

microfiche and, based on the reply, the necessary system commands are sent downline to the main system. Those who have struggled with the totally different and complex series of commands necessary to realise these, from the users' point of view, similar requirements will be grateful for the assistance we provide. All the systems commands we have not protectively covered can be requested in the original format. The net result is that every user can gain *something* from using our system.

What has this to do with a new approach to systems analysis and design? We suggest that further developments in sympathetic, easy to use systems will radically alter the role of the systems analyst and designer in the future. No longer will the

main effort be concentrated on getting the processing operations to work on a complicated and intolerant system. Instead, all the 'human engineering' aspects can be concentrated on to the greater satisfaction of users. Perhaps the systems designer can be entirely dispensed with and the user can be allowed to approach the friendly system directly. The systems analyst's role will then be mainly to advise and encourage in the initial stages of deciding what is required.

This seems to be in stark contrast to the conventional image of the analyst as primarily an expert on the 'system'. Maybe we will require an entirely different sort of person, trained in an entirely different way (Podger, 1978). But that is another problem.

References

- BICKLEY, W. G. (1966). Some thoughts on Mathematical Thinking, *Mathematical Gazette*, Vol. 50, No. 371, pp. 1-8.
- DE MILLO, R. A., LIPTON, R. J. and PERLIS, A. J. (1979). Social processes and proofs of theorems and programs, *CACM*, Vol. 22, No. 5, pp. 271-280.
- JAMES, E. B. and PARTRIDGE, D. P. (1976). Tolerance to inaccuracy in computer programs, *The Computer Journal*, Vol. 19, No. 3, pp. 207-212.
- NEWMAN, I. A. (1978). Personalised user interfaces to computer systems, *Proceedings Eurocomp 1978*, Online conferences.
- PODGER, D. N. (1978). *High level languages—A basis for participative design*, Manchester Business School.
- POPPER, K. (1973). For example see p. 85 of Magee B. *Popper* Fontana/Collins.
- WEISS, P. A. (1971). *Hierarchically organised systems in theory and practice*, Hafner Publishing Co, New York.
- WINOGRAD, T. (1979). Beyond programming languages, *CACM*, Vol. 22, No. 7, pp. 391-401.

Discussion on 'New approaches to systems analysis and design'

Morning discussion

Keith Watts (Thames Water Authority)

I see the papers we have had moving in two directions and I can see a conflict. I'd be grateful if it could be resolved for me. In Peter Hammersley's pivotal talk he said that he saw systems analysis inevitably involving data base in future, and before that Enid Mumford had shown us that in her analysis of users' requirements the requirement for autonomy figured fairly prominently. Peter Prowse said you must have central control of the data. I see data base development as really demolishing the users' autonomy in many ways because, well, Tom Gilb has said that data base technology is the last round of the computer professional trying to exert control; I don't see it as that but I do see it as inherently centralist. I have this problem at the moment to decide data base or not in a certain range of application areas and giving more priority as I have done to the social aspects of the introduction of change my view has been that data base should be avoided unless it becomes inevitable because of the invasion of autonomy. It is not so much the autonomy of the clerical user as the autonomy of the manager, the manager who feels very much threatened that his autonomy is being taken away and he is giving his data to a centrally controlled data base.

Peter Prowse

The way I see it is that the user does not need to lose his authority over data. Now I talked about a logical model which consists of hundreds, maybe thousands, of relations. They are aggregated together into a data base. But we find that individual relations (they might be implemented by records or segments of data)—individual relations are generally updated by a particular part of the business. You then have to be very careful because if you put all data into a hierarchy then you have to have only one group that controls the root of the hierarchy.

That is, generally, common things which are common to the corporation. Now as you go down the hierarchy of data in the subject there are many different sorts of data and each little aggregation is controlled by a different user group. So they still feel they can update and control their own data—but the organisation of it is done consistently and they cannot alter the little bit at the apex. But most people are willing to give up something like that in order to get the benefits they see from a data base approach.

