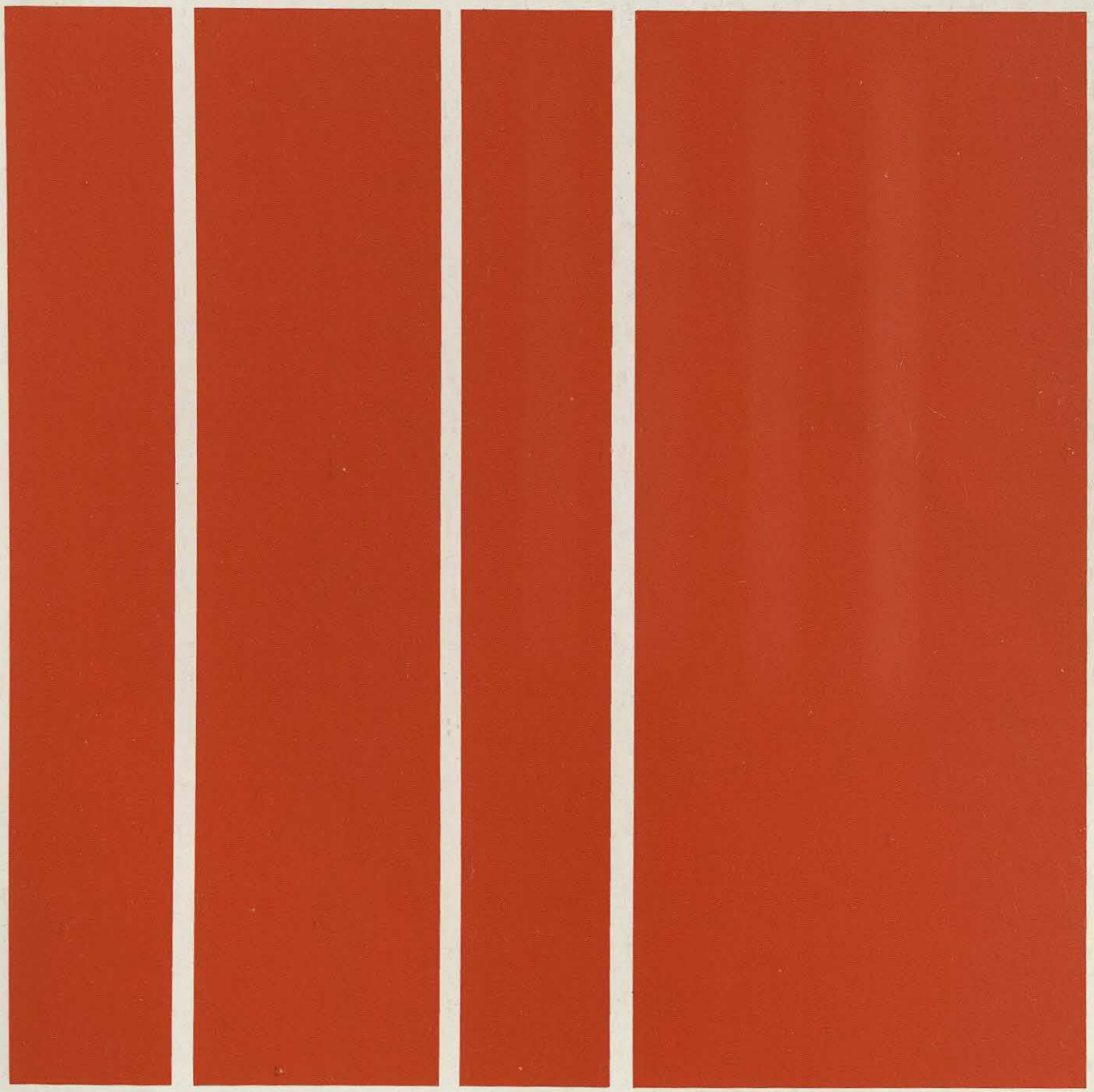
Transcript

Management Conference

Bournemouth
June 29 – July 2, 1981



The Butler Cox Foundation

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NINTH MANAGEMENT CONFERENCE

Bournemouth, June 29 — July 2, 1981

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CONFERENCE OPENING

David Butler,
Butler Cox & Partners Limited

Ladies and gentlemen, I should like to declare this conference officially open. First, let me welcome a particular guest, Mr Ron Potter. Mr Potter is here today representing the remarkably named Emphatic Charitable Trust. The purpose of the Emphatic Charitable Trust is to promote the needs and opportunities of disabled people in the computer industry and in this, the International Year for the Disabled, we thought that it would be useful to invite Ron to come along and talk to us all informally about the work of his Trust. He will be present throughout the conference. We hope that delegates will take the opportunity to talk with him about the work of the Trust. And who knows, if any of you happen to have brought your cheque books with you, something may come of those discussions.

There are several things about this conference that are a little different from ones we have had in the past. In particular, I should like to mention that this evening, at 18.30, there is a session of housekeeping — but very important housekeeping as far as the Foundation is concerned. David Seabrook, the Director of the Foundation, will be taking the opportunity to go through with you the salient features of the Foundation's report on its activities for 1980 and, just as importantly, he will be going through with you the elements of the programme planned for 1982. As you know, it is our custom to ask members for suggestions about research subjects, to offer our own shopping list of subjects, to receive a postal ballot from members concerning their interest in different subjects; and finally, to present a co-ordinated programme of research to the Management Board of the Foundation. All those things will still be done, but we want to use this session this evening to give those members who are here today an opportunity to comment on the subjects and the aspects of them which are most interesting to them.

During the next few months we will also be implementing a series of other steps which are designed to try to improve the fit between the work of the Foundation and the members' needs. As you know, the past pattern of activities has been the published reports which we produce, followed by professional and technical seminars which are intended to provide members with a chance to follow up specific questions or points of interest in the reports. In addition, we have run conferences such as this, and management briefings. In recent months it has become clear to us, both in discussions with the Management Board and with members at large, that the professional and technical seminar format needed some adjustments in order to realign it with its original purpose. The seminars, which had begun as detailed and intimate discussions of reports, had become in fact quite substantial conferences in their own right. But since they were one-day events they did not really provide the opportunity for interaction between delegates, nor for real, direct access to the report authors, which originally they had been intended to provide.

The new schedule of activities which has been recently distributed shows a change in this pattern of activities. Conferences like this one are planned to be more closely linked to report themes, and the professional and technical seminar series will be replaced by an increased number of management briefings which will feature higher-level speakers. The

workshop sessions at conferences, such as the ones that we are having here in Bournemouth this week, will provide opportunities for face-to-face discussions with, among others, report authors. We also propose to hold much smaller and more detailed discussions of report topics whenever these are justified by the extent of members' interests. So each published report from now on will carry a printed form asking you, the members, whether you wish to take part in such a smaller, detailed discussion.

The Management Board of the Foundation which, as you know, includes three elected representatives of you, the members, considers that this new formula will more accurately meet the members' needs. These arrangements will be confirmed in writing within the next week or so. We hope that any members who wish to comment on the working of the new arrangements will remember that David Seabrook, the Director of the Foundation, and I will always be pleased to hear any comments on the working of the new arrangements with a view to their further improvement.

Let me now turn to the subject matter of this particular conference. I must admit that it is a conference which, two or three years ago, I would very much have hesitated to arrange, because it seemed to me that the subjects to which this conference addresses itself have only recently come into the clearest possible focus. The title of the conference is "Personnel issues for management services in the 1980s", and I conceive of those issues as spanning an enormous range of responsibilities and necessary actions. Just by glancing at the agenda for the conference, we can see that there are responsibilities and necessary actions at three different levels.

The first is at the level of national governments and international governmental agencies. In Europe, at a national level and the international level, we face severe, challenging and extremely worrying problems of productivity, of unemployment, of different aspects of informatics policy such as privacy and security. All these problems are coming to a head in most of the European countries at the same time. What will our approaches be? How can we achieve, together in Europe, a level of cohesion and a level of intelligence in responding to these problems that will elude any individual nation?

We are to hear two presentations on these subjects of national and international significance: Mr Morley from the European Commission, and Monsieur Danzin who has been one of those instrumental in forming the French policy towards these matters. At the corporate level we have problems of investment in times of declining markets and eroding profit margins. We also have problems of competition and problems of acquiring the necessary skills to justify competition and to justify investment. In terms of justifying our investment in systems for the future most of us feel that we need somehow to break out of the current expensive, time-consuming cycle of analysis, system development and synthesis — a process which has in the past often proved so time consuming and costly that by the time we have gone through that cycle the circumstances for which the solution was designed no longer obtained. We are happy to have with us Mr Staffan Persson from the Stockholm School of Economics to talk about new ways of systems development involving users.

At the level of our own principal responsibility, the acquisition, development and maintenance of skills within our organisations, we are focusing in two ways. First, Colin Brook of IBM will talk to us about the information systems jobs in the 1980s. What are the new career opportunities that will be open within the area of information systems? Will we see the long-debated, but so far slow-born, Director of Telematics in the large organisation? Will any of the jobs to which we have grown accustomed — indeed that most of us cut our teeth on — such as systems design and programming disappear in the years ahead?

Peter Bennett from Metal Box will tackle the very real problem of the retention and motivation of these people and he will show how individual companies can replenish and retain the stock of skills which they have worked so hard to create.

Finally, on this question of skills, all too often the skills which we have so arduously developed, retained, stored and managed seem, in some way that we do not fully understand, to produce systems which the users find less than ideally suited to their needs and less than perfectly engineered to the environment in which they, the users, want to employ them. Tom Stewart of Butler Cox will be talking about user friendly systems or, as I should like to put it, how to design computer systems that are fit for human consumption.

At the root of the whole problem lies the question of productivity, the productivity of people and of systems and of organisations. We are tackling that in this conference in two ways. First, by asking Michael Redhouse of DEC to talk about how we reward people for productivity and how we motivate them to secure productivity within our own departments. Secondly, by taking a look with Paul Mali at the measurement of the total productivity of systems.

Throughout the conference and throughout the continuing debate on these subjects over the next ten years, the question will arise of how we mobilise the enthusiasm and support of people within our organisations for the causes which we believe are important. Questions will also arise of how we involve them in the decision making process, and how we provide the leadership element which is management's responsibility in trying to harness the undoubted talent within our organisations. So if there is one thread which runs through the whole of this debate from the international level through the national level, the corporate level and the departmental level, I believe that it is to do with the involvement of working people in the shaping of their own destiny and their own environment. For that purpose we have invited Campbell Christie of the Society of Civil Servants to talk about union attitudes towards the telematic revolution. Mr Christie's session is entitled "Union attitudes: a positive response". I am sure that is something which we shall all welcome and my guess is that after his dealings with Lord Soames he will probably welcome a positive response from us as well. For our overseas delegates, let me explain that Mr Christie and his union are currecently locked in an apparently intractable battle with their employers, the British Government.

So that, ladies and gentlemen, is the agenda before us. I hope that during the remainder of this conference we shall focus our attention on these problems and opportunities. It was rightly said a few years ago that we never seem as a species to solve problems until we are posed with a problem or an opportunity at a higher level. We never solved the problems of the village until we were confronted with the problems and opportunities of the tribe. We never solved the problems of the tribe until we were confronted with the problems and opportunities of the nation. We have so far not solved the problems of the nation, but we find ourselves today confronted with the problems of an international organisation.

That is perhaps a minimum claim to put forward for the European Community of Nations — that it focuses our attention more sharply on our own problems by providing an external stimulus. But it is one which the Commission over the years has become extremely adept and adroit in exploiting for the benefit of Europe as a whole. In the European Community today we face challenges of an unprecedented nature of the need to restructure the institutions of the Community to meet new challenges and, at the same time, to expand the membership of the Community in ways which will compound both the complexity of the problem and the diversity of the solutions required.

To tell us how he sees employment prospects and employment issues in the Community and what kind of solutions are now emerging to these intractable problems, I should like to introduce John Morley.

SESSION A

EMPLOYMENT PROSPECTS AND EMPLOYMENT ISSUES IN THE EUROPEAN COMMUNITY

John Morley,
Commission of the European Communities

John Morley is head of the Employment Policy Division in the Directorate-General to employment and social affairs at the Commission of the European Communities, Brussels. He is an economist by training who has worked in government, industry and the academic world before joining the Commission in 1973.

I think that it is probably as well that I start this session with the explicit recognition that we in fact come from rather different worlds — not different planets, although some of us come from different countries, but we come from different worlds of work. We have different centres of gravity in our work and different zones of interest. Your world is that of the computer industry and, as I understand it, your particular concerns are both with the present and future staff needs within your industry and with the employment situation in your industry now and into the future. It is a dynamic and very fast-moving world, but also a rather introverted one as I see it, even perhaps incestuous in the sense that after most computer conferences that I have attended, a number of people end up with different employers.

My world is also concerned with employment, but it is really a world of government, quasi-government, pressure groups and politics. If we were to judge its output in mathematical terms, we rarely do better than produce lowest common denominators — that is when we produce anything at all. On the other hand, it is a very open world and one where, for good or evil, ideas can be promoted and actions taken which come to affect the working lives of people and companies to a very great extent. So I think that at the outset it is perhaps as well that we recognise that we have this potential communications problem between us so that we can seek to overcome it in exchanging our ideas. I like to think that that is why David has invited me here today to speak and I shall certainly do what I can to contribute to breaking down these barriers.

I should like to range a little more widely than David has said in that I should like to deal with three issues. First, I should like to deal with an issue which is closer and more directly associated with your own world and viewpoint. It is the question of manpower forecasting as a way of identifying problems in your industries and companies. Alas, I am led to the conclusion that this approach is not likely to provide any detailed answers to the sort of problems that we have, but the process of looking at success and failure of manpower forecasting in various countries will help us to redefine the problem in a way which enables us to find a solution. We will need to redefine the relationship between demand and supply of labour to find another balance, and to concentrate much more on job content and the training requirements related to this in the future.

The second area at which I should like to look is broadly that which David has suggested — the overall likely trends in employment in EEC countries over the next five to ten years. We cannot bring this down directly to your particular concerns, but I think that it gives a broad indication of the type of economic environment and employment environment in which we will all be operating in the coming years.

The third question that I should like to cover is the political climate and the policy issues that are likely to be on the agenda as regards employment and social questions over the coming years, and to see how far these are likely to affect you and impinge on your own areas of action.

So I cannot hope to be that specific or direct as regards your own particular interests. Therefore I hope that you will in turn help us to make this a fruitful session by telling me how relevant or irrelevant some of the factors or issues that I discuss seem to you to be. Also I hope that you will tell me whether in your view there are areas where governments (whether they operate nationally or internationally through the EEC) should either be doing something or perhaps stop doing something that they are currently doing.

Let me turn first to the manpower forecasting question. There was a time in the 1960s and the early 1970s when we could speak of economic and employment trends with a certain amount of confidence. This was an era of relatively stable and high rates of economic growth, and consequently a period of low unemployment. In that era many companies and forecasting bodies in general turned to manpower forecasting models and econometric input/output models. They hoped that with the press of the button or the turning of the handle it would be possible to predict in ever increasing detail and with apparently ever increasing precision the various implications either of overall economic developments for particular sectors of the economy or, more exciting and of more interest, of the different developments in occupational groups and school groups. It is rather as if we have turned the economist's general equilibrium model on its head, in that it starts with all the details and builds up out of this a whole economy. The manpower forecasting system was trying to do that in reverse, by taking an overall development in the economic situation and following through from that the detailed implications.

Of course people recognised that there were limitations and imperfections in all this. It was clear that the data was not as good as it might have been. The classifications were often too coarse. The statistical tools and analytical equipment were not all that they might have been. But there was nevertheless this overriding conviction that with more refinement and analysis it would be possible to predict with greater and greater precision the number of secretaries or computer programmers who would be needed over each of the next x years — perhaps even looking at this sort of pattern at a regional level. Britain was certainly a country that went in for this type of work fairly extensively, but it was not limited to Britain. In Italy these types of input/output models have been developed in great detail for many regions. This has also been the case in France and in Germany.

This development did not turn out too well, and I think that there were two major factors that shattered the hopes and aspirations for this type of approach, and we should do well to learn the lessons of what went wrong. First, improvements in forecasting methodology, far from giving greater confidence to the actual predictions about how many people would be required here and there, in fact did much more to reveal the weaknesses in the original specification of the problem. It was ignorance about the complexity of relationships in the labour market that enable what I call the "rubber/ruler brigade" to make a living by putting their rubber/ruler between three points and predicting to infinity.

The more sophisticated types of analysis — things like Box-Jenkins forecasting methods, times series analysis and spectrum analysis — all serve to highlight the inadequacies and the imbalanced nature of this sort of approach. In fact we came to realise that these types of manpower forecasting models were totally demand dominated. They started with an economic forecast, say 4 per cent growth a year. This was then related to the output of a particular industry. Perhaps the computer industry was growing at 50 per cent more than the average, so you get your 6 per cent growth there. Then a forecast was produced of the inputs to that industry that were required — the skilled or unskilled labour inputs that were consistent with that level of output growth.

Unfortunately, this overlooked two things. One is that the supply of labour of a given ability level is not infinite. After all, the whole specification of IQ is a statistical one. Inate intelligence, insofar as we can describe it as that, is supposed to follow a normal distribution. Hence, there is very little value in developing a forecast, the fulfilment of which relies on the availability of more people of a certain IQ or ability level than are actually available.

In more general terms, we can say that these types of forecasts were ignoring the fact that there is not only a demand for labour but there is also a supply of labour, and that supply in the economist's terms is relatively inelastic. It is, of course, possible through training to improve on a person's basic ability and exploit that ability to the full, but it does not actually enable one to create additional ability. Even in an era of high unemployment as at present, we all know about the shortages that exist for people of a particular ability level. I will not even say training, just of ability level.

There is a corollary of this, which is simply that in practice employers should not just sit and bemoan the shortages of certain skills. I realise that maybe not all employers do that now, but for a very long time there has been a great tendency to bemoan the lack of skilled craftsmen, programmers, or secretaries. The need is to recognise that the only way round this problem is to redesign the production process and/or the product so as to bring the supply and demand of labour into balance. In other words, in our developed Western economies we need to think in terms of appropriate technology, a technology which can deal with balance within the labour market. We are accustomed to talking about appropriate technology for the developing countries. I well remember attending a press conference — I think that it was Massey Ferguson tractors — where the public relations man was having a certain amount of difficulty with the sceptical journalists present. They had just won a big order to Central Africa. The journalists were asking why all these tractors had cigar lighters, double-sprung seats and super efficient headlights. The fact was that this company, like many others, was simply not relating to the market. Nor were the people responsible for ordering the equipment relating to their own needs. But this is not just a problem for developing countries, it is equally a problem of our own in seeing that we adopt the technology which is the most appropriate in terms of our own labour and capital resources. That is only one thing that went wrong with this kind of forecasting approach.

The second thing that went wrong was that the whole apparatus proved to be far less robust than was required. So long as the overall trends in economic growth were fairly stable, albeit somewhat cyclical, it was not too difficult to identify movements of a broad kind in terms of industrial trends, or even in terms of certain skills. But as we know, since 1973 all that has changed. It is no longer possible to attempt to predict the details on the basis of some single, stable view of economic developments. The 1973 oil price rise and the subsequent rise last year were the trigger that brought about a lower and far less stable level of economic growth. I say 'a trigger' advisedly, because it has become increasingly recognised that the causes of lower growth are both much more fundamental and much more complex than just oil price rises. Hence, an oil price rise which might well have been thought to assist the United Kingdom economy does not seem to be having such an effect at the moment.

The problems are very wide, but in broad terms we can say that there has been a basic failure of governments, of companies and of trade unions to tackle widespread structural problems in all our European economies. We have failed to get out of declining activities quickly enough, and we have failed to get into growth areas quickly enough. We have failed to recognise both the changing international division of labour and the growth of output in developing countries until we have been forced to face them with the collapse of our own industries. We have failed to exploit new information technologies and we have failed even to exploit much of the domestic potential for new patterns of demand. All this has created a fragility in our economic systems so that we are unable to weather nasty shocks. If we then add in currency instability and growing political instability in the world, it is not difficult to see that stable and high rates of growth are not things to which we can look forward during the coming years.

Let me round off what I was saying about manpower forecasting. I do not think that I am denying that it is possible to do that kind of detailed analysis of your own requirements, but I do think that the basic approach was somewhat misconceived. Rather than looking to that kind of approach to give detailed quantitative predictions of how many people are wanted here and there, it is much more important to see it as a tool both for giving guidelines for internal policy and for identifying the types of imbalances that may exist in relation to which actions can be taken. We really need to develop models, whether formal or merely conceptual, which reflect the inter-relationship between demand and supply of labour. We need to develop our capacity to vary the ability content of jobs in order that we can make this matching of demand and supply.

This is a responsibility very largely of companies in terms of what they can do to deal with their own employment and staff requirements. It is very much in their own hands to redesign the types of jobs they have so that they are able to exploit what labour is available, and not simply say what they would like and indulge in wishful thinking, waiting for people to turn up, people who never come. That is the first question.

The second question concerns overall employment prospects in the EEC. I have already suggested in very broad terms that the outlook is not very good. We should be aware of the difficulties of looking ahead to 1985, and beyond that to 1990. A colleague of mine once wrote a rather nice paper in which he started at 1900, 1910, 1920, 1930 and 1940, and he said, "Had I been alive then what would I have failed to predict?" He would have failed to predict two World Wars, the slump and so on. You should be very careful about looking that far ahead. But in broad terms it is clear that we will not easily get back to the employment levels that we had in the 1960s. There are various forecasting attempts to look, say, up to 1985. The most optimistic ones seem to assume that we will not reduce unemployment during that period. Many forecasts assume that unemployment will carry on rising — not quite at the rate in the last year, when there has been another big jump in unemployment in all Community countries (and particularly in Britain). Nevertheless, the trend will be upwards rather than stable, and it is unlikely to be downwards.

Of course, the level of unemployment very much depends both on world demand and world events and on policies. We see in the paper today that at the EEC summit yesterday a big row has broken out about whether or not EEC governments should individually or collectively reflate. This is now on the agenda of the prime ministers, but three weeks ago I was in Luxembourg when it was on the agenda of the employment and economics ministers. James Prior and Geoffrey Howe sat there and had to listen to a superb speech from the new economics minister of France, Mr Delors, when he expounded another view of employment in the overall context of economic policy. It was a very challenging meeting and I am sure that the same could be said of the summit meeting, but this is now the number-one political issue in terms of domestic politics. It may very well determine the pattern of employment over the next five years. So we cannot just look in technical terms at how employment will develop, we have also got to look at the political climate; whether governments have the kind of will to change the situation that they are in; whether they are prepared to take the harsh actions that are needed; whether they are also prepared to have the confidence to stimulate their economy.

So in terms of overall unemployment levels, the future is very uncertain, and even on the most favourable outlook it is not very encouraging. However, there are two aspects of employment development where we can be much clearer about what is likely to happen. This concerns on the one hand the composition of the labour force, and on the other hand the structural, sectoral developments in employment in our economies. In terms of the composition of the labour force, I should perhaps say that although we recognise that unemployment has gone up in the EEC from around 3 million in 1973 to 6 million in 1976, and to around 8 million this year, during the same period there has been a certain increase in employment.

Employment in the EEC is really very stable, around the 100 million to 102 million mark, and it has been like that for some 10 years. Nevertheless, between 1977 and 1980, employment actually rose by 2 million.

The explanation for this overall increase in the labour supply is normally put down to the youth bulge — the shadow effect of the post-war baby boom. We are so accustomed to all the political concerns about waste, alienation, violence and the rest, that we tend to see youth unemployment, demographic changes and increasing unemployment as all part of the same package, so that the youth problem is seen to be part of the cause of the overall unemployment problem. In fact the number of young people entering the labour market has increased in all EEC countries. The patterns vary a little between countries, but in general the trends are very similar.

But much more remarkable than that has been the rapid and continuous increase in female participation rates in all the EEC countries. Of that 2 million net increase in jobs between 1977 and 1980 in the EEC, 90 per cent of those jobs were taken by women. It is this development which has carried on right through the recession. There have been all sorts of explanations tried and models developed to try to see how female participation varies with changes in the economic situation, how this relates to family size and so on. But none of these attempts has done all that well. The end result has always been a figure of continuous increase in female participation. It is not clear if this increase is despite of or because of the economic situation, but certainly it is a very strongly determined trend. So that is one of the base facts that we need to take into account in looking at employment trends over the next five to ten years.

Another aspect is the structure of jobs in terms of sectoral structure of employment. Here again there are some very long established trends. They are rather broad and it does not always help you very much to know that an industry in terms of parts of industry or parts of service are declining or increasing. Such trends do not necessarily relate very closely to a product or a service that is being provided or to a particular company's needs, and they do not relate that closely to particular types of job and particular skills that you may be looking for in terms of recruitment and hiring. Nevertheless, it is very striking how, right through the recession, the long-term declines in agriculture and the continuous increase in service employment have taken place. In fact the increase in service employment is also related to increase in participation of women. Over the last five years the level of employment in the service sector in the EEC has gone up by some 5 million to 6 million, this even during the period of recession. So we now have a situation where industry employment is around 40 per cent in the EEC, services around 50 per cent to 53 per cent, with agriculture accounting for the remainder.

Although it is not quite clear what one can do with that information, it can be useful if we look at the situation in the United States where we find that their level of employment in agriculture is half that of the EEC, and their employment in industry is down to 30 per cent as opposed to our 40 per cent. This certainly gives an indication of the path along which our economies are likely to be heading, and on which we might want them to be heading if we want them to follow the United States' pattern.

So those are some of the stylised facts about the likely development in the structure of employment in the coming years. They are very uncertain and I think that it is a much better approach rather than trying to look at what will be the situation in year x, to look at issues and problems that are likely to be posed and to develop the capacity to deal with types of problems and issues. So finally I should like to run through a number of policy issues which are currently on the agenda at the EEC level and equally at national level, to see how these may affect individual companies.

First, there is the problem of youth unemployment. Here the big question to my mind is whether one sees this as an isolated problem to be dealt with by, for example, compulsory

voluntary work, or whether it is simply a symptom of a wider problem that needs a wider solution. Certainly the policy line that we have developed in the EEC is that there is need for a much closer relationship between education, training and jobs. There needs to be an integrated policy approach by governments, and this needs to be linked up with adult education, with retraining, with all the concepts of lifetime learning and all that that means. It is a very bad approach to put lots of effort into keeping young people off the streets, as it is called, rather than into developing the types of systems which will incorporate them and integrate them into economic life for all of their working life.

The second issue is women's employment. This is perhaps not seen as such a big issue in Britain as in some other European countries, partly because there has been such a high level of female participation in Britain. But in fact that high level is slightly deceptive because although a relatively high proportion of women work in Britain, they tend to work relatively short hours. Thus the actual volume of work done by women in Britain is not so different from that done in some other countries where there are fewer women working but those who do work work longer hours. In many ways this greater participation by women in Britain has been of a rather special kind, with part-time work and more casual work. The greater flexibility of the British labour market compared with that in other countries where there tends to be rather more rigid institutionalisation has given women a greater involvement in work, but when you look at it, that involvement is a secondary one — it is certainly not an involvement of equality in many cases. This is a very big issue within the Commission and I think that it will become a much bigger issue in Britain.

The third issue is consultation and the trade union movement. I know that you have your problems within the computer industry. There are some companies that seek to solve their problems by not having trade unions. But as computers move out into other industries which are heavily unionised, then you run straight into all the questions of consultation and involvement in decision making and the factors which determine people's working environment. Some of the issues that arise are whether technology agreements are the right way of coping with rapid technological change; what is the appropriate stage at which to involve trade unions; what sort of information should they be entitled to?

You may have heard of the draft directive on information by multinationals that the Commission has tabled for the Council of Ministers, requiring multinationals to give much greater levels of information to trade unions in their subsidiaries. The world is changing very rapidly in that respect and I think that companies should always bear in mind that this is the way that things are going and it would be very foolish to attempt to stop the tide.

Another major issue concerns working time. Again it has been an aim of the trade union movement for many years to reduce working time. They would claim that it is one of their major achievements. In Britain the debate is a little muted. There has been a strange kind of position taken up where trade unions have been rather keen on defending long working hours. I think that they have got themselves into a vicious circle of long hours, lower hourly rates of pay and low productivity. The three become self-supporting because the low productivity therefore justifies only lower rates of pay, and the need to earn an acceptable income means that you have to work long hours to do it and the system becomes self-supporting in that sense.

I can recall two or three years ago promoting ideas for drastic reductions in levels of overtime working — and Britain is one of the countries which has very high levels of overtime working — and the TUC was strongly opposed to it. It certainly did not want interference from Brussels even though it was at the request of the European Trade Union Confederation. But now you may have noticed that the TUC is about ready to launch a big campaign to stamp out overtime. They have realised that 2.5 million unemployed is inconsistent with the persistently high levels of overtime working in various sectors of the economy. So I think that one can look to very big changes in limitations on the use of overtime.

We prefer to talk about annual working hours rather than the working week, partly because we recognise that a lot of the improvement in working hours comes from longer holidays rather than reductions in the working week. At present, it is not quite clear what will happen. Annual working hours have been dropping by about 1 per cent a year for a long time, and maybe they will just carry on dropping by about 1 per cent a year. There is, however, a lot of political pressure, particularly because of the high rate of unemployment, to bring about a more drastic reduction. That may or may not occur, but I think that the 1 per cent reduction is likely to carry on as it has done in the past.

Another issue, which again is related in part to women's work but also takes on a broader aspect, is part-time work. The Commission has been pushing for the removal of legal discriminations in the area of part-time work. Part-time work is carried out 90 per cent by women, but there are a number of factors there. In the United Kingdom in particular there is a dual labour market situation, with women working in part-time jobs, particuarly married women without social security coverage, and men doing full-time jobs. There is very active discrimination in that sense. It is a very hot issue with women's groups and it is not quite clear which way all this will go. The more far-seeing or broad-minded see this as part of the process of changes in patterns of working relationships, with men taking more of a role in the home and women taking more of a role at work — more of an interchange and sharing of work both at work and at home. One of the first steps along that road is to drive out discriminations which encourage part-time work only for women.

Another issue in terms of working time, which may be of relevance to your particular concerns, is the question of shifts. There are a number of companies on the Continent, in Holland, in Belgium and in France, that have moved to fifth shifts with the step reduction in working hours that that implies. There could well be some major developments both in terms of shift working and possibly in terms of night working over the coming years.

One of the big problems that the current recession has brought has been not only for young people but also for older workers. This problem is compounded by accelerating technological change, at least accelerating in their working world, and we must find better solutions than early retirement for dealing with it. Early retirement is a waste of human ability and capacity and is an awful social shock to many people. We need to try to find other ways, such as flexible retirement, or partial retirement, or we need to put more effort into retraining and readapting people to slot into alternative jobs within companies. Certainly we must try to find solutions other than just kicking people out. I think that will be one of our big concerns over the coming years.

We have a far more uncertain world to face in the future than in the past. I think that we will have to look much more closely at labour supply and the abilities and capacities of the people we are seeking to employ rather than just looking from the other end at the type of people we should like to have. With the prospect of relatively high levels of unemployment continuing, we will have to recognise that political interest will be high, and that this political interest will impinge on companies. It will not be possible for companies to operate purely in terms of their own internal efficiency and their own criteria. There is an overriding concern about employment which will mean that governments more and more will impinge on companies in terms of their employment actions.

It is important from your point of view not just to see this as some nasty, unhelpful tendency, but to see it as something which you can react to creatively by making your own views heard. In the political world it is very important to make one's point and be heard. The trade unions are doing this all the time and I think that companies could be much more vocal in reacting to political initiatives. Provided that companies recognise the gravity of the overall problem that is being dealt with and the reason why there is political concern, I think it is possible to have a big influence on what sort of political decisions are taken. Political decisions can then be to your advantage, which is preferable to having decisions imposed from the outside that make life even harder than it no doubt is at the moment.

SESSION B

CREATING THE RIGHT SOCIAL ENVIRONMENT

André Danzin,
President Association Française pour
la cybernetique economique et technique
and a Member of the Club of Rome.

André Danzin started his career in 1940 as an industrial research engineer. He was successively head of the research laboratory, technical manager, and the general manager of the Compagnie Generale de TSF (CSF). In 1967, when the two most important electronic companies in France merged with each other, he became vice president of the newly formed Tomson CSF. In addition he was then appointed as president of FININFOR which, on behalf of the CGE (Compagnie Generale d'Electricité) and the Tomson Group, manages their interests in CII (a company created by the "Plan Calcul", later merged with Honeywell Bull). In 1972 he left private industry to manage the IRIA (Institut de Recherche d'Informatique et d'Automatique) — the research and development agency attached to the Department of Industry.

From 1975 to 1980 André Danzin was president of CERD (Comitté Europeen de Recherche et de Developpment) in Brussels. He is now president of the AFCET (Association Française pour la cybernetique economique et technique) and president of l'AFDA.

Mr. Chairman, I would like to thank you for associating me with your projects and for asking me to participate in this conference. I believe that you wish me to look into the future, using tools which are as pragmatic and as objective as possible. I therefore thank you for giving me the chance to make known the ideas that I will now put forward.

Ladies and gentlemen, I am not the author of the works that I am going to talk about. They are the results of a series of conclusions obtained within the framework of the French Plan, where the Plan Commissioner had asked me to preside over a range of meetings which examined French Society and Technology. This range of meetings should clarify the next seven year programme. The Socialist programme draws many of its conclusions from these meetings whereas the request for the meetings came from the previous government. The results of these meetings led to the publication of a book by the "Documentation Française" entitled *La Société Française et la Technologie* (French Society and Technology). But, French society is also a European society and in working on France we have certainly worked (at least as a reference) to progress a certain number of ideas concerning Europe.

I would like to say that our analysis essentially concerns countries which form part of the industrialised and developed world, where the real problems of man are perhaps demographic, and a disparity exists between advanced societies and others which have remained relatively behind.

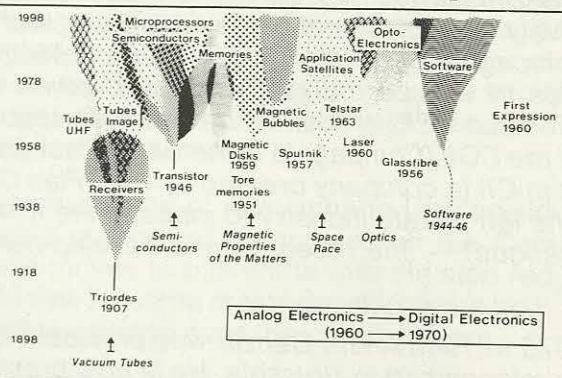
When talking about the transformations of our own society, I mean the Western society which includes Japan. This represents today about 16% of the world population and will represent within less than 50 years, just under 12%. Our superiority of equipment and utilisation of telecommunications is infinitely greater than that concerning the sharing of wealth or food. Usually we talk about the disparity between rich and poor countries. It is

important to know that more than 92% of all telephone equipment is installed in developed countries, more than 95% of computers are in the North, and less than 5% in the South. The same holds true for database systems. This means that the malnutrition and lack of wealth and purchasing power, often criticised, is nothing when compared to the lack of communications equipment, information and education. I will come back to this point later because it seems to me to be important, and is destined to be a major influence over the next few years.

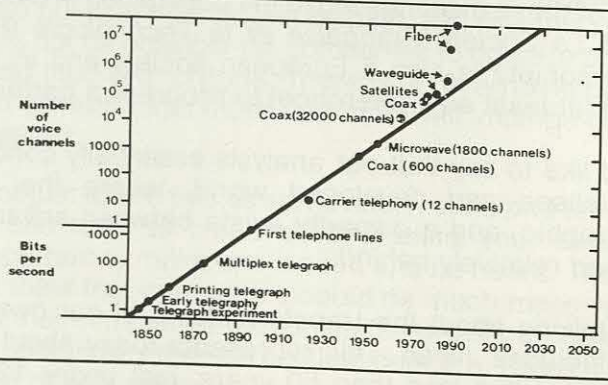
I apologise for being egotistic if I concentrate on what is going on in our most developed countries and particularly in a country such as France. In doing this I will often compare with the evolution taking place in the United States. In order to remind you of the fantastic progress of technology with which we have lived during the last twenty years, I want to give you two view-points.

This is a graph of the evolution of the technologies which are the basis of electronics, telecommunications and computing. There is a specially large growth-rate from 1958 to 1978, and this gave birth to a great number of new devices and to the concept called "software" in English and "logiciel" in French — including the appearance of telecommunications satellites in space. I want to emphasise the fact that technological development has occurred by means of "naturally-selected" systems, with the result that these technological systems have developed and improved rather like the development of biological species in prehistoric times prior to the appearance of man. I emphasise the role played by luck in scientific discovery because this has two consequences. First — a humbling thought — the role of chance will again play its part in the technological evolution of the next 20 years, in the same way as during the last 30 years. There will be technological and technical surprises in just the same way as during the last 30 years. And secondly, if there is no freedom for luck to play its part with respect to a research policy, if we leave no freedom for "natural-selection" to occur (i.e. the market), no advance is possible, because we proceed against the natural way of things. I have not the time to develop these two philosophical aspects, but they seem to me to be most important vis à vis the organisation of companies and international commercial systems. All business takes place within an international context, and not only within the framework of one country. This gives us a particularly clear view of the problem of nationalisation with which we will live in France. It will be a tragic answer to our problems if the country tries to solve them in isolation or if the country tries to lead technology into the future as though the "chance" nature of scientific discoveries did not play a role.

Darwinlike 'natural selection' of the technological species



Telecommunications inventions



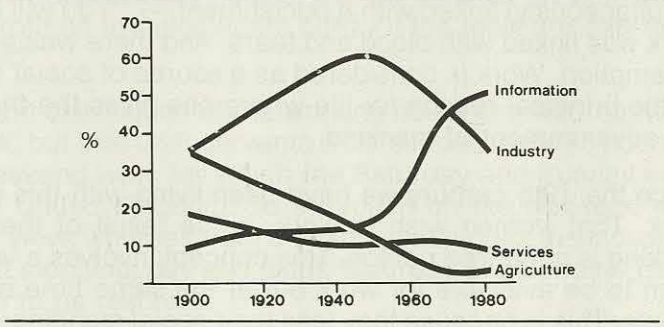
The second slide shows another technological phenomenon that you certainly know, but it is a prodigious one. This is the progress which has taken place concerning the carrier which allows telegraph and telephone transmission to take place. We have evolved from voice channels and very slow telegraphic transmission to the possibility of having telecommunication channels of several thousand millions of bits per second. We will see a real fall-out of practical applications based on telecommunication satellites and fibre-optics.

We lived through these phenomena of society perhaps without realising their depth. I want to try to analyse with you the internal forces involved (and which are working at this very moment) in order to give a sort of new cultural answer to the transformation of the environment by machines and mechanical tools, but above all by the intellectual mechanism. The latter is the most important and it is the way of working on texts and abstract symbols, thanks to electronics, computers and telecommunications.

First, I want to talk to you about work. The previous session has shown you that employment is our main preoccupation. We ask ourselves, without much real hope, how we might correct the supply and demand of work which no longer strikes a proper balance, and which forces a number of able-bodied men and women to be without work. Here, there is an essential phenomenon which has been clearly exposed by the works of the M.I.T. (Ministère Intérieur du Travail) where MM. Marc Porrats, Mashlott and Parker tried to identify those jobs which uniquely concern working on information.

On this diagram you have an analysis of workers in percentage terms taking into account the services and jobs involved which strictly concern working with information. Teachers, design engineers, researchers, lawyers, the clergy, solicitors, bankers, insurance agents, etc. are only working on data processing. We know that there has been a great decrease in agricultural work, but perhaps we have not realised to what extent there has been a transfer of workers from agriculture since the war. In industry and in the service sectors people do not touch the things that they talk about and they never see the products of the symbols that they process. They work on figures or on letters. Those who only work on information represented about 15% of the working population at the end of the last century and, according to Porrats in 1970, in the United States there was suddenly a rapid increase up to about 50% of the active working population.

Working population breakdown (USA)



Information work is in some ways abstract. It is a phenomenon well known by computer people when we look at how our work is divided between software and hardware. In the beginning, around about 1955-1960, the expenses for hardware formed the largest part. With the automated manufacture of microprocessors and electronic components, the price of hardware has become smaller and smaller and it is the software that has become expensive, giving a cost of more than 85% which is concerned explicitly with abstract work. From the previous figure, you will see that we also have a general movement from material to abstract work. It is a kind of generalised software concept.

