technologists are concerned with the meaning of reports to the originator and the recipient. Communication and computer based information systems can be expected to supplement and eventually take over from the written and printed media that have served us so long. The so-called computer grid may well find its justification and its principal use in the distribution, storage and generation of information, rather than in computation or commercial data processing.

Information becomes so only when the mind of some person is informed, that is given a new form, by it, which leads on to a consideration of the roles that people may play in computer systems. As well as operators, programmers and system designers, their roles may include: closing complex feedback loops in control systems in order to act as last-resort supervisors able to cope with unforeseen contingencies, or as monitors of system activity who add a kind of self-awareness or consciousness to the automatic system. In systems with wide-ranging patterns of activity, human intelligence may be needed to steer the system, for example, by changing its optimising strategy or its priorities in response to the flux of circumstances. And, there is ultimately no substitute for men as sensors and as actuators in situations where events are largely unpredictable, and where intelligence and human interest are needed to determine which of an infinite sea of data are relevant and significant to human problems. We can, therefore, expect for sometime yet to find men embedded in close working relationships with computer systems, and it is important that their relationship shall be truly symbiotic—not only is it more satisfactory for each to do what he or it is better at, but great care must be exercised to respect human dignity. Thus, the system must not overwhelm its human associates, nor leave them idle for long periods waiting to cope with sudden disasters. It would, of course, be quite practicable to program computer systems to simulate emergencies or even to fudge up what has been called 'a fluff of busy work' to keep their humans occupied—but we men would soon see through the artificiality of that situation and either resent it, or fail to respond seriously when genuine action was required.

The optimum balance between the human and machine contributions deserves much study.

Professional responsibility

The time has come to draw my two topics together. The concern of the public for its freedom, and the vulnerable innocence of lay users each places extremely heavy responsibility on computer men and women.

The total engagement of information systems with the vital affairs of industry, commerce and government, will mean that failures due to incompetence or haste cannot be hushed-up, glossed-over or ridiculed as minor follies, they will become major public disasters like the collapse of a dam or a bridge. Those who are permitted to design them must be trained to a fully professional level; have had the necessary experience, and act with the responsibility and judgment appropriate to the exercise of a profession. They must give sensible and realistic advice about timescales and costs.

The design and operation of information systems which handle data about identifiable persons, can only safely be performed by men and women acting with professional competence, and accepting professional codes of good practice and good behaviour. The BCS in taking up its new qualifying role has assumed the heavy responsibility for turning what has been an amour, an art, a rag-bag of techniques, into a profession, with all that that implies.

Any profession that takes its duty to society at all seriously must in my view also accept the responsibility for telling lay men and women, whether these be customers, 'victims' or legislators, enough about computers for them to judge the implications for themselves and for society. In any novel situation, and especially in one that is already causing some anxiety, the public thirsts for information; and all experience suggests that new ideas are accepted more readily when people are involved at the earliest possible stage, are kept continuously in touch with developments, and are given the opportunities to discuss them freely and to participate in proposing changes and in making decisions. As members of the BCS we have a duty to communicate, to do so continually, and to do so in the plainest terms.

I sometimes feel that we have been too readily content to talk to each other, enjoying the cosy exchange of shop and regarding the explanation of our activities to outsiders as a tedious distraction or a tiresome chore. The exposition of computers to ordinary men and women is all the more urgent now that they stand at the thresholds of education and of medicine, two fields in which their use could profoundly affect individuals—as opposed to those large, impersonal, abstractions 'industry', 'society' or the 'economy'.

When books and articles have been written in an attempt to inform the general public about computing, they have too often (and this is a vice of mine) gone back to Babbage, or (and this is not a vice of mine) begun with binary. We must, each of us, take pains in these matters to deal not with the absorbing but quite often irrelevant technicalities of our trade, but with those external characteristics of computers which will allow our legislators, administrators, managers and citizens to assess for themselves what the effects on their affairs are likely to be. Perhaps the BCS might consider establishing an equivalent to the Faraday lecture of the Institute of Electrical Engineers, which delivered to lay audiences—or at least to non-specialists, quite specifically attempts to present an authoritative but comprehensible account of recent developments in some aspects of the art, and to point their wider public implications.

In his Presidential Address Prof. Gill asked:

> 'To what extent should all of us, who specialise in computing, concern ourselves with what computers are doing to society?'.

My answer to his question is that we must concern ourselves in very large measure indeed, but that in doing so we must have sufficient humility to recognise that expert knowledge is no guarantee of insight and can be a barrier to communication, that our knowledge is of computers and not of society, and to reflect that the ordinary man realises that on his own subject the expert is to be suspected of bias, and on every other is no better than anyone else.

I hope now that my title needs no further explanation. I feel very strongly that as members of a new profession, we must face both ways: we will inevitably look inwards to our chosen profession, but no less importantly, we must consciously and continually look outwards to the larger lay world outside.

References

BOWDEN, LORD. *Faster than Thought*, London, Pitman.

B.C.S. (1969). Datafair 69—The Society Programme.

B.C.S. (1969). Datafair 69—Abstracts of BCS Symposium Papers.

B.C.S. (1969). Datafair 69—Guide to Industry Presentations—published by BCS in August 1969.

I.C.A. (1969). *Business Management and Computers*—seven studies published by *Accountancy*, the journal of the Institute of Chartered Accountants in England and Wales; papers presented at Datafair 69.