Peter Hammersley

I think, at least I hope, what I said was that if you are going to have a totally integrated system then I would support the data base approach. In the system which we implemented we went for the data base approach and nothing that happened subsequently convinced me that the approach was wrong. But that is if you are going for an integrated system. Now in that final postscript that I gave I pointed out what I see as being the problem of the future, and possibly the problem to which you are addressing yourself, and that is that the user will not wish to have a corporate central data facility, that he will go out and he will buy his own micro with turnkey software, and he will build his own system and he will keep his own data, and the problem for the analyst who feels that a central data base system is desirable is whether or not developments of that kind are capable of being controlled. Now I am afraid I have not answered the question—I have only posed it because only time will answer it, and we are talking about something that is going to hit us in two or three years' time. I do not know if there is anyone here who has actually hit it already? Maybe if there is we ought to be hearing about it. But this is a problem that is going to hit us very shortly and therefore I hope when I spoke I actually presented the conflict myself by saying, 'This is what we did, but it may not be possible for us to do it the next time round for all sorts of reasons'. I am sorry I cannot answer your question except to agree with you that it is a real problem.

Frank Land

May I make just one comment. I think one of the very important elements in the introduction of any system is the process by which it is introduced and if a centralised data base, for example, is introduced by an authority who says 'that is how you are going to do it' then I think you have got much less chance of success than if it springs from the desires and requirements of the people who are involved in the process, and who are ultimately going to be the users of the data base. As far as the technology is concerned, of course the idea of distributed data bases, so you can distribute your data base to the nodes which use them, is also becoming a possibility but it seems to me the most important element is that we have got to have a process of analysis, design and construction which really does get the approval of those who are going to be the end users. If you do not have that then what Peter said is going to happen: you are going to

get users who are going to have the power to develop their own systems either formally by buying their own computer, or informally by degrading the system and your centralised system will not work. The process of doing it is, I think, essential.

Kristen Nygaard

If you look at what is happening when one is introducing a data base it is; well let us first have a look at what is the first stage of the system. You have separate programs and associated with these programs you have a data base, a set of data, and this set of data is a model of some part of the operation of the company. It is a model of part of the company. When you move into a general common data base what you are doing is to insist on a common model of the company. A data base is a model and you insist on all persons in the company having the same conception of the reality in terms of that model. You may add on top of that a particular version but it will rest on the same model of reality. When you are looking at the problems of the data base one thing is what the man from Thames Water Authority hinted at. One aspect of what he said was that you feel that you lose control of the data. The other thing is that you don't have control of reality any longer because you are not able to define the reality around you because you are forced to act not on the surrounding actual reality, you act upon the model of reality, the data base, and this is a quite interesting thing. What is going to happen when the rapidly increasing number of people in the company, instead of relating themselves directly to the surrounding reality, always have to, as in a large proportion of cases, relate through a model of reality? Now these are important, and I think difficult, psychological problems and also something which relates to the flexibility and adaptability of the organisation, so I think there are a whole lot of very important problems which have to be considered, together with the obvious advantages, because the picture is not so simple.

FL Thank you very much. I am not sure, Mr Watts, to what extent you have answers to the thing. I think the answer that we have got out of this is that there are problems. I think we all knew that.

Roger Tanner (Defence ADP Training Centre)

A question for Enid Mumford—in fact two short simple questions. Firstly, how long did your research and development take in Rolls Royce? About ten people so far as I can see were doing this systems work. Secondly, I don't see anybody nominated as the leader of the design group. Did anybody actually turn out to be such?

Enid Mumford

Yes; thank you, they are very practical questions. The actual design process took about six months with the design group working half a day a week. I think it is difficult to shorten this process because, it seems to me, the design group has to learn how to do it and this is not something that you can actually shortcut. By the end of six months they were really experts and it was interesting how the roles of myself and the systems manager changed over this period. At the beginning, when people were rather confused, we always left the decisions to the group but we sometimes had to suggest alternatives like 'look at this' or 'think about that', but it was quite fascinating that as the members of the design group became increasingly expert they did not want us any longer, and if we volunteered a suggestion towards the end of the process this was written off as absolute rubbish and nonsense by people who really didn't understand, so I think about six months. To get things going, we started off with the systems manager in the chair but he was anxious to abandon this particular role as quickly as possible. In fact, one of the senior clerks in the group emerged as a kind of natural chairman and he took over and chaired the thing right through to the end. But it was very much a group of equals and really didn't need a chairman particularly.