This fundamental phenomenon, concerning Western societies, is completely different from the agricultural age, from rural and industrial societies, with respect to the type of society into which we are evolving — a society where the essential, unlimited raw material is information.

To recap — the industrial society, the consumer society whose motives are often denounced as essentially materialist, seems to be giving birth to a society turned towards the abstract and perhaps the "civilisation of the mind". We will progress towards a social organisation something like the Appollo mission where there were two people on the moon who were assisted by thousands of people at Cape Canaveral working on data processing equipment. The industrial factory of the future, automobile production, textile production, electronic tool production will be driven by machines. Robots will perform the necessary material work, supervised by a small number of men and women. There will be an enormous amount of preparatory work on data processing, and a great deal of work for supplying production to customers who must also be educated to receive the results by data processing methods.

In France, a study has been undertaken in order to better understand the situation in the Paris area. You know that Paris and the suburbs include, unfortunately, the largest part of the intellectual and data processing work undertaken in France. In the Paris area, which contains 20% of the French population, 68% are working on information processing and only 32% are really working with their hands — touching the things that they are making or selling or driving. This means that two increases in productivity will become important. Firstly, an increase in productivity by using robots as a substitute for the actual work done with tools, nowadays especially performed by immigrant labour. Secondly, there will be a greater increase than forecast a few moments ago in the area of office automation.

This will lead to the problem of the value of work, and we must consider perhaps that during the next few years, work will become a more precious thing. It will certainly have a different character than that at present, and it will perhaps have other values applied to it. I remind you that, throughout the history of Christianity, work has been successively (and sometimes simultaneously) linked with a punishment — "You will labour by the sweat of your brow", — work was linked with blood and tears. And there was another trend, work acting as a sort of redemption. Work is considered as a source of social standing, as a "fount of honour", and as the principal reason for life where one gives the fruits of ones labours and takes part in the advancement of mankind.

Since the 19th century we have been living with this work concept, based on the value of work. That women wish to work, is the result of the concept that somebody who is not working is not a free person. This concept involves a very large number of people by asking them to be available for work but at the same time brings new problems for unemployed people. This is because they lose their social standing — a most important attribute brought about by their work.

We have a most beautiful thought from Pascal which was recently used by Hans Klung in his book *Does God exist?*. Pascal said during the 17th century "Nothing is so unbearable for man than living in complete idleness, without passion, without business, without amusement, without things to do. He feels his nothingness, his surrender, his lack of power, his emptiness. Unchaste, his soul will reflect the boredom, the blackness, the sadness, the resentment, the despair." In the feelings expressed by Pascal there is, perhaps too much sentiment. However, it is something which corresponds fundamentally to the problems we have to resolve today, where we have to consider productivity increases and the transformations of society which result from our technologies.

So, I would like to say that, in order to progress, two aspects must be considered. Firstly, the examination of work values, and secondly, to verify that there is an unlimited raw material in information. When working on information, we create needs for new information and communication. In 1970, the Club of Rome highlighted the problems caused by the impending lack of oil, energy and agricultural resources for a world made up of eight thousand million human beings. Those remarks about the scarcity of raw materials and their waste are not true when we talk about information. Information is an unlimited raw material which increases in value as it is processed and increases the need for its communication as it is stored and exchanged.

So, there is, with respect to work values, much hope. Probably a new type of civilisation will emerge where the major raw material (but this time unlimited) will be information, and consequently we shall discover that, in spite of our enormous capacity to increase productivity, there will be a large requirement for work because we will have a very large need for information. By information I include knowledge, education, culture and probably spirituality and happiness in an aesthetic sense.

In the meantime, we are in a transition period and we must think about this transition which will be indisputably somewhat painful. There is certainly a problem concerning the division of work and that is the reason why the French Government rightly or wrongly believes in work sharing. This means a reduction of the working week to 35 hours and the introduction of early retirement, perhaps at 55. To me, this seems like an experiment without forecastable results, because there is a double contradiction between the fact that we reduce the work and at the same time, and in the same period, the human population will increase by several thousand million people. In order to supply man's needs, it would be necessary to increase the number of mines, schools, hospitals, factories, etc. It is somewhat paradoxical to think that the working week is going to be reduced to 35 hours when a great effort will be necessary to reduce the inequalities which exist.

But there is another objection which presently dominates the discussions between the French business community and the trades unions who are supported by the Socialist government of our country. The fact is that, as employment tends towards information processing, the investment necessary to provide that employment becomes quite considerable. With office automation, a secretary's job will represent an initial investment of 35,000 to 50,000fr. whilst a secretary working with a simple mechanical typewriter represents an investment of only 3,000 or 4,000fr. Consequently, there will be a large investment in equipment, and how can we earn a profit on this significant outlay if the tools are only used for a small number of hours per week?

This requires, therefore, a reform of the distribution of the working hours in order that work tools can run for say 168 hours a week, but that their servants work successively 35 hours at a time. The same thing applies to weekend work for which the Saturday and Sunday have become sacred in France, as in the United Kingdom. To encroach on the weekend may seem senseless from a social point of view, whereas from a financial viewpoint the industrial conditions would require work without stopping, day and night, Saturday and Sunday. There is thus an extremely difficult problem to be resolved.

The second possibility besides the sharing of work, is that a new notion will develop of the creation of amenity work. The idea is not to leave man alone with the machine, not to create a world that is purely mechanical, but to create jobs like guides — i.e. people who explain, such as teachers, supervisors, security personnel, even to the extent that these jobs may seem to be not strictly necessary. They will, however, help to make the working environment more humane and will help instruct the different users in order that they never feel lost with the machines.

I believe that the experiments carried out in the area of database systems prove that the systems may be operated by anyone who can use a keyboard. But, when an operator is allowed to intervene in order to help the person making the enquiry, the operator immediately feels much more at ease and wants to use things of which he was previously afraid. Thus we must create jobs concerning communication.

The third kind of notion of work is that of freetime. Taking into account the influence of work within the "black economy" (where in Italy the internal wealth has not really decreased, whereas the industrial activity has decreased over the last 8 years) we are obliged to reconsider the statistics and admit that such clandestine work represents a minimum of 10% of the gross national product (experts think that it is probably more than 15%). A kind of "Underground Society" is thus growing up, manufacturing and producing goods, exchanging and selling them outside of the normal commercial and tax processes. This is a sort of

proof of the need for freedom to work in one's freetime for oneself, and to perform those tasks which cannot be effectively undertaken by administrations or big companies.

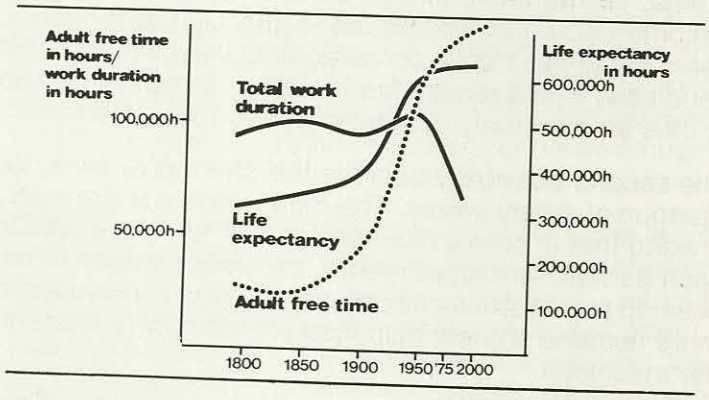
In the Eastern bloc countries, the need for such work really exists. The communist regime has never succeeded in ending this "black" work and perhaps they consider it to be a good thing — although that is not official! When I was in Georgia, someone told me a story about one Russian asking another, "Do you know how we can earn our living by doing only one job?". The reply came back, "It is impossible to know, nobody has ever tried!"

In other words, there is a need for the development of work to be performed in one's free time. The solution is not to support all forms of this clandestine work, which would involve some dangerous exaggerations, but to give a more institutionalised response. We may think that the development of an economy will occur without a role for middlemen or a merchant class. The commercial economy that existed before the 19th century — and which still exists in developing countries — is such an example.

Finally, perhaps "telework" will help save the large amount of time and cost involved in daily travel and transport. In the suburbs of Paris, the average time lost in daily travelling is about two-and-a-half hours per day. If the place of work is brought nearer to the home, we would gain one-and-a-half hours per day. It is better to do this than to reduce the hours of work from 45 to 35 hours per week, and it gives more free time.

Above all, of course, man will be the principal element in the improvement of productivity by his capacity to use the right tools and as a result of his education. This discussion of work and its evolution brings us to the major topic of transforming society — education, including further education and apprenticeships. But before I move on to this topic, I want to show you some graphs which demonstrate that this phenomenon of time management has become a major issue. Perhaps it will also explain to you why President Mitterand has created a Ministry of Free Time. Free time is becoming a major phenomenon in our present civilisation, and it is also becoming a political issue.

The graphs shows (in thousands of hours) the amount of hours for France, from 1800 to 2000, of working time which has been transformed into free time. You can see the reference to an average life span. The life expectancy has risen from 36 to 72 years during the last century. There was a fantastic growth between 1920 and 1970 but this has now stabilised.



The quantity of work realised during these 36 or 72 years is a function of the life span. We have brought this back to the average person, living 36 years in 1800 and 72 years nowadays. This man, of course, does not exist, he is a statistical invention. However, taking into account that, in 1800, holidays didn't exist, that there was no pension, that young people started working at the age of 12, and that there was a long working day, we still get a total of approximately 100,000 hours of work, despite an average life expectancy of only 36 years. After the period 1935-1940, there is a decrease in the total working hours and we just don't know what will happen in the future.

The most important phenomenon shown on the chart is the variation of the amount of free time for activities other than work. This free time has to be reduced by the time taken by the physiological needs (sleeping, eating, and rest), which comes to 10½ hours per day. Thus

with a further 2½ hours per day for commuting, you can see that along with the vastly increased retirement period, this variation is one of the most important phenomena of our civilisation.

Urbanisation is an important problem for our society and leads us to waste a great deal of time that could be recuperated by telematics or by working at home using "telework" systems installed in well organised areas — such that people could meet each other in new workplaces, but near their homes. They could still work with their bank, and insurance companies, etc. and in all it would be an important saving in time. Time management thus becomes one of three great problems. There is no possibility of killing free time. It thus becomes necessary to use this free time — but in what way?

It is important that free time be devoted to human aspects rather than to material things, because man's principal wealth is his own free time. We know that his time is more limited by death than by economic factors, so it is most important to teach man how to use this time.

This time will be used for consumption. The new man will need a new type of education and our Plan Commission has noted three major faults in the present education system. Education is conceived as something given to a child or to a young person and which forms his stock of knowledge to be used during his life-time. Well, it is impossible to define the necessary programmes. The amount of knowledge available is so large that it is impossible to choose them. It is also impossible to transmit future knowledge, of course. Teachers transmit the knowledge that they received from their own teachers. Thus, they give information to children in 1981 which they received in 1960 — and this is to equip management for the year 2000. There is a profound anachronism concerning the mechanism of knowledge transfer which is connected to the past. Lastly, there is a gap between school education and television or radio, between the English or French classics learned at school and the discovery of the moon, space explorers and other reports as seen on the television.

This gap is such that school still does not seem like something where children are educated for the real world. Consequently, the whole education system needs to be re-thought in order to replace the basic idea that we should receive our stock of knowledge at school. It is wrong; we need to learn how to learn and after this, one's life will become a continuous apprenticeship. We have a fine future before us, a future where the adult will continue to learn so that he can constantly change his profession — and also use his free time properly.

You can see that this notion of continuity extends to information. It is necessary that the information provided by the media be one of several channels of education and not in contradiction with formal education. So if we consider education over a whole life-time, we see that there is no longer a problem of choosing the subjects. If we think of a continuous education of school, apprenticeship and further-education, we must think of a significant reform of the educational structures. If we believe that there is also a link between education and information, the whole information system needs to be re-thought. In Japan, just over 7% of the gross national product is spent on education, whereas in my country it is only 4.3%. This means that the educational investment of Japan is 50% higher than in the European countries.

In Silicon Valley, and even in the Japanese firms having the best results, the amount of the time spent on further education is equivalent to about 6 weeks per year. A little more than 10% of a career spent with Mitsubishi (or others) is consecrated to education, which must cover cultural, financial, artistic, aesthetic and spiritual communication. Over a career lasting 35 years, a Japanese manager will receive 4 years further education. I therefore leave you to compare that with what happens in Europe and as to whether there is not some action to be taken — and quickly! It will not be possible to modify society to deal with information if no major effort is made in the field of education.

I want to talk to you now about non-commercial activities. Some mass production will become more and more automated. This production will need extensive international

markets to be generated. The microprocessor is an example of an object that may be produced in large volumes at a very low price. But it needs a very large market, which is at a minimum the equivalent of the American or Japanese market. Of course, Europe has just succeeded in dividing its territory into states which represent a maximum of 60 million consumers, each consuming half as much as in Japan. Thus it is not possible to compete in the field of mass production when a large enough market is not available.

For such mass production, the labour tasks and the middle-management tasks will certainly be most unexciting and it is not possible to forecast whether man will find real enjoyment in this work. However, when we are working on information, it requires a mental effort rather than a muscular effort, so perhaps there will be a positive change in the interest provided by work.

We may, however, hope that the increase in free time provoked by automated production will constitute a sort of compensation for the lack of interest. We can forecast (with a large question mark) the development of new structures, the organisation of non-profit-making associations, "black" work which is allowed, and the development of flexible work-shops — sufficiently flexible to be used by a small number of people and yet still remain competitive. With further research in manufacturing, it will be possible to manufacture at a low price thanks to computerised tools. You can therefore see that if the development of these non-commercial activities takes place, there will be a convergence between advanced and developing countries.

I want to say one or two words to you about something that seems to me to be essential, and which is a result of this whole thrust towards information. It explains a lot of the worries and the problems with which we have to live, and will have to live with for many years — with or without success. In fact, what we are living with now is not so much a thrust towards information, it is a movement towards complexity. A complexity of our society which continues the evolution process that we have had within each geological period.

Biology shows us that there is a constant increase in the complexity of a biological system — from the monocellular to the vertebrate, from the primates to homo-sapiens. Man, by his very society, takes part in this evolutionary process — this complicating phenomenon — which is no longer genetic but which is an evolution of society. We are approaching a period in man's evolution when the movement towards complexity is particularly strong. If the tools of computing and telecommunications had not provided a technical response to this complexity, we would now be certainly strangled by all the problems.

But we live within this complexity and we must manage it. The great temptation, the great dictatorial, political temptation which threatens us continually, is to deny this complexity. If we break up the complexity by insisting that decisions be taken by a small group of people, we constrain the liberty of the others simply because things had become too complex.

We would only know how to treat problems by simplifying them. The scientific and technical response, even the spiritual and human response, is to admit that this complexity is a positive quality and within this complexity resides liberty which must be increased, not reduced. We must create new management systems which can deal with this complexity. Thus, in order to create such systems we are obliged to use the method of "natural-selection" which is a sort of neo-Darwinist response to the needs of progress.

So you can see the solutions on the one hand of decentralisation, of deregulation — whose particular exponents are Mrs. Thatcher and President Reagan — and on the other hand, the French Socialist Government, which believes in regulation by means of the state, by nationalisation and by examining particular problems with study groups over which the state exerts a certain control. I don't believe that these two methods provide the right answers to this complexity. I think that the answer is probably in combining free "micro-regulated" systems with "macro-regulated" systems which are determined by the state.

A crude analogy would be the individual human cell and hormone regulation — a sort of "macro-regulation" — of the body. The latter does not involve the brain, which is involved at another level of regulation. The different levels of the human regulatory systems are very complex and there are many of them. Today, in spite of the enormous progress in biology we still do not know them all and therefore we cannot control or manipulate them. Nevertheless I believe that, if a group of computer experts could work together using biological systems as a basis, along with their knowledge of large operational commercial systems — where we must define the levels of "micro and macro-regulation" — an advance could be made over our present knowledge.

To conclude this subject, I want to mention something written in "Le Monde" by Jean Voge, Chief Telecommunications Engineer. He said that the technologies of energy have been those of a large society and have concerned its production, its consumption and its media. The information technologies could be those of a "confederate" society made up of groups of locally co-operating small companies — a society of micro-societies independent and yet co-ordinated, but not forming part of a pyramid-like hierarchy. Stability and cohesion would be assured by the elements of common interest and by the sharing of profits rather than by means of some central authority.

The difficulty is that we don't know how to transmit these concepts to people who are not scientists or technicians, who do not have our jargon or logic. On the other hand, we cannot be fully aware of the complexities of the problems of man-management, in particular with regard to national or international politics. But amongst the ideas that I have spoken about, I am sure that there are topics that will generate much political discussion during the next 20 years.

Another specific characteristic of this information society is that it may no longer be national, but must have an international character. The ubiquity given to man by telecommunications satellites, computer networks and database systems which are accessible everywhere, establishes a sort of common destiny which unites all the nations who form part of this development process. For the first time in the history of mankind, we have a situation where economic forces will be stronger than ever and where war will not exist because it is impossible to imagine going to war with one's best customer who is, at the same time, one's best supplier.

The best example of this is given by Samuel Pisard and concerns the present relationship between France and Germany. This is very important for our youth. France and Germany have developed to the point where they both now depend on each other. A solidarity and interdependence at an economic level is now quite evident. This fact invalidates the strong notion that my generation was brought up with, and which said that Germany would always be the enemy of France. Of course the relationship between Germany and France could change if there were a reunification between the two Germanies.

What is certain, though, is that our civilisation, our future communication civilisation, will replace man's military aggression with the research and development necessary to increase economic production. Thus in the case of "war" the losers will not be dead but will be unemployed. Not only is war impossible between nations possessing the atomic bomb because war becomes too dangerous, but it has become impossible because of the international economic solidarity which exists.

Clearly, what I have said is not true for the two types of society which have not followed us towards the birth of the information society. The Soviet Union, for very basic reasons which preclude Darwin-like economic development, has stayed firmly fixed in an industrial society where power is wielded in another way. This creates misunderstandings and antagonism which seem to me to be extremely serious.

Also, there are two thousand million people in the Southern hemisphere who, with a few exceptions, are completely separated from the metamorphosis towards an information

society. However, they exist, and something must be done one day. But I would like to say that, in this respect, the information society offers some hope. For the first time, despite what these countries say vis à vis loss of national identity, of culture, etc., they are fascinated by our progress and our success. Up till now, in the past we have been dealing with a non-transferable model. You know that each American's energy consumption is the equivalent of 11 tonnes of oil per annum. When extrapolated to 8 thousand million people in 2030, this means that world consumption will be in the region of the equivalent of 90 thousand million tonnes of oil. This is unobtainable during the next 50 years, but perhaps it will be possible with the advent of fusion reactors in 2100.

As a result, we have proposed a non-extensible model for the rest of the world. But the model based on information defined as an unlimited resource is extensible. It is perhaps what Servan Schreiber meant in his book "Defi Mondial", but in a slightly over-simplified manner, when he talks about the microprocessor as a solution for the underdeveloped countries. Indeed, if nothing happens — no war, no economic break-down — which can stop our movement towards an information civilisation, we will offer an extensible model to the rest of the world because the "consumption" of culture, spirituality, aesthetic pleasure, communication, information and inter-personal communication is extensible to the rest of the world. Perhaps it will thus be possible to find a shorter route by which the poorer may catch us up.

That is all that I wanted to say, Mr. Chairman, but I would like to put a great deal of humility into my conclusion. I have tried to ascertain some of the internal forces that work within our present day societies and which are bringing us a new destiny, different from our past experience, a future that we did not set out to create. I believe that if we can adopt this future as an objective, as a project, it will attain a certain validity. It will thus seem more probable the more that we describe it and aspire towards it, and perhaps those who are now disappointed and afraid for their future will have more hope.

But I believe that something new is happening. The tools of understanding are completely new. I have referred to chance, I have referred to complexity, but I did not mention the name "system" or "systematic", although you can feel that it was always present. All this means that our thought values must be reformed. For us French people, it means that we must admit that the Cartesian approach is a very limited tool which no longer can be applied to all things. Contrary to what Descartes said, it is now impossible to separate a part from the whole. It is impossible in the complex process to avoid the inter-relationships which result from circuits that loop back via the outside environment and give rise to unexpected effects. We must agree that in taking a decision we can forecast its direct results, but we must be aware that there will be indirect effects. These are produced in complex systems and usually oppose the goal being sought. That can be an advantage. I believe that we have an unexpected result concerning the development of our techniques towards the information civilisation.

However, it could be negative if, for example, we increased unemployment by decreasing working hours. Thus, if we adopt a pragmatic attitude, a non-doctrinal attitude, if we try to ascertain from our experience that which is necessary for an education for the future, we will probably manage. If we want to force things because of some doctrine, then we will probably fail. So these new ways of thinking can help us form an understanding attitude vis à vis the new situation. I thank you for making it possible for me to talk to you today and for your kind attention.

SESSION C

INFORMATION SYSTEMS JOBS IN THE 1980s

Colin Brook,
IBM United Kingdom Limited

Colin Brook studied Theoretical Physics at University College Oxford gaining his BA Honours degree in 1963. He joined IBM United Kingdom direct from University and after initial training he worked successively as Systems Engineer, Salesman and Account Manager with a large petroleum industry customer.

In 1973 he became Systems Engineering Manager in one of the new General Systems Division's offices. This was followed by a period as a product announcement manager for the System/32.

From 1975 to 1979 he was first, a senior instructor and later education manager at IBM's Advanced Marketing Institute at La Hulpe in Belgium. During this time he was concerned with education in the Customer Executive, IBM Management and latterly Information Systems Management areas.

In 1979 he rejoined IBM in the UK in the internal Information Systems Group as Manager of the Information Centre which has responsibility for all aspects of personal computing for internal users.

This afternoon I am going to give a personal impression; it really cannot be much more than that because we do not have, internally within IBM, a road map that tells us what jobs we will have in the future and what sort of work we will have to do. You have already heard about the tremendous rate of evolution that has been alluded to by previous speakers, and that rate of change is bound to continue.

So what I shall try to do is to give this personal view. You should understand that it is based on my current experience and my current job; and that current job is within IBM UK's own internal data processing function. I am one of the managers of that group and my particular responsibility is for all aspects of personal computing, end-user computing, or end-user information services, delivering all of those services to the end users within IBM UK. There are something like 2,000 to 3,000 people who, every now and again (which might be anything from once every few minutes to once every few months), want to sit at a terminal or some other fairly friendly device at some friendly system and access the company's data. So that is my particular interest and you should be aware of that in understanding some of my prejudices.

Let me comment on the title of my presentation. In talking about the future, it is extremely difficult to come up with a title that is not too committing. I did not want to talk about organisation because we are all working in very different companies, and our organisational needs have to match our business needs, our corporate strategies and so on. Nor did I want to be pinned down to specific "occupations" which has an air of formality about it. I rather want to say that, as you are well aware, there are some things to be done. Those things to be done have to be combined together to make meaningful occupations in our own companies. But I

do not want to tell you how to do that, I merely want to point out some of the things that have to be done.

I specifically have not limited myself to data processing. I have used here the title "information systems". I might well have used the title "information services" (IS). As you will see later, I feel quite strongly that as we carry on through the 1980s the only way that those of us in the internal information systems or DP function can succeed is by becoming much more active in our partnership with the user and the user management. That is a theme to which I will come back. So I wanted to take a fairly broad title.

My objective is to review some of the new jobs that I think will emerge; perhaps talk about some that will disappear, and some that will change significantly. I really want to do that in a way that looks forward from now. There are two alternatives: either I could paint you a picture which would be my view of an information systems organisation from 1990, and immediately you would disagree with it. You would not like the organisational structure that I had chosen; you would not like the titles that I had chosen. So I prefer to go in a rather pragmatic way — and I hope a not too subjective way — from today forward.

So, the order in which I want to proceed is to remind you of the key change factors that will influence us in the coming years. I do not see these as change factors where I have to ask the question: will they happen? but rather: when will they happen? For some of us they may be happening now; for others of us we may be lucky enough to be able to benefit by other people's problems and wait a few years.

It is perhaps a sign of the times that yesterday evening, when I went back to my room, I was able to watch on television a programme called "Managing the Micro". In our backward British society, it is quite interesting that on popular television we have such a programme. At the point where I entered the programme, halfway through, I was hearing that it was absolutely vital to have flexible management and flexible thinking for the future; and I think that is quite a key point. So I will look, I hope flexibly, at the impact of those changes on the existing activities. I have grouped those in very simple terms into a "development" activity and an "operations" activity, because I want to avoid any further organisational constraint.

Then I will talk about some emerging functions. You will immediately get the impression that, as you would expect, in some companies some of these things are already being done — even done well in some cases — but in other companies they are not being done at all, and that is quite reasonable. So just because in your own particular case you find that you are already well into all of the things that I describe as emerging functions, do not assume that there is nothing further to say. On the other hand, do not be put off if you are not into those things at all yet.

Finally, I will look at the impact of much of what we are doing on two sorts of people conventionally outside of the data processing department: the end user and user-management. Talking last night at dinner, I understand that one of the most common words that appears on the slides for the presentations during the coming day and a half is the word "end user". I can assure you that I do not have it up here as a buzz word. I am not even particularly keen on it, but it seems to be something that we all understand.

The reason for laying such an emphasis on the end user side is quite simply that, in my view, whether or not we are forced to get involved with the users, we should take the opportunities afforded to us by the future developments — not just opportunities to work with users but opportunities, particularly from a personnel viewpoint, to move people both at the professional level and at the management level between the two functions: the user on the one hand, and information systems and services on the other.

Let me now spend a few moments reviewing what I see as the major pressures affecting

myself, affecting IBM as a company, and affecting the IS function within IBM. David Butler has already well stated the overriding importance of the productivity issue. I see that from two viewpoints: the DP department and the end users. The analyst/programmer is still a relatively scarce person. There is still a major backlog of significant, conventional, large applications to be developed. Even if we thoroughly involve the end user in the next three to four years and get him to do an enormous part of the work — and I doubt that we will achieve that — there is still sufficient of a backlog to require that we increase our productivity in the conventional development sense and that we maintain our skills.

In addition, in the operations area I think that we can see the situation where operational staff have to be pruned. There is a pressure from a cost viewpoint all the time, and we have to look at that. From a user viewpoint, all our users in all companies are under productivity pressures, both at the operational level, on a day to day basis, and at the management level. These things, combined with the tremendous pressure in a fairly rapidly changing business environment for more and more information, mean that these areas which are opened up to us by new technologies will be particularly important to support that productivity drive.

Then there is the office automation area. Whether we are talking about centralised hardware and software via terminals, or whether we are talking about decentralised hardware, or something in between, there will be a major pressure to go into the office automation area. More text at the company level, more text at the personnel level, will be moved around on our networks in the future. We have to manage that and we have to operate it, and in doing that we have new jobs to do.

Also, many of us already operate fairly large data networks. The bulk of the data that is transmitted is still numeric, and the volumes become rapidly higher but are still nowhere near the sorts of volumes that we will achieve in the future. In addition, there is a pressure to make sure that our networks are integrated and, on top of that, have the ability to link in the international environment with other companies and operations in other countries.

Finally, from a technology viewpoint, there is the pressure for distributed data/processing. You will notice that, quite specifically, I did not use the abbreviation "DDP" which seems to me to lump all of the problems into one bucket, but does not then get us very much further. I distinguish, at least in my own mind, quite clearly between the possibilities to distribute data around the network or to a terminal or an intermediate processor, and store it in one place or the other, and the possibilities to distribute processing capacity, again in the same way. Those two different things afford us all sorts of possibilities and offer up all sorts of management problems. They are different management problems and we have to get to grips with them.

So a combination of technology in those areas, together with decreasing costs for technology and user need for performance, for better control, for better security, could well take us down either of those two distributed routes.

Finally, under the heading of "social trends", we have already heard a great deal said about this. I do not want to add much except to summarise. There are many, many things that will affect the way in which we organise our jobs in the future. For example, in IBM we operate, as do many of you, a form of flexitime, which means that people can choose, within limits, when they start work and end work. That imposes all sorts of operational and organisation constraints in running a computer system. The possibility of part-time working and the basic attitude to out-of-prime-time and shift work can all influence the way we operate our systems in the future. The pressure for home working which is seen in some companies, which we would be able to satisfy from a technological viewpoint very easily, raises new questions.

In addition, I would include things like the impact of legislation in certain countries, whether it be works council type legislation or legislation specifically requiring the involvement of

end users in the design of any system that affects them. I understand that this legislation is around and effective in some European countries already. That sort of legislative impact has to be considered. I must say that I consider that sort of impact to be a positive thing rather than the negative thing that some people would think. To me, it is vital that you involve the end user and end-user management in the design process anyway, you should not need legislation to force you to do it. But if legislation is there, then maybe we should be opportunist.

So those are the major change factors. You are well aware of those, there is nothing new there; I did not intend that there should be.

Now I should like to look at the impacts on existing activities and the sorts of changes that will occur in our current data processing operation. I have this under two headings: the development process and the operations process. Many people have the perception — and I think it is a fair perception — that the analysis and programming job is still to be thought of very much as a cottage industry. It lacks a lot of the formality of more mature professions. Very often, when introducing new tools or techniques to apply to that job, we find the reaction from the professionals in and around it that says, "If you formalise my job, if you require me to use certain processes and techniques, that takes away the skill of the job."

That is the problem that we face, but I would suggest to you that it is only a problem that arises if the objectives of the analyst and programmer are not clear in the first place. If he feels that his objective is to write sophisticated code, albeit in a very high level language, or to do clever things with the database design, then he might well feel that the application of more formality and good management practices is de-skilling the job. If, however, he feels that his prime aim in life is to meet a user need with a system, within cost and on time, then he will accept these new techniques very readily. I think that is an important point for us to remember. In the main, the thing that motivates people is meeting their objectives. I understand that there are one or two other things around, including the money, but if one thinks positively there is a prime motivator in the job itself. But the objectives have to be clearly expressed.

For example, if the right objectives are there, satisfaction can increase with the introduction of new tools and techniques because the achievement is likely to be there and productivity can increase as well.

What sort of new tools am I talking about? Obviously the pervasive use — and it is not there yet — of high level languages. Most people accept that as an obvious thing to do, but there are still a lot of situations where they are not used. Also, the use of things like table-driven code. We had an example of this recently in our own organisation where, in order to meet user needs very rapidly, we decided to use a table-driven program to extract data, sort data, merge it and produce reports. One programmer would comment, "Hey, that's really taking a lot away from my job." But if his job is to meet the user need in half a day as opposed to three or four weeks, and with a lot less machine resource, then he will rapidly accept that tool. We have found that to be the case. I see a lot more of those type of tools coming in.

We have already introduced improved programming technologies in many of our organisations, and I think that will continue. Again, there is great possibility to enrich the job of the programmer/analyst. An example of enrichment that I would give is what we call the "moderator" function, which some of you may know under the heading of "inspections"; where a professional analyst or programmer from one project area formally looks at other people's efforts in terms of quality. This can be potentially quite sensitive, but we have found that it is a major improvement to the job of the analyst and programmer and, once introduced, it is a positive thing.

I think that one of the things that will clearly happen is a much more businesslike process for

the whole of the development activity. Again, this is just a question of evolution; formality applied to user requirements; formality applied to the whole development process in phases. These things can be seen by analysts and programmers as negative. In fact, if they are seen as contributing to the successful completion of the task, they can be seen as a very positive thing. I think that all of these things will change the job of the analyst and programmer.

One of the biggest problems that we face in the data processing organisation is getting an accurate definition of user requirements. That has been the case for years, and there are new tools coming which will formalise that process and make communication between the user and the DP professional much easier. But again, they will impose more formality and more structure to the job, but this formality will be compensated for by other techniques — for example, prototyping. I believe that this will be covered later in this conference. But certainly for us, the ability of the analyst/programmer to sit with the user and prototype his requirements dynamically at the screen; to see whether he is meeting the user's needs in a very rapid way, before going away and writing the large system needed, can add a lot to the job. That is another positive thing.

I have already mentioned that more involvement from the user, who has for a long time been left out of the partnership, can significantly contribute to the programmer/analyst's job. Finally, I think that there will be a continuing emphasis on database and data communications. We have lots of database systems around, and in the future most of our big systems will be database systems, and most will be on-line. That means that instead of putting your database skills into a specialist group, such as a database administration function or a database engineering function, those skills have to become pervasive across all analysts and programmers. We are seeing this happening now in our own organisation, and it is something which can only enrich the job.

If I can summarise as far as the DP analyst/programmer is concerned, I think that he or she will become more formal. There will be more formality, more structure to the job; there will be more high-productivity tools. All of those things can be seen as positive contributors to the job, provided that it is clearly identified that the goal of the analyst/programmer is to deliver the goods to the end user, or to the company as a user, rather than to write super code or beautiful systems. Those things may be desirable, but they are subsidiary objectives.

Moving onto the operations area, I am sure that in the period about which we are talking, most of the activity that many DP functions have as a data entry and control function will disappear from the central DP shop and will move, as our systems become on-line, to the end user or to the user department. This is happening already, but in the next five years I would suspect that many data entry departments will disappear as end users take up that role for themselves.

That has some positive benefits because often the data entry function was a bottleneck. It is a rather tedious job as well. But the problem that it poses is that if we have a large number of systems which now have their input directly from the end user, perhaps under end-user control, these systems still need to interrelate together. We still need to have some time sequencing in the running of many of our large applications. This will put an increased responsibility on the people who operate our large, central systems, particularly the rather large number of batch type programs which need to be run during the night. If you take that, together with the pressure not to operate a third shift, it is obvious that we have to become much slicker and better at managing this vast number of batch programs that occur in many computer organisations.

This ties in with the second point which is that in order both to achieve higher productivity of the operations staff and also to decrease the number of problems caused by operator intervention, we will see a trend towards more automated operation. The effect of that will be

that there will be fewer people around in the computer rooms of the future moving tapes, mounting discs and adjusting printers. Those people will not be needed because we will be able to automate many of those functions. However, what will be needed is much more effective central control of the overall installation. So, if you like, it is an opportunity to raise the skill levels of operations-type people. There will be less semi-skilled staff and more fully-skilled staff.

There are many large networks installed today. They work quite effectively. Many of them, such as the banking networks, and the insurance company networks are specialised. They have not yet moved into the multi-access integrated network environment. We have tended to think of network management as a function which goes alongside or is added to the management of the computer system hardware and software. In the future that balance will change. Networks will be very little involved with the physical operation of the computer system, which will become very much a subsidiary role to the management of a network handling not only numeric data, but textual data and voice data. So, there will be a shift in emphasis away from operating and managing a central computer towards operating and managing an integrated network.

Let me relate back at this point to something that John Morley said this morning. He was concerned that we might be getting ourselves into the box where we defined all sorts of complicated jobs to be done and then complained when the people were not around to fill them at that skill level. With what I have said so far, I see no problem in that area. I am quite convinced that, with retraining, our existing analysts and programmers can move into this more formal, structured and businesslike environment; that our existing semi-skilled operators can move up to be trained and look after networks and more sophisticated computer systems. So for me, his concern is not a real one at the moment.

So, I have talked about how things will change as far as I can see in the existing sort of organisation. But what about these things that I called emerging functions.

One of the biggest and most important functions for me is data management. I have specifically said "data management" and not "database". Just by way of comment, my feeling is that our existing state of methodology in the data management area is very similar to the development state we had with conventional analysis and programming some 10 to 15 years ago. It is very much still a mystic art. During the next 5 to 10 years I am sure that data management will do two things: it will move away from being a mystic art to being something of a science, with quite specific methodologies of its own, and it will move away quite significantly from databases, which I think we understand fairly well, towards distributed data and towards the combination of numeric data (which again I think we understand) with textual data, which I think we understand very little.

If you combine those problems with the potential need to distribute and manage a distributed data network, then you can see that an emphasis in the future IS organisation on data management can be expected, with significantly more staff in that area, broadening out from thinking conventionally about databases.

There are other questions to be raised at this point. Do we need in our companies to have some form of information or data tsar or high level director? I do not have an answer to that question. I know that earlier David Butler posed two or three questions which he seemed to think I might answer. I felt that I might answer the first and the third, and luckily I cannot remember what they were; but the one thing that I did not think I would answer was whether we would need or have a director of telematics. I had a job working out what he was, let alone whether we would have one. But I do see the need for somebody, perhaps outside of all of our existing user functions and outside of our current information services function, who has some overall corporate responsibility for our company direction and management of data. I do not think that he will have an operational role, but he will have a strategic and tactical role.

In the text and office systems support area, certainly in IBM, we see the need to integrate the way we manage text and office services into the information systems organisation. I know that is not something with which all of you would agree. Sometimes I wonder myself whether it is sensible since it sits in my particular area as well. However, if one assumes that one wants to do that, then one certainly needs to have some new skills; because instead of developing systems my people now find themselves more and more designing services. These services will be very much like the telephone is now when we consider our environment five or ten years away, and one of the critical things we have to think about is the way they will all fit together. How do they appear from the user viewpoint or, more particularly, from an end-user viewpoint?

The role of the information systems group will be very much one of providing an infrastructure and not one of needing to concern itself too much with the way that things are being used. Its role will be to provide the facilities to the company.

Similarly, in the area of distributed service support there are new skills to be learnt. For example, so far as my thinking is concerned at the moment, I think that if we go into the distributed network, as we are soon to do, it is highly desirable that the remote processors in that network are controlled centrally; that they are started up and stopped and the data on them is in many cases managed from the centre. But that poses all sorts of new operational skills.

Some of you may well be thinking of having distributed nodes which require operator attendance, and that will be another new role for the information systems function — providing remote operators. I do not know where they should belong organisationally, but that is a problem that one has to face. So there is a new role there. Again, it is one of providing an overall data and service infrastructure.

The final emerging function is the support of "end users", and I have used inverted commas to indicate that this is really lumping all the things that you understand by the end user into one common category and hoping that it is about the same as I understand. If IS or a DP shop looks at its own organisation at the moment, many of us would feel that the organisations are not bad; they make a lot of sense from a DP organisation viewpoint. That is the way that we have been thinking in the last five to ten years. We have got our own house in order. We have been rather introspective, as somebody said this morning. We have been preoccupied with our own problems.

One of the things that it is very valuable to do at the moment in many companies, certainly in IBM, is to go and sit outside of the DP shop and look inwards. Pretend you are an end user: you will be horrified. I am certainly horrified by what I see sometimes. For example, consider the complexity of support groups. Imagine the person sitting at a screen in some remote part of our fairly geographically dispersed company, and there is something wrong with what he is doing — no more than that. The question is: who does he call? Does he call the network service line for one computer centre or the other? Or does he call the applications support group for an IMS system? Or does he call another group concerned with the office systems? Or is there nobody he can call because the data is lost somewhere in between?

I do not know whether you have done this in your own organisation, but it is quite worthwhile to go and have a look outside to see what it looks like, looking inward. If it is fairly complicated and you cannot clearly understand who you need to call when you have a problem, then you do not have a very good end-user support organisation.

What do end users need? I know some of the things that they need. They certainly need a clear statement of who will do what when they have a problem. Actually they prefer to have more than that. They prefer to have one person or one group within the company to whom they can go with all of their problems. If you go ahead and try to set up something like that, it

is a bit of a white elephant or a problem to manage. But it is the sort of thing that the end user wants and the sort of thing that I would suggest to you that we must provide in the future.

We have tried to do that in IBM UK with something called an "information centre", of which I am the manager. We keep finding ourselves putting more function into that centre as we keep looking from the outside in, because we see more and more that is wrong from an end-user viewpoint with our existing organisation.

One of the things that we provide to help our end users is consultancy. We try to advise them on how to use these services. We try to be positively promotional. Most data processing departments do not have a tremendous record in marketing their own services. There have been very good reasons for that. They have usually been under resourced, and every time they tried to write a major system they were late and did not quite meet the user requirements, and they prefer to keep this inside rather than let it out. But if we are going to get the end user to become more and more involved we need to be talking much more to them in their language.

Something else that they need is a different approach to communications. I do not mean network-type communications, I mean communications with them. If you are an end user sitting at a screen or some other terminal and something goes wrong, the last thing that you want to do is to leaf through 300 pages of documentation. Even if the data processing department has managed to condense that documentation down into 15 pages, you want it written in your language. In fact you do not really want it written at all, you want it on your screen.