RT When you say half a day a week do you mean that on the other four and a half days the other people were carrying out their normal clerical activities?

EM Yes, they were, but they were thinking about the various design problems at the same time. People always ask the question, how much did it cost? But it was difficult to identify any major cost. There

was the systems manager's time but if he hadn't been doing this then he would have been doing something else. There was the time of the clerks, but if they hadn't been doing it the professional systems analysts would have been, so one could not identify any major costs as a result of the approach.

Bob Latchett

I would like to revert back to the previous question because I think that you have the answer in the words spoken by Peter Hammersley, where I rocked back when I heard them. Basically he said 'could computer technology be introduced into a normal working environment to improve the working situation?' I have faced the very same question myself. How could computers be used to improve the management information system? The question which should have been posed is not that but how could the management information system be improved and therefore having analysed the management information system you will come to a centralised data base system or a distributed data base system. But you start off with the problem first and then you look at the technology. I think the question of data bases will eventually smooth itself out depending upon the type of organisation you have and your actual needs and how you have analysed them.

Frank Romanelli (Ladbroke Racing)

I'd just like to add to that particular point of view that it all, I think, depends on what one means by data. Peter Prowse's definition is that data is a corporate asset and not that where a user says 'this is my data, nobody else is going to touch it'. So one really has to judge the question of whether to go data base or not, based on the definition, I believe, of data and what it means to the company.

FL But I think it has to be said also what it means to the people who are going to be using it or providing it. They have the power to withhold it or degrade it if they feel it has been used in a sense against them or not with their approval. That is why it is important, as mentioned earlier, to get the users initiating a data base project rather than one being imposed from above.

KN Just commenting on the last. You see, there are two aspects of this autonomy. One is relating to the structure of the data base, that is what kind of model, what conception of reality—that is one area of conflict. The other one is the action of values which are in the model. Should you have access to the actual values of the pieces of information, or should they be kept apart?

Guy FitzGerald (Thames Polytechnic)

I would like to address my question to Peter Prowse really. He said that the data model could be built up because it was a static model. Now I am not sure that this data model can be static and I am a bit worried about the problems we are making for ourselves in the future, because we have assumed that this type of data is static when we build it up and it forms the business rules, but these rules eventually change slowly and if we build a system up almost in concrete, there is going to be a problem in the future and I think a lot of problems of industry today is that they have been built on a system where the basis has now changed and that has caused problems. A second point, talking about micros, is that if we spin off files and copies of information to micro systems are we not getting back to the original application based systems and how do we overcome the problem of the update anomalies when things have been changed in a lot of different places?

PP Perhaps I can answer the last question first. By spinning off data for the micros from a central system you have one common definition of data, you have one common source, one place where it is updated, and you can spin off copies. You may allow those to be locally updated during the day, but tomorrow you receive a fresh copy from Head Office with the changes having been propagated into the Head Office in the meantime. We actually have many systems with this in operation, so that local people make changes in the short term but in the long term, or the medium term, the entire data base is replaced by a fresh version from the central control point. The disadvantage is that we may have to do a lot of dead transmission but it is one way of keeping control. Now if you define

customers, you have got to allow some local change to the customer master to cope with particular delivery conditions, perhaps new customers coming in, taking up the product immediately. You have to reflect some change locally very quickly. That change has to be propagated through to the central system and then we generally refresh the local data base to make sure that it is common throughout still. Hence I still believe in the advantages of central control but still allow some local activity. On the first question of change then I agree with you that business is not static. The model does change. What you have to try to get right is the basic structure of data. If you get that more or less right then you can add to it and you can make minor changes to meet the business changes. And these do occur regularly. You quoted the business rules. We have special table-handling systems that allow these rules to be changed every day, not during processing, at a static point in a day when you can change these rules.