In a conventional DP department our designers do not naturally think that way. If we want them to think that way, we have to advise them of that, perhaps retrain them and get them looking at things from an end-user viewpoint.

If we look at the four emerging functions I have mentioned, we certainly see some significant new skills; big new skills in the data area; perhaps some fairly significant skills in the next two categories; but above all, in the end-user category, we see the need for an attitudinal change — the positive role of the DP function rather than the negative. Instead of, "I'm sorry, come back in two or three years", the answer should be, "Yes, this afternoon". We will not make that change very quickly and it requires a lot of management to achieve it.

So far we have looked at the way the DP department might change, some of the new jobs that we will have to pick up and some of the things we will reduce, but we have missed out on one of the most important jobs. You will be well aware of what that is.

One of the key jobs in information systems in the 1980s will not be in the information systems department at all, it will be outside. It is the job of the end user. In five or six years' time, the end users will run their own work, manage their own data, want quick results, and they will need support to do that.

There are two possibilities. First, the DP department can say, "That's your problem, Mr. End User", or it can say, "This is an active partnership, we'd like to get involved with you." If you take the first approach, then it is my personal view that there will not be much of a DP department, and there might be some resulting chaos from which somebody will have to recover. But let us say that that will be five or six years away. The alternative is to take a positive approach, to make a partnership and to start working with the end user, who is becoming much more aware of what he can do, and to educate him. That comes back to my previous point.

A lot of what the end user will do will be screen based. I am aware of concern in some countries about the level of screen-based activity. From my own viewpoint, in the UK, in a company which has as much productivity pressure as any other, I am in exactly the opposite

situation. I find myself under continual pressure to provide more people with more screens and more services, more of the time. So you have to understand that perhaps my perception is different from some of yours. But whatever our perception, and whether people are going to sit for one-and-a-half hours a day at a screen or for a lot longer, whether they are going to perform most of their work from a screen or very little, what they want is to have a fairly friendly system.

We will hear more about user friendliness later on, but one of the things that I would stress is that, very often, a great deal of user friendliness can be provided for very little cost within our existing systems or existing on-line services. The way in which it can be provided at very little cost is again by getting your staff to think in terms of end users rather than in terms of computer systems. They need to in terms of very simple things, such as communication aids, consistency, using the same help formats and the same dialogue formats. All of that is under your control if you want it to be and if people think of it. So it is a question of management direction; but the end user certainly will want it.

If you do not provide user-friendly systems, you get this other interesting syndrome of end users, which is that they will choose the most friendly thing you provide and they will do everything they want to do from that one thing, whether or not you intended them to use other services for something else. The net effect is improper resourcing and an uncontrolled environment. So I think that it is in our own interests to get to grips with the problem.

There is another thing that we see growing which offers us quite an opportunity. I must say that it has already offered me some opportunity. It is a growing degree of specialisation within the user area. By that I do not mean that the user will begin building central-type data processing skills. He is not going to learn about database systems, but the end user is going to have specialists who understand how personal computing systems can be used effectively in any particular function. They will certainly want to have specialists to advise user management of their responsibilities and the successful operation of their department based on these sorts of on-line services.

That offers us great possibilities. In my area we have exchanged two staff recently from our own function out to the user to become those sorts of specialists. I see that sort of interchange of staff between users and the central DP function becoming far more common than it is today. It is something that we talk about today as being desirable; it is something which in the future I think is essential.

So, I see two sorts of new jobs in the 1980s in the end-user area: the end-user professional, whatever function he is in, and the end-user specialist, both of whom will need education and guidance if the partnership is to be successful. And that can come only from the DP department or the IS department.

I said that was one of the key jobs in the 1980s. To complete that partnership, another key job is user management.

In looking at some of the things that the user manager will have to get involved in I put several of them under the heading of "regain control". Some of you may know that I have a perspective about this which says that over the past 10 to 15 years we have been building more and more of these large central database systems, which are very complex and quite difficult to operate, and which have significant impacts when they fail. As a result, we have taken more and more business management responsibilities, such as for company security, for the successful operation of a department, for justifying expenditure and for directing the way that particular function might evolve. We have taken those responsibilities away from the user manager when it comes to talking about computer systems, and we have built them into the DP manager's job, which is one of the reasons why DP managers have the biggest headaches.

We do not do this for other sorts of usage of capital resource or equipment. We expect a functional manager, a user manager, to take full responsibility for the operation of his department. As he becomes much more responsible with personal computing systems, with end-user driven systems, he will have to get back into this if he is to have a successfully managed operation. I call it regaining control. That can only make both the user manager's job in the long term more controllable and accountable, and the DP executive's job a much better one.

I think that the relationship between user managers and the IS executive must change. It must be much more a partnership or a participative relationship. Currently we see with many of our users a relatively stand-off approach. We are protecting ourselves all the time. We are protecting ourselves from criticism of our performance. We are not working together. Now we have to work together. Again, that requires a positive effort from the DP executive and the DP management to go out and explain what the user's role is and his role in developing a system; what his responsibilities are, and what they are not; what his role is when he has his own people develop systems; what his role is in managing the company's data; and, if he is a data owner, what his role then is.

He will not get these messages mystically; he will get them only if somebody has a positive programme to give him the messages. That person has really got to be the DP executive. Increasing executive interest may well be a foregone conclusion, but I really meant it as a positive thing here. Again, most executive interest has been more properly expressed as executive concern in the last five years. I think that is a fair view: a lot more money being spent in many cases; more and more staff; more complexity. When something failed more people were impacted, people were concerned. Now that has to be turned around and, if we get in with user management in these two areas, we will inevitably end up with more interest in the future from the executive. That can only be a good thing. It will mean that in future there will be less problem for the DP executive with his budgets and his resourcing, because the user executive will want those things put into a DP budget rather than always questioning it.

If any of that is to work, then the user management needs more communication at the executive level; more education; but perhaps most important of all, more interchange of management between users and between the DP function. We have already said that the DP function will become more professional, better managed, perhaps slightly more formal, but it will deliver the goods more often. What we come down to is a rather technical but still a business management function.

Similarly, we can look at many of our user management jobs and see that they will have much more of a technical content about how systems and services will be used. This will enable us much more easily to exchange people. Certainly we see that need very strongly and are starting to do it, and I know that some other companies do so, but much more needs to be done. I think that is something that can help to resource some of these new management positions or changing management positions that will occur and help to foster the joint partnership.

To summarise: within data processing I do not think that we will see any fewer analysts and programmers. I think that they will become more professional. I think that we will see slightly fewer operations staff, particularly the non-skilled. I think that they will move into much more creative and challenging jobs managing networks and more complex operational situations. I think that we will see significant growth in the activity of managing data, both within the DP function and in the user area. I think that we will see a definite need to install some form of end-user support centre within the IS or DP organisation.

Finally, we will see a significant change in the jobs of end users and end-user management.

SESSION D

CASE STUDY: RECRUITMENT AND RETENTION OF STAFF

Peter Bennett,
Metal Box Limited

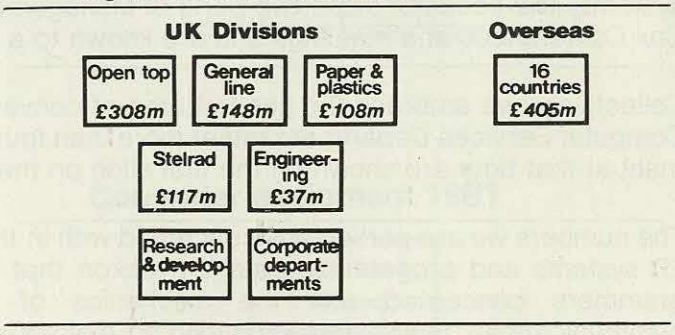
Peter Bennett has worked in the application of computers for over twenty years, since coming down from Cambridge in 1960. He received his basic grounding in data processing with International Computers and Tabulators Limited before moving to Plessey as one of their first Management Services managers. His thirteen years within this function in Plessey provided a wide variety of experience and responsibilities. In 1977 he became head of computer services in Metal Box.

I am neither a personnel person nor professionally involved in this field at all. I believe that I have been put into the programme at this stage in the afternoon to provide some light relief — perhaps as a user ground between two manufacturers, or at least to illustrate the practical problems we in Metal Box have experienced in expanding our numbers of systems and programming staff from 25 to 85 over the last four years.

Within this story there are some key lessons which I shall try to identify.

First, however, I must set the scene, and also ask for your indulgence in one important respect. I have responsibility for the provision of computer services throughout Metal Box, a company with some 50 sites in the United Kingdom and an annual turnover last year in excess of £1,100 million — predominantly in packaging but with substantial interests in central heating. About 60 per cent of this turnover originates in the United Kingdom, and the remaining 40 per cent from subsidiary and associate companies overseas.

Metal Box Limited—
Organisation and 1979/80 turnover



It is often said that Metal Box is one of those major companies that most people have heard of but are not quite sure what they do. My first slide shows our main divisions. Our open-topped factories make food and beverage cans, cans for baked beans, tinned food, mushy peas, millions and millions of beers, lagers, cokes, of all sizes. Our General Line Division make all the other tins, cans and fancy boxes — lots of them at the moment with an eye on the Royal Wedding festivities. And then there are our interests in shoe polish, tobacco, paint, tennis balls, oil, aerosols, biscuits, toy money boxes and goodness knows what else. The paper and plastics side of the business has been growing in the last few years, manufacturing margarine tubs and yoghourt cups, bottles for washing-up liquids and the new two-litre coca-cola bottles, bags for frozen peas,

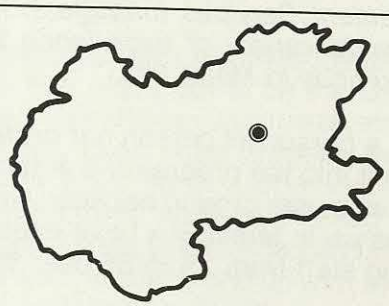
labels and a quarter of all the cheques printed in the United Kingdom — that I suspect you did not know — and the new wonder product, plastic wine bottle corks that really breathe. These corks are really catching on, which we are very pleased about. Stelrad make radiators and Ideal boilers. I think that we are now the largest domestic central heating organisation in the world.

So if all our products suddenly disappeared from your homes, leaving just their contents behind, they would make a rather nasty messy sludge oozing its way from your kitchen outwards.

Moving in from this squelchy global scene, our Computer Services Department has up to now been centralised in the Ruritanian city of — well, I hesitate to mention where by name so I will just give you the map shown on the next slide as a clue.

The reason I hesitate to name the town, although you all know where we are, is that we have painstakingly and with some success recruited and expanded our Department. The last thing I, or my Personnel Manager would want, is for me to stand here and tell you about all the talent I have acquired, and then find that our local papers are full of prestige page 3 advertisements exhorting their readers to come and work elsewhere.

Metal Box Limited



I have been asked more than once to give talks similar to this one at computer recruitment conferences in Birmingham or the Midlands, but I have declined to do so in order to protect our own interests. But here, hopefully, we are among friends, and I did not feel I could refuse the invitation. As stated, however, I ask your indulgence in subsequently respecting our privacy.

Organisationally, Metal Box's computer department is part of Corporate Management Services which reports to a Vice-Chairman. The other parts are Consultancy Services and Communications Services which cover O & M, operations research, work study and factory systems. The heads of those two parts of Management Services have been at other Butler Cox Conferences and meetings and are known to a number of you.

Collectively, we embrace the general area of convergence. I took on responsibility for the Computer Services Department rather more than four years ago. The numbers in the department at that time are shown on the first slide on the next page.

The numbers we are particularly concerned with in this talk are those on the second line — 20 systems and programming staff. I reckon that at the time three were systems programmers concerned with the mechanics of our basic machine software and communications, twelve were engaged on maintenance and support activities, which left five to look after the new computer developments for one of the United Kingdom's major companies. Obviously, we had some work to do. To complete the picture, our actual computer equipment looked something like I have shown on the second slide on the next page.

For the non-technical among you, this was not a very large or very modern installation and as you see at the bottom only six of our 50 sites actually had direct access to any com-

puter facilities. Quite a number of others had facilities for transmitting paper tape produced from ageing accounting machines. It was speedily obvious, then, that the department was faced with four major problems which had to be solved if it was to be an effective unit able to play a proper role within the company.

The first, obviously, was the inadequate equipment we had. The other three were really personnel problems and the ones I shall be dwelling on today — inexperienced management, insufficient staff and inadequate accommodation.

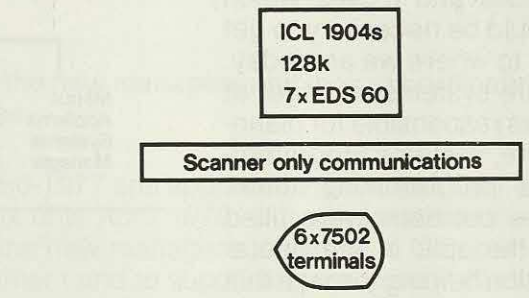
The next slide shows the measured growth in processing at our centre over the last four years. There is a mistake in the righthand column which should read 117,000, not 98,000 as shown, which compared to the start line four years ago is considerably larger, being five times larger rather than four times larger. I went there in April 1977, and at the end of the first year I asked some of my critics from the factory and divisional management how easily they would cope with doubling their output in 11 months. (I must admit to having had a few critics and still to having a few there, but you get used to taking the rough with the rough.) Sometimes this question provoked a reply which came close to sympathy. As a result of this growth the company's computer inventory now looks like this.

I am not trying to blind you with science, because I know a lot of you are not computer people. I have drawn these boxes larger than the boxes on the earlier slide to denote greater power and capability. What they do show, however, is that we now have almost 50 terminals in our factories and that we also have a number of sites (the nine ME 29s, shown on

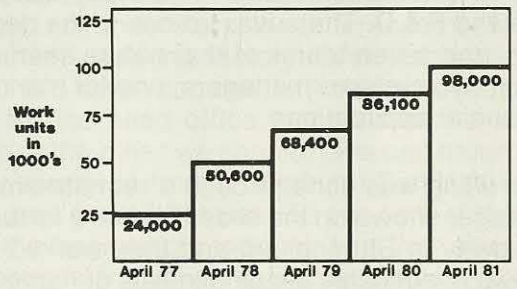
Computer staff 1977

Management & Administration	7
Systems & Programming	20
Operations	12
Data Control & Data Preparation	49
	88

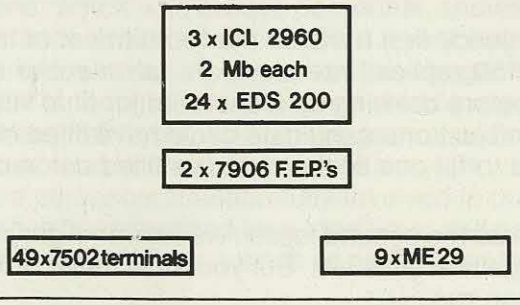
Computer equipment 1977



Growth in computer usage



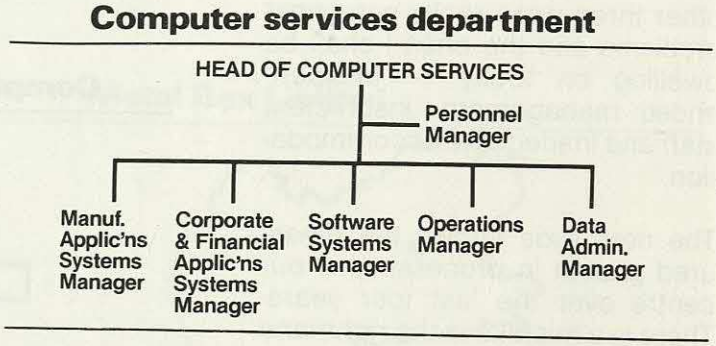
Computer equipment 1981



the right), installing their own minicomputers. That is actually more sites than had terminals four years ago.

Let me now deal in turn with the problems I have just described as being of a personnel nature — management, numbers and accommodation.

The first problem consisted of defining the organisation necessary to manage the expansion and then filling the slots with people of sufficient experience. The organisation which I decided on at the time with a bit of help from my friends, was that shown on this slide. Starting on the right we had a data administration manager who looked after data control and data preparation, seeing work through the computers so as to allow the operations manager to concentrate on hardware and the successive upgrades and moves which we saw would be necessary to get us through to where we are today. Our software systems manager at the time was responsible for planning, software, systems programming and a programming team. These three positions were filled internally, the split in the operational function helping to make this possible.



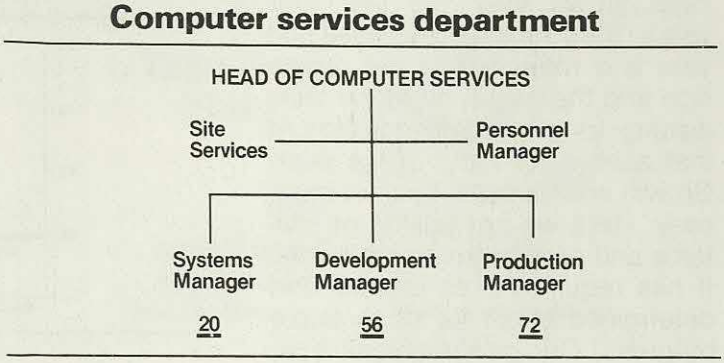
The systems area I defined as needing seven project teams if it was to provide a professional continuity of service to its prospective users, which were the four divisions I showed on one of the earlier slides — the payroll, pensions and personnel function, corporate finance and R & D. There was no one in the department with the attributes to handle such a position, and seven teams of that nature seemed too many for a newcomer. So we decided to recruit two systems managers, one for manufacturing applications and one for corporate and financial applications.

The recruiting was done through a recruitment agency as we did not then have the personnel manager shown on the slide. We were fortunate in having a good agency with offices not too far away in Birmingham and they worked hard on our account for some years. There were always agencies sending in lists of names or dossiers of life histories (today, they ring up in desperation), but if you are really looking for staff and need outside help, I recommend you to let one agency into your plans and work with them consistently. If you choose this one agency carefully, they will give you a lot of help and advice, not only on recruitment but also on organisation, salary rates, job descriptions, career paths, local situations that may affect you, and so on.

Our agency first handled the recruitment of the two systems managers. They received well over 150 replies, interviewed a fair number and subsequently offered a selection whom I saw before drawing up a short list for final interview with my director. It is fair to say that at the end just one candidate could have filled either of the two positions and another one was suited to fill one of them, so we filled our vacancies but without any reserves.

That was the second lesson we learnt — good applicants are rare, as we were to learn again and again at all levels. But you must never drop your standards; it will cost you even more in the long run.

Almost as an aside, it is worth seeing how the organisation has developed since then. At the beginning of April this year we reorganised to the situation shown on this slide.



The recruited systems manager who could have filled either role is now the systems manager responsible for high-level interfaces to our users. The other recruit at that time is now what we call the production manager controlling all the operational areas, while our previous software system manager now looks after a central development section. The numbers underneath the job titles, to which I shall return, show an increase against the starting point. I think it has evolved correctly, but as with our hardware we could not have gone straight to where we needed to be. Both the new managers and their subordinates needed to grow into an understanding of their roles.

The initial organisation was planned in mid-1977 and approved in principle then, but it did not get budgetary approval within Metal Box until April 1978. Our advertisements appeared in May, we made our offers in June, and the new managers joined us in October and started making a real contribution to the department and to supporting me around Christmas 1978. So, the third lesson is that it all takes a long time.

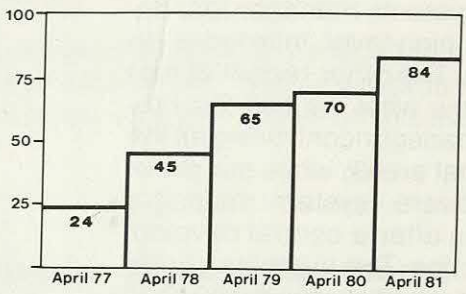
In the autumn of 1978 we had a stroke of luck. Our department had always been located on a factory site along with certain other head office functions. The factory personnel department had always provided us with a service but it had always been somewhat remote. There may well have been faults on both sides but they did not understand the differences between the computer market place and recruiting for a metal working factory. Even if they did understand, they probably did not approve. In mid-1978 it was decided, without any direct request from me, to appoint a personnel manager for the head office functions in the aforesaid location. This has been a great help to us and without her we should have had much greater difficulty in reaching our present position. My own department, Computer Services, is numerically the largest of her responsibilities and now constitutes over 50 per cent of the people she is responsible for. On this basis, from the beginning I took the line that she was the department's personnel manager. She has been fully involved in the department as a member of its management team and after the initial period of adjustment from a factory environment this approach has paid off handsomely.

Personnel matters are things that as managers we all have to handle and I expect we all muddle through better or worse because we have to. But the amount of time that we used to spend at my management meetings on item one, which was always personnel, showed just how much we really needed professional assistance. I think it took us about a year before we were actually able to move on to item two before lunch time. As a result of this I began to find that a number of actions that used to take a lot of thought, or were even shied away from, actually became quite simple. I mentioned earlier that if you lacked professional assistance in this function, a good agency could be invaluable as a source of consultancy and advice. But there really is no substitute for a dedicated personnel function fully involved in the day-to-day running of a department. I suppose this has been realised for a long time, and particularly by personnel functions themselves, but like many things it tends to have taken its time to reach computer departments.

Having dealt with the problem of management the next identified problem was the number of systems and programming staff.

This slide shows how the numbers have grown over the last four years. The very small increase last year is a reflection of the recession and the way it hit Metal Box, leading to a ban on recruitment that applied for most of the year. Growth on this scale has not been easy. Here we are talking of systems and programming staff only. It has required a consistent and determined effort for us to make progress. Our geographical location has some disadvantages in this respect and some advantages. In general, our area does not have adequate numbers of the trained and experienced staff we need so we have to be prepared for the expense of staff relocation. However, there are not many large installations in our neighbourhood, so we do not have much local movement of staff, and if our own staff want to leave us, they may well have to accept the need to move house as well. Situated in a fairly rural area, with comparatively inexpensive housing, though it is certainly not cheap, this may well be a daunting decision for them. All we can say, for whatever reason, is that we have more than held our own, but we know that we cannot afford to relax. I believe that once we relax, or stop recruiting, our numbers would not stay steady, they would fall, at least in normal times.

Growth in systems and programming staff



In the first half of this period, until our personnel manager and systems managers found their feet, we continued to make a lot of use of our favourite agency. For 1979, we specified at least ten positions that we wanted them to fill, and they filled them. We altered the balance of their normal commission rate so that they made less than usual on the first few, then they made their normal rate, and then we paid them a premium. They had to get ten for us to achieve their normal commission, and above that number we were very happy, and I believe they made a killing. It worked to everyone's satisfaction.

In dealing with them we learnt a lot about advertisements. In the pages and pages of the computer press a standard script advert like the one shown on the next slide tends to be lost among hoards of similar ones.

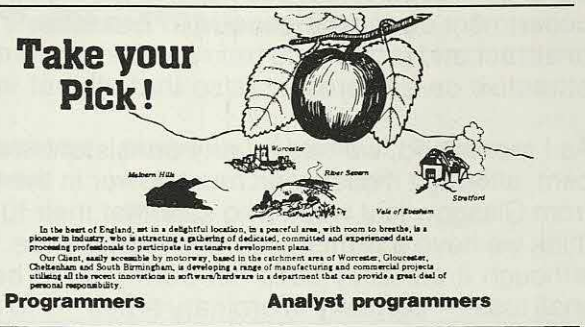
You see lots of advertisements like this — just lines of blurb with really no great imagination, or a little bit of an attempt at it, but they do not stand out at all. One of the things we learnt was that if in fact you do something similar but draw it up vertically, say half a page deep and two columns wide, the printers or the people who lay out the pages tend to put it in the top corner of the page. It is something to do with it being awkward for printers so they place it on the page first and put the others round it. Colours and pictures are also good. We tried a number of different variations.

Advertisement

Software Programmers
Application Programmers
Support Programmers
Systems Analysts
Lift the Lid on a Bright New Future with
Metal Box

This slide shows one of them — the top half should really be in green, presumably apple green, but if you can envisage it, what we did there was to try to do something eye-catching in our advertisement. We were pleased with this although it did not do terribly well in practice. We are stressing our rustic origins here, our fruity nature, and our proximity to Shakespeare's birthplace. I think perhaps that is why it did not do too well — there is a suggestion of culture.

Advertisement



Anyway, as time progressed, we became more confident and started handling the advertisements ourselves. Here again we discovered some interesting situations. You probably all know that agencies buy advertising space at a much lower price than you or I can do on our own. The difference will make a contribution towards their fees. But we also discovered the value of our local press. We can cover all our market towns (some of them shown in the advertisement and quite a few that are not there) and all the people within commuting distance, for less than a national advert in *Computing* or *Computer Weekly* and we can obtain a higher number of replies. We did find that we must not do this too often, or at least that the returns drop if we try to. But we believe that a trawl through the local waters should be the first step for all but the most highly specialised vacancies. In fact, we have just done one in the last month, after a long interval, and have received 126 replies for one type of vacancy.

In 1977, we started with 24 analysts and programmers and now in 1981 we have 84. We took in 21 from agencies, seven as a result of replies to advertisements, 11 were direct applications, eight were internal appointments and recruitments, and 40 were trainees. That would have taken us up to 111 staff, but in the same period we lost 27 people, which was a turnover of 12½ per cent. In fact, to expand you need all the recruitment sources you can find.

As I mentioned, our favourite agency looked after us well. We took 21 recruits from agencies. Some, of course, came from the vast range of papers sent by other agencies, but a lot came from the one source. As you know, agencies like to be able to charge for their advertisements so they have a client and they will look after him, and the people who are left over from the advertisements are then offered to everybody else. That may be wrong, but that is my belief.

Our own advertisements brought us in seven recruits in this period and, particularly on the local scene, have been most cost effective. But again, with applicants you always get more quantity than quality applying. Not all the 126 responses earlier this month actually had the makings of shift managers. The direct applicants — I said we had 11 of those — were partly friends and relatives of our own staff or other people in the company, and partly letters from people further afield wishing to move to our area, either for housing, boyfriends, wives, or other reasons. Here again, I suppose, we are helped by not being surrounded by competition. Also in that number were a few of our former leavers who returned to us, which of course is nice because you have to choose only the ones you want to.

The level of internal transfers — we had eight — has been a disappointment to us. I am not sure why it is so low, but I gather that in other companies they do a lot better. Perhaps the fact that Metal Box is so widely spread geographically has worked against us here. I should have liked to see more transfers, either on secondment or on permanent transfer, although

you always have to watch out for other units within the company just looking for an opportunity to offload their seconds.

This brings us to the clear conclusion that to meet the long-term objectives of having a significant department you have to grow your own staff. We had 40 trainees coming into the department during the period 1977 to 1981. In the still expanding computer market you have to attract and recruit and train people of talent and potential, and then you have to offer them attractive career prospects so that all that investment is not wasted.

As I mentioned, we had a fairly consistent staff turnover ratio during this period of 12½ per cent, although it has fallen much lower in the last few months. I actually met a friend of mine from Glasgow last week who said that their turnover for the last 16 months had been nil, so I think we have a rather special circumstance. But 12½ per cent overall, I gather, is not bad, although it certainly does not permit us to be complacent. It means, for instance, that we shall lose — certainly in ordinary times — 10 analysts and programmers in the coming year, while I want to recruit 18 and a further nine trainees, so the 10 losses have got to be on top of that. Of our trainees, half have been graduates, with the others coming partly from school-leavers and partly from young applicants who feel they have made a mistake in their first choice of career. We have also taken a small number from TOPS courses. We cultivate the better of our local schools, we attend careers evenings, receive visits, help where we can to keep ties going with them. We do not have a high opinion of the HNC or degree products of polytechnics. In another forum I would seriously question their place and cost effectiveness in the higher education scene. But we do find that their sandwich students who come to us after two years for a year as programmers make a useful contribution, and may well justify an eventual offer of employment on completion of their courses.

Graduate recruitment is almost a subject in its own right and I should like to dwell on it for a few minutes. Up until 1978 our department received a one-page mention in the normal company "glossy" for graduates and we used to have a number of applicants channelled through to us by corporate personnel who were mainly, and quite rightly, more concerned with recruiting engineers for the company. It was well intentioned but not very effective. We did not have a great number of applicants to choose from, and they were generally not of a high calibre and I do not suppose we made much of an impression on them either. So before the 1979 university milk round, with my management team and a personnel manager in position, we considered how to alter the scene. We decided first that the two systems managers, the software manager and myself would each cultivate three universities, making 12 universities in all.

We have established contacts with the careers officers and with the computing faculties at these 12 universities. We have given talks on computing as a career — not just on Metal Box — to meetings of their societies or to careers conventions. And we each make sure we have continuity of representation in interviewing computer applicants in each of our three universities. This has certainly paid off on a soft-sell approach by keeping Metal Box's interest in computer applicants in their minds and giving us the opportunity to discuss the standard of any particular applicant with someone who knows them.

The list of preferred universities is shown on the slide on the next page and it may seem a trifle idiosyncratic, but while approaching it with an open mind and reviewing it annually we believe it is right for us. We start with Cambridge and Oxford, because that is the order in which I prefer to start. We then have a number of local universities, or as near local as a university can be if you live in the back of beyond. I actually found in going through a publication in one of the university careers libraries that it was split up geographically and no university covers our county because it is not in the catchment area for any university. So that is not a very useful publication to us. But we have a number of more or less local universities. We find the next block of universities on the slide technically strong and therefore useful to us, and we have traditionally recruited well in Scotland — I think probably because of the

paucity of job opportunities north of the border. It is a long drive up there to develop the contacts, but generally it is well worth the journey.

If other members of our company find high calibre applicants at other universities, we consider them along with those from this preferred list, but we do not make any special effort outside this dozen. We have prepared a booklet of our own in addition to the company's "glossy", as a supplement to it — a dozen pages or so. We update this booklet, *A Career in Computing in Metal Box*, each year and we send it out to the careers departments and computing faculties of these universities. Its aim is to describe our department and how it is organised, the career development paths and the training plans, the likely salaries and salary progression and some general information on conditions of service. It also includes a summary of the second interview programme for that year with its dates. Apart from sending it to our own universities, any Metal Box interviewers going elsewhere have it as a reference document.

"Preferred" universities

Cambridge	Birmingham	Liverpool	St. Andrews
Oxford	Aston	Manchester	Glasgow
	Bristol	Leeds	
	Swansea		
	Cardiff		

Having developed our initial lines of communication to these universities and their students, we then planned to introduce a group second interview programme — we had not had one before — so as to maximise our own impact and to enable us to get an in-depth assessment of chosen applicants. In practice, we now call in two groups of around 12 candidates — never more than 16 — on successive days from lunch time to lunch time. The first afternoon and evening we keep them in a local hotel, where we are lucky in having a suitable room on the sixth floor in the centre of the city with a view over the cathedral, the River Severn, the county cricket ground, the race course and the Malvern Hills. It looks gorgeous and it also looks very interesting and fascinating when it is all under water. As some of you may remember, we are very prone to flooding in those parts; 15 feet of water can look quite something as it rises. Rumour has it that the view at the back of the hotel on the sixth floor is less attractive, but rumour is said to be a lying jade.

We start off by welcoming our dozen or so candidates, introducing ourselves, myself, my senior managers, my personnel manager, telling them about the company, about the city, about the department and what we can do for them. Remember that they will probably be nervous. It is quite true that some of them will never have stayed in a hotel before and they find it a bit overwhelming at times. For our benefit and for theirs we like to put name badges on them so that you know who's who. But remember to give them the option of changing their first names to whatever they prefer. We also like to take a photograph of each of them because that makes it much easier for us after the event to identify a name if we are actually discussing respective merits. That needs explaining to prevent them thinking of us as some sort of Gestapo organisation. But we always do promise not to fingerprint them!

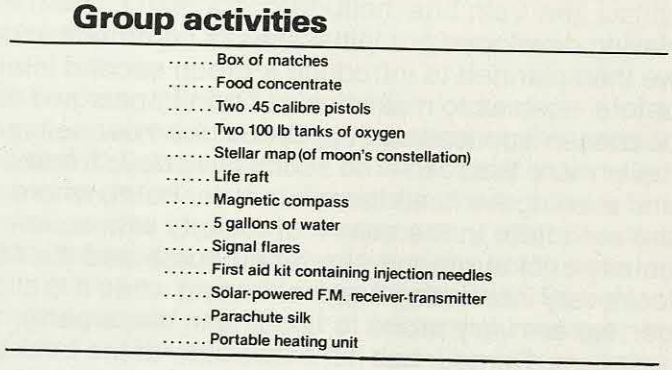
After these introductory talks and a film about Metal Box we have tea, and then we set them all an aptitude test. We are not quite sure why we set them an aptitude test except that it seemed a very professional thing to do, and certainly we are not sure what value we attach to it. We find it useful though — and I shall come back to this — as a check on our conclusions. We never make offers on the strength of the aptitude test results alone, but we might fail people because of them. One of these days, when we have more data, and more time, and the first recruits who were subjected to the test have been with us longer, we shall try to make an objective assessment of its contribution.

It quite often happens that people have already done the same aptitude test. It did not happen to us this year because one of the major United Kingdom computer companies did not seem to be doing much recruiting. Having done the same test before may help them, particularly with an awareness of the time they have available, so I always try to unsettle people in that position by saying that it works against them by making them over-confident. That seems fair to me. Anyway, for our purposes it does not affect the issue.

After the tests they can relax for the rest of the day — or almost the rest of the day. We ask along some of their predecessors to join us for the evening and to talk freely so as to give an insight of what it is all really like.

I should explain at this stage that we plan for each of my three managers who are present and the personnel manager and myself to learn as much as we can about each candidate during the 24 hours. As such, the person who did their first interview does not do their second interview and we arrange the seating plan for dinner very carefully to put them next to others of us. Hopefully, nothing happens by accident although we try to keep it very informal. We have drinks and a good dinner, taking due note of any birthday boys or girls present, with candles being carried in by the head waiter. Somehow port always seems to be ordered when it is my birthday despite my strict instructions for economy. Then we all adjourn for what we call group activities.

For this we usually split them into three groups and set them a problem such as the one shown on this slide. Basically it is to decide the order of jettisoning your load of partly vital and partly useless equipment when you hit trouble with your lunar buggy. People come up with the most splendid ideas, such as working out how far backwards you will go if you fire both pistols together. It is great fun, and a lot of fun sorting them out and looking at the answers presented to them. We also observe carefully who takes the lead, who can think and who is persuasive. This year we had a different game which was perhaps more interesting because they had to put in their own personal solutions first and then argue and decide their way through to group ones.



We go through their answers verbally but we make sure we collect in the answer pages. It is all designed to provide us with more information on the applicants.

At the end of a fairly long day, particularly if some of them have travelled a long way, just before they turn in we outline the plan for the next morning and we give them each a subject to prepare a talk on for five minutes, something simple and non-controversial — like there are too many universities, or that the Olympic Games should be boycotted.

The next day's session takes place in our computer centre to give them a chance to see the working environment, our canteen and the computer installation, which is all quite impressive since we moved to new purpose-built premises last August. This, incidentally, was the solution to the last of our 1977 problems that I mentioned earlier. They also have a short interview with the personnel manager and a longer second interview with one of the managers, and of course they give their five-minute talk.

We then give them a good lunch — some of them have long journeys back again — and we send them on their way with a wallet of brochures and information to remind them of what they have seen and heard. Before they go, however, we get them to complete a questionnaire on ourselves and the interview sessions to see where we can improve.

We handle the second batch of applicants immediately after the first and when they in turn have gone we sit straight down to sort out our selections. First of all, what are we looking for? We are certainly looking for talent, a good level of intellect, rounded personalities, people who will fit into the department, will settle in Worcester, and who will grow and contribute to the department. We are looking for high flyers and future managers. But we are also looking for solid, steady citizens who will do a good job and be content to do it. We are not just looking for computer scientists. In fact, we sometimes think that computer science faculties do not attract the best quality people — perhaps the best ones just go to software houses or to London.

Our final selection list tends to look something like I have shown on this slide. I cannot vouch for the accuracy of all the names. Quite a lot drop off or are crossed off very quickly and they are not even on the list. Others require quite a lot of discussion and this is where our emphasis in getting to know everyone pays off, because it enables us collectively to make objective comparisons between people whom we obviously have not all interviewed formally.

Graduate selection list

		Aptitude test	Probability	
1.	Albert Einstein	86	10	
	Bill Rutherford	83	15	
	Marie Curie	79	40	
	Frank Whittle	77	30	
				95
2.1	Margaret Drabble	68	60	
	Anthony Trollope	85	35	
	James Flecker	87	35	
	Virginia Woolf	75	30	
	William Shakespeare	82	55	
	Charles Dickens	66	40	
				255
2.2	Susannah York	69	40	
	Ronald Reagan	77	15	
	John Wayne	61	20	
	Sarah Miles	73	35	
	Claire Bloom	62	65	
				175

The aptitude tests in the first column on the slide are a good check. Our chosen top group, those whom we have no doubts about wanting in the department, almost invariably get good marks. Notice in the example here the marks tend to be better at the top of the slide than the bottom, though it does not follow invariably. If the ones we really liked in the top group did not get good marks, we should worry, and if they fall below 60 per cent we should almost certainly exclude them.

Having decided whom we want, we come then to the really tricky bit — making the right number of offers. We believe that if we want to recruit someone we should appear keen and make our offer quickly. That is why we sort them out and send out the offers straight away, and they should all be received by the end of the week. But in a normal budgetary situation, you only want so many recruits and you know that a number will reject your offer, so we work out a percentage of the probability of acceptance. That is the righthand column on the slide. This requires all our expertise in small talk, observation and probing. Good people will have more offers to choose from, that is for sure, so the probability of our getting Albert Einstein to come would be pretty low and there we give him say 10 per cent. But some people may like cathedral cities or have an aunt in the place, or actually live there — that may well mean that they will not come — but there are various clues you can get. On this example we would expect to get one of our first group — they add up to 95 per cent — three (or perhaps two) from the second group, which adds up to 255 per cent — and another couple from the third group. The total on the slide is 525 per cent, so we would expect to have got five from these 15 offers. I wonder which five we would have got.

In our first year we wanted six recruits and we made 13 offers. Corporate personnel, in their wisdom, told us we should have made 18 offers, but we got six exactly. In 1980, we calcu-

lated we needed to make 12 offers for six places and again we scored a bull's eye. This year, a very difficult year for the company as well as for graduates seeking employment, we had permission after quite a fight to recruit just four graduates. At the time I prepared this slide I knew I wanted four recruits but I did not know how many acceptances we had received. We calculated that 11 offers would give us 325 per cent probability. We really needed to make 14 offers to land four, but I ran scared and refused to make 14 offers — I made 11 offers. I was terrified when the first two replies were acceptances. In these days you just do not go over budget. In the event we had four acceptances — another bull's eye. It will be very hard one of these years to explain if we really come unstuck.

Graduate recruitment

	1979	1980	1981
Applications	89	156	184
Interviews	54	97	92
2nd interviews	20	35	32
Offers	13	12	11
Acceptance	6	6	

The slide also shows how the interest in joining our department has grown. I had 89 applicants the first year we operated the graduate recruitment scheme and that had risen to 184 this year. It is not just quantity. We, and our corporate personnel department who keep a watchful eye on us, are convinced that the standard of the applicants is improving. We want our chosen universities to appreciate that their graduates have to be good to have a chance of joining us, because that way they are likely to send us even better ones.

So far I have concentrated on what we have done to attract recruits and improve the quality of those we attract, but in the few minutes left to me I should like to turn to the question of retention of staff. I suppose here I am moving from fact into theory. We know we have recruited more staff, we also know we will not stop people leaving. It sounds trite to say that people are our most important asset and you have to work at them all the time. We have been helped in the last few years by being an expanding and busy department, with lots happening and most people fairly stretched. I was also fortunate soon after I joined four years ago in being permitted to restructure the department's job descriptions and gradings within the company job description grading scheme to reflect what I saw coming, rather than base them on the set-up of the previous decade or so. Again, in achieving this within the company's schemes I had the benefit of outside professional help. This enabled us to offer reasonable salaries within the normal bands of the company's grading scheme. The salary bands for each job are published within the department so that people can see how well they are doing and what they can look forward to. We then drew up a comprehensive chart showing the relationship between each of the jobs in the department, and what movements might normally be expected in the course of career development.

The first slide on the next page shows the section of the chart concerned with most of our analysts and programmers, but it all inter-relates across the department. We have here three vertical lines — analysts, application programmers and software programmers. It goes on higher above that. It is a bit out of date and some of it has been altered, but it does show the levels at which we might expect people to move from one stream to another, to alter their direction either to gain more experience or to clarify their own interests.

In the bottom right of each box we have the expected minimum age for each position and the number of years we would expect people to have been in that stream before holding any position. There are certain other house rules, such as graduates get a credit of one-and-a-

half years, but essentially it is straightforward and it makes a useful basis for our annual assessments among other things. The lefthand number is a cross-reference to the training plan, which is shown on the second and third slides on this page.

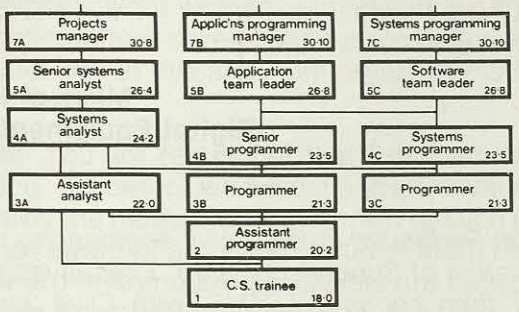
We have tried here to define the essential training that our staff should receive in a position before progressing to the next one. It is viewed in two aspects — the management one in the lefthand column and the technical one. Everyone starts at trainee level with basic Cobol and job descriptions in the top righthand corner. But whereas assistant analysts need report writing (3A in the middle of the second slide), programmers are trained in this only much later at team leader level (somewhere like 5B, on the third slide).

Similarly, systems analysts receive training in financial appreciation to help their work, but ultimately everybody needs this if they are to move into management levels.

We believe in this plan and we check out progress on it during the annual assessments. Again, it is available to people and they say why have you not taught us this. It is, of course, in our own interest to have well-trained staff and make the most of their potential, but it is also true that staff like to be sure that they receive the appropriate training. I think that the preparation and publication of these career paths and training plans have been beneficial.

I do not think I have anything more to add without pontificating on theories. I hope that these experiences of ours have been useful to you. I thank you for your patience.

Career development summary



Computer services—training schedule

Position	Management	Technical
1	Company induction	Cobol Basic JD/SCL
2		Advanced JD/SCL, Filetab Programming techniques
3A		Data analysis Basic systems Presentation techniques Report writing
3B		Advanced Cobol
3C		Advanced Cobol
3D		Operating systems maintenance
4A	Project control Metal Box information	Advanced systems Financial appreciation

Computer services—training schedule

Position	Management	Technical
4B	Project control Metal Box information	Systems design Advanced programming technique Basic systems
4C	Project control Metal Box information	Systems design Advanced programming techniques Sizing and tuning
4D	Metal Box information	Sizing and tuning
5A	Supervisory skills Interviews and meetings	
5B	Supervisory skills	Data analysis Report writing Financial appreciation
5C	Supervisory skills	Report writing
5D	Supervisory skills Project control	Report writing

SESSION E

MOTIVATION AND REWARD OF COMPUTER STAFF

Michael Redhouse,
Digital Equipment Company Limited

Michael Redhouse studied civil engineering at Birmingham University and then joined the Association of Supervisory Staff, Executives and Technicians as a trainee full-time official. ASSET then became ASTMS (with Clive Jenkins as its General Secretary) and Michael Redhouse became personnel officer for the Union, first in Glasgow and later in Manchester. His responsibilities included recruitment, organisation and collective bargaining.

In 1975 he joined ICL as employee relations and compensation manager for the Customer Engineering and Spares Group. Subsequently, he became ICL's employee remuneration manager for all United Kingdom staff.

He joined Digital Equipment in March 1981 as compensation and benefits manager for the United Kingdom.

As you have heard, my job throughout my career has been as a personnel professional and, as some of you at least will expect from a personnel professional, I intend to raise more questions during my talk than to give answers. I hope also to challenge some thoughts and stimulate some ideas amongst you about some of the problems of motivating and rewarding various groups of computer staff, as opposed to attempting to provide any panacea. Having said that, I hope I might at least hint at some resolutions, or changes, to the various problems.

I hope to show you that personnel management, or thinking about these problems, can play some sort of role in the way in which you, as managers — as DP managers especially — approach the problems of motivating and rewarding the computer staff.

I shall look at the question of motivation and reward in a number of different areas, and the areas at which I am looking are addressed to the sort of people that we are talking about. The first group I want to look at will be the computer specialist. I want to review the motivation and reward of the highly valuable technologist who may be a systems analyst or even a highly qualified programmer, but whoever he or she is, is the only person who can do whatever that job requires them to do in your particular organisation. So my definition of computer specialist is deliberately wide and may well in the future include the person who understands something of the inter-relationships between the various bits of information that exist in your companies. He is, also probably the only person who understands how the various items of DP equipment you have inter-relate and talk to one another. Whoever he is, my definition of him is that he is rare and esoteric. He is rare because he understands your problems and therefore he is valuable to you in terms of motivating and rewarding him.

The second group of people that I want to review in regard to motivation and reward are the office computer users. By that I mean drawing office, or 'office' office, if you like. In particular I want to look at the impact on the job content of such people in your organisations, and how the impact of new technology can enhance and motivate them through job content, rather than demoralise and degrade them.

Finally, I want to look at what I call the new 'home worker'. These are the people, referred to by one of our earlier speakers today, for whom data processing has made it possible to work from home. They might be clerical workers, technical workers, managers, production control workers, or any of the various types of professional trades that exist. I want to see how we can motivate and reward these people as well.

This is an important area of work for some people in our community, because home working will, I believe, be very attractive in the future, especially for women of child-bearing age who will see home working as an opportunity to continue their career without disruption to their families. It is important, therefore, that we should look at this area with regard to motivation and reward.

Let us start by looking at computer specialists. You will remember that I defined them as being an esoteric, but valuable commodity to you. But before we examine the motivation and reward of such a specialist we must establish why the motivation and reward of such people should be any different from the motivation and reward of any other group of staff. I believe that the differences for the motivation and reward of computer specialists are based upon the technology with which they work. There is no other technology in existence which changes as rapidly as computer technology. Computer technology is, I believe, different from any other technology, because the information and experience gained from the previous range or generation of computers can be not only of no benefit in the new range or generation of computers, but in practice may actually inhibit the learner from learning freely and extensively about the new system. It is this problem, this feature of the industry, that it grows so quickly and changes so fast, that past information and experience may not be of benefit, which makes the challenging difference.

The other challenging difference, of course, is that we are dealing here with technology which is not on the periphery of a business. We are dealing, are we not, with information systems and the computer technologist will, therefore, be at the very heart of our industries. Therefore his motivation will be a key to the success of our enterprises.

So the computer specialist is different because experience is not necessarily an advantage to the job holder. In the past, both in traditional areas of our industry and in the public sector, the chief criterion for promotion and progression has been the length of time which the job holder has spent in a particular grade. The time of experience has been a key factor. I believe that, given a choice, many of you as DP managers would actually choose a graduate more capable of adapting to the new technology (or who may have already learnt about some of the new technology) in preference to a 50-year-old experienced programmer. Naturally, I am making generalisations and there are 50-year-olds who can adapt and graduates who will not learn. But, by and large, experience is not the factor that will determine your selection and development of the computer specialist. The same problem exists when you recruit from within your own organisation. The most adaptable and successful people who will progress most quickly and be most able at their technology are not those with the longest experience at other jobs. So the greatest number of years of service is not an indication of a computer specialist's ability.

Secondly, and perhaps more controversially, ability to manage people may not be an appropriate factor by which to measure the computer specialist. Traditionally, a high priority has always been given to those candidates for senior jobs who have skills in management techniques. However, the computer specialist requires an understanding of the new management techniques — the management of information systems, or the management of technical problems — rather than an understanding of the management of people. Understanding the interface between the systems, or the interfaces between the various software elements of a package, may be different to understanding how to manage people.

The difference here then is that, although the computer specialist is esoteric and valuable, it may not be valuable or necessary for the computer specialist to be able to manage people. So for the personnel professional there is a difference in the profile.

Finally, in assessing how the computer specialist is different, we must remember that the market in which we are recruiting him is not the same as the general one. The market is a false one, in as much as it is created in waves by the creation of new technology by the computer manufacturers. Waves of change in computer design or computer architecture produce false (i.e. temporary) changes in the market which cause quite violent fluctuations. The year after a new range of computers is launched by a major manufacturer, people skilled in the knowledge and use of that particular range are rare and therefore they become more valuable. However, as the range matures, they then become less valuable. So we need to be aware of the fact that we are operating in a peculiar, and a world-wide, market.

One of the ways in which we can measure the market is through surveys. I have no doubt that most of you are as bored as most of my staff are at the innumerable surveys we are asked to complete. Some of the surveys I have seen recently have been carried out by people who have set themselves up as consultants (because they see consultancy as a lucrative market) and who seem to have given up any hope of job matching, or any of the important techniques of surveys. They now rely simply on matching by job titles, and I believe that such people should be avoided. We must be very careful when we survey markets to make sure that we use professional and properly managed surveys.

What then are the problems that arise with the different computer specialist in this fluctuating environment when we try to reward and motivate him by putting into action the normal personnel procedures?

The first problem is with the job evaluation schemes that are frequently used for deciding on remuneration. These schemes are used by personnel staff to measure the different values of jobs in the organisation, and thence to decide on the different methods of remuneration. The most highly weighted factors in all of the schemes that I have ever seen are experience and the number of people supervised. I challenge anyone to think of a scheme that does not rate at least equally highly these two factors.

Yet these two factors do not necessarily relate well to the computer specialist, and so the application of job evaluation schemes may well disadvantage him. Remember that job evaluation is a relative process, and does not provide any absolute value at all. In the past, the relative process has used experience and people supervised to determine the relative grading of a job. If we apply this type of traditional job evaluation scheme to the new-technology jobs, we will inevitably create problems.

Because computer specialists will score lowly on both of those factors they will be disadvantaged in terms of company-wide grading schemes or pay schemes. Using traditional job evaluation schemes leads to grades, or bands of salaries, or ranges of salaries, or levels (or whatever your particular company calls them) for computer specialists that are inappropriate in the marketplace. From my own experience, I know of several companies where immense friction has been caused by the results of a job evaluation scheme which have graded computer specialists in a way that did not accurately reflect their value to the company. That is why we need to revise our application of job evaluation schemes to people who work in this area.

The second problem area is the question of promotion policy. The traditional policy is for employee specifications to relate to the number of years in the previous job and for interview techniques to look for man-management ability and personal sensitivity. Many of us in the personnel field have made quite a bit of money by telling people how to perfect their interview techniques, so they can be absolutely certain that they identify the people who have the highest personal sensitivity, and who have the best man-management ability. Our behavioural colleagues have specialised in helping us to identify things called leadership qualities and man-management abilities in these interview sessions.

However, these qualities and abilities need not necessarily be the features most applicable to the person or the job concerned. A prime example of some of the problems in this area arises in the UK Civil Service, where in certain areas, interview techniques are used as an across the board method for promotion from one grade to another. I believe we are looking in this area for the wrong qualities and we must be careful to acknowledge that.

The other problem with traditional promotion policies is that promotions in British industry tend to be based on a hierarchical model of industry. In most of industry there is one charge-hand for every 12 shop floor workers, and there is one deputy foreman for every four chargehands, and so on up the hierarchy. The hierarchy of establishment control becomes an important mechanism for control amongst personnel staff. You wait for a vacancy to arise, and you then set about selecting someone to promote into that vacancy. The vacancy is filled by interviewing candidates, where, as I have said, we are looking for the wrong qualities. That procedure restricts the speed at which the computer specialist, who we may have to pay a great deal of money in order to keep and motivate, can move through the organisational structure. We need to be rethinking the methods and ways in which we conduct those promotion policies. They work well in hierarchies, but I believe that they are inadequate for the computer specialist.

Another problem is that the computer specialist may not be personally affable or may have graduated only recently. This reinforces what I was saying just now. The typical promotion criteria will militate against the computer specialist being able to move quickly through the hierarchy, especially with high-change technclogies where experience need not be the largest factor.

There is also the problem of market rates. The problem of market rates is that in general they go in waves. This is caused by the inherent problem of keeping up with technology and, in keeping up with technology, in keeping up with the market. The application, therefore, of standard personnel systems — even of establishing the market rate — may not be appropriate for the computer specialist.

Finally, we must also look at the problem of the computer specialist's benefits package. The benefits package is an important feature of most people's reward and motivation. The trend in Europe (and in the United States) has been for benefits packages to have a very high 'core' benefit element. By 'core' benefit, I mean a traditional paternalistic benefit which is given to the employee whether he wants it or not, and which usually relates especially to retirement or other forms of pension. It may be that a more attractive feature for the young people who work in our industry will be different benefit systems not necessarily aligned to long-term benefits. Indeed, on the evidence of the current campaign in the Sunday newspapers for the transferability of pensions, a more attractive feature of a pension fund might well be that it is easy to transfer the funds should you ever decide to leave, rather than massive (or even small) increases in the pension package. The young and vigorous specialists who work in the computer industry may be better motivated by cash or leisure than by long-term benefits.

Throughout our industry the average age is very young. The average age of DEC (UK) is 29, and the average age of the management team of DEC (UK), which is equivalent to the UK Board, is 35. The average age of our operating Board in the United States is 43. I have used DEC as an example, but I could pick any of the younger computer manufacturers in the world. That is a demonstration of my thesis, which says that the traditional promotion methods are inappropriate for our industry. By the age of 29, the average factory worker would not have progressed further than foreman. If we are to stay competitive in our industry, we need to have advanced people to much higher positions by that age.

It also makes me, and should make you, worry about what my UK Board will do for the next 30 years until they retire. Their challenge presumably is to expand my company and to make it bigger. But it will be a prcblem. We shall, I think, face problems in the next 10 years of ground-out staff at that level. However, that is not a subject for motivation and reward today.

To summarise the problems, the application of current personnel policies to the new profile of employment for computer specialists — who are a group of people in a special situation as far as personnel profiles are concerned — will create problems in job evaluation, in applying promotion policies, in benefit packages and in determining the market rate. I started by saying that although I could state the problem, I was not so good at providing the answers. Well, here is a statement of the problem. It is that 'the application of traditional personnel policies to the computer specialist will at best leave them to competitors, and at worst give you demotivated staff'.

I should like now to at least attempt to outline some solutions. We can start by looking at the job evalution techniques. I believe we here have only two alternatives. The first is to accept that the company-wide job evaluation scheme should apply in the computer area, but that we should be flexible in its application. That is an euphemism for 'cheat a bit' in terms of scoring in the job evaluation scheme. The second alternative is to exclude the computer area from the job evaluation scheme altogether.

There is, in fact, a third alternative, which I reject, and that is to change the job evaluation scheme. My reason for rejecting this alternative is clear. I have run several job evaluation schemes in my time, and if you change one word of one factor of a job evaluation scheme, everyone in the company sincerely believes that that is the one word which prevented them from getting into the grade above when their job was previously evaluated. Changing job evaluation schemes, in my experience, is a very expensive business because everyone then appeals against their evaluation. Hearing all of the appeals or doing the evaluations again is very expensive and some people will succeed in showing that the changed factor was the one that applied to them in terms of their career.

So we need to find a way of applying the job evaluation scheme in a flexible way. That applies even within my own company, which is a computer company, where we have a factory in Ayr in Scotland with a successful job evaluation scheme based on the traditional factors that I have said that we should not base job evaluation schemes on (such as experience and service). The scheme is applied to the computer technologists who work next door to the factory, and it is causing us grave problems.

The second solution I want to look at is a total compensation approach. I will define what I mean by total compensation. The total compensation splits first of all into two categories. There is, for want of a better term, the money compensation, which is the cash and the benefits provided in terms of the reward. Then there is the intangible compensation, which we must not ignore because for the reward and motivation of computer staff it may well be that the intangible compensation is more important than the money compensation.

One example of intangible compensation is the challenge of peer group associations. The computer specialist may well be motivated by enjoying coming to work to argue with his colleagues about the best approach to a systems problem or an applications programming problem. Alternatively, he may be motivated not by the money he earns now, but by his potential to earn money in the future. He might be motivated more by the thought that he will be paid in the future for his own performance than by the pay that he receives now. These are examples of what I term the intangible, non-cash, part of his compensation.

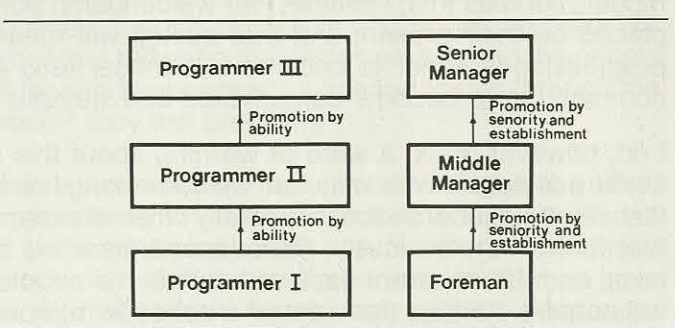
I also split the cash part of his compensation into two — the salary compensation and the benefits. If we are genuine in our concern to properly motivate computer staff, I believe that the benefits need to be in the form of low core benefits. Thus the benefits that are thrust, willy nilly, on the computer specialist (such as pension schemes and vacation schemes) need to be minimised, and the optional menu items need to be maximised. We need to maximise the flexible way in which each individual can choose from a package of benefits which best suits him. It may even be that in the future our vacation programmes will be an optional item. Certainly DEC is considering a situation where we might well say to an

employee "You can either have an extra four days' leave or you can have the cash. You can either have a pension scheme that is inflation-proof after you retire, or you can have the cash. You can buy these benefits with that cash and therefore choose the benefits which are most applicable to you."

The concept of total compensation means a flexible approach that will allow us to reward a person in the way which he finds most motivating — and that, after all, is our task.

The most important element of the intangible compensation that I mentioned is the creation of a technical career path. When a graduate joins a company, the rate of salary which we pay him on recruitment as a graduate is almost exactly determined by the market. Surveying the rate which we pay graduates is the nearest thing to a perfect art in survey work, because the benchmark is so clear. Graduates are a nice easy benchmark to use in terms of survey work. A graduate is more likely to ask questions that relate to where he will be in three years' time. In fact, where he will be in three, or five or ten years' time with the company will depend on his own ability as opposed to any other criteria such as service or age, etc.

Therefore, what I mean by a technical career path is to build a structure where the computer specialist can move up through the grades as a result of his own performance. In other words, instead of just one grade of systems analyst, we have senior systems analysts, even more senior systems analysts, absolutely super-duper even more senior systems analysts, up to principal, even more principal (and even unprincipled) systems analysts. If we do that, and we say to the technical specialist that his progression up to the dizzy heights of chief executive principal senior deputy senior systems analyst will be on the basis of his own ability, we begin to reach the concept of pay for performance, which I believe is what we are aiming for with the remuneration of this group of staff. Pay for performance is more important in terms of providing that technical career path than is either progress through a particular grade or remuneration within a particular job. The slide shows you exactly what I mean.



On the right I have shown the traditional 'foreman', but apply it to whatever model you find most familiar. In the traditional model, the foreman is promoted to be a middle manager by his seniority — he has to have been in that job for x years before he can be considered for promotion. He has to wait until a middle manager's slot becomes available. After all, if there are only four departments, there are only four departmental managers. When he becomes a middle manager he sits back and waits again for a job as a senior manager. Again his promotion will be on the basis of his own service and waiting for an establishment position to become available. In my view, if we apply that model to the computer specialist we shall find that we do not have any left, because they will not be prepared to stay in a company in a market-short situation.

On the left, I have picked 'programmer', as an example of a market-short situation. Real motivation here comes about by a programmer at Level I realising that, by his own ability, he can become a programmer at Level III, or IV, or V, or however high he wants to go. Possibly, we can increase the motivation element in this model by making the ability measures a formal decision process by a board of superiors, or even peers. We might be able to increase the technical challenge of the intangible compensation by applying a formal committee approach to measuring ability.

One point occurs to me from my previous existence as a trades union official. There is one great rule in collective bargaining as a trades union official when you are negotiating on numbered structures. You will notice how this programmer structure is a numbered structure; it starts at I, and progresses through II, III, etc. As a union official, you always insist, of course, that the numbering is done from the bottom up. The thought of adding a Level IV, V, VI, VII or VIII fills no one with any great concern, and the ability of your members to progress to even more senior jobs is completely ensured. But notice how, with a management hat on, I can number those jobs from top to bottom and make it very difficult to introduce a Level 0, or Level – 1.

I believe the model shown on the left of the slide, which permits a computer specialist to progress to very senior levels in the company, is a very valid model. We should not be afraid of our computer technologist being paid the same and having the same total compensation package as our most senior company managers. Also, we should not be afraid at the more micro-level further down our companies of recognising that there are some people who will actually be better at management than they are as technologists. The advantage of this model is that it avoids pushing our top level technologists into management jobs for which they are completely unsuited. I am sure that we all know of examples of technologists who, for the sake of getting on in the company, have had to become managers even though they would have preferred to remain technologists. More often than not, such people have made very poor man-managers.

We are developing models in DEC in which progression through the management chain (the one on the right of the slide) can be by people who have very poor technical knowledge, but who are backed up in their technical ability by people from the chain on the left. In turn, the technical people are backed up by management from the other chain. Nor should we be afraid of having a middle manager (as I have called him on the slide) actually in charge of a programmer at Level III who may be earning more or be graded higher than the middle manager is. (Indeed this is something we are now putting into practice in DEC.) The middle manager is looking after the motivation of the people in his team and the management in the budgetary sense; the programmer is coping with the technology. If we do not implement models such as this, I believe that we condemn our technologists to always having a ceiling placed on their growth, and that ceiling will mean that the technologists only method of progressing is either to become a manager (and a poor manager at that), or to leave the company, or to become demotivated and stay put where he is.

I do, however, have a word of warning about this model. It may worry some of your traditional managers, who may not welcome long-haired or be-jeaned youths standing next to them in the executive loo, especially when the manager waited a long time to get the key to that toilet. More seriously, there is, and there will be, some resentment about the youthfulness, and the apparent ease with which the people in these high-change technology areas will acquire a status (for want of a better term) equivalent to the managers. But if we are to motivate and reward computer specialists, I believe that it is necessary to implement this type of model.

I now want to review the problem of the new office users. I apologise for my lack of technical knowledge about the computers or the hardware or the software or the applications we shall be talking about during this conference. There is plenty of opportunity at other times during the time we are here to talk in those terms. I wish to address myself to the problem of motivation of the user in the office — in the drawing office and the manager's office. Many office workers feel that their jobs are threatened by new technology, which is enough by itself to demotivate them. But there is also the hidden threat that the people who survive whatever reduction in staffing levels comes about as a result of the introduction of new technology, will find that the satisfaction element of their job has been taken away from them. There are real motivation problems here. In talking to managers in industry, I have learnt that there is a lot of fear amongst their office staff and drawing office staff about the impact on job satisfaction that the arrival of the word processor or the computer-aided-design unit will cause.

The new users of the computer or the computer terminal will be office staff and clerical staff, who are unused to new technology eroding their skills. This compares with the workshop and the shop floor, where workers have now accepted that the process control computer will help them in doing their job.

But the relationship of clerical staff to the whole business is rather different to that of the shop floor worker. For a start, clerical workers, and in particular secretaries, tend to report to management at a very senior level. The most senior director in any company has a secretary and she reports to him in a very unusual situation. All the other people who report to him are senior managers, who due to their experience, education or technical expertise are very capable people. Also, clerical staff tend to relate to work in a rather different way from the way in which hourly paid or workshop staff in general relate to their work. Clerical staff relate to their work in a much more personal way.

In fact, when you examine an office worker's job — and I shall look at that more closely in a minute — you find that the majority of the work is creative and not routine. Most of the office worker's job is concerned with communication of one kind or another. They are either giving information or advice, or getting information and advice. They could be involved in decision making or problem solving; they could be involved in negotiation as a draughtsman, or in bargaining the price of the product, or the hours of work on the shop floor. They arrange meetings, they contact people, they respond to prompts, either computer prompts or general prompts, in terms of their work. It is my view that we need to persuade that group of staff that text will be an acceptable medium of communication only for a very tiny part of that whole communication process. I believe that there is no way in which computerised text transmission, or computerised electronic telexes, or text processing itself, or any other features which the office worker will be offered as a result of automation, will replace the importance of face to face contact between people. Indeed, the theme of the latter part of my presentation is the importance of face to face communication. I believe in this very strongly, and I believe that we also need to emphasise this very clearly to this group of workers in order to retain their motivation and to gain their acceptance of the new technology. The same is true of the drawing office, where, however hard we try to provide a computer which will do the laborious and detailed work of the draughtsman, there is no way in which the computer will ever replace the need for the face to face contact between the design person and the people for whom he is providing the design. That face to face contact is needed to talk through the design or to discuss the nuances of whatever they are providing.

Therefore, the use of the computer in offices will remove the tedium and it will give the office worker and the drawing officer worker an opportunity for creative thinking. It is this aspect of the use of computers that we need to sell to that group of people in order to motivate them. Remember that I am talking here about motivation of those staff who remain after we have got over the problem of job losses. If we create jobs where face to face contact is no longer necessary, I believe we face an even worse problem of trying to motivate isolated managers and secretaries who communicate with other people only through the medium of electronic messages or communication networks of all kinds. If that is true, and if that is the future method by which all communications will be done, I believe we face huge social and technical problems. Of course it is not true, but there are a lot of secretaries and drawing office staff around who I believe think it is true, and we must address ourselves to that problem.

I do not think we shall ever reach the stage where a manager sits in his office of the future and gazes at his banks of television screens and vdu screens, and whose secretary types his messages into electronic message systems that replace entirely the need for face to face communication. Face to face communication is not a wasteful mechanism. It is important to people, and we should never try to replace it.

How then should we plan the system for the office of the future? There are two types of problem here. First, there is the worker for whom new technology actually represents an increase

in job satisfaction, and that is one group of staff which we must bear in mind. We have no motivation problems here. I am talking about the copy typist who becomes a word processor operator and for whom the new technology — the word processor — is more satisfying and motivating than copy typing all day. I am talking also about the tracer in the drawing office for whom the use of a computer-aided-design process represents an increase in job satisfaction.

Secondly, there is the other area of motivation which concerns secretaries or draughtsmen, where we need to divert them from focusing their attention on the replacement of the mostly tedious tasks that the computer will in future do for them. We have to acknowledge that the computer will change their jobs, but we must also emphasise that in practice this will enhance their opportunity to think. How can we do that? It is a complex operation. We should emphasise to them the concept of job design, and we should emphasise that they must use the new technology as a tool to support their function. In that respect, I believe that the organisation of offices in the future will be most critical for the motivation of the staff who work in them. I believe that we should resist the temptation, which will be emphasised by our managers and directors, of saying that the reason for introducing new technology is efficiency and better cost-effectiveness. They will emphasise that the optimum way to use new technology will be to concentrate word processing facilities, or computer-aided-design facilities, in one part of the organisational structure, for example, to centralise word processing on one floor of an office block. Introducing new technology in this way would, I believe, destroy the motivation of our clerical staff. I believe that as managers, as personnel managers, as DP managers, we should resist that temptation. We should, in fact, encourage the use of such facilities in individual work places as aids to the manager or the secretary as opposed to providing some centralised service function. We should support existing functions and resist the centralisation which tends to occur in order to increase productivity.

My example of that is the vdu operator, where countless experiments have shown that the operator suffers if she is required just to be a vdu operator, and is not required to understand, appreciate or become involved in the work. Continuous vdu operation creates visual fatigue, boredom, a high error rate and, eventually, an antipathy and antagonism to the new technology that workers believe may have caused the problems.

Finally, we also need to ensure that the computer system will be interactive and will relate to the people concerned. The economic gains of a new computer system can only accrue if the remaining job holders readily accept the new technology and are motivated to use it effectively. The implication of this is that the word processing facilities and our computer-aided-design facilities will appear to be inefficient because they are distributed. But, in practice the overall efficiency will be enhanced, because the staff will be better motivated by giving them those facilities to use as a tool, rather than providing them as a centralised service.

Therefore, we need to re-evaluate the new jobs, to train the people and to shift managers' understanding of how these jobs will operate. We need to re-evaluate the new job and not simply pretend that a secretary is still what she was before the new technology arrived. We need to acknowledge that that person will now make a greater contribution to the creative thinking of the environment and as a result we may need different reward systems and different motivation systems to adequately reward and motivate those people.

On my next slide I have put together a list, though it is by no means exhaustive, of the types of tasks that a secretary currently fulfils. The first six of those tasks are the face to face elements of the secretary's role, and these elements will never be replaced completely by new technology. We need to emphasise this to our clerical staff and to our design office staff in order to motivate them and to reward them properly.

If we can persuade our best staff of this (and as a personnel manager I am always saying the people we want to persuade are the people that we want to keep), then the minicomputer (and other new technology) will arrive to properly motivated staff.

I want to consider now the new home worker. Why 'new'? Because, in the UK and I suspect in Europe as well, the term 'home workers' has been used to describe the group of people who have been garment makers, dressmakers, soft toy makers and the myriad of other simple manual cottage industry tasks that have been performed by people in their homes. My new home worker is a creation of the new distributed communication abilities of computers. I am talking here perhaps about programmers, certainly about some office workers and, if my vision of the office of the future where a manager communicates only through electronic systems turns out to be accurate, I am talking also about managers, secretaries and everyone else. Certainly secretaries and other groups of staff of that kind will be able to do most of their work at home, and as the communication capacity of the computer develops it will become possible for more people to work at home.

Example

Secretary tasks—
- diary
- answering simple queries
- telephone
- administration
- chasing
- shorthand
- typing
- filing

it is the former 6 which motivates and pleases the secretary. The computer will only do the tedious tasks

Notice I am using the words 'will be able to' and 'possible', because it is a vision which frankly frightens me as a person as opposed to a personnel professional. I believe that the lack of social contact is an alarming prospect, quite apart from the other things we shall talk about in terms of motivation that are inherent in this vision of the future. However, we should be shirking if we did not attempt to face up to it.

The big problem, of course, is that all our traditional motivation methods depend absolutely on face to face contact between the boss and his subordinate. The tools of people-to-people motivation (such as appraisal, team work, friendship, social contact, and all the things that a manager relies on in order to motivate his staff properly) depend on their meeting together. How are we going to motivate these new homeworkers (if we are going to worry about their motivation at all) if the contact exists only via a vdu? After all, the computer itself is not capable of motivation.

When we consider reward systems, I believe that an even more horrifying spectre arises. ICL already has several home workers working on some of its systems, and the way in which ICL control the vdus that they use is that the home workers essentially clock on and off. The computer itself records the time at which they switch on and switch off, it records the number of pages of program, or lines of program that the individual writes. It also records the number of key strokes they make and things like that. How, in the future, will we reward work like that? Shall we go back to the days of piecework when we pay people by the number of lines of program written, or by the number of key strokes made, or by the number of validated errors in any piece of work? If we do that, are we saying goodbye to any reward which is related to performance? I do not mean mechanical performance, but I mean creative performance that makes a contribution to the problem solving ability of the team.

The computer will record everything automatically. If the home worker does not clock in on time, can we rely on the computer to take away the seat from under the worker and leave him sitting on the floor, and then to give him his cards through a slot in the top of the vdu, and then to self-destruct after 15 seconds or something of that kind? There are very real problems here of motivation and reward. Shall we pay the secretary by the number of letters produced? Are we back to the old problems of piecework?

Finally, and perhaps most importantly in terms of reward and motivation, are the problems of teamwork and the creativity generated by group discussion of the problems. I know of no

one who would challenge the theory that says that a group of people who get together to brainstorm or solve a particular problem, generate better and more healthy solutions than they would individually, however good and subtle the electronic communication between them may be. In my view, this lack of face to face communication inherent in home work will create a sterile envrionment. Face to face communication is not important if you are a garment worker or a soft toy maker, because I presume that the creativity required is in the design stage rather than in the manufacturing stage. But it will matter if our managers are going to work at home and it certainly will matter even if what we consider to be more mundane tasks are performed at home. People are important if they are working together. Teams are important to people.

I promised some solutions and there is one obvious one, and that is to not switch to home workers. That is the answer I happen to believe in. However, there will be great social pressure on us to have home workers. We cannot ignore the fact, that for the bulk of the population, working at home will be the only option they have to work, either because of the place in which they live, or because of their family commitments. So not switching to home workers may be right in terms of the productivity of British industry, but it may not be right in terms of satisfying the demands of a large number of people.

We therefore have to find a solution to the problems of motivating and rewarding home workers. I think that it is important that the home worker should not lose touch with the organisation, or worse should not become identified with something or somebody else (for example a customer). We may need to use travelling supervision, and certainly we shall need to insist that the home worker, however committed they are to working at home, will need to attend frequent team meetings. Otherwise their motivation will suffer, and the supervisors will not be able properly to motivate their staff. I envisage a travelling supervisor for a group of five home workers, spending one day a week with each of them, as the only solution to the problems of the motivation of those staff. That in a sense will militate against the productivity gain of using home workers, but the expense of properly motivating the staff will provide an economic payback to keep the balance right.

How will we pay home workers? If we do motivate them properly, if we have travelling supervisors, and if we invite them into office meetings, I do not see why we should not pay them on the same basis as we pay everyone else. Everyone takes the car industry as an example. It is a rule in personnel presentations that you must use a car industry example, and here is mine, which says that the car industry in this country and in the United States was tempted five or ten years ago into piecework, because it looked attractive to reward people directly for the output of their operation. If we were to pay home workers on a piecework basis, I believe we will discover, as the car industry discovered, that any growth in efficiency and productivity lasts for a short time only. In the end, it is the total compensation of the people that matters. It is how they are managed and the environment in which they work that matters.

Changing to a piecework system on a factory floor changes only one element (the cash element) of the total compensation package. If you have not changed the culture or the management style, or if you have not provided career opportunities, or if you have not motivated people through regular appraisals, then cash compensation achieves only very short-term productivity increases. Those other elements of the total compensation package are equally important for home workers. Thus the management of home workers will be as important as it is for all other types of workers.

So, is there a theme to what I have been saying throughout this presentation? I was tempted at one stage to close on that question, but I think there is a theme. First, I think that motivation in the future must be towards creativity. As computers take over more and more of our tedious tasks we must never forget that the real motivation comes from encouraging people to think creatively. That is the theme which runs through my suggestions for reward systems for computer specialists, and runs through my suggestions for motivating the office worker and the home worker affected by computers.

Secondly, the thing that distinguishes an organisation's human asset from technology is the people's ability to think. The thing that the human can do that technology cannot do is think, and to make a creative input.

Finally, our reward systems must, too, become specifically orientated to our goals. We must look very critically at all our reward systems, as I hope I have shown. We must not be frightened to change those reward systems if that is appropriate. In that respect, I think that the concept of total compensation is the key. This concept says that the rewards that people get from their job are not only the pay they get, but also the flexible benefits system that enables them to choose the benefits most applicable to themselves.

An example that occurs to me is that we in DEC are still considering whether we should introduce a private medical insurance scheme for our staff. Several of our staff are, of course, already covered by private medical insurance schemes by their spouses at other places of work. For these staff, the introduction of private medical insurance is totally valueless. The total compensation approach is to give people whatever it is a year that would enable them to buy the medical insurance, but we allow them to choose whether they have that benefit or not. This concept can be extended to provide the flexibility of allowing staff to choose their own pattern of vacation, or their own pension scheme, whichever they feel is most important to them.

The final element of total compensation, and perhaps the one which achieves most motivation, is the element of intangible compensation. This element can be summarised in the questions: 'Is it an exciting place to work? Do I feel challenged when I come to work? Do my colleagues challenge my intellectual ability at every meeting we have? Do I have the opportunity to progess in the company by my own efforts in terms of pay for performance?' I have tried to show we should apply the concept of total compensation irrespective of what our corporate personnel policy says in terms of outdated job evaluation schemes, or anything else.

SESSION F

STRATEGIES FOR MEASURING AND MANAGING PRODUCTIVITY

Paul Mali,
Paul Mali & Associates

Dr. Paul Mali is a leading authority in Professional Management. His reputation in the Management Community stems from 28 years diversified experience in Industry, Business, Universities, and Government. He is a Certified Management Consultant. He heads his own Management Consulting firm and has been or is currently a Consultant to such firms as Sun Oil, Celanese, IBM, Kimberly Clark, Westinghouse, Aetna Life, and General Dynamics.

Dr. Mali holds a Professorship of Management and has taught in the Graduate Business Schools of several Universities. He received his B.Sc. degree in Engineering, and M.Sc. and Ph.D. degrees in Management from the University of Connecticut, and he has authored 4 books: Managing by Objectives; How to Manage by Objectives; Improving Total Productivity; and the Management Handbook (all published by John Wiley & Sons in New York City).

The measurement of systems is a lot like the proverbial three blind men who are asked to find out what the elephant is like. The first blind man gets hold of the tail, and finds that the elephant is like a rope. The second blind man feels around and begins to have a totally different experience. He gets hold of its great big foot and discovers that the elephant is like the trunk of a tree. He begins to argue with the first blind man. The third blind man feels around and has a totally different experience. He feels a great big, soft wall and thus concludes that the elephant is like a soft wall. The three of them begin to argue about what the elephant is like.

The moral of the parable is my position as the storyteller. From where I stand, I can view what the elephant is really like. I see its totality. I see its systems and subsystems, and parts and inter-related parts. I see where the blind men are. I see the correctness of their position but I see the incorrectness of their inference of the totality. I see the geometry; I see the complexity; I see the envelope.

Measuring productivity very fundamentally is measuring work. Work processes are complicated — for example, one component of its complexity is that much of the work of information systems and information management is submerged. How do you measure work when much of it is submerged? Thinking is not on the surface, is it? Analysis is not on the surface, is it? It is submerged. How can you measure work processes when they are below the surface? Therefore we begin to conceive of the complexity.

There is a new question asked about the elephant. We want to know something else about the elephant. We want to know what it is like, but we also want to know what I regard as the 64-dollar question: how to get it to move — because these elephants can be symbolically represented by your organisations or by your departments — complex. So we asked the blind men: "Find out what makes the elephant move." So the one who had the tail pulls on it, and that great big elephant moves from side to side. He concludes, "The way we get that elephant to move is to pull my function." The second blind man who had the foot steps on it. That great big foot moves up and he concludes, "I know how to get the elephant to move and

that is to exercise my function." The third one who has the wall pinches it, and that great big wall moves from side to side. He says, "I know how to do it: exercise my function."

Again the position of the storyteller who is standing back at a distance is that he sees all of what is happening. He sees the different parts of the elephant move, but the elephant did not move at all. Thus another very important insight is collected. In the measurement of work we truly are dealing with the integration of all the various parts and how they all fit together.

There are several implications from this parable. First, to measure productivity it must be seen from an overview. You cannot grab hold of a piece of it, measure it, track it, improve it, manage it, and expect that the total effect will occur. The overview is important. By overview we are talking about tying together information generators, information distributors, information storage elements, information retrievers, and information analysis. If we make it more complicated and talk about information decision making and talk about truly building management information systems, we are talking about a very complex phenomenon, tying together generators, storers, decision makers and analysis.

In the United States we view information systems as part of the management decision process, and therefore we are concerned about how effective and how efficient they can be. We tabulate that about 60 per cent of management time is devoted toward decision making and communicating. We have also tabulated that management salaries in the United States are around $200 billion, which is roughly 28 per cent of the GNP. If you add the benefits package to it — that is management benefits — which is another $100 billion, we have a total package of about $300 billion — roughly 40 per cent of the Gross National Product of the United States. That is a lot of money for management salaries.

This area has always been a sanctuary. We never talk about management salaries, it is always our subordinates. It is always the other person, the great big, juicy plum. We are beginning to ask the question: are we as effective and as efficient as we should be? So we are beginning to look at the complexity of the management process and we are wondering how to manage it — but we are also raising the question about our ability to do this.

The second implication of the parable is that the ripple effect in systems becomes very important in productivity measurement. A positive effect here can produce a negative effect there, but because of the complexity we see only our aspect of it. We see only our part and we say that it is positive, not realising that we created a series of ripples that have caused some serious problems elsewhere. As we said earlier, most work in the information business is submerged.

Another thing that we have noticed is that measurement of work occurs after the work is in process. It makes it very difficult to measure a work process that has already been designed and is operating. What we need to do is to incorporate measurement components within the design before the work process is installed and operating. This is a new awareness, a new concern and a new approach in the measurement of productivity.