There is only one place to change business rules and that rule is propagated into many different applications. So we have to have a very high level, responsible person who controls those changes. In the past all those rules were embedded in application programs. When the business changed you had to have programmers changing the programs. Now we have got rid of that. We have taken it out and put it into tables which are controlled largely by the user but via this business analyst who can sense the interaction with all the applications so that is a reason for perhaps getting this business analyst's role slightly diverged from the users because one change may affect many users. Hence, you require someone a little independent from the user organisation—but still a part of users, not a part perhaps of data processing.

Bert Thompson (Coopers and Lybrand Associates)

I would like to ask Enid Mumford a question in regard to control and control of development. The examples she described were a study of development within one particular department, but across most of its activities as I understood it. If we take that to the broader approach of various systems going into various parts of an organisation at the same time, all in a sense drifting along in a participative way, how do you see the control mechanism working across the company to draw it in line with overall corporate strategy and overall information needs as, for example, came up in Peter's outline of the data base approach.

EM Well, I think that is a very interesting question. We do have an approach for doing this although most of the systems that I have personally had experience in have been related at the bottom of the organisation to one or two departments, but we have tried to think through this problem and we feel that one has to then have a participative approach of a different kind at each level in the organisation so that, in terms of Peter's model, when you are at the corporate strategy level at the top of the company, you obviously cannot have everybody doing their own design but maybe you can use an effective consultative approach at that stage so as to make sure that the groups who have got important interests in the sort of major system objectives that are set are really consulted and able to express a point of view and I would think this would be, even at this level, representatives of the trade unions of lower level users. In terms of Anthony's middle level at the operational planning level where in fact your system has been implemented but is crossing a number of departmental boundaries, we would then suggest a representative approach would be appropriate where you would have management representatives from the different departments who were going to be affected by the system really in a position to speak for their departments and identify very clearly at this stage of the system's design the important objectives and interests of their departments and of the people in them. Again it might be appropriate to have trade unions represented at this level. I think it is only at the grass roots of the organisation where people start thinking in terms of work design, designing people's jobs and so on and in terms of job satisfaction of people at the bottom levels of organisation that you can use this consensus approach and actually try and involve everybody in the design of their own system. I think we would see this as being a hierarchical approach as well.

FL I wonder if I can add just one word to that. In terms of institu-

tions this would mean that perhaps there would be a steering group which would have possibly a number of design teams working. The steering group would be responsible for setting some of the targets, objectives and constraints for the design groups and would also act as referees when the conflicts or difficulties between the different design groups, in terms of what they are trying to do, and one might have again a hierarchy of these groups from the corporate level down to the grass roots level.

John Brittan (MVEE)

I'd like to address a question to Enid Mumford. It's been said that war is too important to be left to the generals. I think certainly our experience in this country in the last 15 years would suggest that in very many activities the particular activities are too important to leave to the experts. One can think of reorganisation of the Health Service, which hasn't been a blazing success, and the Civil Service, which hasn't been a blazing success either. In many other fields one could think of the design of houses being far too important to leave to the architects. Could she suggest, because she is clearly saying that computer systems, and particularly the design of systems involving working people, is too important to leave to the professionals and the experts, where she sees the expert—the systems analyst or I shall have another name to coin for him or her as well—where she thinks that person is going in the future?

EM It is very difficult to answer because I think, as Peter Hamersley was pointing out, his job seems to be increasing in complexity the whole time. I, from a personal point of view, would see the role of the systems analyst as becoming immensely important and that the role is very much that of the organisational change agent and perhaps facilitator of change. For example, if you are going for these sorts of participative processes they don't happen of their own accord. You've got to have somebody in there who really understands organisational needs and can actually give the people who are involved in the design exercise these tools, techniques and skills to enable them to make a contribution. So I would see the expert very much, in the future, as more of a kind of teacher, internal consultant, organisational analyst requiring, in fact, as Peter pointed out, a lot of very complex skills and talents which perhaps have not been necessary in the past.

PH I instanced the example of the integrated system and I mentioned that one of the things that we were attempting to do was to build a transaction which you would use as a means of designing transactions. It seems to me, therefore, that if that is achieved that method of design can be immediately passed to the user and the user can be told 'well you can now design your own transactions—you can build your own system. You don't need a systems analyst sitting beside you to help you at all. Just get on with it'. Well, if in fact one did that then two things would happen. First of all the users would design the systems as badly as the systems analyst had been designing them because they would not have the benefit of the systems analyst's mistakes or knowledge of those mistakes and secondly, as indicated on this question of system performance and so on, they would wreak havoc with the actual system performance of the total system, because the user, for example, could see something that, in fact, one of my designers actually put up, which was a proposal for a transaction—this was actually on waiting list maintenance—there was a proposal that on waiting list maintenance the priority of a patient on the list could be obtained at the time that patient was put on the list, and I said that that in fact would take something over 700 data base accesses. At an average of 20 a second, what has happened to your half-second response? Now if a systems analyst is going to propose a transaction of that kind what is a user going to do with it? Even if you get to a situation where the users can design their own systems they have still got to have this very expert technical advice sitting behind them telling them what is sensible and practical and what is not. Now if we move across again to this question of the users going out and buying their own micros I think the one situation that we have got to avoid if we're going to have any sort of corporate policy at all is one user buying a system based on a KIM and the next one buying a system based on an Intel and one has got a magnetic cassette storage and one has got floppy discs and another is online to a mainframe and so there becomes a total hotchpotch of

completely incompatible systems in the organisation. Now again, here is a role for a systems analyst and this role, as Enid has just said, is not a functional role, it is an advisory role and it is an advisory role which at present is corporate but which in the future as I was trying to indicate, may be something which is rather more than corporate although one cannot define exactly how much more at the present time.

Afternoon discussion

Peter Prowse

I was very interested to hear Kristen Nygaard talk about the union's requirement that the systems specifications should be readable to them. I have included in the proceedings a paper that I have written with Roger Johnson of Thames Polytechnic on a natural language data base interface to the user. This was an attempt to make data bases understandable by the layman. I included it because I felt this was something that I would like to talk about but when it came to the event time was short and I never had a chance to introduce the paper. I would encourage you to read it. I think it takes us part of the way to what Kristen was saying. We cannot afford to talk to people only in our terms, we have to find ways of talking to them in their terms. Now what is described in the paper is a first attempt. There is no formal methodology for producing a natural language interface but there is an example. I shall continue to work, taking the very loose definition I have at the moment and making it into a formal method for creating a natural language from a set of relations. I think this recognises the need to talk to users in their own language, so I was particularly interested to hear the words about the unions in Norway.

Kristen Nygaard

What I was saying was that there are three major new tasks confronting people. One is the participative design of total systems for human beings, machine and information equipment. The second is that they have to start to design operating systems, and the third is that they have to start to design languages. I think it is a very important part of the work of the systems specialist to be able to define job oriented languages in which people express themselves in terms which are meaningful to a particular job. But a sociologist at the Computing Centre has made a point here. He says that from a union point of view we should be a little careful about job oriented languages because we should rather strive for what he calls profession oriented languages. Instead of thinking of a language which fits the person to a particular job we should strive for languages which are relative to a profession that is a collection of jobs so that people can embody new skills related to this language. In this way people get more freedom. They can move about instead of being tied down to a particular job. It is very interesting to see a paper because it is just an example of what I am hoping for.

Neil Goodenough (Davy Computing Ltd, Sheffield)

Enid Mumford pointed out, with some surprise, the existence of people with a preference for the repetitive aspects of their work. In view of this, and with the reference to morality in her talk, would anybody be prepared to go on record and say that certain people's preferences for repetitive work should be taken into account when designing systems, even to the extent of producing a less efficient system.