I think that basically I am saying that we should not install systems or implement systems unless we can thoroughly understand what the impact will be in the organisation — not only from a standpoint of decision making and output but from a standpoint of productivity. We may have to alter our system just a little bit to get that measurement but when we do, great benefits occur.

The last implication about the elephant is that it is unique. Each of you has his own elephant. There is no model that we can design and say that five thousand organisations can have it and great improvement, measurement and management will occur. Your model must be fabricated and constructed to handle your unique requirements.

I will share with you a major study of 122 corporations that we conducted in the United States. Whenever we compared two excellent corporations managing productivity, we compared their figures, we measured their strategies, we saw the improvements they achieved — and we found that they were all different. If you take two companies successfully managing productivity, they are doing it differently. So the unique aspect of this measurement is that it is built into your requirements and it is unique to your organisation.

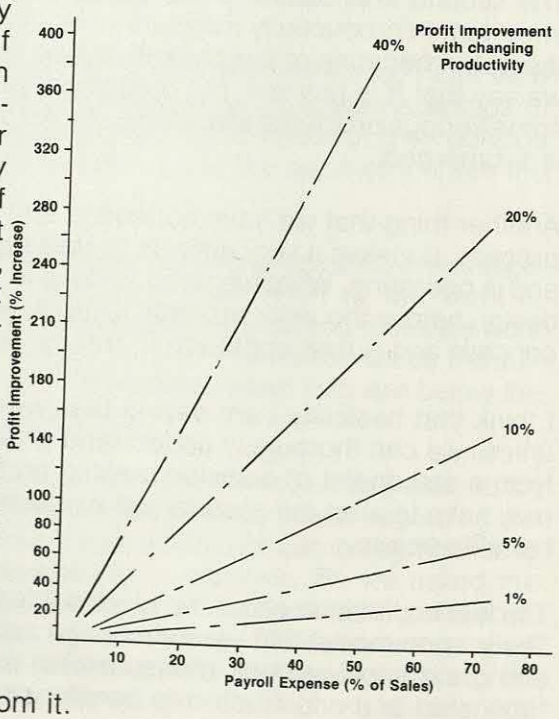
Having said that, let me introduce the first slide. All my remarks for the rest of this presentation will be based on the study of these 122 corporations and the findings that we have had with these companies.

We divided the corporations into three categories — class A, class B and class C. Class A companies were those which were very deliberate in their productivity management. Roughly 15 per cent — the smallest group of the three categories — we regard as class A. Their efforts towards productivity measurement were formal and visible. They had strategies. They were dealing with time as a resource. Time was not just a measurement for the allocation of benefits, time was a resource which could affect productivity. They never played it by ear, they always played by the clock. They used formal, measurable, productivity systems. We will share some of these systems with you. Finally, they were profit expectant. They made a connection between productivity and profitability. I should like to share with you just one curve shown on my next slide which will suggest to you what I mean.

PRODUCTIVITY CLASSIFICATIONS

Company classes	Strategy Approaches
A	• Formal & Visible • Time Limit • Measureable • Profit Expectant
B	• Informal • Submerged • Time Loose • Non-Measureable
C	• No Effort • Mediocre Management • Poor Perception • Ignorant of Modern Management Concepts

Here is a curve of payroll expense versus profit improvement. You will notice a series of empirical curves that indicate the percentage productivity improvement. In other words, for any one level of payroll expense, changes in productivity can result in changes in profitability. Class A companies formalise the benefits that would occur with changes in productivity. It was not a lucky happenstance, it was deliberate. We know that if we get 5 per cent improvement in productivity it can result in x per cent profitability. Incidentally, that is one of the guidelines that we would suggest to you in this whole matter of productivity management.



There is a lot of motherhood in this area. Everybody loves mother; nobody is against motherhood; it is something that everybody accepts. If I were to say to you, "We should all improve, shouldn't we?" that is motherhood. If I were to say, "We should all improve productivity," that is motherhood. Nothing wrong with it, but we want to go beyond it. It is not just a question of improving productivity but how much productivity, what will productivity cost me, and what will be the benefits from it.

Class A companies were very deliberate in their objectives and aims and the efforts that were required to reach these aims.

Class B companies, roughly 60% per cent of the group, were informal in their productivity management and measurements. That is, their efforts were casual and quite random, usually in concert with other concerns of the organisation. If you were to ask a manager of a class B company, "Are you managing productivity?" the answer would be, "Of course, but I do it in concert with my responsibility." "Is there any visibility to your efforts? Can you isolate it?" "No, I can't because whatever I do, I do with great productivity." In these organisations the work of productivity measurement was not visible, it was an inward component in the work process along with other components. These people usually respond by saying that productivity cannot be measured.

I had an interesting conversation last night at the cocktail party. One of the delegates approached me and said, "I want you to know before you put your presentation on that you can't measure productivity." I said, "Well, thank you for encouraging me. Explain yourself — what do you mean?" He went on to explain his areas of responsibilities, and I have to admit that he has some very challenging areas. But if our attitude is that you cannot do it, then you cannot do it. But it is different if your attitude is, "Well, let's see what we can do." Incidentally, I believe that the measurement of productivity is in the infancy stage. We are really getting started in this whole area. I will try to give you some reasons why later. That is very important. But class B companies respond by saying, "You can't measure it. It's part of the work, it's submerged and time loose." Incidentally, casual management is a part of class B companies, the casual approach to doing things in this area of productivity. The casual manager hates productivity because it demands that I see your process, I see your decision making, I see what you are going to do in advance of doing it, consequently the casual manager is reluctant to get involved.

I happen to believe that the casual manager is a marked person, and is on his way out. The casual manager has been disappearing for the past decade and I think that by 1990 he will have disappeared. By casual manager I mean the manager who does in-process planning, in-process decision making, in-process analysis. The deliberate manager is one who has given some forethought to planning and measurement.

We would regard about 25 per cent of the companies we examined as class C companies. They have absolutely no productivity effort. They do not even know what productivity is all about. In fact these companies have such a poor perception of the whole idea of productivity that we even question their understanding of modern management concepts.

Our discussion will centre around class A companies because this is where we have found most of our interesting progress in this area of productivity measurement.

This next slide shows the opportunities for productivity improvement that the class A companies thought they had. Forty per cent indicated that capital equipment substitution for employees was the most attractive area for productivity measurement and improvement. Twenty per cent thought that better methods and procedures were the answer, whilst 15 per cent thought that worker effectiveness was the key. The remaining 25 per cent believed that higher productivity depended on the removal of bad practices. If you look at those figures you will note that the third and fourth items depend on personnel issues — personnel work and personnel handling. Those two items represent 40 per cent of the opportunities — the same as capital equipment substitution. What this slide shows is that we have a notion that the way we can improve productivity — and rightly so — is equipment substitution for people. But let us not ignore the other attractive opportunity offered by handling people as well.

At this point we will make the statement that for capital intensive organisations, the

emphasis should be on looking at worker effectiveness and removing bad practices, but for labour intensive organisations the emphasis should be just the opposite. But both represent opportunities for productivity measurement and improvement.

There are several reasons why productivity measurement is difficult. First, the work processes are complex both in quantity and quality. We indicated earlier that much of the work in information systems is submerged and out of sight, so what we need to do is to bring it to the surface. A flow chart is an excellent example of something coming to the surface. That flow chart embodies what has been going on beforehand in terms of thinking and analysis. If we can only put down the thinking process and analysis process along with the flow chart, we can then bring up to the surface the total work process that may be involved. Having done that, we can then examine how to improve the work process.

OPPORTUNITIES FOR PRODUCTIVITY IMPROVEMENT

	Percent Expectation
1. Capital Equipment Substitution for Employees	40
2. Better Methods & Procedures	20
3. Worker Effectiveness	15
4. Removing Bad Practices	25
Total Opportunities	100%

The second reason why measurement is difficult is that the measurement is made after the work is in process. We know that most computer people and information people have backgrounds in science and technology. Very few have had a business experience. Productivity is a business idea. Productivity is an economic idea. We are now asking, "Is it true that if we give our scientific and technological personnel an insight into the business world so that they can do their science and technology in the context of business, wouldn't they be able to come up with their own measurement systems?"

We toyed around with this idea in a highly technical division of Westinghouse, and it was amazing how some of the engineers were practising their engineering function without understanding the elements of business. Westinghouse has now instituted a policy that no engineer will be hired unless he has (or will eventually get) an MBA degree. The MBA in the United States is a Masters in Business Administration. What they are saying is, "We cannot understand how an engineer can practise his engineering function without understanding the business context in which it lies." I think that the same applies to computer people. If they do not understand the context of business — and this is the reason why they do not understand the context of productivity — then how can they practise that in terms of the way we would want it?

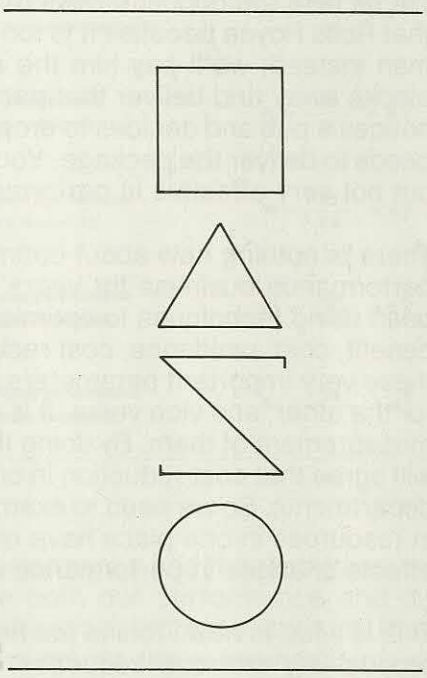
One of the big applications of the measures that I will suggest to you is that these tools are not something that management does to others. They are not tools which we impose on others. The measurement is not a club that we use on others. The tools are given to the people who are accomplishing the work to use for themselves. They are the means by which they can answer the questions: "How am I doing? Am I effective? Am I efficient?"

Another problem of productivity measurement is the language problem of what we mean by certain words, such as economic, morale, quality, improvement. Each has a quantitative component. When you talk about improvement there is a quantitative aspect to that. But what does improvement mean? We should get a better understanding of that word if we could pull out that quantitative aspect. Words mean different things to different people, and that is a problem we have when we use these words in a qualitative sense and in a quantitative sense.

Another difficulty is that we still are struggling with the distinction between activity and achievements or results. We have not been able to separate the definition of these two

important parts of the work process. Activity is necessary to produce results, yet the worker, whoever it might be — the management practitioner, the information worker, no matter who it is — must have a clear concept of the difference between activity and results. So we are still having difficulty in trying to separate those two terms.

The final reason why productivity measurement is difficult is to do with the measurement of work on the macro-level of the economy. Productivity has always been a tool of the economist, and as a tool it has always been used in the very broad macro-systems and industries that we find throughout the world. That is hardly useful for us in our companies, in our departments, and in our individual work. One thing that I will do is to suggest to you how we can bring these very nebulous and broad areas down into a specific, usable series of tools.



Now that we have talked about why measurement is difficult I should like to try out an aptitude test. We heard a presentation yesterday about the use of aptitude tests in hiring new personnel. I want to try an aptitude test on you. We have been working on this for some time and it might be useful for our purposes as well as for yourselves to find out what is your natural propensity and your natural aptitude for proceeding with the measurement of productivity.

You see four symbols on the slide — a square, a triangle, a Z, and a zero. Select the one symbol which best describes your approach, whatever that might be, in productivity measurement. I will give you about five seconds to do that. (Pause) How many picked the square? One. That tends to suggest that you have a very aggressive approach to productivity measurement. How many picked the triangle? Quite a few. That tends to suggest a leadership approach to productivity measurement. How many picked the Z? One. That tends to suggest a creative approach to productivity measurement. How many of you picked the zero? Quite a few. We have a problem with this one. The problem is that it is indeterminate because those who select it are so preoccupied with booze and sex! I want to say that this represents our latest thinking on the development of aptitude tests for productivity measurement.

PRODUCTIVITY INDEX

$$\text{Productivity Index (PI)} = \frac{\text{Output}}{\text{Input}}$$

$$\text{PI} = \frac{\text{Performance Output}}{\text{Resource Use}}$$

$$\text{PI} = \frac{\text{Effectiveness}}{\text{Efficiency}}$$

$$\text{PI} = \frac{\text{40 Work Pkgs.}}{\text{10 Weeks}} = 4$$

Productivity is a measurement concept. Its very meaning is a measurement concept. As shown on the slide, the economists have always defined it as output over input but, as I said earlier, that is hardly useful to us. We have now translated output and input into some new parameters, and we are now calling it performance output over resource use. We have done this because performance is output and resource use is input. The reason that we define it that way is that it becomes far more useful to us in our organisation. We know what performance is and we know what resources are, so therefore our concept becomes a

measureable ratio of performance over resources or, putting it differently, effectiveness (which is the question of performance) over efficiency (which is the question of resources).

Let me describe that in more detail. If I had a package to deliver two blocks away, and I hop into my great big Rolls Royce and deliver the package two blocks away, you might say that I was very effective in getting the job done: but you could also argue that it was a gross misallocation of resources. Productivity incorporates both of these aspects.

Let us take the opposite point of view. Suppose somebody said, "Oh no, you shouldn't use that Rolls Royce because it is too much of a resource for such a small job. We'll use a young man instead; we'll pay him the minimum wage, give him the package and say, 'Run two blocks away and deliver that package'." But let us suppose that as he goes on his way he notices a pub and decides to drop in, take a little time and enjoy himself a little, and then proceeds to deliver the package. You might then say that that was an efficient use of resources, but not very effective in performance.

There is nothing new about optimising performance or resource use. We have been in the performance business for years — ever since the Pyramids were erected. We have also been using techniques to optimise resource use for years and years — cost analysis, cost benefit, cost avoidance, cost reduction. What is new, though, is the management of both of these very important parameters simultaneously. A decision to affect one must be looked at for the other, and vice versa. It is not only the management of these parameters but also the measurement of them. By doing this, we handle the ripple effect. I am sure that many of you will agree that cost reduction in one department can produce a negative effect in three other departments. So we need to examine what this ripple will do by seeing what effects changes in resources in one place have on performance elsewhere. We also need to examine what effects changes in performance in one place will have on resources elsewhere.

This is what is new. This is the new concern that we have, and therefore we do not equate productivity with cost reduction. We do not equate productivity simply with performance. They are components within the process. They are components with which we must deal. But productivity is the management of both of these things in such a way that we gain, and do not lose with the ripple effect.

There is another aspect that is new, especially in the information business. We said that the work is not only submerged and beneath the surface, but it is also continuous and uninterrupted. Remember that good management says, "Keep people busy. A backlog of work is good utilisation of people." Now we are beginning to realise that that attitude in many ways works against us. We are now talking about taking the work and dividing it into chunks. Continuous work is very difficult to measure, but chunked work is easy to measure. In other words, design work in such a way that it has starts and stops. If you have a start and a stop you have a program, and you can measure it. Then you have another one, and another one, and another one. We will show you how some of our measurements can be developed in terms of status symbols, and so on. But a very important principle in the measurement of productivity is to chunk the work and think in terms of outputs and inputs, starts and finishes.

I have given an example on the slide. If we did this chunking and we had 40 work packages within a program and we estimate that it will take 10 weeks to accomplish that program, our productivity index is 4. That index represents a guide, almost like a standard that we should reach as we work our way through the program. If we beat the index our productivity goes up and if we go below the index our productivity goes down. But it is a way of relating how work is accomplished in terms of expectations.

Here on the next slide we have five models for the improvement of productivity once we have measured it. I mentioned measurement in terms of output or input performance of resouces, and that also has a strong implication for the management of the resources. First,

we can increase the performance if we hold the resources constant. Thus, we can experience productivity improvement by managing both of them simultaneously, holding the resources constant and increasing the packages. In this particular case we are increasing the work packages to 80 while maintaining the weeks, and our productivity index goes up to 8.

FIVE APPLICATIONS FOR PRODUCTIVITY INDEX (PI = $\frac{40}{10}$)

1.	Increase Performance hold resources constant:	PI = $\frac{80}{10}$ = 8 ↑
2.	Hold performance reduce resources:	PI = $\frac{40}{5}$ = 8 ↑
3.	Increase performance reduce resources:	PI = $\frac{60}{7.5}$ = 8 ↑
4.	Increase performance increase resources:	PI = $\frac{160}{20}$ = 8 ↑
5.	Decrease performance decrease resources:	PI = $\frac{24}{3}$ = 8 ↑

The second model is to hold the performance constant with 40 work packages but reduce the resources. Instead of doing it in 10 weeks we do it in five weeks. Again you will see that productivity goes up to 8. So the first insight is that we do not always have to use performance improvement to get productivity improvement. We can obtain productivity improvement by staying with the same performance but by reducing our resources.

The third model is to increase the performance and reduce resources. This is a little idealistic. We would all like to do that, but nonetheless it is a model and we can pursue it in that way.

The fourth and fifth models become very important approaches in the conceptual measurement of productivity in periods of recovery and in periods of recession. The fourth is to increase both the performance and the resources, but increase them disproportionately. If we double or triple both our performance and our resources, our productivity remains unchanged. But when we increase both of them disproportionately (for example triple the performance and double the resources), you will see that productivity does go up. This is important in a period of recovery in the business cycle. When we let ourselves go, we are in a period of recovery — let us go out and sell, let us go out and do all kinds of things, but we must watch our resources at the same time.

During a recession, the fifth model is important. Here you allow both your performance and your resources to decrease, but they must decrease disproportionately. Resources must drop faster than performance. General Motors is a firm that operates on this fifth model. During the last recession, General Motors experienced one of their largest drops in sales performance in their history. You all know what is happening to the auto industry in the United States. The Japanese are really giving us a lesson.

We discovered some interesting things about the Japanese. The Japanese are not worried at all about the American workers. They know that the American workers do not want to work. They are, however, worried about the Koreans. The Koreans work four times harder than the Japanese. So I think that before long you will be seeing products from Korea, if you have not already. The quality is good; the cost is much less; and you will see a whole barrage of products coming in from Korea.

In Japan, their decision-making method handles the ripple effect to a considerable extent, and it also handles their co-ordination problem to a considerable extent. If you were to enter the office of a Japanese company president, you would also see his vice-president there, and also executives at a couple of levels below that, all in the same office. In Japan, they have not separated the offices. When there is a decision to be made they just talk across the office. They discuss what they would like to do and they chat across their desks. In America, we would separate these executives and it would take about four days for a memo to go from

the president to all of the other levels. The Japanese do it in a matter of 15 minutes. In the United States, we are now looking at the way in which the Japanese are doing things.

We are beginning to discover that in the Japanese, we have a very formidable competitor who has entered our markets and whom we have to deal with in the real world. I have a theory about this which I will share with you. I believe — although you may disagree with me — that World War II continues for the Japanese. They are a very proud people, and they lost the physical war. They were humiliated. But now a nationalistic spirit has been engendered. They have been pulled together in a spirit that no other nation has seen (apart from Israel which is fighting for its life). Consequently, they are now engaged in an economic war. They intend to show the world that they are very important people. One example is their stated claim of out-competing General Motors in Detroit, but they are moving also into various other markets. This is my theory as to why this tremendous national spirit exists in the Japanese people. We Americans are fascinated with this and we are looking at it very carefully.

The Japanese, however, are just as fascinated with the Americans as we are with them. I am going to Japan next spring to put on a seminar for Japanese management.

I will now give you seven methods of measuring productivity. The first measure is simply a ratio method. So let me give you some sample ratios that I have shown on my next slide.

Profits over equity capital; sales over operating costs; actual direct labour over scheduled direct labour; and rework over time in rework. This represents our first way of measuring productivity.

I also want to preface my remarks by saying that I do not make any special claims for these measurement systems. I said earlier that the measurement of productivity is in its infancy stage. I do not think that we have yet come up with a real scientific approach that is foolproof. At best we have some primitive approaches, but they can be made to work.

Let me remind those of you who want to challenge the ratio approach that the most powerful way of measuring the financial health of a firm — at least in the United States and I am sure it is the same here in the British Isles and in other countries — is by Return On Investment (ROI). I do not think that any of you would dispute that it is a very powerful way of measuring the financial health of a firm. But if you look at return on investment, it is a ratio. It is the ratio of profit over capital investment. But if you look at this conceptually, profit is equivalent to performance, and capital investment is equivalent to resources. Therefore the ROI is a productivity ratio.

SAMPLE RATIOS

$$\frac{\text{Profits}}{\text{Equity capital}}$$

$$\frac{\text{Sales}}{\text{Operating costs}}$$

$$\frac{\text{Actual Direct Labour}}{\text{Schedule Direct Labour}}$$

$$\frac{\text{Rework}}{\text{Time in Rework}}$$

Conceptually we have been doing productivity measurement for years — it is just that we have not recognised the concept. We have just been using that financial ratio of profit or earnings over assets. So we have been using these ratios, except that now we have identified the concept, we are saying, "Let us see if we can broaden it to use it in other areas." So the concept is performance over resource use. The slide shows some of the ratios that are possible. There are hundreds and hundreds of ratios, each to be selected,

developed and made unique to the firm, to your department, to individuals. Those of you who are interested in seeing some of these ratios can find them in my book.

In measuring the financial health of a firm, one ratio is not enough. We usually use between six and ten ratios, and some firms use as many as 30, although I do not think that you need that many. The ratios we use are current liability, sales per employee, profitability per employee and so forth. With these ratios we find that we can get a 90 per cent assessment of the financial health of a firm. We are suggesting that some of the ratios shown on the slide can also be used. I am doing a case study right now with United Technologies, which is the corporate set-up for Pratt & Witney engines, Sikorsky Helicopters, Carrier Air Conditioning, etc. It is a fairly large corporation in the United States. Harry Gray, who is the chairman of the board, has given me a licence to go in and take a look at their corporate set-up and their productivity. We are also looking at their MBO (Managing by Objectives) and we are calculating these ratios. Basically, it is the way that we will be measuring productivity for United Technologies. These ratios, which are close cousins to the financial ratios, are one way in which we can measure productivity in terms of a total corporation.

MBO MEASURE

$$\text{Productivity Index (PI)} = \frac{\text{Actual Output}}{\text{Expected Output}}$$

$$PI = \frac{\text{8 Wk. Pkgs. Completed}}{\text{10 Wk. Pkgs. Planned}} = 8$$

The second measure is what I call an MBO measure. Those of you who are in the MBO business know that an MBO package has a set of objectives or an objective with all of the associated planning and resources that will be used to accomplish that objective. Therefore, we can think of MBO in terms of a chunk of work that is being done. In the example on the slide, our MBO measure will be the ratio between the actual output and the expected output. If we have ten work packages developed in an MBO planning cycle, and at the end of that work cycle we have completed only eight, we then have a productivity index of 0.8.

This concept of MBO works well with white-collar workers, engineers, programmers, analysts, etc., where the work is very difficult to measure. We can, however, use an MBO measure to relate what was expected with what was achieved. Expectation then can be a kind of standard.

MBO PRODUCTIVITY

$$\text{Productivity Index (PI)} = \frac{\frac{\text{Quantity Produced}}{\text{Quantity Expected}}}{\frac{\text{Resources Consumed}}{\text{Resources Planned}}}$$

$$PI = \frac{\frac{QP}{QE}}{\frac{RC}{RP}} = \frac{\frac{\text{24 Wk. Pkgs.}}{\text{20 Wk. Pkgs.}}}{\frac{\text{4 Weeks}}{\text{5 Weeks}}}$$

$$PI = \frac{24}{20} \times \frac{5}{4} = 1.5$$

Our third measure is MBO productivity, which is an extension of the previous measure, except that we now make it a little more formal in terms of the quantity produced and the quantity expected. This could, for example, be the ratio of expected and actual work packages over the ratio of resources consumed and the resources planned. Thus, if we have 20 work packages that were expected to be completed in a work cycle, and 24 work packages were actually completed, and if the timing also changed so that instead of using five weeks that were planned, we actually used four weeks, we come up with a productivity index of 1.5.

So, in addition to the simple MBO measure, we also have the MBO productivity measure where we include the resources consumed. Thus, we have another conceptual model by which we can proceed to measure productivity.

Our fourth measure is called total factor productivity. Here we relate all of the input resources that are used to deliver the output. On the slide, I have shown the resources as labour, capital, resources, and other miscellaneous items. (Partial factor productivity, which would be a derivative of this, would remove from the inputs those things that have very little bearing.) So if we have sales of $1 million, purchases $80,000, materials $300,000 and so forth, we can total up our inputs and outputs to compute an index.

TOTAL FACTOR PRODUCTIVITY

$$PI = \frac{\text{Output}}{\text{All Inputs}} = \frac{\text{Output}}{\text{Labour + Capital + Resources + Misc.}}$$

Sales:	$1,000,000
Purchases:	$ 80,000
Materials:	$300,000
Depreciation:	$ 20,000
Salaries:	$300,000
Capital:	$100,000
Total:	$800,000

$$PI = \frac{\$1,000,000}{\$800,000} = \$1.25$$

The fifth method of measuring productivity is value added productivity. The concept of value added is well known in Europe, especially for tax purposes. We can also use that same concept for productivity purposes. By definition, value added means what is added to our purchases. We can calculate this by subtracting the cost of our purchases from the selling price, or our total purchases from our total sales, and we can use those two figures for a total firm or a total department or a total function, to measure what the value added is per employee. Changes in this ratio would occur pretty much as I said earlier. If I want to improve the productivity, I can adjust either of the two parameters — but I can do it simultaneously.

VALUE ADDED PRODUCTIVITY

Value Added = Selling Price — Purchases

Value Added = Total Sales — Total Purchases

VA = $1,000,000 — $600,000 = $400,000

$$PI = \frac{\text{Output}}{\text{Input}} = \frac{\$1,000,000}{\$600,000} = \$1.67$$

$$PI = \frac{\text{Value Added}}{\text{Employees}} = \frac{\$400,000}{2,000} = \$200 \text{ per Employee}$$

People always ask what happens to quality when we deal with productivity? The answer is that quality is as important, if not more important than productivity. We do not ignore it. Anything we do in terms of productivity efforts must take account of the sensitivities and the needs for quality.

The sixth measure is what we call quality-factor productivity. On the next slide you will see that we again have the the productivity index defined as quantity produced over quantity expected, but in this case we multiply it by a quality factor. Let me explain what we mean by the quality factor. Quality is another motherhood term. Everybody loves quality — it is a great term. But it is a term for lay people. For management, quality is synonymous with standards. When you say that you have quality in your work processes or in your design, you are meeting certain standards. If your quality is changing, or if it is sometimes there and sometimes not, it means either that you do not have standards or your standards are erratic. But those who have consistent quality, consistent reliability and consistent levels of achievement, have consistent standards that they are achieving. So a much more real way of dealing with quality is with standards.

We can then think of that standard as a numerical level. Level 1 is our standard. If we have

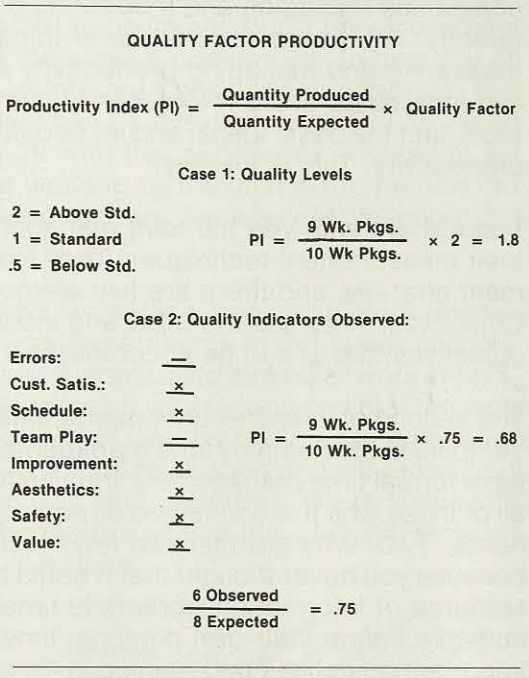
not reached our standard we could represent the lower level as a numerical value of 0.5 or 0.8. Alternatively, we can go above the standard and represent this as a value greater than 1. So the quality factor is nothing more than a weighting that we give to the productivity index.

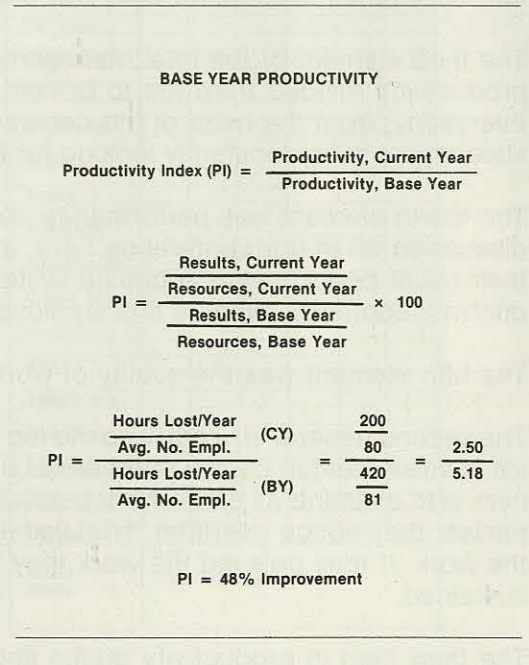
Another way of calculating the quality factor is to take account of several quality indicators, such as customer satisfaction. How do you measure customer satisfaction? You might say that he smiled. Is that a measure? I do not think so. You might argue that the customer comes back a second time. Is that a measure? It might be a little better. If the user keeps coming back you might say that was a measure of satisfaction. You might argue also that it is not such a complete measure. Of course it is not, because it is very hard to measure customer satisfaction, user satisfaction, employee satisfaction and your satisfaction. But we know that they become important parts of the whole process of measuring productivity.

You can stand back and say, "I can't measure it, so I'm not going to do it," or alternatively, you can say, "Let's try to get some indicators." So that is what we have done. We have put together some of the indicators shown on the slide and, if these indicators exist, they then form the ratio which we can substitute for our quality factor in the measurement of productivity. It is hardly scientific or foolproof, and it is certainly primitive, but it is a start.

We are only just starting to measure both quality and productivity. If you go back in history and study the literature and our past traditions, we have not even come close to bringing those two together. To some extent, we have done it intuitively, but we are trying now to build a science so that we can use it in our systems.

The seventh and last suggestion that I make to you in terms of measuring productivity is the base year concept, and this is illustrated on the next slide. With this concept we relate productivity in the current year to productivity in a base year. Again you will see that productivity is defined as results over resources, except that now we have results over resources for the current year versus the results over resources in the base year.





In passing, let me say that the most powerful way to use productivity measurement is not in comparing department A with department B, nor even in comparing company A with company B. That is not where the power is. In fact, one could even argue that productivity measurement is very weak in those two areas. The power of productivity measurement is in measuring department A with itself over a period of time. Once you develop your model and

have some historical data, you can say, "I know where I was last year. I know where I was two years ago. I know where I will be next year."

I started by saying, and I will repeat it here because it is worth repeating, that if you have two companies managing and measuring productivity in an excellent way, they are doing it differently. We would say the same thing about departments. If you have two departments measuring and managing productivity excellently, they are doing it differently. If you have two individuals doing it excellently, they are doing it differently. Our role is to provide the tools, and the basic ideas, and let people develop these tools so that they can track their own productivity. This is the key.

I now share with you the total management strategies used by our class A companies for their measurement techniques. They use five general strategies. The first is a total management strategy, and there are five elements to this. First they use Managing Productivity by Objectives. They use the MBO and incorporate in it productivity objectives as well as other objectives that are to be accomplished in the firm or within the department.

The second element — time management — is very important. In every one of the class A companies they employ time management. I want to raise a question here. How many of you have formal time-management training for your systems analysts, for your programmers, for all of those who are connected directly or indirectly with the computer operation? Raise your hands. Two. Why are there so few? Is it because you do not believe it to be useful, or is it because you never thought that it could be useful? I should like to suggest to you that the key resource of information workers is time. If they cannot measure time, if they do not know how to manage their own personal time, they will have difficulty. Why not give them some important guidelines and training in time management? It is very important. In class A companies all information workers, including managers and supervisors, are trained so that they can utilise their time in the best way possible.

The third element of the total management strategy was that the class A companies were productivity minded from top to bottom. Productivity was not treated like a transient fad. Everybody, from the head of the company, the heads of departments, all the way down to supervisors, was constantly looking for productivity improvement.

The fourth element was performance appraisal systems, which we have already had some discussion on in our conference here. In passing, I will say that what they did was to take their usual performance appraisal system and attach to it another sheet of paper for productivity appraisal. What is this employee doing to improve productivity?

The fifth element was the quality of work life improvements.

The second general strategy was the top management strategy and here the first item on the list is investment in capital purchases i.e. in better or more efficient equipment. The second item is to examine all of the work policies. Let me give you one example about class A companies: they notice overtime. Traditionally, overtime gave employees an incentive to delay the work. If they delayed the work they would qualify for overtime. The backlog was to be sustained.

The third item is productivity audits and these are new. They involve the examination of practices and policies in various parts of departments and the company. The fourth item is incentive programmes for employees, and these have already been mentioned. The final two items of the top management strategy are union/management agreements and organisational development.

The third general strategy is the task force strategy — i.e. problem solving special projects. It also involves activity value analysis. I am sure that everyone is familiar with value analysis,

but activity value analysis is an examination of every activity in the firm. Is it productivity-action related? If it is not, it is examined to see if it should be eliminated or not. The third element of the task force strategy is productivity benefit analysis.

The fourth general strategy is the expert consultant strategy, which implies the use of internal consultants. You all know about the use of external consultants, but a new movement towards the use of internal consultants is evident in the class A companies. To give you an example, two years ago General Electric instituted an Internal Consulting department. This department employs experts in all areas. If a supervisor has trouble, he can ask for an expert in his department, and the expert consultant will work with that supervisor. Instead of the supervisor floundering and wondering what to do, or working by trial and error, he now has available at the end of a telephone somebody who is very knowledgeable about his department that he can call to obtain some counselling.

General Electric instituted this. Miriam Kellob, who wrote the books on performance appraisal, is heading up that function. Setting up these departments in the larger corporations seems to be a trend in the United States. General Electric also looked at work simplification and work distribution, and in most class A companies it was recognised that the work process must be examined and redesigned from the point of view both of measurement and motivation. A speaker yesterday addressed the subject of job motivation and job redesign. It was a powerful idea, and I just want to confirm what was said yesterday. We redesign jobs both for measurement and motivation, building in the factors so that the work will motivate people and also so that we can measure how well it is done.

The last general strategy used by the class A companies is modelling, which means taking all of the strategies that are available (i.e. those listed on the final slide) and selecting from these various strategies those combinations that will work for a department.

Strategies		Frustrations: Costs	Measurement	Practices	Accountability	Motivation	Leadership
Total Mgm't	MPBO						
	Coaching						
	Perf. App.						
	Time mgm't.						
	QWL						
Top Mgm't	Invest cap.						
	Policies						
	Audits						
	Incentives						
	Union Agree.						
	Organ. Dev.						
Task Force	Projects						
	AVA						
	Benefit Anal.						
Expert Consultant	Work Simp.						
	Work Dist.						
	Equip. Aids						
	Training						
Modelling	Select above	Combinations					

I should like to summarise my presentation in terms of why measurement is important. First, there is a serious issue about the measure of managerial effectiveness and efficiency, both from the standpoint of performance and from the standpoint of resource utilisation. How do you know that you are an effective manager? How do you know that you are an effective information manager? What measures do you have? The fact that you have a job? The fact that you have been retained? You must deal with that issue, as professional people always do. In fact, the professional outlook is: I want productivity measurement not for the boss, not for the president, not for the stockholders, but for myself. That is how I know that I am effective in the job that I am doing. Measurement is important for the manager himself in terms of determining how effective and efficient he is in his decisions and the way he handles the systems.

The second important reason why measurement is needed is to ensure that decisions minimise the ripple effect. I personally feel this ripple effect. I think that it is one of our biggest problems. The way that we minimise the ripple effect is to manage and measure

both performance and resource utilisation. They must be handled together. A decision to do one must be viewed in the context of the other.

Thirdly, resources, at least in the United States, are predicted to be scarce. If you think that resources are scarce now, it will get worse. I do not think that it will get better, and if anything, we predict that we will see a formidable resource scarcity. As a result, accountability will be sharpened up. In the United States we will de demanding accountability before the resources are allocated. "Show me where you're going to use that money and tell me if that's the best utilisation of the money". That attitude is central to the issue of productivity.

Productivity therefore in the next decade will be the basis for justifying budgets and money. The productivity manager is not a separate animal: it is your responsibility. The productivity manager will be the individual who can show, "If you give me x dollars in my budget, these are the kinds of things I can predict will happen," and to justify it during this planning period.

Fourthly, productivity measures will be of great help in the justification of the high cost areas that we can see coming. I find that in the computer industry we have some very exciting developments in the pipeline. Examples are word processing systems — not just as a tool to aid the secretary, but as a tool to aid engineers and managers, printing systems, copying systems, electronic communications systems, facsimile message switching systems, and electronic mail systems. All of these are very exciting developments, but they require equipment that has a high cost to it. As inflation takes its toll, the cost of this equipment will rise sharply. It is my feeling that those who can measure their results will be in a far better position to justify that expenditure.

A fifth area is the productivity of the management team. I hate to say this, but I believe it to be true, and I will argue with you if you want, but there is a new awareness in the United States by top management about middle management. We are beginning to ask, "Are we getting the productivity from our management group?" So we are beginning to separate the casual manager from the productivity manager.

The sixth area and the last (but not the least) is that we have found that productivity in itself is a resource. If you are doing well as a department or a company, and you are not quite sure where you are productivity-wise — or maybe you do know where you are — any increment of productivity will bring about greater benefits. So productivity is now viewed as more than a measurement, more than something you need to manage. It is now viewed as a resource itself that we could use in our firms.

SESSION G

NOVEL WAYS OF SYSTEMS DEVELOPMENT INVOLVING USERS

Staffan Persson,
Stockholm School of Economics

Staffan Persson is Professor in the Department of Information Systems at Stockholm School of Economics. He holds Ph.D degrees in Mechanical Engineering, Business Administration, and Computer Science from the Royal Institute of Technology in Stockholm, Stockholm School of Economics, and University of California at Berkeley respectively.

Since receiving his degrees he has been responsible for undertaking and supervising research activities concerned with the development and uses of computerised information systems in various kinds of organisations. His main interests have been concerned with formal representation of information systems requirements, evaluation of quality and value of information, and different aspects of user involvement in systems design.

Staffan Persson has put his research into practical tests in several Swedish organisations. He has written a number of books and papers.

Today, I will try to talk about some experiences concerning users and information systems. It is mostly my own experience, working in Scandinavia.

The first problem is to define who the user is. Unfortunately, users do not form a homogenous body with which we can work in some specified way. Users are many different kinds of people, in many different kinds of situations. Today I will talk about the so-called end users — people who are working with terminals and actually touching parts of the hardware of the information system. But I will not dwell very much on that area, because there are also users who employ the computer for obtaining information, by trying to use a computer as a tool to further their ambitions of being a better and better man in the organisation. Therefore, I must develop some kind of approach that covers all kinds of users.

First, we have to see the situation as it is in Scandinavia just now. For many reasons the end users are very strongly involved in systems development. Many people think that this involvement is a great obstacle and that we have to think of ways of getting round it. Other people think that it is great, and these people are very much in favour of the laws that we now have that actually say that we have to have the users involved in systems development. We have to clear everything through the unions. We have to have some influence from the users in every respect of systems development.

So, what is the great obstacle that many people perceive? Some people claim that users do not know about computing or the computer. Other people, however, point out that users know a lot about their jobs and their situation, and that they are anxious about their future, and so, of course, they should be involved in systems development. They argue that if the users work with us, then we know that our systems will work well. So we have two schools of thought, and I think that the latter is winning.

What can we do to involve users in systems development? The first problem is that the

users in many cases are not educated when it comes to the computer. There is a school of thought that says we have to teach every worker in Sweden about using the computer, and that that should be done during company time. It is actually suggested that every worker should have at least 30 hours tuition, paid for by the employers.

Other people say that training of this type will not solve the real problem. They argue that users know about their situation, and ask if there is a way that the users can make decisions about the computer that concern them. They ask if it is possible to give the users an opportunity to make a decision, without everybody having to be a specialist on computing, or at least having to learn a lot about it. That, then, is the subject of my talk today.

We have found that we can teach the user by demonstrating the system and by letting the user test-run the system before it is designed, and before it is even completely specified. I will talk about methods for doing that. Therefore we will see ways of teaching users about potential systems; ways of gaining the users' acceptance; ways of getting the users to feel that they are involved and can really participate in decisions.

But then we have another aspect. Users know a lot about their own situation, and we who are developing systems have to learn from them. So we have to find ways of learning from users in order to build good systems for them. That means that we have to start thinking in slightly different terms than before. We have to think about the systems development process as some kind of a pedagogical one. We have a process of learning, where both sides are learning all the time. When we do that, we soon find out that there are many kinds of different problems. And different problems in different situations need different kinds of solutions.

This means that the traditional methods of systems development are probably not sufficient any more — at least not in a situation such as the one we have in our country. Traditional methods are based on formal, analytical reasoning. That kind of reasoning works well in many cases, given that we know the goals and know about the resources. But, in many instances, we do not know these things. Therefore, we have to find some complement to these traditional methods that permits us to learn during the development process. Consequently, we are now interested in something called "experimental systems development". That is not some kind of development method that is in conflict with the traditional methods — it is a complement to the traditional methods. Nevertheless, in some instances it is very different to the traditional methods.

Carrying out experiments implies that we cannot specify everything about the area under consideration, and that we do not have a theory that explains all aspects of the area. This is particularly true where people are involved, and in many cases it can be more productive to carry out experiments than to attempt to specify and theorise about the area.

I have a simple example that illustrates the differences between experimental system design and traditional methods. A doctoral thesis in Sweden has said that it is very important in systems development to minimise unnecessary iterations. In other words, we should minimise re-doing things. If the definition of "unnecessary" is that we could do something in some other way which is cheaper, then we should not do it. Minimising unnecessary iterations is, of course, one way of minimising costs. But if we look at it the other way round, it can be equally effective to maximise the number of productive iterations. Productive in this sense means that by doing an iteration I have some kind of benefit that costs less than the cost of the extra iteration. So, I want to maximise the number of iterations if they are productive, and that is where experimental systems design comes in. Are there ways with systems development in which we can do things many times, re-do them, test them, try them out, without their costing very much?

Experimental systems design contrasts with pure analysis, in that with pure analysis we

minimise costs by minimising unnecessary iterations, by very rigid planning, and then by doing things in a straightforward way. We are very careful not to have to re-do things. But, I am not very clever, I am fairly lazy, and I cannot plan very far ahead. So I ask myself if there is a way in which I can do things to see how they work out, to try it again and again, and then gradually to improve it without losing anything in that process? That is the difference in philosophy between experimental and pure analysis. These two types of analysis can, however, be combined. So let us look at these different methods.

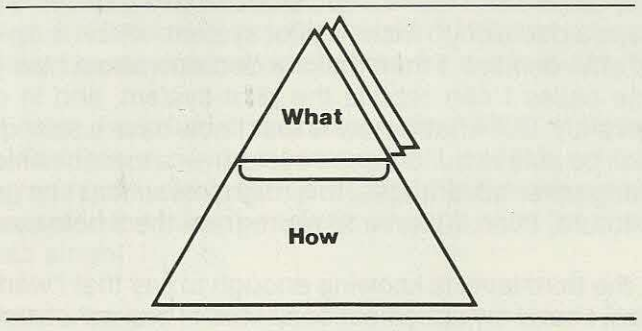
I will talk about three different levels of the experimental method. The first level is called systems sketches. The idea of systems sketches is to provide a communication tool that permits us to talk with users, to let the users really have their hands on a working model of a real system. The idea is to enable users to learn about a real system in order to be able to make wise decisions about the system; to change it, to re-do it, or to accept it. But it is only a communications tool. These sketches are not supposed to be run in production mode. Most people working with systems sketches in Sweden think that they are, so I have to warn you about that.

The next level is called pilot systems, and these are slightly different in that we actually want to run them in a real situation, but usually on a smaller scale than a fully operational system. The third level is called evolving production systems, and this is just a way of expressing the concept of building production systems in steps so that we can gradually improve them and make them flexible enough, and so that we can afford to change them quite frequently, if necessary. I will give you some examples to illustrate all these three levels, including examples of what I am doing myself nowadays. I am now building fairly large production systems that keep changing all the time.

Why is user participation important? It is important for different reasons at each of these three levels because we can meet different kinds of users. One important reason is that the traditional ways of describing a proposed system keep the user fairly far away from the real system. It is difficult to visualise a system that will not be operational for a couple of years.

Another reason is that users, like most of us, usually have difficulty in specifying their requirements, because they might not know what they are. They might not know what is possible, and they try to adapt their specification to what they think is possible. In other words, they are kind to the people talking to them, and they try to provide requirements that are realistic in some sense, and therefore they do not specify their real requirements. This is a very important point. When designing a system we have to stimulate creative thought among the users, to activate users, to reduce the communication gap between users and systems developers, and in different ways we have to try to make our description of these systems vivid, so that the users really see and feel what they are.

In some way we have to be able to illustrate what I have shown on the first slide. As I said before, a traditional description is very difficult to understand by people who are not used to them. Therefore, if we want to illustrate systems by using running models of the systems, we somehow have to separate what we call the 'inner' characteristics of the system from the 'outer' characteristics. By the inner characteristics I mean everything that is inside the computer, everything



that depends on how the computer works. By outer characteristics, I mean what the user needs — the dialogue, the kind of reports that he gets, the kind of algorithms that he uses and the kind of rules embodied in the system.

If I can find a way of illustrating the outer characteristics by using very simple inner characteristics, then I can make a model, which may be very cheap to build. My next slide shows what I am talking about.

I shall talk about the levels of models shown on this slide. If I want to communicate only ideas about the system, then I can use a model of the real system of the outer characteristics — I do not know yet exactly which system I want, so I take the best specification I have. I can take an old specification, and add some improvements to it, or I can take a preliminary specification. I can take a system from a neighbour and try to make a model of that, so that I have something to discuss. That is why I mean that it is a model of the outer characteristics. The outer characteristics are not defined yet.

		Inner characteristics: Model	Inner characteristics: Real
Outer characteristics	Model	Systems sketches	?
	Real	Pilot systems	Production systems

Then I also take a model of the inner characteristics, which means that it does not really matter how I do it as long as to the user it seems to be a living computerised system. Instead of algorithms and rules I might have tables of data. It really does not matter as long as it looks right and works correctly when the users are trying it. So, a systems sketch consists of a model of the inner characteristics and a model of the outer characteristics. Remember that a systems sketch is a communications tool.

At the next level of model I say, "I know enough now about the inner characteristics. I know fairly well what the specification should contain. But I would like to test the model in a real environment. I would like to test it with the people and the manual procedures in the organisation. I want to run it as a pilot system." I can still have a very simplified computerised solution — that is, the programs might be very simplified. But now the requirement is that this system should be able to work in at least a part of the real world, and it has to work properly.

The idea is that by running a pilot system for long enough to know about how the system works out in reality, we can then say, "Let's make some changes." Either "Let's try it again," or, "Let's make a production system out of it." The point of these models is that they represent a set of decisions. I make a decision to make a systems sketch, which is a communications tool. I make a decision to make a pilot system, which is an experimental model that I am trying in a real environment. I then make a decision about how to implement the production system. In some cases I can rebuild the pilot system, and in other cases I have to do it completely differently. But what I know is that I now have a tested specification, and so I can assume that I shall be able to build a good system — a system which I will not have to change very rapidly. Among other advantages, this might mean that I have a smaller maintenance requirement in the future, even if I have to reprogram the whole system.

So, the third level is knowing enough to say that I want to build the production system. At this stage, I have my specifications, which I can construct in the traditional way or by using some experimental approach. That is the three-way process that is used in many instances now.

The question mark shown in the fourth box on the slide is quite strange. You have real

production programs with all the efficiency requirements, security requirements and everything else that you need, but you do not know exactly what to use them for. That is the problem. These programs really do exist. At least one insurance company in Sweden has developed a very nice relational database system which the users are using to define systems themselves. All their systems development is being done that way. The users have the software, and they define how to use it, and then they run it. It is used in their international department, which typically has less data than a traditional insurance company, but it is a very interesting approach.

Another thing about making experiments is that we expect sometimes to be surprised. Whether the surprise is negative or positive does not matter, but if everybody knows what the outcome will be there is no point in doing the experiment. For experiments to be valid, we have to be insecure about the outcome, otherwise there is no point in working in an experimental way.

Let me now talk a little bit about systems sketches. What I want is a realistic model for a systems specification. I want a tool with which I can simulate the results from applying certain rules. I want a tool that I can use to obtain rapid feedback of results or proposed solutions. Let me give you a couple of examples. Unfortunately, I cannot show you the whole thing on the slides here — I just have to take parts of them.

This is in Norwegian, but who cares about the language when there are numbers involved? This is just part of a model, and it is just a picture of a screen. It is from an insurance company. They had specified a system which handles loans for people who had life insurance with that company. This display was the most important one when they were communicating with the users. The idea was that you identified yourself and you were presented with a sequence of displays to fill in, and after a while this picture was displayed in front of you. You can see that at the bottom it says 200,000. That is the amount of money the customer had applied to borrow.

Bilde 02 ★ Individuell länerammeberegning ★ Dato: 77.06.16

Födselsnr. Kunde: 11114436994
Navn Johan Inge Pedersen
Adr. Urabakken 12
6017 ästestranda

Polise	Länepos	Länegrl	Restr. ärsak
504858	0	66725	Icke pants. Overdr
503655	0	31418	NY polise
433073	4896	8568	Icke pants. Overdr
755939	0	34443	Icke pants. Overdr
Sum	4896	141154	

Innvilget Tilsagnsbelöp: 200000

Behandling: 3

You can also see a sum of 4896 and 141154. These figures are computed in some strange way based on historical data about the insurance held by this particular person. There were complicated rules to compute these figures, and it takes about two hours to do it manually. But what do they mean? If the left-hand figure (4896 in this case) is at least 5,000, the loan may be obtained. The right-hand figure says that the maximum loan that can be made is 141,154,

But the user can always override these rules. He could, for example, say "4896 is close to 5,000. The customer could take out a new insurance, pay some money on it, and this will bring the figure up to 5,000". With the existing manual system, the users could make decisions of this type without asking anybody. If they wanted to make a very large change, then they could ask the boss and he might say that it was alright.

The users began to worry about what would happen when all of the data was stored in the computer. They began to wonder if the computer would say "No, no, no, you can't do that, you have to go back", or if it would store the data and at the end of the year say, "Well, you did these things — you allowed large loans to be made to all your friends and all your relatives.

You will have to answer for that." In other words, people were actually scared at that time about how this data would be used.

This model we built contained in a little database all the data necessary to handle the applications for a particular day. The data was taken from the regular systems. It also contained the possibility of registering a new application for insurance, going through the kind of displays, and getting all kinds of results.

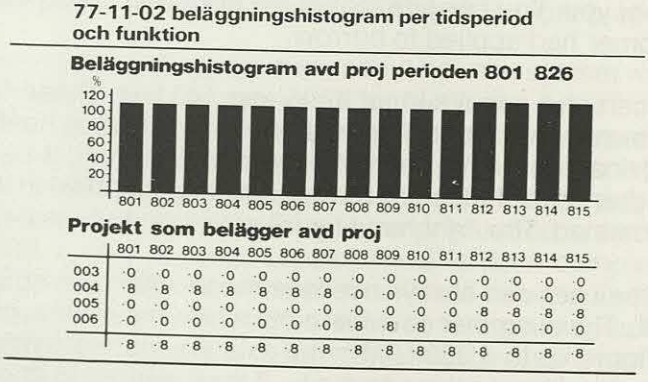
The end result was that the system would tell you what kind of loan you can have, the rules concerning it, and it printed out the full form and all the papers concerning that loan and these were sent to the customer. In other words, it was a model. The total programming time for the model was about half a day, and to get the Norwegian text in took one and a half days, because it was quite a lot of text and you had to select and build those letters. So it was a two-day job.

It was put into production as a pilot project. It was run for a couple of weeks so that the users could see whether this kind of system was good for them, whether the dialogue was good and whether this was the kind of thing they wanted. After that period, the users simply said, "No, we don't want this system," and it was abandoned. This was a great surprise, because the users had accepted the written specification of the same system but they did not accept it as a running system. That was because there was a heated debate on integration integrity at that time, which meant that they had to wait for some time.

I think that if this model has been prepared in another way, if it had come earlier in the process before the specifications really were considered final, then they could have negotiated about how to handle these deviations. They did not, and so the project was stopped.

You can ask whether it was good or bad that it was impossible to do this project at that time. Nobody knows the answer to that. Would they have stopped this system when it came into full-scale production, having had a million crowns spent on it? Anyway, it was a surprise, so that was a good thing about it. But it is an example of a very typical, very simple model. It was a complete system. It could be run as a pilot. It was a typical two-day development cycle. It usually takes about two days technically to build a model like this. It can take a lot longer to get the specification to start with, but technically it takes around two days.

Here is another example. This is taken from a large company in Sweden, Sandvik, who produce and sell all kinds of tungsten carbide tools. Sandvik had about 150 development projects for new products. A project could consist of around 80 to 200 different activities performed in different parts of the company. A project could take from one to four years.



The problem was that the projects kept changing all the time. There were new priorities. They had to stop one project and speed up another, which led to a lot of confusion. They planned to build a computerised system to keep track of all this. Their planning system is quite traditional. They had worked on it for a long time but they had not come to any conclusion about what was good or bad about it. They had really got nowhere. So I was allowed to try these systems sketches.

I went to one of their meetings, I obtained some documents, I heard the discussion, and I went home. The next week there was another meeting, and by then I had programmed a system. It was not a proposed system — it was my concept of the kind of system they were talking about. As I was an outsider and could not be expected to know about their business, I was allowed to make a lot of errors. That is a very strong point — that you are allowed to make mistakes, because there is no prestige involved, you are not supposed to know anyway. So, it was my system, based on their ideas.

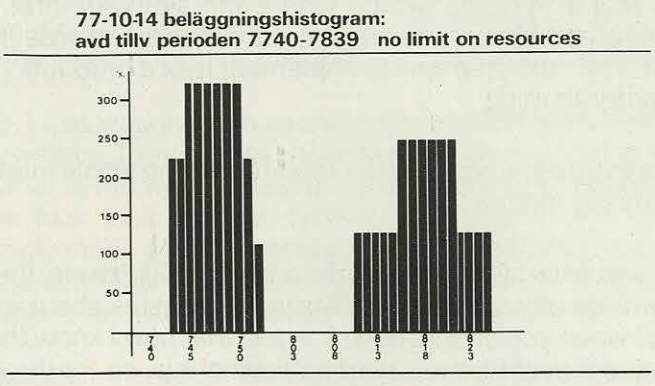
I had a computer, some TV screens and a printer, and we started to run the system. We started with simple things such as how to register one new project, how to do the planning, how to present the results. Unfortunately, I do not have all the pictures I would like to show you but one comes to mind. One man said, "It's all very nice if we get this kind of system, but we won't have these gantt charts — these bar chart activities plotted against time". Then I said, "But I wrote a program for gantt charts this morning, can't I show it to you?" I was allowed to show them a gantt chart of one of their projects. It was for four years ahead, every week. It was a big project with about 80 activities in it.

They saw it and they said, "Wonderful! Now we can have gantt charts. We need lots of gantt charts". But why did they need gantt charts. It was quite simple. They had manually prepared gantt charts in about 100 different departments, covering 150 different projects, and they kept changing all the time. No gantt chart was consistent with any other gantt chart — that was the problem. Now that they could get them from the computer all of them were consistent with each other. They were wrong — but they were consistent, and you could correct errors. That was what they really wanted, because they were accustomed to working with this kind of presentation of the data.

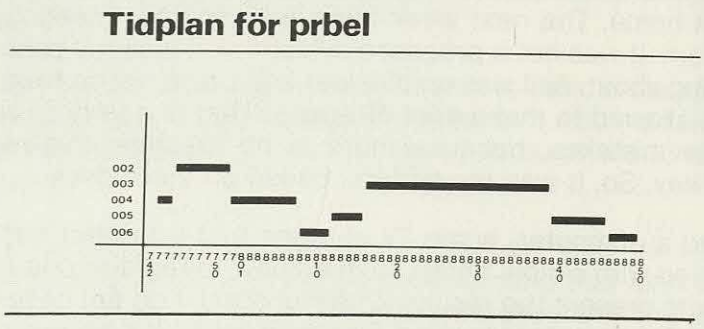
So they started to discuss what kind of gantt charts they needed, what levels they wanted, and so on, and we built some programs for doing that. The slide shows a typical one produced by the computer. They wanted to know the load on different departments, so we made a histogram like this. The first time they had only the upper part of the picture, and they said, "It's nice to see how much this is occupying, but it would also be nice to know which projects were involved in that department." So the second time I met them, I produced the lower part of the picture as well.

When they saw that, they said, "That's quite nice, but it would be very nice to know which activity in that project they are working on in that department." So they got another table. It kept growing. But I show you all of this for a specific purpose. They had restrictions for every department on how much capacity they had if they were performing particular activities. The second time I showed this model I had all the real known data about the tungsten carbide drills.

If I took out the restrictions on personnel in this particular department, I got the picture shown on the next slide. In other words, this is the way in which this department ideally had to work. Of course, in reality there has to be a delay. I have to cut it and alter it somehow, as you saw on the previous picture. Somehow it has to look like that with some overtime and everything else involved. Then you can ask, "What effect does that really have? How much does it delay things?" We tried that, too, and got the next picture.



This is for a particular department. The idea was simply to look at the projects to see when they start and when they finish. It is a simple kind of gantt chart really, but it is not a regular one. If we take the bottom line, we see that the project starts but has to stop because a higher priority project comes along. It is delayed by about 40 weeks.



When they saw this they said, "That can't be right — there must be something wrong." But they had told me they had a priority rule which said that if a project with a higher priority came along, everybody else had to stop and that one had to go ahead first. They said, "That can't be right — we need new rules." So new rules were specified. For example, if a project is at least 50 per cent completed, and if there are at most four weeks of work left, then that project must be completed before the higher priority one can start, unless that priority is at least two priority levels higher. They specified a whole package of these kinds of rules.

So we put those rules in and we ran the model with all the available production data, and with three different sets of priority rules. Then they were able to find out that none of these rules were any good. Some of them were better than others, but none of them were satisfactory. They discovered that, as some IBM salesmen say, they had to do some manual thinking. In other words, the system would indicate if there were some strange things going on. Then they could decide on the changes and put them in manually, and the system would continue.

So, we now had a system model that we could talk about, which meant that the development process started to accelerate. They had been working for two years on this project and had achieved nothing, but now in three weeks they had the specification of the future system. But that specification contained about 70 different reports. It contained a lot of diagrams, and things like that. It had been tested with production data. The priority rules were actually tested, and they had been able to clear the ideas among all the different groups of users. There were 40 users in that project group, which is why they got nowhere in two years; with 40 people you cannot go anywhere in two years.

This was a systems sketch where the aim was, first, to show and produce something to discuss, and second, to test the rules. In other words it was a simulation of the real environment. The next step was to implement it as a production system, with some improvements in the programming.

The total programming effort required for the whole model was about three man-days, and it is a fairly big model.

The aim of a systems sketch is to try to illustrate the things that you feel are important, regardless of what they are. There are no rules about what you should do. There are no rules about when you should do it. It is just that now I know that we need to clarify these things and the model might be a way of achieving this, so try the model.

I myself have now built more than 50 different models. They are models of just about every type of system you can imagine. However, I usually claim that every system is exactly the

same, at least at some level. You put some data in somewhere, you store it, you retrieve it and you print it out. At that level, all systems are the same. If you are working at these model levels that I am talking about, then you can treat the systems as being almost always the same. You just change the labels around and the system behaves properly. That is why technically they can be built quite easily, because it is always the same system — it just has some different labels on it. Usually, only about 10 per cent of a model is rules that you have not met before.

Earlier, I said that when you work with these sketches, you sometimes need surprises. Sometimes you just get something that you can show to people and discuss with them — you can communicate about it and get the users involved. I think that is very important. In this way, you can get the users to understand some things that are quite difficult to describe otherwise. You can adapt to the users' ideas about the system. You can use these models for training. Whilst you are developing the real system, you can use these models as a training tool because they look and behave like the real systems. So you have an educational tool there too.

You can also use the models to find out at an early stage about such things as latent conflicts in the organisation. I want to give you a couple of examples — the first three models that I made all exploded in some way, and I want to tell you about that.

The first one was a project accounting system. We built a very nice system and we could keep track of just about everything. We could present the information in all kinds of ways. The organisation wanted to discuss the model and to show it to the project leaders. We had a nice session. We started out by showing how the system worked. We put in information and answered questions. Then we could see that people were beginning to get angry. They got angrier and angrier. It turned out that they threw out every attempt to build a system for this kind of project accounting after that.

We got a psychologist to come and study this organisation. He came to the conclusion that they had had a latent conflict going on there for a long time. It was to do with a conflict between some authoritarian people and others who wanted to be more free in every respect. That conflict came to the surface when they saw this system which was, from some people's point of view, very authoritarian. The psychologist said that he would love to use a system like this to test an organisation, to see whether it is ready for a change in the organisation, in the information systems area or whatever. He liked the idea of sharpening the tools and studying the consequent reactions.

It is important to stress that these people felt that the system was an attempt to impose an authoritarian regime over them, and therefore they reacted very strongly. They would have reacted in the same way with a real system, but it would have been more expensive. That organisation has since changed dramatically because the two groups of people could not work together. This system was not the reason for that change — it was just a symptom.

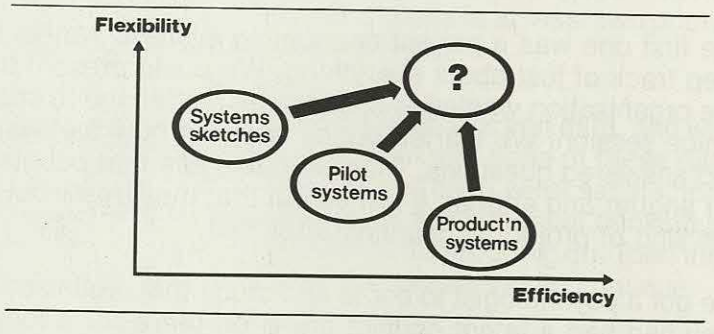
Another example was also interesting. I was working with a production company that wanted the world's best production planning system. They did not know what it was, but that is what they wanted. So we tried to find out what is the world's best production planning system for that company. To try to find out, we took their present system, including a lot of batch routines and manual routines, and simply made a model containing everything they had, and changed it as if it worked in real time and let them test that. We had real data and we could find out the risks in the material inventory and things like that by using this system.

But then we came to an interesting question. I asked, "What questions do you want to put to this system?" They said, "If a salesman calls from headquarters and asks 'Can I have this order processed earlier?' what effects would that have? What scheduling changes do I have to make? Will I have the material? I would like to ask the computer to provide the

answers on the screen, and then I can tell the salesman." I rather stupidly asked, "But why shouldn't that salesman have his own terminal? Why should you put in that data?" When they heard that, they stopped the development of the system. They wanted this system for their own use. They had been decentralising, and they felt that now they wanted to be a free unit, not controlled by the sales people. Now it turned out that this system would be a great tool for the sales people, and if they found out that all their questions could be answered in that way, then of course the people in the production planning department would have nothing to do with it any more because the system and the salesmen would do the planning. That was their fear. So they had to stop the development, and they thought for about a year about what is the world's best production planning system for them. A very important criterion is that the salesman should never touch it. They finally worked out what they wanted, and they got their system. So those are the kinds of surprises that you might get out of these models.

You can also use these models to test a system. You can test it against the users' ideas about it. You might, for example, want to adapt the dialogue. I think that is the most common use — simply to test dialogues in interactive systems.

You will see that when I am talking about systems sketches I am usually working with fairly small amounts of data. I might have complicated programs, or they might be very simple. That means that I want them to be very flexible because I want to change them all the time. Efficiency is not important at all. In a production system it is different — I want a lot of efficiency. I also want flexibility but I cannot always get it, so I have to make some trade offs. (I have represented the flexibility/efficiency relationship of systems sketches, pilot systems and production systems on this slide.) Maybe one day we can build systems in the area shown with a question mark that are very flexible and efficient systems. That depends on the development of hardware that is applicable for these kinds of ideas.



If you approximate the cost of hardware to zero, which you can do sometimes, then you see that efficiency is not relevant any more. This means that we can build systems in any way we please, as long as they give the proper results.

If we continue thinking in those terms, we want to build a simplified system. We will use the pilot systems to review the performance not of the computer or the system itself, but the whole system in the organisation — with the people and the procedures around it. We want to decide on how to proceed. Maybe we should stop the development altogether. Maybe we should make some changes and try it again. Maybe we should implement the system with some minor changes. Who knows?

Pilot systems are quite interesting not only because we can test things, but because in a way they add new dimensions to the field of systems development. I will focus now on two things: time and complexity. Both are things that I hate when they grow too large, which means that I want to make things rapidly, and I want to make them very simple — otherwise I cannot make them at all.

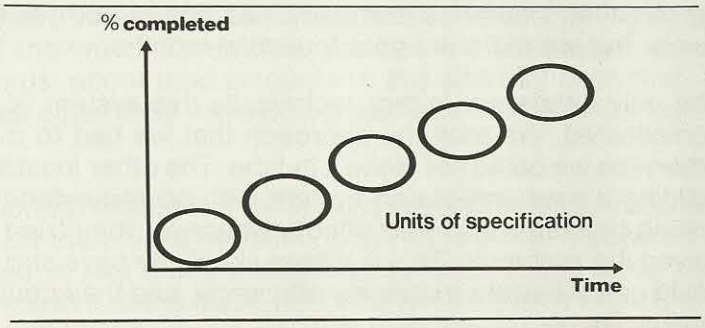
I should like to give an example from a Swedish insurance company to put forth some ideas. Unfortunately, I do not have all the pictures that I should like to show you so your imagination

has to work for me. It was a very complicated system when it came to rules. A system for pensions was to be designed. For many reasons, there were only four months available to do it and, we had to try to find some way of doing it.

I had previously been in the company demonstrating these systems sketches on a very similar system. So when they found out finally that they really saw no way of doing this pensions system, they asked, "Can't we build these kind of sketches? Then we could try to run them until we can reprogram them to make a better system." I wanted to try it — so we did so.

The rules were very complex, but they could be subdivided. The first question I asked the users was, "If you were working manually with this kind of work, how would you organise and divide the work behind you so that you can work without disturbing each other too much?" As a result, they found a lot of subsystems which could be worked on quite independently, and I have represented these as units of specification on my last slide.

The first one, down on the left, we called 'duration', which simply computed the ages of people. That sounds easy, but actually the rules permitted one person to have 40 different ages in the same system. At different places in the system he had a different age, depending on whether he was sick when a new agreement came into existence, (and there were three agreements overlapping) and many things like that.



In addition, many women had to be handled completely differently because of the equality question. It is strange that when women were not treated equally they could be treated the same way. So each unit (the duration, the wage computations, all kinds of pension tables, etc.) could be done separately. Then we put the users to work to describe and define one of these subsystems in one session. Day and night almost, they had to sit down and define a functional description of it.

This description contained a lot of paragraphs, and it contained a lot of terms, exactly as they used them in their job. As soon as this was done — it usually took about four days with the lawyers, the users and the analysts working together — they came to me with it. I then programmed those rules, which actually was a recoding. I took the first paragraph of their description, and I wrote an APL program of one line, using exactly the same terms as they used. I then took the other paragraphs and did the same thing, and so I built a program which was a coded version of their description.

I added some good readings, some data to print out results and all kinds of other information that was interesting.

The next day they started to use the program, and they started to test their specification. Why that kind of hurry? To answer that question, I need to refer to some studies of work on complicated systems. If you work on a complicated system and you have to stop working — say be away from it for two weeks — then you need some time to catch up before you reach the ability that you had before the break. That catching up period is quite a long time.

In studies of construction projects the studies have shown that if you are away for about 14 or 15 days, then you have to spend about 30 per cent of the previously used time to catch up. If

that is true, it is very important that the user should be able to sit in on something until it is completed, so that he does not have to restart. If you are working on one of these small units and you can do it, complete it and test it, then you can say, "Now I can forget about it. I don't care how it looks inside. I have all the terms defined. It doesn't matter, I can take a break now and I can start on the next one when I have time." So that is the way it was done. We worked very intensively on each of these subsystems. They were then tested separately and then they were added together in a long string, and the system was run as a whole.

For the sake of flexibility, all controls are situated in each of these subsystems, so that if you need to check some program code, it is checked in every place where it occurs. That is inefficient, but it is flexible. All these subsystems are independent of the others. If rules are changed in one of them, it will not affect the others at all — I just change the controls in that particular subsystem. If I want to use the rules outside of this system, I take them out.

So we managed to get the whole system running. I do not know how much user time it took, but there were five people involved at different times. However, I do know that it took four man-months in analyst time. Exactly the same specification was being produced in another insurance company at the same time. When they had spent four man-years on it they gave up. Another insurance company had nearly completed the specification after four man-years. But we did it in about four man-months.

The only difference is that technically this system is completely trivial, but the rules are complicated. We took the approach that we had to make a simple but inefficient system, otherwise we could not make it in time. The other insurance companies took the approach of building a nice, integrated system with no redundancy whatsoever. They had all kinds of testing problems and side effects whenever they tried to change anything, and they never solved the problems. This is where simplicity pays and where the short timescale pays. We could use the users extremely efficiently, and they could feel that they really helped to build the system.

The system was run as a pilot system and, after that, the decision had to be made as to how it would be run in the future. It was being run on a real-time basis every day, on a borrowed computer. Finally, a year later, the insurance company decided that the system would continue to be run on that kind of computer, and so they bought one instead of reprogramming the system.

This example illustrates several lessons. First, we can reduce time by using the users in an efficient way. I think that is very important. Intensive inquiry is very important in these cases.

Second, by implementing gradually each subsystem, one by one, the users feel that things are happening all the time, and they see that there really will be an end sometime. That is also very important for the relations with the users.

Third, it is very important to see where we should put complexity in a system. Should we put it in the system? Should we let the user keep it in his head? Where should we put that complexity? When should we put it in? We can control when and how to put complexity in a system, and that is a strange situation.

Let me now tell you about a few of the things that interest me most. It is what I call 'evolving systems design'. The idea is to design and implement a very flexible data processing system. Evolving systems design permits gradual redesign of an existing system, and periodically reviews a system's status.

My favourite example is a banking system. The banks are usually working with two kinds of systems. First, they are handling masses of data. They are not very clever systems, but they handle a lot of data very rapidly. The other kind of system has much less data, and the rules for handling that data are more complicated and the people who are working with the system

need to think a lot. The latter systems are by far the most frequent in the banking world, but they usually are a very low priority for the computer departments because they are accustomed to working on the big, cost-reducing systems. What I am now talking about is the small, profit-increasing systems that are very interesting in the banks.

The system that I will tell you a little about is an information system working within the foreign exchange department of the largest bank in Sweden. Initially, there was a traditional specification of how this system should look. It was estimated that six man-years of programming effort were required to develop a live system.

I made a bet, saying that this system ought to be live within two weeks from the start. Of course, I was wrong — it took four months. The reason for that was the delivery of terminals! It could actually have been live after two weeks. We then had to run the system inefficiently, and it was not complete, but the users knew that a system was on its way. They could use it but they had to be careful. They were very interested in trying to do this.

So we put that system into operation. It handles around £900 million at present, so there are fairly large amounts of money in it. It handles a couple of hundred transactions a day, so it is fairly small in those terms. The initial aim was to provide a tool for use when making deals with all kinds of banks in the rest of the world. To do that, you require information about exchange rates, about limits of all kinds, about total amounts to this and that customer. It was an information system to be used when they were doing business, and also for some reporting. That was all.

After a while we added increased reporting facilities. It turned out to be a very nice accounting system, and we could actually audit the official accounting system against it because it was always right (because it operated in real time). It was also possible to put some risk monitoring into the system for the president of the bank. He could get very nice reports out of it all the time. The bank discovered that their customers were very interested in receiving these reports. So the auditors of the customers have accepted the reports that are produced by this system as accounting reports for their big companies — for instance, Sandvik.

As a consequence, the bank's marketing department started to make the system more and more marketing oriented, and it is now a very effective marketing-oriented system. So, you can see that a few new systems were added to the original currency exchange system. Originally, the system was only an information system, but it is now officially recognised for use in government reports and all kinds of other reports. But it also turned out that a production system was easy to incorporate — writing all the notes to the customers, and things of that kind. So that facility was added as well. The system is now running in two banks, and it keeps growing. Changes are made at the rate of at least one a week, and that is the minimum rate of change.

This summer, a chart-making facility will be added. It will construct seven-colour diagrams on the screen which will automatically be made into overheads for the president of the bank. It will also be connected to a top-down reporting system. We start with the chart produced at the top, then we go down. In some systems the data is collected automatically, whilst in others we put the data in manually, until we connect all of the systems within that department of the bank into the same reporting system.

The system has now been in production for a total of two and a half years. It has grown tremendously, and it is now 20 times larger than at the beginning. It is about 8,000 APL functions, which is a fairly big system.

All the programming has been done by me in my spare time. I go to the bank when I feel like it and make some changes. The changes are made to the system whilst it is in production and when business is being transacted. I tell you this to give you an idea about evolving

systems design. The system really is evolving. As changes are being made there are many control functions involved. It is a very heavily guarded system with all kinds of control aspects, so the risk that a mistake will ruin anything is very small.

I wanted to give that example because people find it difficult to see that these sketches are useful only as a tool for very rapidly producing working models of systems. It is very difficult to explain to people that these models are not real systems and that they are not supposed to be put into production. They say, "But they do the work. I can compute. I can figure it out. It's proper. It's OK." I tell them, "It can't. We don't handle the data efficiently. We don't have the security we need."

But eventually you come to the conclusion that there are many systems which, even if they are important and really are in production, can be designed in similar ways. In other words, with some kind of simplified programming but still with full responsibility for the security aspects.

These kinds of systems are very common in banks, insurance companies, within government communities, and many other organisations where planning is important. I see, at least in Sweden, that now there are quite a few places where they are developing systems in this way.

Sometimes experimental systems design is carried out in conflict with traditional data processing departments. Sometimes it is in co-operation and within the data processing departments. The point is simply that these are different systems. They usually serve fairly few, highly competent users, where the users want to have something that makes them function better in the organisation. They usually handle fairly small amounts of data and fairly few transactions.

Those systems can be treated differently from the others. Efficiency is not very important any more. That is why it is possible to use these ideas.

The main message that I want to convey to you is that, in many cases, it is easier to make something and try it out with people, than to sit down and try to design the world's best system. My message can be summed up by saying, "Do something; test it out; and then maybe put on paper how it should be". That works quite well now and there are tools to do it. Sometimes the tools are readymade and sometimes you have to make them yourself, but that is not difficult.

It is important to come to terms with this development otherwise the users will go their own way. They are starting to do just that. They are buying all kinds of help from outside the organisation, and it is very important that you are aware of this.

SESSION H

UNION ATTITUDES: A POSITIVE RESPONSE

Campbell Christie,
Society of Civil and Public Servants

Campbell Christie has been Deputy General Secretary of the Society of the Civil and Public Servants (SCPS) since 1975. He joined the full-time staff of the SCPS in 1972 after almost 20 years as a civil servant involved in the administration and development of the Social Security system. During this period, he was an active lay officer of the union at a stage when the present system of local collective bargaining was being developed.

Campbell Christie has had special responsibility for the SCPS data processing membership and, as a result, is currently a TUC nominee on the NEDO Computer Sector Working Party Information Technology Working Group and also the Employment and Technology Task Force of the Electronic Industry ECD. He served as a member of the Computer Sector Working Party Manpower Sub-Committee which was responsible for producing the Final Report on planning the future manpower needs in the computer industry. He was latterly Chairman of that Sub-Committee.

I am very pleased to have the opportunity to speak at your conference, though I regret I have not been able to attend the whole conference because the areas you are discussing are areas that my union are particularly interested in. In the Civil Service and public service, the post office and a number of other public service organisations, we represent members who are in the personnel management function, the management services function, the finance function, as well as ADP users and ADP specialists. Therefore, I should have found it particularly interesting to have participated in the entire conference. Unfortunately when I booked to come here I did not appreciate just how iron was the Iron Maiden and how long it would be before the Civil Service pay dispute would be resolved. But most of you will have observed that the Civil Service dispute goes on, and while I am not able to participate in your entire conference, I am willing to offer advice on how to get passports, or when not to fly from Heathrow, or how to save on your VAT bills, or how to invest your PAYE and National Insurance contributions that the government does not want to collect.

The subject on which I have been asked to speak is "Technological Change: a positive Union response". The chairman said that my union is in the Civil Service, but I should like to make clear that our union is a non-party political union. We have no party political affiliations and therefore any comment I make about governments I make not in a party political sense. We find all governments difficult to deal with. It just happens to be that there is only one government at a time and we particularly dislike dealing with this government.

But I have been asked to give a positive union response on technological change. I do not believe that there could be an 'era when dealing with technological change could pose greater difficulties, because the greatest single problem facing the country at present is undoubtedly the scourge of unemployment. The greatest fear facing individual workers is that it may be their turn next to join the misery of the dole queue, with all that that means for their own self-respect and the financial position of themselves and their family. Against that background I find it particularly difficult to articulate with any degree of enthusiasm a

positive union attitude embracing new technology. At worst, new technology could massively increase the level of unemployment, and at best it will require an extensive programme of training and re-training, coupled with changes in employment practices. This will require a positive planned programme of change, if we are to benefit from new technology.

It cannot be denied that this country will face massive unemployment if the growth of our economy does not keep pace with the increase in productivity made possible by the microchip. If the introduction of microelectronics coincides with falling of stagnant output, some of the more alarming predictions about the levels of unemployment could come true. We believe that the current recession is made worse by the deflationary policies of the present government, and that is the worst possible background for the introduction and adoption in this country of new technology.

On the other hand, trade unions recognise that things cannot stand still. Whether we modernise or not, it is clear that our international competitors will modernise, and if we fail to match their productivity, our ability to compete for exports will be further reduced and eroded, and increased unemployment will inevitably follow. The issue facing trade unionists, therefore, as far as I assess it, is one that we have started to tackle over the past few years: how to embrace new technology and at the same time protect jobs, protect earnings, protect the working environment, improve job satisfaction and ensure that all workers share in the benefits which will flow from the increased productivity.

In other words, the problem as I see it, is how do we avoid the apparent conflict between those who, because of their professional or managerial skills and the nature of the work they are involved in, continue in full employment, and therefore benefit both from job satisfaction and improved earnings, and those workers (possibly the majority of workers) who face unemployment or reduced earnings and therefore suffer from reduced status as their jobs, whether they be manual, clerical or technical, are replaced by technological advance?

We are clear that our objectives — the objectives of those representing workers — cannot be met simply by leaving the necessary changes to come about through the pressure of market forces. Planning for these changes, I profoundly believe, requires government, unions and employers to work together continually, to move forward on an agreed basis. All four parties need to continually monitor the technological changes and establish flexible and responsive training arrangements to ensure the availability of the necessary skilled manpower. These arrangements should be backed up with manpower and public spending policies which will stimulate the economy and provide both new jobs and improved public services. Therefore, what I am saying is that if progress is to be made by agreement, workers want to be sure that by embracing technological change they are not buying a pig in a poke. Certainly for those of us who represent those workers we will want to be sure that the mechanisms are there to ensure that re-training is available, before we will recommend that jobs are given up, that old skills are shelved and that new techniques are adopted that will permit increased productivity and fewer staff to be employed. We will want to be sure that alternative work is planned through improved services whether it is by the public or private sector, and that the benefits of the new techniques will fall into the economy generally and not just to a selected few who can benefit from the new working environment.

I believe that it is important that any trade union speaker makes that statement and that position clear in any discussion about a positive response to embrace new technology. It is important that we emphasise that the current policies of leaving change to be developed through market forces is militating against trade union acceptance, or trade union participation in the change that we believe must come if, as a country, our economy is to prosper. Much as we want to co-operate and participate, it is important that the background and our position are understood against the current economic background.