EM I was astonished to find this group at Rolls Royce but I think it would be a very dangerous assumption to assume that they always exist. We encountered them simply because they came up to us and said 'here we are, this is the sort of work we like doing'. But I think one of the problems of systems design in the past is that it has been built on assumptions that people are only capable of doing routine work. There has been this considerable routinisation, particularly of clerical work, over the last 15 years which has led to a deterioration in the quality of working life of so many people. My philosophy would be that one ought to design systems that enable groups to develop themselves and are associated with education programmes and learning opportunities so that people can enhance their personal skills. Hence routine work should only be created if it is based on a really sound diagnosis and appeal from particular groups that this is the sort of work they are wanting. It seems to me that the whole

history of systems design has been one of tending towards routinisation instead of enhancement of human ability.

Frank Land

My reading of the question is really that of 'If there is a conflict between job satisfaction as a design goal and efficiency as a design goal which would you choose?' That, it seems to me if I read the question correctly, is what underlies this and routinisation is only one example. If there is a group of people who get job satisfaction from routine and that makes against efficiency, should we allow them to have that routine? If there is a conflict between job satisfaction goals and efficiency goals do you sacrifice your efficiency goals? That seems to me to be what he is asking.

Enid Mumford

Kristen has talked a great deal about models, and one of the personal models I have is a lady who lived many many years ago called Mary Parker Follett. She was one of the early contributors to ideas on scientific management and her philosophy always was to try to come up with solutions that really met the different needs of a situation. You don't look for compromise solutions or trade-off solutions, you start to look for solutions which give you the benefits of all the things you're seeking. So I would always try to go for both efficiency and job satisfaction and hope that there isn't a conflict. Where there is a conflict then you are in a negotiating situation.

Roger Tanner

I don't know about the problem of building in routine and hence making the system less efficient, but certainly there are many occasions when one makes a system more complicated to operate, and therefore less efficient, in order either to preserve a skill or to give greater job satisfaction to the operator of the system. For example, air traffic control, certain weapon systems, this sort of thing. You leave skill in the hand of the operator, deliberately so, even though it may be more efficient if you did the whole thing by computer. The opposite applies in terms of routine.

FL Talking about the routinisation in office work, observe what is happening to computer programming and the values behind the changes in programming style (modulisation and so forth) and just wonder what that is leading to in our own organisation, whether that ought also to be subjected to more enquiry than it is at present.

Anthony Bevis (Alexander Howden)

I like the idea of participative design, but I think one of the bases of design is that you are going to improve the efficiency of an area and this can inevitably lead to redundancy. How on earth do you achieve participation when people know that they are cutting their own throats at the end of the day?

EM I think that that is an absolutely devastating question. It would be very interesting to have the views of the people here on the subject because it is one we are constantly being asked at this moment in time. I think my quick reply is that I do not think you can. It seems to me that if you are trying to make people redundant and enhance the quality of working life at the same time you are in a straight conflict situation. You have got a straight conflict of objectives and participation just cannot work in that sort of situation. You are in a fight effectively. Some people say that this is not a very correct view; in fact I was talking to a manager only last week in ICI who suggested that if everybody participatively agreed on what was a fair redundancy policy and this was accepted, then you could still use a participatory approach in systems design. I don't think I know the answer but I think it is a terribly important question.

KN I have a feeling that this issue, this question, is very central and it represents the main problem that we have to face with this approach. Consensus participation and what we are doing in the union is the nub of all this. We are trying to build up a rapport and we are dealing, we are negotiating, we have simply a bargaining negotiation. When we go into things we are very well prepared so that after there are claims that redundancies must be made we have to fight as well as we can. We have had quite a tough fight in the

social security system just a few weeks ago which we won, by the way, but this doesn't always happen.

E. F. Ferraby (Automobile Association)

I should like to comment both on the last two replies and on your comment. Is it our job to decide this? I think it is not. I believe that we are to keep our role as an honest broker, and I think that is one of the things that we have to do, and to keep the trust of both sides of industry, which I prefer to call the partnership of industry; you have to keep out of this fight. Let them fight it out for themselves but try to bring them together. So I should say keep out. The other thing I should say is that if you think that you are working for a firm that will not deal honestly with people who are made redundant, then you shouldn't work for them.