Having made that non-party political statement, what I should like to go on to do is to discuss

some of the important areas where the trade union movement believes that specific action is required, if we are to make progress in adopting new technologies and co-operating in the change that there needs to be. The theory that I want to deal with is, firstly, the importance of technology agreements as the trade unions see them. Secondly, the role of the public sector in the new environment, and thirdly the education and training dimension that we believe is necessary in any package that we would find acceptable nationally, when it comes to embracing new technology with enthusiasm.

The cornerstone of trade union acceptance of new technology is the concept of technology agreements pursued through the collective bargaining machinery in the industries and companies concerned. An important step forward in that respect was the TUC booklet *Employment and Technology* which was approved by Congress in 1979. In some respects that booklet formalised what was already happening in better companies and in better industries, but nevertheless it was an important declaration of the view of organised labour in this country. In that booklet we set out a checklist for negotiators. I should like to comment briefly on several of the important points in that checklist, because I believe that it is important that I emphasise where I believe the trade union movement stands on these issues.

The first item of interest in the new technology agreements is the requirement that there should be an agreed introduction of change embracing new technology. It is clearly desirable from everyone's point of view that there should be a smooth and efficient transition to new technology, and this we believe is best achieved on the basis of negotiated agreements. It is one of the principal aims of unions that new technology should be introduced after agreement has been reached. It is important also from the union viewpoint that negotiations to achieve a new technology agreement take place at an early stage, so that the trade union can make an effective input on their members' behalf to the end product of any new system.

This requirement to make progress only by agreement obviously raises difficulties for management with regard to the dearly held view of management of management prerogative. Indeed, in our experiences since 1979 this has proved a difficult hurdle to overcome.

What I want to say to the management side in that respect is that managements must understand that progress in achieving change can be achieved only if there is leadership from both management and from the unions. In many cases an end product of a new technology discussion will be an agreement that will not meet all the requirements of the trade union side. The trade union side will require to provide leadership to their members in seeing that progress to change is being achieved. They will on occasions see that jobs are lost; they will also see that skills that their members have acquired over many years are abandoned; they will also see a requirement for new skills to be acquired; and they will perhaps even see a need for staff to be transferred and for their families to be uprooted. Seeing that these changes are accepted by the membership of the unions who have reached agreement will test the trade union leadership, and I believe that in going into new technology agreement bargaining, the trade union leadership is saying that they are prepared to see that leadership tested.

Similarly, I believe there is a requirement, if we are to achieve change agreeably, for board-level management to demonstrate their good will and commitment to change by agreement. They can do that by being prepared to embrace the concept of new technology agreements and of proceeding by agreement. Some companies have already seen the value of this approach. For example, the undertaking to proceed only by agreement and to negotiate well in advance is spelt out in an agreement with Lucas Aerospace. The first three procedural points of that agreement which the unions have with Lucas provide that the company undertakes not to introduce any machinery, equipment or working methods without mutual agreement with the unions on all aspects. On all matters relating to the plans for design and installation, the type, purchase and siting of new machinery or equipment, and any work matters arising from these, are all to be the subject of mutual agreement with the unions

prior to implementation. Failing such agreement, negotiations for new technology will be subject to a status-quo provision.

I am not claiming that there are vast numbers of agreements where these sort of provisions apply. But I am saying that there is a test on both management and the unions in this new field to make progress by agreement. It will require leadership from both sides. I believe that the trade union movement, through the acceptance of the TUC policy, has declared itself prepared to give that leadership. I have not seen in any large measure that sort of leadership from management.

The second aspect of new technology agreements that we find important is the provision of arrangements to monitor the development of new technology. This requires the establishment of joint machinery which is capable of monitoring the outcome of negotiations and reviewing progress of achievement against the stated objectives. From a union point of view, such machinery is important to ensure that progress is maintained on the agreed basis, and that any subsequent change is subject to negotiation. From a management point of view I should have thought that the provision of monitoring machinery was important to ensure the principles of the agreement are operated in practice by the union membership.

The third area that we find important is the provision of information. This is an area where the union movement over the years has felt that the denial of information has created great difficulties for us in adequately representing our members. Therefore, we judge that a key element in new technology agreements should be the requirement for trade unions to receive sufficient information at an early enough time to ensure that bargaining takes place on a reasonably equal footing. In order to be useful, such information must have content that is relevant, it must be given in an understandable form, and it must be received at the right time. This, in my view, is a key element in making joint progress in the introduction of new technology systems.

If a joint approach is to work, there must in my view be a new openness between trade unions and management, so that detailed management plans are given at a very early stage with sufficient detailed information to allow sensible discussions to take place.

The most important issue in this field is, perhaps, that technical experts must be prepared to discuss with the unions the details of what is being proposed, and to discuss it with them in a meaningful sense, in a sense which union representatives can be expected to understand. I believe that if we are to have a joint approach in this area it is important that the technicians, as well as the personnel management staff, are aware of and participate in the joint discussions.

From the trade union side, it seems there must be a much greater effort to ensure that we are equipped to deal with the type of detailed discussions that will take place. There is normally within trade union membership a great deal of collective intelligence about the industry. That collective intelligence has to be harnessed by the trade union movement through greater involvement of shopfloor representatives, and by trade union training and education designed to make use of this specialist expertise which we have available to us through our membership.

I think also that if we are to have meaningful discussions, there has to be provision of time for trade union representatives to consult with their membership and to be trained, and there has to be a provision to ensure that expert advice can be obtained. I believe that it is important that in new technology agreements there is provision that information will be available, and available in a timely manner.

The fourth point that I want to make about new technology agreements is the protection of jobs. Obviously there will be concern over the implications for jobs in any discussion on a

new technology agreement. If new technology is not to decimate employment opportunities, it is clearly insufficient for individual agreements simply to contain a compulsory no-redundancy clause. This however may well be the finishing point for many local collective agreements since it could be argued that it is beyond the competence of local bargaining to comprehend the entire economic framework of overall job loss. I think, however, that it is important to emphasise what is said in the TUC policy statement on employment and technology in this regard. That statement urges negotiators to go beyond simply achieving no-redundancy pledges. It said: "Negotiators should adopt as their aim that new technology is implemented in the context of seeking greater output through the expansion within existing product ranges or through diversification. Unions must also play a full part in the pursuit and analysis of new or alternative products and markets. This point is equally applicable to the public sector where new technology should be geared to the provision of better quality services and benefits rather than a reduction in employment levels. Wherever possible an essential condition for the smooth introduction of new technology is to guarantee full job security for the existing work force. Workers need to be given confidence that changes which are introduced are not implemented to have the effect of destroying jobs without at the same time creating new opportunities. Otherwise they will naturally oppose such changes. This is the challenge to governments and to managements in the negotiations in the new technology agreement. They need to win union and worker co-operation and agreement if they are to secure their own objectives. This will only be done in the context of jobs being secured both in the short-term in relation to the workers directly concerned and generally for the work force."

This aspect seems to me to be crucial if we are to harness new technology in a helpful way. I should like to develop that argument and take as an example of new technology an area within the Civil Service with which I am familiar.

The social security system in this country is administered from 600 local offices throughout the country and the scope for the use of new technology to provide an electronic information retrieval system seems to me to be immense. If it is taken throughout the whole of the local office structure with some 90,000 staff employed, the possibility of massive manpower savings must be considerable, because, in the main the local office filing systems and retrieval systems are all manual and deal with large numbers of units of work.

On the other hand, when looking at a project to provide an electronic information retrieval system within local offices, I believe one has to take into account that the DHSS services to the public leave much to be desired. For example, the provision of information to those who have an entitlement to benefit to make sure that they have knowledge about their entitlement is not at all common. The provision of extra resources in this field alone could considerably improve the services we give to the public. So the question is, should the development of new technology in this area have as its aim to cut manpower or to provide better services? At the very minimum, there is clearly a trade union viewpoint on this matter, and it seems to me provision has to be made in any negotiations on an agreement for that sort of system for the trade union viewpoint to be expressed at an early enough stage for an investment appraisal decision to be made on what is the objective of the new system. In that sort of system it is important that the unions are involved at the initial stage of the system being thought of. The unions should be provided with investment appraisal information which enables them to quantify the social implications of giving a better service to the retired, to the sick and to the unemployed, and enables them to compare these implications with the straightforward manpower savings which will flow from simply using a new system to reduce manpower costs.

My range of experience is not extensive in the private sector, and it may be that some of you will say that these sorts of questions will not arise. But it seems to me that similar arguments can be made about decisions in industry. Should technological change be to achieve manpower savings or to use the same workforce to produce more and to sell more? These,

I believe, are not just decisions for management: they materially affect the workforce, who are entitled to express a view through their trade union representatives. That can be provided only if there is negotiation at the proper stage with the provision of proper information.

It is against that background that I say that it is a legitimate objective of the trade union movement in these negotiations to argue the case for the alternative view of retaining jobs, or expanding jobs, rather than cutting jobs and reducing costs.

The fifth point I want to make about new technology agreements is the difficult problem of sharing the benefits that flow from new technology. New technology offers enterprises the opportunity of various benefits, not least of which can be financial savings through increased productivity and overall efficiency. A number of new technology agreements acknowledge that the contribution of employees to these savings entitles them to share in the benefits gained. A number of agreements exist on that basis, and the benefits need not take the form of direct productivity bargaining. They may focus on the equally important considerations of a shorter working week, or a shorter working day or a shorter working life, so that employees benefit in a way which provides for the maintenance of employment, rather than simply productivity bargaining.

I have highlighted these five areas because, in my view, they are important in new technology agreement bargaining. There are many other areas, which I have not mentioned, but which deal with some important requirements such as the arrangements for training and retraining, the arrangements for redeployment, the job content of new jobs, the job satisfaction from new jobs, health and safety considerations, and many other problems. I believe, however, that the programme the trade union movement has set out is not impossible to achieve, given that there is a will on the side of management and government for progress to be made.

My experience so far at national level is not one that fills me with hope. The response from government and management at national level has been disappointing. A draft agreement between the TUC and the CBI on the text of a proposed joint statement on a framework for technological adaptation has been rejected by the CBI member companies, although ironically many of these same companies have reached agreements with their own workforce. I can only regret that a national agreement has not been endorsed because I believe it would have given an impetus in new areas for negotiations to have progressed.

At national government level I have more experience. There was a trade union initiative to negotiate a technology agreement covering the whole of the Civil Service. These negotiations have failed after almost two years of discussions, and they have failed because of the government's failure, in my view, to face up to some of the crucial issues which I have already described. They have refused to budge on the issue of management prerogative. They have refused to give satisfactory assurances about the protection of jobs, even to the extent of not being prepared to give a no-compulsory redundancy pledge for the Civil Service. They have rejected the concept of staff sharing in the benefits flowing from technology, somewhat ironically on the grounds that the pay agreement from which they were withdrawing did not make provision for productivity bargaining. This seems to me to be a great pity. The CBI opposition can be overcome, I think, if company-level agreements are reached, but it would have been so much better in my view for there to have been a national lead.

At government level the position is very bleak indeed. The scope for new technology in the Civil Service is immense. The staff in government departments are unionised to the extent of some 90 per cent, and unless there is a change of heart by government, major new projects like the computerisation of the Inland Revenue PAYE system, like the DHSS Camelot system which is to computerise some aspects of local office work, and many other projects will be fiercely resisted. Not only would this resistance have an adverse effect on the provision

and the cost of public service, it would also, more importantly, adversely affect the suppliers of new technology in this country, who are looking to the Civil Service and the public service generally as being an important market.

I now want to turn to the role of the public sector in the development of new technology. I believe that it has an important role to play in the whole basket of considerations which should be there if we are to make progress on an agreed basis.

There are two aspects which I should like to deal with. First, the role of public purchasing and, secondly, the need to expand employment in the services sector of industry to create the new jobs that will be necessary to deal with unemployment.

First, the question of public purchasing. It is calculated that at present the public sector accounts for about 40 per cent of the total UK market for information technology products and services. The scope, therefore, for public sector purchasing to be used as the basis for providing markets for British manufacturing is considerable, but in my view so far it has not been sufficiently exploited. The ICL preference arrangement for central government purchasing was a gesture in the direction of support for British manufacturers, but was extremely limited and, of course, was withdrawn because of the EEC directive on this issue and because of the GATT regulations. I am sure, however, that this can be re-established in a fuller form covering the entire public sector area, given a little imagination and initiative on the part of government.

It is my view that despite the EEC directives and the GATT restrictions, the French, the Japanese, and the Americans have all found ways of using public purchasing to assist their own manufacturers, and thus have established their own manufacturing base. I see no reason why we in this country, if we are going to embrace new technology, should not use the public sector as a means of providing a market for British manufacturers, thus ensuring that jobs that are lost by users in implementing new technology are gained through our having a manufacturing base in this country.

Similarly, it seems to me that the opportunity for the public sector to be used as a shop-window has not been sufficiently exploited. There has been some work in this field by the Department of Industry recently, but I do not believe that sufficient work has been done to provide the shop-window type arrangement which could present manufacturers with the opportunity of demonstrating new systems on an operational basis. Also, I regret that in using the Civil Service as a shop-window, the failure of government to reach agreement with us on a technology agreement makes that provision even more difficult to implement.

It seems to me therefore that the role of the public sector could and should be important in the development of new technology in the UK. This opportunity should be available given proper government initiatives and given a willingness in government to look at new technology agreements in the Civil Service and in other areas of the public sector. Such agreements should be based not on the narrow basis of the public sector's role as an employer, but on the much broader basis of the role that the public sector can play in providing a ready market and a shop window for British manufactured goods.

The second point that I want to make about the public sector is the need to expand employment in the services sector of the economy. In my view, the government should give a clear commitment to an expansion of the public services, because if we are going to have a package that will be acceptable to the trade union movement, and if we are going to have a contraction in the manufacturing base through the development of new techniques, there need to be alternative jobs to replace the jobs that are lost.

I do not believe that these jobs will be found in the manufacturing area. All our competitors will be competing, with new technology and with new practices, and therefore I do not

believe that the scope for vast new markets is great. Therefore, if we are to provide jobs for the increasing workforce to replace those that are lost, I believe that these jobs can be provided only in the services area of the economy and largely in the public sector area:

It seems to me that it is a major fallacy to regard expenditure on public services as being detrimental to the future growth of the economy. Indeed, I would argue that the reverse is the case. Cuts in public expenditure are damaging not only to the provision of employment in the public services, but also, through reduced demand and purchases, to jobs in the private sector, and also to the overall level of activity in employment in the whole economy. All the available evidence strongly confirms the view that expansion of public services is an essential component of a balanced growth path for modern industrial economies.

A study by the OECD recently has shown that, in terms of the proportion of the GDP allocated to public welfare expenditure, in the mid-1970s the UK was 13th in the list of 18 OECD countries. Economies with significantly faster growth rates, including Germany, France and Belgium, are much closer to the top of that list. That was in the mid-1970s. Since then we have had further contraction in the public services in this country, and I believe that is detrimental to the introduction and provision of new technology, because if jobs are to be created, if mass unemployment is not to follow, then it is important that the service area is expanded.

The last point that I want to deal with is the education and training requirements. I want to deal with it in two respects. It seems to me that the first role of education and training is to deal with the shortage of skilled computer manpower and to see that those shortages are made good. This is necessary so that progress in the implementation of new technology is not delayed because of a lack of skilled resources. The second role is to ensure that those whose skills are lost because of new technology have the necessary opportunities for retraining. I do not believe that either of these needs is currently being met.

I first became involved in the NEDO manpower committee in the mid-1970s at a time when our problem in the Civil Service was a shortage of programmers and a loss of trained staff to other industries. I was surprised when I first became involved with the NEDO working party that there should be questions raised as to whether or not there indeed was a shortage of skilled computer manpower in the country. We spent the next three years or so on that committee establishing that there was in fact a shortage. We were able to evaluate from a study that the shortfall of electronic engineers up to the mid-1980s amounted to something like 6,000 and that the shortfall of programmers and systems analysts amounted to some 25,000.

We spent a long time establishing that there was indeed a shortage. But we had great difficulty in convincing the educationalists and the Manpower Services Commission, and we had to go about establishing that there was indeed a shortfall. Having established that, what could we do about it? It seems to me that the problem starts in the schools. In my view, there should be three priority areas in the schools.

There needs to be the provision of hands-on computing experience for the vast majority of schoolchildren. There needs to be a programme of educating the educators, and there need to be curriculum changes. I want to deal simply with this prospect of hands-on experience, because one of the points that I believe is important in relation to the shortage of skilled programming and systems manpower is that we have pitched our qualifications too high for those whom we recruit as programmers. One of the early tasks that we undertook was to try to discover how we could break through all the mysteries of government in relation to influencing programmes in school curricula. I can assure you that it was a very difficult task, because we found government departments shuffling us around, one to the other, when it came to trying to get someone to influence this concept of having computer skills on the programme for schools.

One of the first interviews we had in order to try to break through this problem was with one of the council members of school teachers who advised on careers. We called this member of the council to meet the NEDO manpower committee, and we discussed with him the importance of ensuring that schoolchildren had knowledge of computer hardware and computer careers when they left school. His response was to say that of course there were all sorts of pressures on schools to influence children in certain directions. Indeed, only within the past few weeks he had dealt with the Guild of Silversmiths who were concerned to influence children into a career in that area, and he saw no new dimensions in the discussions that we were having with him.

It seems to me that it is important, if we are to get the youngsters into computing, that we have in schools computers that are not only available to those who are pursuing computer science courses, but also available for the average school youngster to gain experience of dealing with computer terminals and computer hardware.

I think that the success of the Threshold scheme run by the NCC, and of the TOPS training scheme in training programmers indicates that perhaps we have pitched too high the educational qualifications. Perhaps we have been setting aptitude tests too high. It seems to me that we have to overcome the mystique of ADP. If we can do that, I believe that we can attract into the programming area people who perhaps are currently without work.

I believe that computers in schools are an important objective, not just in relation to those who are going on to higher education, but to those who are leaving at 16 and taking CSEs. I think that perhaps we should be saying to recruiters that when it comes to recruiting for ADP they should lower their requirements of educational attainment in order to fill these vacancies.

The second problem of education or training is the question of re-training and advanced training. It seems to me that in this respect the current initiatives of government are heading in the wrong direction. If we are to deal with the re-training that is necessary, and if we are to ensure that we have the advanced expertise, then it is important that we have the provision of courses both from employers and from the state sector. It seems to me that there are many gaps in the role of the industrial training boards in that respect.

For instance, in computer training the Engineering Industries Training Board arrangement provides for the levy exemption scheme to operate only in the engineering industry, whereas in many cases the training requirements for ADP specialists come not only from the manufacturing area but also from the users, from the software industry and from the computer services companies. These organisations are not involved in the EITB arrangements. They make whatever arrangements they can in-house, or make use of the public sector. What is clear is that they are not within the scope of the EITB and the recommendation that we have made from NEDO to the government is that there is a need for a computer industry training board to replace the role of the EITB in this respect.

That industry training board should be financed by government and by levy and by levy exemptions from the companies concerned. In this way, everyone can make a contribution to the necessary training that will be required to meet the need for specialists, and also to deal with the re-training programme that we will have on hand.

In conclusion, I believe that training and re-training are key ingredients in the planning for change. It is important that the state sector and the company sector meet together and finance the necessary training in order to ensure that we have the necessary skills to meet the upsurge in the economy that we all hope will happen.

Finally, let me return to my starting point. The trade union movement's embracing of new technology is vitally important if we are to achieve the dynamism in the economy that is

necessary in order to provide the employment for the people of this country. I do not believe that can be achieved simply by leaving it to the pressure of market forces. It requires a unity of purpose from government, from industry and from the unions. That can come about only through planning and co-operation. I hope that is the way ahead that we shall find from government and from industry.

SESSION I

USER FRIENDLY SYSTEMS

Tom Stewart,
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Tom Stewart is a senior consultant with Butler Cox & Partners, specialising in the human aspects of information technology.

He holds two BSc degrees from the University of Glasgow; one in Mathematics and Natural Philosophy, the other in Psychology. On graduation in 1970 he worked with the Human Sciences and Advanced Technology Research Group at the University of Technology, Loughborough where he became a Research Fellow and later a lecturer in Ergonomics. His lecturing, at both undergraduate and post graduate levels, included ergonomics and psychology.

He led a number of research projects on office communications, information retrieval and the ergonomics of VDUs. He also participated in studies on the impact of computer information systems on managers, professionals and clerks in various industries. Many of these research and consultancy assignments involved extensive international collaboration with researchers in Sweden, Germany, France and Denmark.

He joined Butler Cox & Partners at the beginning of 1979 and has carried out consultancy assignments and seminars in Europe, North America and Australia. He is Honorary General Treasurer of the Ergonomics Society and a member of Council. A well-known author and public speaker, his publications include Visual Display Terminals (of which he was co-author) — the recently produced book which nas become the worldwide standard handbook on terminals and operator-health. In 1980 he was awarded the Leon Gaster medal by the Chartered Institute of Building Services for his paper on 'Problems caused by the continuous use of VDUs'.

I believe that every personnel issue that has been raised so far is extremely important, but my own personal view is that there is one further issue which will dominate the 1980s. That issue is user friendliness.

The term 'user friendly' is very widely used, frequently over-used, but it conjures up an image of a system or a piece of equipment which is easy to learn, easy to use, useful, and probably pleasant, rewarding, or satisfying in some way to operate. A good example is the videotex systems developed round the world. In Britain we have Prestel, and in France there is Télétel. These videotex, or viewdata systems as they are sometimes called, are specifically designed to be user friendly.

Certainly the hardware they use is familiar to us all — the colour television and a calculator-like keypad similar to those shown on the slide. They are easy to learn to use, and no complex manuals or training are required. They are easy to use for simple information retrieval. You select an item from a numbered menu by pressing a simple, numbered key. They are fairly pleasant to use. Some people even say that they are fun.

But perhaps this user friendliness has been achieved at the expense of real usefulness. Those of you have have tried to use Prestel will find that if you are trying to retrieve information which has not been organised in quite the way that you would like by the information provider, it becomes extremely difficult to search the trees and locate the pearls of wisdom that you are trying to find. Nonetheless, I think that it is fair to say that videotex systems have set new standards of user friendliness in the computer world, particularly if you consider that their ancestors are the on-line computer information retrieval systems that appear to require a degree in hieroglyphics in order to operate them successfully.

But the term 'user friendly', in addition to frequently being overused, is frequently abused. In some circumstances, what it really means is that the product is unnecessarily complex, in that it has lots of extra features and goodies which are unnecessary. The only thing those features add to the product is cost; they make it too expensive.

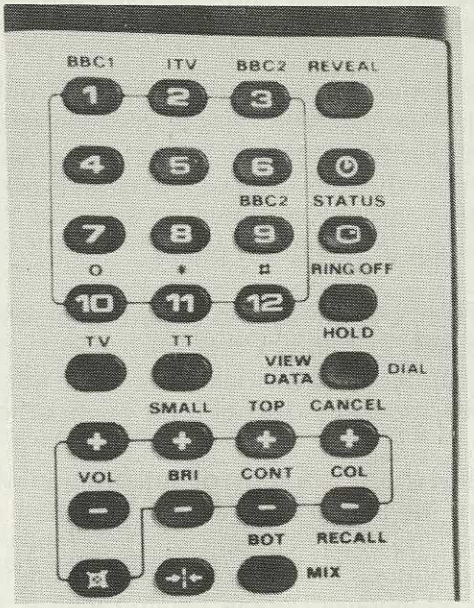
A good example is the adjustable visual display unit desks which are proliferating on the market today (and I show an example on the slide). These adjust to suit the operator. One might even say that they over-adjust, because every conceivable surface and facility has its own adjustment and moves in every conceivable direction. This kind of workplace, the manufacturer believes, is perfection.

My view is that some of these workplaces are more suitable for adjusting than for performing real work. That is a compliment, because some of them are not even good for adjusting. Quite frankly, in this environment over-adjustability is a gimmick, and 'user friendly' is frequently a gimmick.

The example that springs to mind is the cash register or till that, instead of having a little light that stays on to tell you that it is working, says "Hello" in its display. That fools nobody. It is a cash register. It takes money. It is not really saying "Hello". All that the "Hello" is saying is that the power is switched on. That is a gimmick and it is very irritating after a short period of time.

It betrays a design philosophy which is rather interesting. There has been no intention or no attempt to incorporate the user into the design. What has happened is that something has been added on afterwards to make it more palatable. It is a means of tricking ordinary people into thinking that the machine is rather nicer than perhaps it is. So if you ask the question, "What does user friendly mean?" I am afraid that the answer frequently is "Not a lot". Even the Prestel example that I gave earlier is not consistent in its user friendliness.

If we look at the particular Prestel keypad shown on the next slide, we find that the key in the middle on the right has its meaning pretty effectively obscured by the labels that surround it. Above the key is the label HOLD; below the key is the label CANCEL; on the left it says VIEWDATA and on the right it says DIAL. Which of those labels refers to that key? It is not easy to decide, because labels have been placed above the keys at the top of the keypad, at the bottom of the keys elsewhere, and at the side in other places. The keypad is totally inconsistent in its use of labelling. Arguably, that key is the most important key on the keypad, because it is the one that connects you to the viewdata computer. So even in a system where there has been considerable effort to achieve user friendliness, we are not always all that successful.



Let me recap. When it is used properly the term 'user friendly' means that the system is easy to learn, easy to use, useful, and in some way satisfying to use. Used improperly, or abused, the term is frequently a cover-up for the system being at best complex, expensive and gimmicky; at worst, it does not mean very much at all.

Regrettably I believe that our suppliers are rather better at putting 'user friendly' into their advertising copy and into their brochures than into their products. Clearly, the term 'user friendly' as I have used it so far means rather more than just friendly and pleasant.

I prefer to use the term 'usability' for this concept, because it is essentially a cost benefit judgment that the individual makes. He is prepared to take into account the benefit that he gets from the equipment when he is evaluating the cost of operating that system. It is not an absolute by any means.

User friendly systems

$$\text{Usability} = \frac{\text{Benefits}}{\text{Costs}}$$

Benefits	Costs
Accuracy	(Money)
Speed	Effort
Satisfaction	Risk

The kind of benefits involved often include being able to perform the task at all. Many people routinely use computer systems today to perform tasks which were quite impossible only a few years ago. There is a tremendous benefit from that kind of system in the field of design, in the field of planning, and even in the field of management.

Secondly, the benefit may come not so much from being able to do something new but being able to do it better. Thus one's capability may be extended by the system or the equipment — extended perhaps in terms of greater accuracy or in terms of greater speed. Collectively, these can be combined into greater productivity of the form that Paul Mali spoke about this morning.

But I believe that there is another category of benefit which we often overlook. That benefit is the satisfaction that one can achieve from using a tool to do a job better. Contrary to press

opinion, I believe that the working man is often very pleased to take a pride in his work. A great source of frustration is when the tools do not do the job. Many people get great satisfaction from knowing that they can now do a better job with a computer tool (or whatever) than they could previously.

Sometimes the satisfaction comes from learning a new skill, whether that skill is computing or the manipulative skills involved in operating a terminal. Sometimes the satisfaction comes from greater understanding of our environment. It is a quirk of human nature that we spend our time trying to understand what is going on around us, and computers can often help us to do that rather better even if we do not necessarily have the opportunity to use that understanding to any great effect.

Some of the interest in expert systems and decision support systems comes from people who, although they know more about what is going on, still cannot do any more about it, and cannot necessarily make any more effective decisions. But they get a satisfaction out of a better understanding of their environment.

Finally, there is a form of satisfaction which we get from dealing with people — the kind of warm feeling you get after a pleasant and successful interaction. We sometimes get the same kind of satisfaction with machines as well. I have noticed several of us fiddling with the simultaneous translation devices. The handle is actually quite a pleasant shape, and I have noticed several people fiddling with it, perhaps unnecessarily, because you get a certain degree of satisfaction and pleasure from using a tool that is fairly well designed and performs its function reasonably well. So these are the kinds of benefits that we might get from using a piece of equipment.

What sort of costs go into the usability equation? I am talking about cost here primarily in the personal sense — what it costs the individual in terms of effort to use the equipment. So the financial side may not be relevant. I know only too well that the people who use the equipment are frequently not the people who buy it, so the money cost might be totally irrelevant to them. Clearly, it is very relevant to the people who provide the equipment. As managers, I am sure that we are all concerned with keeping down the costs, particularly in the office, where they appear to be soaring out of control. But to the individual using the equipment the money cost may not be significant. What is significant is his personal cost in terms of effort.

In terms of mental effort, we are talking about a rather complex judgment that the individual makes. When we judge how much effort it takes to do something, a whole lot of factors go into that judgment, such as our own motivation, our experience, the previous situation, and the environment. I am sure that we are all familiar with actually taking a longer route in driving somewhere, simply because it is less mental effort because there are fewer junctions or fewer decision points. That perception of mental effort is a highly personal thing.

In the usability equation there may also be physical effort, energy expended, or the physical stress of an unwelcome or hostile physical environment. But the personal cost includes another component. I call that component 'risk' — the risk of failure, particularly making errors, and particularly when these errors are public. An amazing number of systems make a bleep or a funny noise when you make an error. In many circumstances that is quite good feedback. But when you are in a room full of colleagues and the machine is going, "Bleep, bleep, bleep!" it does rather inhibit you from exploring facilities that you are not absolutely certain about. There is a tremendous incentive to stick to what you know and not really try to get the best out of the technology.

But the risk of failure may not be just in terms of error, it may also be in terms of breakdown, risk of damaging the system, and a quite genuine fear that you are going to blow up the computer or destroy the stock records. This again is quite a major inhibition on many people.

I heard of an example recently of a vdu operator whose terminal was not turned up brightly enough, and when the person looking at it said to her, "Why don't you turn up the brightness to make it more legible?" she said, "My husband doesn't let me touch the television at home so I assumed that it was the same here." These risks can be very real.

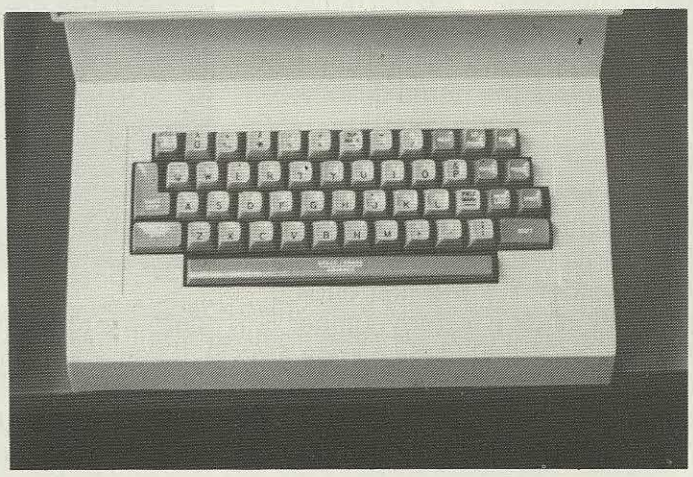
There is also the very widely publicised risk of health damage. "Vdus make you go blind; they destroy your back; they make your face rot." These are all genuine claims — I am not making them up. There is a lot of very real concern and fear that new technology is dangerous or, if it is not dangerous to your health, it is certainly dangerous to your comfort. Very many people using computer equipment do indeed suffer undue aches and pains and fatigue from badly-designed equipment and perceive that as a very real risk.

Finally, there is a considerable amount of anxiety surrounding computerisation. The talks that we have heard earlier, from the trade union point of view and others, have stressed how many people see the future as extremely uncertain. Will new technology remove their job? Will it demand skills which they do not possess? Will they become redundant in the long term if they cannot keep up with the rate of change? These anxieties can be very real to the people who hold them.

So I have said that usability is the term I prefer to use. Usability is a cost benefit judgment that the individual makes, where he weighs up the benefits in terms of accuracy, speed and satisfaction, against the personal costs, perhaps money, certainly effort and certainly risk. Out of that equation he comes up with some figure of usability which determines how successfully he will use that piece of equipment and how he personally will respond to it.

If we are interested in usability, it is clear that we can do at least two things. We can aim to improve the benefits — the accuracy, speed, or satisfaction; or we can aim to reduce the costs — effort, risk or money. There is a third choice, which is that we can do both. In the next part of my talk I should like to outline some of these approaches and give an example of the kind of action that will result.

If we first consider increasing the benefits by increasing accuracy in the task, this is an area where traditional ergonomics, or human factors as it tends to be called in the United States and in British Telecom, has a very large role to play. There are many standard techniques and procedures in ergonomics which can be applied to equipment to improve its accuracy.



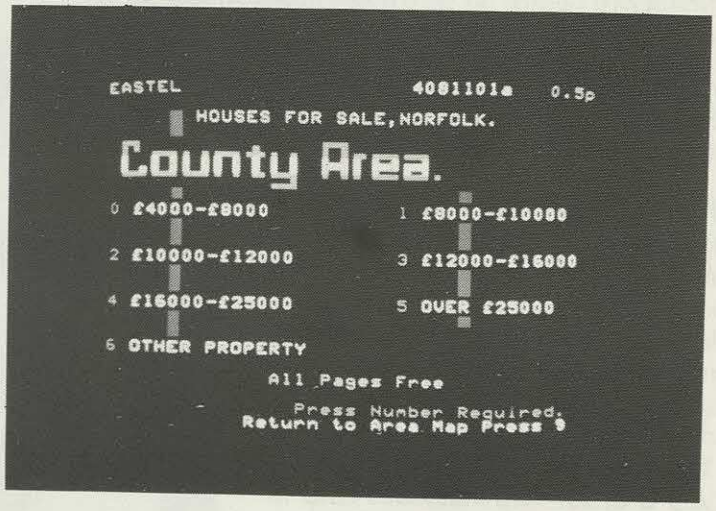
For example, suppose we have a keyboard on a computer terminal and we need to provide a means of inputting numbers. In the particular case shown on the slide the numbers are provided on the upper shift of some keys just to the right of centre on that keyboard. You cannot read them from where you are, for two reasons. One is that the slide is a little small compared with a keyboard sitting on your lap. The other reason is another good, healthy, ergonomics problem — the reflection in the top of the keys. But I am sure that you will take my word for it that, in the middle of that keyboard to the right, there are numeric keys on the upper shift of the alphabetics. What happens in this situation is that people forget to change shift, and the number of shift errors and the consequent error problem in the input can be quite considerable.

Frequently, it is worth providing a totally separate numeric keypad, as in the next slide on the far right of the keyboard. In this particular case the keypad is provided in addition to the numeric keys along the top of the letters, as in a typewriter. We can greatly increase the accuracy of keying performance in this way, by providing facilities that suit human skills better, rather than trying to make the task more difficult.

We can also improve the speed of performance by conforming to what is called 'population stereotypes'. These are expectations that we all have that a control will operate in a particular way. In the United Kingdom we expect a light switch to turn on the light when it goes down, and put off the light when it goes up. There are international differences in these expectations, but they are very consistent within a population and they are very strong. If in a computer system you go against that convention, either because you are using imported machinery or because you were not aware of it, then the delay involved in transforming the expectation can be quite significant.

I can give you an example which you might not expect, which is that if we are presenting a menu list of items to be chosen (for example, with Prestel as I mentioned earlier), most people will expect that list to start at 1 — not to start at zero. It is only computers that count from zero, people count from 1.

I can illustrate that on this slide, where not only have they failed to put the first point as number 1, but they have made it worse. The lines emphasise a vertical relationship between the numbers. In fact the menu choices are laid out horizontally. This kind of menu makes it very difficult for someone successfully to select the items quickly.



If you do it differently — this next slide comes from Prestel again — and number the items sequentially, then it makes a lot more sense. Item number 1 is the first choice. Your fifth choice is item number 5. It conforms to what we expect. Indeed, I would point out that on this layout, zero comes after 9. If you are using the telephone-type numeric keypad which has 1, 2, 3 at the top, then zero does indeed follow 9 at the bottom of the keypad. So again, by having a consistency between the keypad and the display, one can speed up the interaction quite considerably; and one can also reduce the number of errors.

Those are the kinds of things that we can do to improve performance. I will not go on, because there are endless ergonomics considerations that one can apply to equipment, and there are endless sources of such information. But one thing that we sometimes overlook is

the possibility of increasing the satisfaction of the individual in operating the equipment, and the possibility of increasing the benefit from making the interaction more pleasant and rewarding. There are several things that we can do here.

I mentioned skill development earlier, and we can encourage that. It is surprising how many organisations discourage people from learning more than their job requires. There is a kind of military 'need to know' attitude that gets carried through. What happens is that some people who do want to learn more find themselves learning despite the organisation. They learn ways of beating the system. They apply their not inconsiderable talent to finding a way round the security system, and to improving their job at the expense of validity or of somebody else's job. I believe that we can do a lot to encourage people to develop those skills themselves.

I am not saying that every clerical operator wants to become a programmer. I think you might find that some of them do, and could do it very well. But an amazing number of people do want to learn skills, and they get a lot of satisfaction from those improved skills. We can encourage this rather than fighting it, by providing the kind of information and back-up that you need to carry the skill through.

We can do the kind of work design improvements that were mentioned by Michael Redhouse. Enid Mumford, in Manchester, has published a considerable amount of work on improving the quality of jobs by designing them specifically, and by creating groups of people who work together. In this way, you can improve job satisfaction and, as a result, people are much more tolerant about imperfections in the equipment.

We can do something which you might find hard to believe — we can increase the 'friendliness' of the computer system. This is an interesting point. I find it hard to imagine a friendly computer in the true sense of the word. I realised that I was not very certain what we meant by 'friendly' so I turned to the psychological literature and identified seven qualities which we expect from a friend.

We expect a friend to be patient, tolerant, warm, polite, understanding, helpful and sincere. Can I really be talking about a computer system? These are not the terms that spring to my mind when I interact with computers. I should like to say yes, I am thinking about a computer system. I think I must be slightly more honest and say that what I really mean is that I do not think we need to make computers more friendly — we need to make them less unfriendly, less rude, less arrogant, and less boring. By going back over these attributes of a friend and giving you an example of computer behaviour under each of these headings, we might see some ways in which we could improve our computers by making them less unfriendly.

Let me start with patience. If you interact with the General Electric timesharing system, marketed in this country by GEISCO, and you find that you have not operated your keyboard for a fairly short period of time — like half a minute, or a minute and a half — the computer gives you a message. That message is: "You've been idle too long!" Idle? If you are like me, the last thing you have been is idle. You have been sweating blood trying to understand why the system has not worked yet again. You have been trying to work out what on earth that

message means. How can I possibly retrieve the data from this corrupted file? Idle is far from your mind. A computer that tells you that you have been idle is impatient in the extreme.

Computers are not even tolerant either. I am sure that we have all experienced systems where, if you enter the date and you type it in in some particular format, say 300681, it throws it back and it is not acceptable. You say, "Perhaps it's American," and you type in 063081, and it throws that back. So you think that you have probably forgotten the separators, and you type in 06/30/81, and it throws that back. So you go back to the British version and put in the separators and type in 30/06/81, and it accepts it, and you are delighted. Except, of course, that it has been perfectly obvious to any human right from the beginning what you were trying to communicate. It is only the intolerance of the computer system that makes it a problem.

Yet the software overhead from building flexibility into the date format need not be that great, because a simple routine can cover it. That routine can be used again and again in different systems. The number of errors, delays and frustrations that could be relieved in that way can be remarkably significant.

Can a computer be warm? I know that they generate heat, but are they really warm? What are the typical languages that a computer uses to speak to a user? I am not referring here to Cobol, Fortran, or APL, I am talking about the messages that appear on the screen — things like "Fatal error". Does that mean you have just killed somebody? Or "Terminated". Does that mean you have murdered them? Or, "Illegal entry". Is that a criminal offence? Is it any wonder that users are intimidated by computers that talk to them in that way? It might not be very important to you because you are too experienced and too knowledgeable to be fooled, but to the ordinary person coming up against a computer for the first time, it scares the hell out of them.