FL I think it is fair comment that your own values often determine how you react to a firm which has values other than your values. On the question of keeping out you are not given that option. You are the change agent. You may not determine that there shall be redundancy—You may not set the ultimate objectives of the system but you are the change agent.

EFF Yes, you are and yet I think that you can with a bit of skill make it the job of management and union to face this problem and you do not have to make the decision. You can put it to them honestly on both sides and let them fight it out.

FL That is really saying that the position should be what Kristen suggests, namely that the unions should have the knowledge and the power to be in an effective position to negotiate on this.

EFF I would go further than that. I invariably make it plain to the union people that I deal with that I am as open to them as I am to my employer.

Hazel McGee (Tradax England Ltd)

There is one aspect of Enid Mumford's discussion this morning that I found very interesting and on which I should like her comment. That was when she referred to the end of the project or the end of the development stage. I wonder what happens to the clerks, to the ordinary employees, who have been involved in this quite sophisticated development process when they return to what is primarily routine work; when they no longer have half a day a week on this interesting development and design work. I wonder if, after a period of time, either their morale drops or alternatively you have a lot of pushing for promotion in those departments that you haven't previously had? I just wonder at the effect of this on the organisation as a whole.

EM I think you have to bear in mind that I still have had only a limited experience in doing this so I do not have a great mass of information on which to base an answer. But to give a different example from the Rolls Royce one, the most recent project I have been doing has been helping a group of secretaries to analyse their own needs and to design their own word processing system and the way in which it is to be organised. In the process of doing this, they have become able to contribute a very important secretarial point of view in terms of how they want to relate with new technology, and I can see this role continuing into the future as more and more new technology comes into the office situation. This group of secretaries are always going to be able to intervene and give the secretarial point of view. And it is interesting how the attitudes of their own managers or the technologists in the situation have changed. Whereas the secretaries tended in the past always to be ignored they are now actively consulted because they are seen as a knowledgeable and informed group. In the Rolls Royce situation I think two things did happen; that one or two members of the design group did become inspired by the exercise and one in particular tried to become a systems analyst as a result of participating in it, but again I think what we created was a very effective knowledgeable monitoring group. It was clear that this system wasn't going to stand still either technically or in terms of people's job satisfaction needs and this group had the knowledge to be able to monitor the system constantly and make suggestions as to how it needed adjusting and changing as

both efficiency and job satisfaction needs altered.

KN I want to make a comment about something which has been said and I want an answer from the chairman. He said something about what is going to happen to the systems people. And it is a very obvious question to ask because of the changing cost picture. In the future the major costs are going to be the systems development cost and the software cost and when managers and employers, etc. look at these high cost components they will concentrate their efforts on reducing exactly those cost components. And this is obviously going to affect the systems people. They are now really in the searchlight. How can management cut down on the expensive people which they have? There are all kinds of strategies. This also links up with all kinds of interest groups and, from what you are saying the whole picture is becoming very very complex.

David Flint (Buttercups and Partners)

That comment of Kristen has given me a lead on to something which I wanted to say anyway. I want to say something in favour of prototyping systems but particularly from the point of view of improving the productivity of the systems area. It seems to me that if you can build a prototype system, if you can build a fully functional system, not just a model of one part of the ultimate system, then you may well have something which is meeting perhaps 80% of your ultimate objectives, having spent maybe 20% of the cost. The old 80/20 rule. In that case one of your options is to stop at that point, not build a full system but just leave the prototype system in place. If we are going to be able to do this we are going to need new sorts of software; better software and easier to use software than we have had in the past. I think one can pick out some of the things we are going to need. Firstly, we are going to need data base management systems, where you can define the conceptual data model, the sort of thing we were hearing about this morning. You can default straight down into some sort of implementation and be sure that it is going to work. We are going to need high level programming languages which do not tie us into procedural approaches, and some of these things are available in connection with data base management. We are going to need quick and easy ways of defining screen formats so that we can set them up quickly and be sure that they are going to tie up with everything else, and we are going to need easy to use data communication systems so that the whole thing can be tied together because increasingly we are in the online systems environment. What I am saying then is that the suppliers will need to do something. When we are picking the tools we are going to use as computer people, we ought to think of the ways in which we are going to need to use them in the future, and that ought to guide us in, for instance, which DBMS we take.