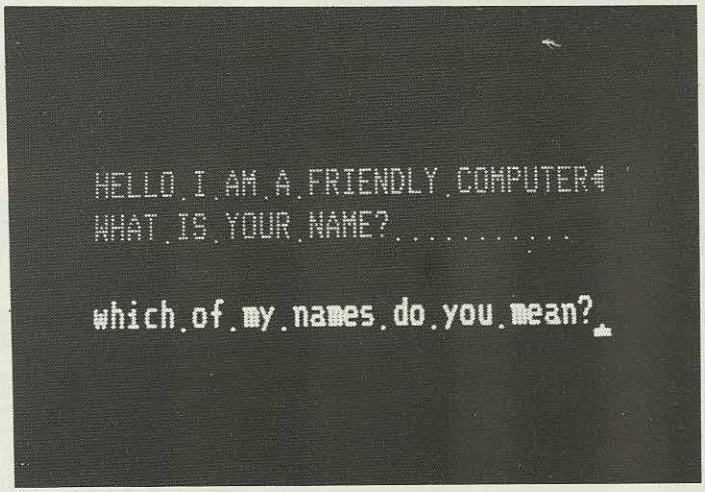
Not only that, but computers are not even polite. If you are a human and somebody says something that you do not understand, it is polite to say, "I'm sorry, I didn't understand you. Could you repeat it?" If you are a computer you say, "Error". The implication is that the human is wrong and the computer is right. If you read between the lines, what I think the computer is saying is: "You're a snivelling little worm. Get it right!" Again, that attitude permeates a lot of computer systems and terrifies people from exploring them, from learning, from exposing their ignorance in ways which really would be quite helpful.

What about understanding? The first meaning of understanding is that the computer should speak in a way that makes sense to you. I do not think that I need to give you many examples of that. We have recently bought a small Apple computer to do some analysis, and generally it is quite a user-friendly machine. But when you load the first floppy disc and it is waiting until that has been digested before it speaks back to you, it displays on the screen "Loading integer into language card". I presume that means something. It means nothing whatsoever to me. What it means to me is that it is a couple of seconds before you can do anything on the keyboard, and it might as well say, "I've gone for a cup of tea". I might understand it better if it did.

The other aspect of understanding that we demand from a friend is that he takes your point of view and sees it your way. I should like you to imagine a user with a remote computer terminal. In fact what you have probably imagined is somebody sitting at a desk with a terminal on the desk. The terminal is not remote to them, it is remote to the central computer — it could not be closer to the user. The whole language of computing is computer-oriented. Computer output is what the person takes in; computer input is what the person has to put out. It may not be a very significant difference in many cases, but it reflects a philosophy that it is the computer that is at the centre of the world, and people have to see it that way. That is not understanding in the way I believe it should be.

What about helpfulness? I have mentioned obscure computer mesages before. If you have ever sat at a terminal I am sure that you have had something like "#94*" thrown back at you. What it really means is that you have overloaded a buffer or you have forgotten to specify a file name correctly. I say that is what it really means, but in fact that is not true. What it really means is that you have probably forgotten to put a comma on a command line, but the computer has interpreted your error in that way and, as a result, the helpfulness of the message is minimal. It may even be downright distracting to the user and set him off in the wrong direction, trying to solve what appears to be a very complex problem when it is actually no more than a missed separator.

The final characteristic of a friend is sincerity. The thought of a sincere computer is a strange concept. I have already mentioned "Hello" and the till which smacks of insincerity. I think that there is lots of insincerity in computing.



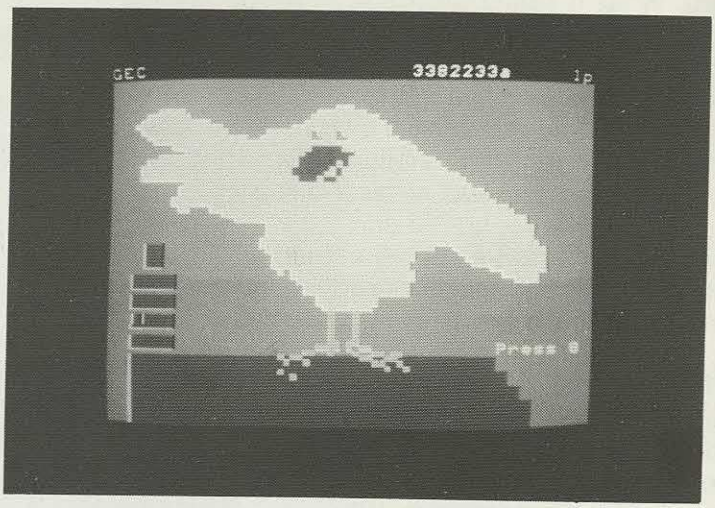
This example on the slide is actually fictional, but it is quite plausible. It is a computer that is trying to be friendly and says, "Hello, I am a friendly computer. What is your name?" Being a wise user you do not know whether it wants your user name because it is a security check, or if it is being nice to you and wants to know that you are called Tom. So you say, "Which of my names do you mean?" The clever computer comes back and says, "May I call you Which?" If you typed in a string of abuse at it, it would have said "May I call you ****?" It is very insincere. These things smack of the gimmicks that I mentioned earlier. I do not think that they fool people. If anything, they become extremely irritating because they are insincere.

These are all ways that we can make computers more friendly. There is another way that we can add to the benefits, not strictly in performance terms, although there are times when that would be justified, and that is that we can make the system more interesting. We can use colour and graphics far more than we do. We know from psychology experiments and from brain research that the use of colour and graphics or pictures is a tremendous aid to memory and perception. When you see a memory man on television memorising list after list, the system that he uses typically involves making very rich associations in his mind with absurd ideas, bright colours and crazy notions of people with things on their heads. Most of the systems involve tricks of that kind. By creating these very vivid images our brain remembers far better than if it was simply a piece of textual information.

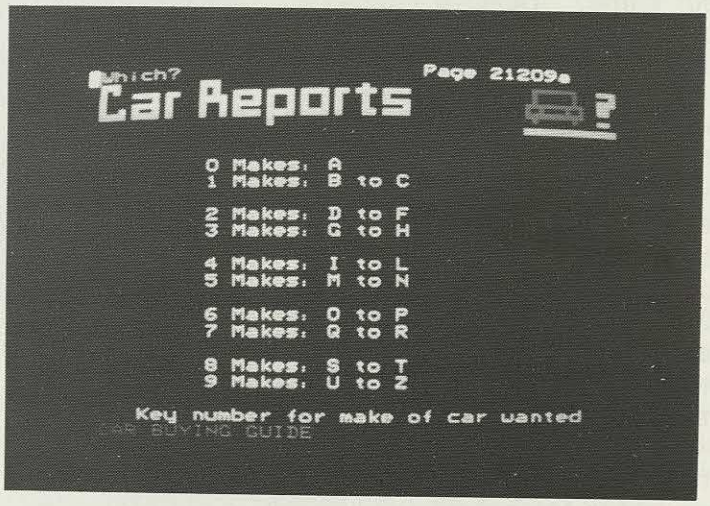
I am not suggesting that we fill our computer systems with pictures of Presby (shown on the next slide). For those of you who do not know, Presby is Buzby's brother; and for those of you who do not know Buzby, he is the corporate symbol of British Telecom. He is a little bird that keeps telephoning people, encouraging you to spend more money on your telephone bill. Presby does the same thing, only he encourages you to spend money on Prestel. I am not certain that this kind of fun is really appropriate in the sort of systems that we are talking about.

What I do think is appropriate is the use of things like the little symbol up at the top right of this Prestel page. It is a very effective but simple symbol telling you that you are in the Telewhich part of the database looking at the car guide. In commercial terms that sort of label

tag sticks. People remember it. They remember where they got the information from. The next time they are looking for car information they will remember that there was a little car up in the corner and they will be able to go to that information provider. The use of simple graphics and simple pictures and bright colours can greatly increase both the readability of such screens and their memorability, and also make them much more interesting to the individual. That kind of intrinsic reward built into the system is actually much more effective than external rewards.



If I may refer back to Michael Redhouse's comments earlier, the intangible compensation in a job is often far more significant to the individual in the long run than the tangible external bribery in which we need to indulge. In fact there have been some experiments which have proved what I am sure we have all suspected — that if you bribe someone to do something, it is not fun any more, it is work. Experiments have been carried out with children with marker pens — the felt pens that are good fun to play with. Some of the children were bribed to play with the pens, and were then given the chance to play with anything they wanted. They did not play with the pens again, because that was work. The children that were not bribed, continued to play with the pens because it was great fun.



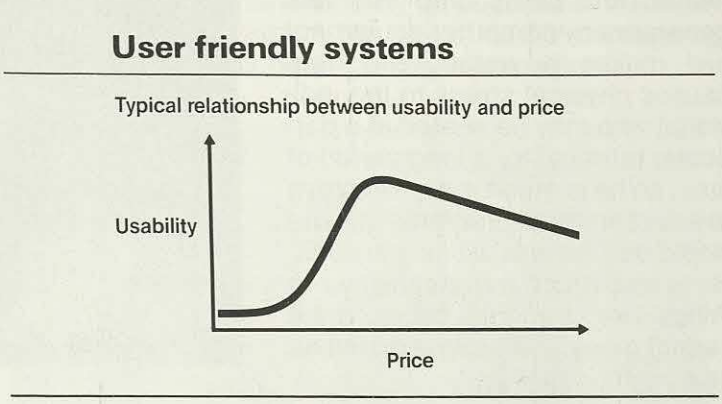
I am sure that as parents we realise that the opposite is true. If you tell children that something must not be done, it makes it even more fun. Nothing is more fun than the things that are forbidden. I am not suggesting that we tell people that they must not touch the computer terminal, or that we take money off them, and that will make them very much happier in their work. I do not think I am suggesting that, although if you walk down the road to the pier you will find a number of people queueing up to put money into visual display units. I refer, of course, to games such as Space Invaders. People are putting money into visual display units in order to play with these games. I am sure there are lessons to be learnt from the way that these systems operate that we could apply in making clerical jobs a lot more interesting.

I have talked about increasing the benefits in terms of performance and satisfaction. I think that there are many ways that we can achieve these benefits in practice. What about reducing the cost? As I said before, making the system cheaper is not necessarily of any concern whatsoever to the individual who sits in front of it. It can be, though, because it may mean that the company can afford to buy more of them. This may mean that the company can provide each person with his own individual piece of equipment which can then be personalised. It can be taken home, and the person can become more experienced with it.

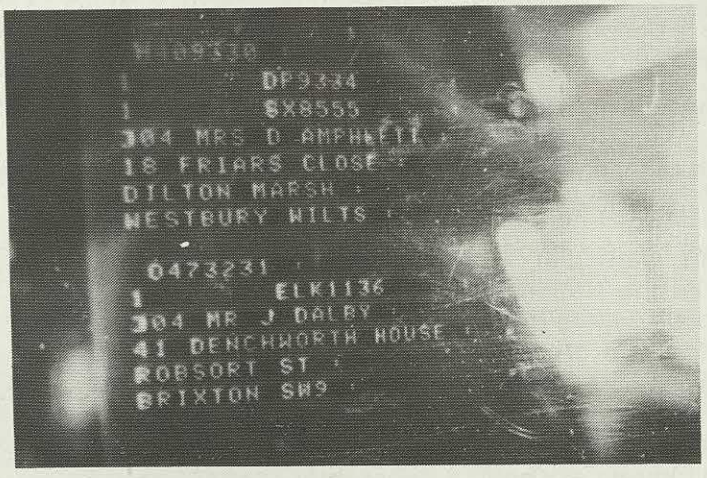
Cheaper equipment can mean that the company can afford to purchase more equipment — so making it cheaper in that sense can help.

But, I hear you ask, does not making equipment usable increase the cost? Is not usability just a way of making it more expensive? I do not believe that is true for one moment.

On this slide I have shown what I believe to be the relationship between usability and price. This relationship does indeed say that in order to improve usability you sometimes have to spend money. Features that improve the usability, such as quality or performance, may cost you money and may put up the price. But I believe there is a limit, and beyond that point the more features you add, the more they contribute to the price, and the more they detract from the usability. I believe that there is an optimum level of price where the usability is at its maximum. Going beyond that price does not increase the usability — it decreases it. So, equipment price may be a significant factor, but in terms of the personal effort required to operate the equipment, I think that there is considerable scope for standard ergonomics techniques to be used, and these techniques do not impact significantly on the equipment price.



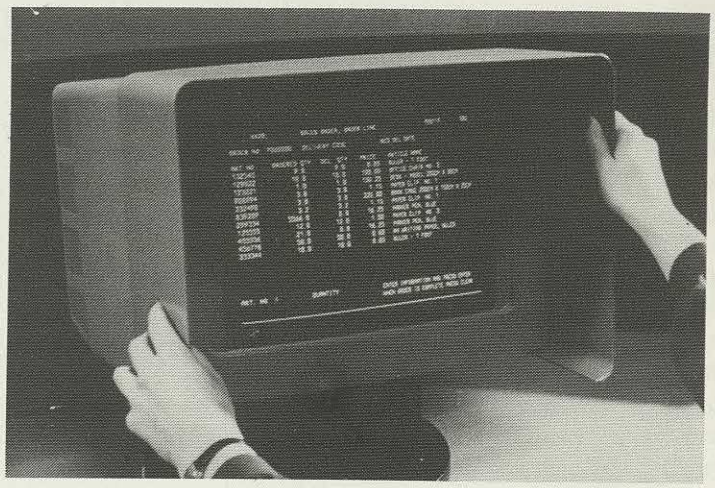
For example, the mental effort involved in reading an unreadable display can be quite considerable.



Now, from where you are sitting the screen image shown on the next slide is totally unintelligible. This is a very realistic, genuine photographic of a visual display unit, used by a girl in an organisation for seven hours a day. The lighting conditions you saw it under before I asked for the lights to be dimmed are fairly realistic. It is an extremely difficult visual task. The mental effort involved in trying to fight your way through the grime and scratches and blurring is quite considerable. It is little wonder that that girl was having severe problems in reading the display. It is quite unnecessary, of course, because this particular device is worn out. The cathode ray tube is worn out. The raster is illuminating in between the characters, which it should not do. I believe that the technical expression for this condition is 'knackered'. It is quite unnecessary.

The next slide shows a display image at the opposite end of the spectrum, and devices of this sort are widely available. It is really quite easy to create displays with legible characters, with good contrast, with character images that are sharp, clear, bright, and stable. We can greatly reduce the mental effort involved in reading a display by using a properly designed terminal.

We can reduce the physical effort of using a terminal by controlling the physical stress from things like excess heat. There are vents at the back of the terminal to allow the heat to escape. All the computer equipment that is put into the office generates heat. Frequently our offices are already a little bit overheated and stuffy, and the heat generated by computer equipment just makes it worse. The heat causes physical stress to the individual who may be seated at a particular terminal for a long period of time, so he is much more sensitive to environmental problems than he would be if he was walking around. He is also much more sensitive to things like draughts because he cannot move to the same extent as he could in the past.

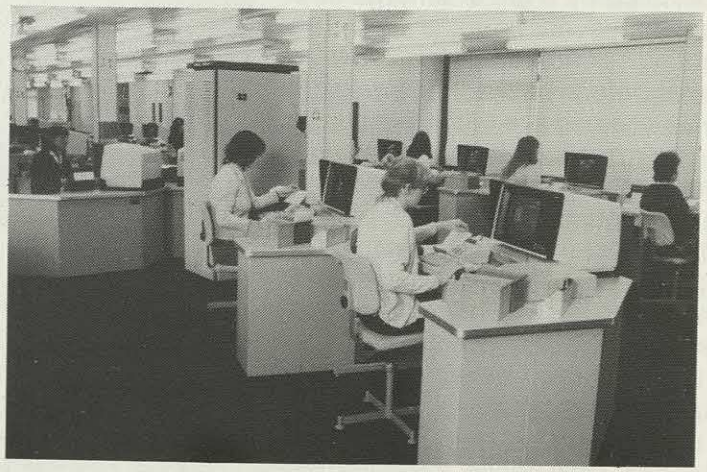


Where there is heat there is also frequently noise from cooling fans and printers, and from the hum of a transformer. That kind of noise does not necessarily cause a health problem — I am not suggesting that computer equipment causes deafness in the office. What I am talking about, though, is noise that interferes with concentration and interferes with communication. It seems to me rather strange that we talk about automating the office by putting in equipment that will substitute machine effort for human effort, thereby allowing people the time to concentrate and focus on their key activities. Yet we are creating a physical environment where the last thing the office is suitable for is work that requires concentration.

If you do not believe me, go and stand next to a photocopier the next time you want to have a conversation or have a good think, and you will soon realise that those noise levels can be quite distracting.

The final aspect of the environment that can be far from ideal concerns lighting. The requirement is to maintain a low enough level of illumination to read a display of the kind shown on the slide, but still have it high enough to be able to read the paperwork. It is possible to solve these problems quite easily with sensible design of the workplace and the environment.

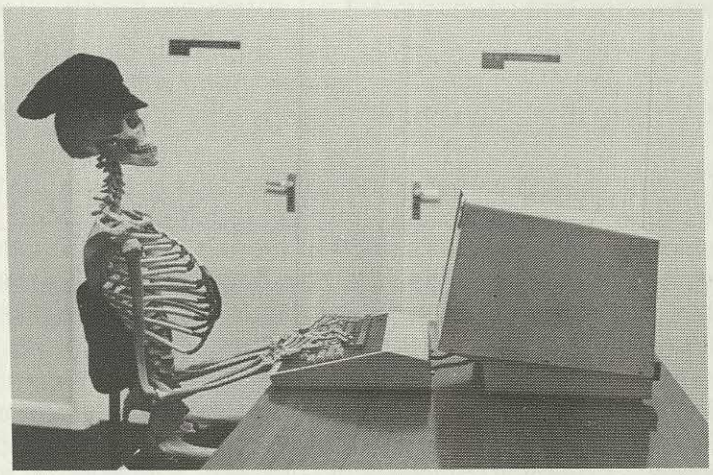
This particular example comes from the National Giro Centre in Bootle, where they have put some effort into creating special workplaces for their people. This is not a normal clerical operation, because these workplaces include an imprinter and a character reader as well. It is rather more complex than it appears from what you can see on the slide. Nonetheless, by putting some effort into the environment and the workplace they were able to achieve very much higher levels of productivity and acceptance of the computerised system than they would have otherwise.



The other way we can reduce the cost of systems is to reduce the perceived risk. I mentioned earlier the risk of failure. So many systems, if you make a mistake, drop you into

the operating system and scare the hell out of you. A page full of unintelligible commands comes back to the sales manager who selected the wrong menu item on a sales report. That sort of thing should not be allowed to happen. We should have failsafe systems where, no matter what you do wrong, you can recover from it in some way. I think that recoverability is a key issue in creating a confident user in that kind of interaction.

We can minimise the effect of errors by checking for them as early as possible in the interaction, picking them up before it is too late. We can reduce the risk of health damage by taking it seriously, even though I know that the risk has been grossly overplayed.



This slide indicates the magnitude of the problem in some people's eyes. If you took the computer press seriously you really would think that this was going to happen to you if you sit in front of a terminal. When the health effects of vdus are overplayed as much as that, it is very tempting to dismiss it. But that is very dangerous. Managements who dismiss concern of this kind do so at their peril. A management that is seen to care and seen to take its responsibility seriously can avoid a lot of these problems before they emerge in the public view. Once these problems have arisen they are very difficult to put down.

We can do things like providing eye tests for vdu operators if they are concerned about the damage to their eyes. We can certainly minimise excessive fatigue by designing jobs where using the terminal is part of the job, not a sole job on its own. Where someone is trapped at a terminal all day, the ergonomics problems I have been talking about become critical. Where the computer is simply a tool in a real job, the individual has far more flexibility.

Finally, we can reduce the anxiety that I mentioned earlier, the fear of the unknown, by having clear policies on redundancy and re-manning. I know that it is very difficult to achieve a clear policy in these areas because we do not know what the future holds either. However, I have certainly found in a number of organisations that the fear of the unknown was, at the end of the day, more damaging than the reality. The reality was actually much more reassuring to people, even though there were some people whose jobs had to go.

Referring to the conversation earlier with Campbell Christie, the people who stand to lose their jobs can never see that as reasonable. It is never right that it is your job that goes. I do not think that we can expect them to see it that way. What we have to do is to reassure the others that they have a future, and to deal with the people who are made redundant in a humane way. But bringing the problems out into the open solves a lot of problems.

Which of these various things that I have mentioned is worthwhile? What is the pay-off? How do we establish the pay-off in making these different improvements? The first complication in answering that question is that it depends on the type of user we are talking about. All the following can be considered to be users of a typical computer system: the consumers who buy it; the operators who provide a service for other people; the end users themselves; perhaps the customers of the organisation — the people who receive the gas bills or the travel bookings. The people who work for the suppliers in designing, building, installing, and maintaining the equipment, all have usability requirements. Frequently the requirements of all of these various users conflict with each other. For example, the maintenance engineer

who wants ready access to the back of the terminal might find that that requirement conflicts with the interests of the end user or the operator who wants to have a proper workplace. The only way that we can establish the trade-off between these different types of user and establish what compromises should be made is to look at each situation on its merits. There are no general rules that can be applied with certainty. What we have to do is to establish practical tests and practical criteria, which are realistically controlled in order to quantify the relative benefits of the different approaches. There is no point in my saying that changing a keyboard layout will save someone 10 per cent of their time, if that 10 per cent just means that they have to wait longer for the computer to respond. That is not a realistic benefit. You must quantify exactly how that benefit could be used, whether it is a real one or not.

Apart from the obvious merits of improving usability, why should usability be of concern at the present time? Why do I believe that it will become a critical issue in the 1980s? I believe that there are a number of reasons why it is becoming more, rather than less important.

The first reason is that some suppliers have begun to take notice of usability requirements. Wang, IBM, and Wordplex have all recently produced terminals with detachable keyboards which are thin, and screens that tilt and swivel. Despite saying in the past that these things were not necessary, they are now beginning to give way to user pressure and put them into their products. When some suppliers do this, the others have to follow. So there are very strong marketing pressures on supplier organisations to take these things seriously now.

Secondly, there are regulatory reasons. We heard earlier from Staffan Persson that in Sweden there are laws that compel organisations to consult people and take account of user needs. Certainly in Sweden, in Germany, and even in the United States, there is legislation, either on the books or proposed, which is aimed at improving usability, particularly with regard to terminals. In other countries there are health and safety guidelines which have very strong national backing. In Holland, the Social Affairs Department has produced some very strong guidelines on vdu terminals. Even in Britain, our Health and Safety Executive produced a report on visual display units. They promised to back it up with some guidelines but these have still to materialise. We have been waiting for them for a couple of years now, but I believe that they are expected any day. I have been saying for the last 18 months that we need these guidelines — one of these days we will get them. Nonetheless, there is a lot of regulatory pressure (actual and potential) on people to take account of these issues. These regulations will become stronger throughout the 1980s.

There are also industrial relations reasons why usability is important. Some of these are direct reasons, such as the genuine concern among trade union officials about health and safety. In many countries, trade unionists have been very active in promoting health and safety. But there are also indirect reasons concerned with industrial relations. Bad usability and bad ergonomics can be very effective weapons in the fight against job losses. A lot of proposals for computerised systems have a weak link when it comes to the ergonomics of the equipment, and many trade unionists have not been slow to find that loophole and to expose weaknesses in computerisation plans.

The last reason why usability is of growing importance is because of the users themselves. More and more users have discretion, and can choose whether or not to use a computer system. If they do not like the system, they choose not to use it. These users are not the captive audience that the early users of computer systems were.

The number of users of computer equipment is also growing considerably. The recent Eurodata study predicted that there will be something like a five-fold increase in the number of terminals in Europe by 1987. That is a lot of terminals, and it is probably a conservative estimate because Eurodata were conservative in the past. Indeed, in Foundation Report No. 23 we pointed out that some organisations are currently planning on a level of one terminal

to every three employees in the next few years. The number of people who will be affected by these usability issues is increasing enormously, so the problem itself is becoming much more important.

What do we do about these pressures — the marketing, regulatory, industrial relations, and user pressures? I do not believe that it matters whether we are users, designers, suppliers of equipment, or managers. I believe that we all experience these pressures and what we need to do is to mount a comprehensive attack on usability at several levels in our organisations at the same time.

First, we need to ensure that we have hardware standards for the purchase and acquisition of equipment. There really is no reason why we need to buy bad equipment, so evaluating it in usability terms should be a normal, routine part of the purchase procedure. We need to maintain standards both in the field of software and the design of dialogues, because increasingly the dialogue virtually defines the user's task. So we need to apply very tightly controlled standards to the kinds of jobs that we allow system designers to create. These standards are necessary because in the past system designers were frequently not aware that they were creating jobs at all — they thought they were writing programs.

That is why I believe that we also need to involve users more in the design process. The kind of experience that we have heard from Sweden this morning is very relevant in this area. The benefits of involving users are not just technical, since users do represent the source of business knowledge. They may not be able to express themselves in the way we would like, but it is the job of the analyst to tease out the knowledge from them. Users have a valid contribution to make to job design, which is certainly as valid as the system designer's contribution. You get a bonus by involving users in this way, in that their own job satisfaction is greatly enhanced.

The next level of action involves training. Training is not just something you do once at the beginning of an exercise and then forget about it, because people learn at different rates and people forget at different rates. I believe that training for computer systems is a continuous function that merges into continuing support as the systems develop and evolve. That training should not just be geared to users. A lot of the issues that I have mentioned today, some of which are very real problems in many organisations, could be solved if system designers were more aware of the issues. To make the designers more aware of the issues is not a tremendous education problem. It simply requires an awareness that when you are designing something you should consider the needs of the person who is supposed to use it. All too often when we look at products and services, it is difficult to believe that the person who designed them had any idea how they would be used in practice.

The next level of action involves implementation. A gradual, evolutionary approach is extremely important. Far too many systems are implemented suddenly, quickly, abruptly and rudely, and the negative reaction that is generated takes a long time to overcome. People are very good at holding grudges. Usability is a perception, and that kind of negative attitude can destroy the usability of a system which, viewed objectively, meets your criteria. It is rejected simply because it is seen as an intrusion, and this means that people will not find it usable.

The implementation of a system needs to be gradual and needs to take the users with it, and that in itself requires the last level of action, which is an environment that is conducive to change and conducive to confidence. One needs to have confidence in both the users and the systems. One needs to have confidence that the system will be useful and usable. One needs to have confidence that the users will feel that this is a new system that they welcome and want to use, and that they will come to it with a positive attitude. We do not want users thinking, "Not another intrusion, not another thing that's going to stop me doing my job." If that is their attitude, they will find ways of picking holes in the system, so you need to create this positive environment.

The other aspect of that environment is confidence in the staff. I get very worried when I hear people say, "We've made our systems idiot-proof", because, quite frankly, if you are employing idiots you are employing more than one. If you employ idiots you are in the wrong business. The trouble is that if you actually try to make things idiot-proof, people who are not idiots can still get round them. They see solutions that you had never imagined. The attitude of treating the users as idiots creates a barrier to the acceptance of systems. What I should like to see is an environment where users can be confident that what comes out of the systems department is well worth having, and that environment means that the users will be prepared to invest some effort in using the systems.

Also, I should like to see an environment where the systems people say, "These users know what they're doing. How can we help them do it better?" rather than "How can we protect our nice systems against these idiots?" because that attitude permeates right through the philosophy of the whole organisation.

So, what I am suggesting is a multi-level approach for achieving user friendly systems that involves standards for hardware and software, design procedures, training of users and design staff, implementation that is gradual and evolutionary, and the creation of an environment that is confident both about its systems and about its staff.

I should like to finish by summarising and showing some final slides to illustrate a few outstanding problems. To summarise, I believe that usability is extremely important, and it is much more than just creating 'friendly' systems. It is an individual judgment of cost and benefit. We can improve it by increasing the benefits or by decreasing the costs. It is a ratio, in Paul Mali's terms.

The benefits can be improved in terms either of the performance that one can get out of the system or the individual's satisfaction in that performance or in using that equipment.

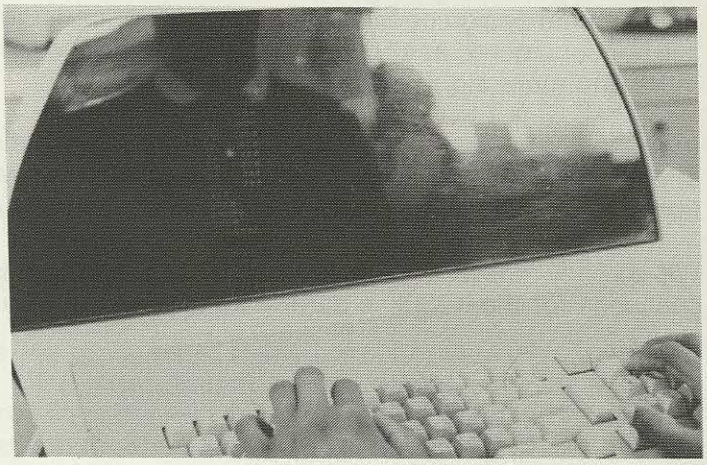
The costs that we want to reduce are in terms of effort (both mental and physical) and the risk of failure, health damage and other problems. Usability will be even more important in the future than in the past, because of current market trends and because of regulations and industrial relations, and particularly because the users now have more discretion and more choice. It will also be more important because there will be far more users than in the past.

I think that this affects us all, no matter what our role. We need to tackle usability at several levels in our organisations, from the standards for hardware and software development, to the way we design our systems, including training the users and the design staff, to the way we implement our systems, and finally to the kind of environment that we create in which we develop systems. This all sounds very much like the 'motherhood' that Paul Mali was talking about — just common sense. To some extent I wish that was true, but it is certainly not. It is more than just sense because a lot of the issues, when you look into them, are not the way you expected them to be. They are not just sense. And it is certainly not common. I never cease to be amazed at the number of times I go somewhere and see something which is so bad that I cannot believe that it was unintentional. It really seems as if someone has gone out of their way carefully to analyse user requirements, and then do the opposite.

I know that you do not believe me, so I should like to illustrate my final point with three slides.

If you were trying to put someone off reading a screen, I think that what you would do is put a mirror in front of it. That is exactly what the black plastic shown on the next slide is. It gives you an excellent reflection of the window, of people walking past and of your own shirt front. The human visual system evolved at a time when we were expecting nasty things to fall out of the trees, so any movement in the corners of our field of vision attracts our attention. It is a basic response that we cannot stop. So when you are sitting at a terminal and somebody

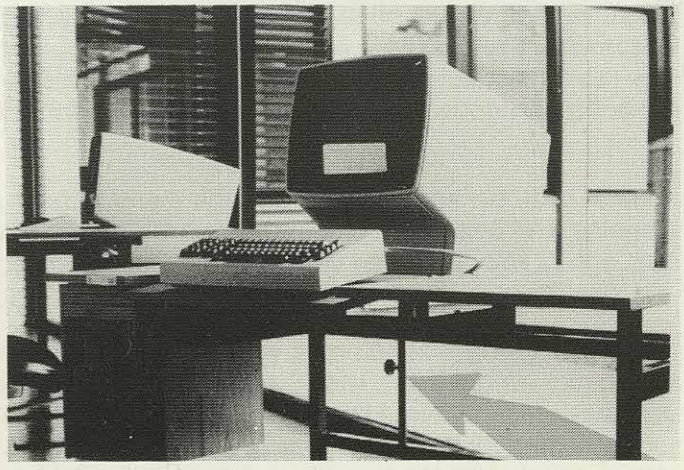
walks past, you think it is a Neanderthal man about to jump on you. It is very distracting. It is even worse in this case, because that plastic filter has the cooling air for the terminal drawn behind it over the surface of the CRT, so the dust is deposited on the inside of the filter. Those of you close enough to see it can see the blurred characters disappearing completely by the time you get to the top of the screen.



What about creating a workplace that you do not want people to work at? Could you do better than what is shown in the next slide? There is only one thing you can do efficiently in that workplace, and that is catch your tights on the handles of the drawers — at least so I am told — it is not a problem I have experienced myself. But if you were trying to stop someone working efficiently I think you would find it hard to create a worse environment.

I can see you do not believe me, so I should like you to demonstrate for yourselves that there really is a conspiracy to identify human requirements and then do the exact opposite. I should like you to imagine that you are designing one of the vdu desks that I mentioned earlier. You want to put a platform at the back of the desk on which to put the display, and you want to make the platform tilt. I should like you to analyse ergonomically the best place to put the handle to control that tilt.

Having done that in two seconds, I should like you to put on another hat and determine the worst possible place to put the control handle — the most inconvenient, inaccessible, awkward place that you could possibly imagine to put that handle. If I asked you, I am sure some of you would say "at the back". If I said that I was sure you could do worse than that you would say "at the back and underneath". That is precisely what has been done, as my final slide shows.



I think I should like to end by paraphrasing Winston Churchill in my comment on these last three slides. This is nonsense up with which we need not put. Usability is not an attractive extra. It is not a magic ingredient that we sprinkle on to products to make them useful. It is a fundamental design consideration. It is either considered from the beginning of the design or it is not considered at all. As the discretion and the numbers of users increase, it will become more and more significant. It will not go away.

It certainly affects productivity. It certainly affects morale. But I believe that increasingly it affects the quality of life itself, not just for the select few who are strapped to a computer terminal for most of their working life, but for all of us.

We already know a considerable amount about usability. I believe that our greatest challenge for the 1980s is putting all that knowledge into practice.

CONFERENCE CONCLUSION

David Butler,
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Looking at this conference as a whole, we have heard many times phrases which we have heard on other occasions, such as "the new Industrial Revolution". We have heard reference to the fact that there are now frequent television programmes about microelectronics and its impact. We have talked about national strategies, about fast-growing industries, about "knowledge is power", about the information society, and so forth. It is perhaps beginning, but only beginning, to dawn on us now the scale of the opportunity and the scale of the problem that the maturity of information processing and information technology really represents.

I do believe that for everyone in this room it is quite something to look forward to and to think that we will be able to say in 10, 20, perhaps 40 years' time, that we were in on the very beginnings of it.

Just to show how much has changed, and how little has changed in a way, some friends of mine recently rang me up and said, "We're thinking of organising a 25th birthday party for a computer." I said, "That sounds a good idea, I'd like to attend that." The computer was installed 25 years ago by a funny little cake-making company in Britain, called Lyons. The thing that I find most amazing, 25 years later, is that the name of that computer was 'the electronic office". How much has changed in 25 years, and yet in some ways how little. I shall let you know what the celebration turns out to be like.

The question most clearly posed at this conference — and in many ways least easy to answer — is what on earth we are actually going to do with information technology now that it has begun to mature, and now that we begin to get some feel for the scope of the problem and the opportunity. Are we going to be like a skiing party who accidentally trigger off an avalanche and stand and gape, watching as the mountain disappears into the valley, saying, "We never really thought it would be like that."? Or are we going to be like Moses glimpsing the promised land, but merely waving to succeeding generations, pointing in the direction but never seeing it ourselves? Or are we perhaps — the most daunting of all destinies — to become club bores, sitting around with a drink in our hand, reminiscing about the good old days when it was all in its infancy.

Let me be candid. When I talk to young programmers about the days when we used to code everything, prepare our own punch cards, compile the program and run it, and how splendid it all was, I already find that their eyes begin to glaze over. Clearly I am destined for the club chair.

My personal view is that the one thing we cannot do is simply stand back and say, "Well, it's all started now. The rocks are rolling down the mountainside. There's nothing we can do but stand and gape." In the perspective of history — and I say this in all seriousness — we may have as great a responsibility for the nature of the world in which our children and our children's children live as did the nuclear physicists who developed atomic weapons. We must understand — we simply must understand — the monster that we have created.

I believe that there is a positive aspect to this, and that is that management services has a leadership role which, if correctly exercised, can be the guiding force within our companies. But if we neglect that opportunity and fail to match up to the scale of the opportunity, then we may be at best irrelevant, at worst reactionary, and possibly even dangerous.

We need not only to look at information technology itself, but also to attempt, however difficult — and Monsieur Danzin made this difficulty very clear in his presentation — to synthesise the force that we have liberated with many other forces. These forces include a new world economic order since 1973, and a new world political order which we can see emerging around us. My own impression, talking to my children and their friends, is that young people today are deeply sceptical of the world political order that we have created. They are deeply sceptical of market forces which leave so many millions of them unemployed and educated for work that is done or will soon be done by machines. But they are equally sceptical and suspicious of the top-down centralist — the state capitalist orthodoxy that has masqueraded as socialism in Europe throughout their lifetime.

There are new world markets that we must come to understand. Convergence of technologies is becoming a reality in those market places. There are home systems, such as videotex which Tom Stewart mentioned. There is the increasing overlap between entertainment systems and information systems. When we had Professor Negroponte from MIT with us in Torquay and he showed the enormous power of the videodisc as a learning system, he also was using precisely the same technology as is now erupting into the entertainment industry.

I believe that there are four basic lessons that we can take away from this conference and from the other discussions that we have had of these important, almost frightening, matters. First, I think that we are in the middle of a period of transition where information technology is changing in its fundamental nature. Up to now I believe that it has been basically technology driven and that what we have been able to do has been a function of the technology that was available. How we chose to use that technology has been, to a great extent, a secondary consideration. We have gobbled up greedily the fragments of technology that the manufacturers have thrown to us, and thought ourselves lucky.

I believe that we are in the middle of a transition to a point at which the technology will be fundamentally people driven. There are many pointers in this direction. I would not have bet any money at all on the phenomenal progress that has been made in the last five years in the field of international communications' standards. The communications' users of the world really are saying now, "We no longer wish to be technology driven. We want to say what we want to do and we want the suppliers to conform."

There are the ergonomic aspects which Tom also mentioned. Exceptionally for a professional enthusiast in a particular field, he somewhat understates the case, perhaps deliberately in order to capture your enthusiasm. I believe that in a few years' time it will be virtually impossible to recruit people to work in some of the badly designed environments that Tom showed us. The technology is becoming people driven and users will vote with their hands and feet.

The second great lesson that we learn and need to carry away from this conference is that history really is bunk. The roots of any great change are highly deceptive, and the roots of information technology are highly deceptive. We can see the way that the thing has developed right now. I think that it is in the process of turning around. Like a plant, you can plant it where you like but it grows its own way, and in the end turns to face the sun. What that sun is I shall say in a moment.

Thirdly, I believe that our biggest danger — and I say this without disrespect to you the delegates, or to our speakers — is the danger of taking too narrow a view, of tunnel vision. It was noticeable that we were all of us much more comfortable with the subjects that were more

familiar to us during this conference, with the matters that we are accustomed to dealing with, rather than when we ventured into any of the cosmic problems, for example those posed by Monsieur Danzin. I think that our biggest danger is that we fail to see the wood for the trees.

Fourthly, there is real progress that I think we can take away from this conference. I mentioned the convergence of technology and the way in which computer technology, telecommunications technology and office technology are coming together into a single discipline. We have been talking about that for a long time and perhaps we almost begin to understand something of it now. But what I have detected in this conference is that there is a new and corresponding convergence of skills taking place. Technical skills, skills in system design, implementation, and operation are combining with business planning skills, skills at identifying the real aims of an organisation and the real economic value of systems. These in turn are converging with behavioural skills — skills of a technical, business planning and human factors nature. This coming together in a convergence of skills is, I think, very exciting. It is also very daunting, because I suspect that in these three areas a mark of 2 out of 3 in the very near future will be a "fail", and that all three are in fact necessary.

So we face the difficult question, in the light of those four basic lessons which I think we have learned this week: has this conference been a success? I would say yes and no. I would say no because we still only dimly perceive the true nature of the fusion of those three sets of skills — technical skills, business planning skills, and behavioural skills. I would say yes, because I think that the Butler Cox Foundation is at its best and most useful when it is grappling with these very difficult issues on the frontiers of knowledge. To be candid with you, it is much easier to put on conferences about things that we all fully know and understand, with star speakers from all over the world. It is much harder to try to come to grips with these more vague and shadowy issues, which are nevertheless at the heart of our real problems in the next few years.

So I go away from this conference personally hopeful that we shall build on what we have heard in the last two days to create a better understanding of the convergence of those three sets of skills.

I should like, on your behalf, to offer a very sincere vote of thanks to the speakers who have been with us this week. I know that all of them have put a great deal of thought and effort into the preparation of their papers. They have all performed admirably and dealt with candour and openness with all our questions and comments.

I should also like to thank the technical team who have been in charge of all the equipment for the conference. They are at their best when they are least visible. We have seen very little of them this week, which suggests that they have done a good job.

The hotel also should receive our thanks for the facilities and the service which they have made available to us, and also our translation team. It is not always easy, when people standing at that rostrum get excited, to follow in the wake of their enthusiasm without losing the odd paragraph or two. I believe that our translators have done an excellent job for us this week.

Finally, on behalf of the Foundation, may I thank you, the delegates. Your interest has been unflagging, your questions and comments always to the point. Thank you very much indeed.

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