KN It is exactly because of this that I am working on the kind of thing I am working on now.

Z. Simons (London School of Economics)

First I wanted to make a personal comment. I am basically an architect and as such I think I am sitting here in an advantageous position because I can associate with the users of computer systems and I am not a systems designer. On the other hand I can associate also with the systems designer because I am an urban system designer. Hence, I look at the situation from both ends. The point I want to relate to is the efficiency of systems; I want just to mention that a few days ago I spoke to a shopkeeper who went to buy a computer system for his shops' accounts and stock control. He came back and said 'No! he could not buy the computer because it was too efficient'. He said for tax purposes he didn't want a system in which everything was registered. Perhaps the user doesn't always want the efficiency that real designers talk about. The same sort of comment would make me concerned about participation in planning, particularly town planning. Some planners consider participation not efficient enough because it consumes more time and more money and more effort and so on. But then perhaps the user, which is in this case the citizen, doesn't want the system to be too efficient, otherwise his life will be designed for him and he won't have a chance to control the system to make sure that the system is not being misused. If a system is too efficient it might enable the designer and the management to misuse its power rather than use it in a controlled way.

FL Thank you very much. I think in a sense it ties up also with the observation which researchers have made, which I mentioned in my introduction. This was that those organisations which have a rich network of informal systems, which some may regard as inefficient, are often the ones which are the most effective organisations. Certainly the ones which achieve, however one defines effectiveness, some element of satisfaction which is missing in other organisations.

Peter Hammersley

I should like to conclude by making a short statement about one of the objectives of today's meeting. As a number of you have probably heard in the course of the day, this particular seminar was mounted by The British Computer Society at the request of the Editorial Board of *The Computer Journal* as a tribute to the co-founder, with Harold Gearing, of the Journal, Eric Mutch. I don't think it is any secret among all of us here that *The Computer Journal* has a reputation, quite possibly well deserved, for being a little bit up in the air, academic, not really relevant to ordinary BCS members and 'we only get it because it is free but we do not read it, we put it on the shelf'. Don't be under any illusion that those of us who help to produce it are not aware of this current of feeling among a very large proportion of the membership of the Society. That this has happened is in no way a deliberate part of the policy of the Editorial Board, in fact the Editorial Board is as much disturbed about it as possibly some of you members are. One of the reasons for mounting a seminar of this kind is to try to demonstrate that our intention at least is to talk about the really practical things of life in computing. It is very gratifying to me to see the high proportion of people here, as Harold mentioned right at the beginning, who are practising in industry. The proceedings of this particular conference are to be published in *The Computer Journal* next February, and I should like to think that people will see this as something relevant to real day-to-day computing. If they don't in fact, the whole of today has perhaps been a waste of time. I hope they will see it like this, but it is not going to be enough for them just to do that and then stop. It has been quite clear from a number of things that have been said that there are a lot of unanswered ques-

tions. In fact, some of the criticisms that I heard at lunchtime—not nasty criticisms—constructive criticisms, were that in reality we haven't answered any questions today, we have only posed them and left you to do the answering for yourselves. I think that is probably true, so that if there are a lot of questions which have not actually been answered, it would be very useful to have some people contributing to the Journal by answering these questions. You may not have the time to write full papers of four or five thousand words. You may not have the time to read all the back issues of *IBM Systems Journal* and *Datamation* and things of that kind which we would have expected anybody to read before they started making formal pronouncements on aspects of systems analysis. On the other hand we do have a correspondence section—any length, any topic. We do have a short notes section, 500 to 750 words, which doesn't take all that long to write. If people who have got something from this seminar feel that they could contribute something which would in turn make others feel that the Journal was relevant to practical business computing, then we should have done something which Eric would have very much liked to have seen and which I feel would have made the efforts of today well worthwhile.

FL Thank you very much Peter. I think that was well worth saying. I hope that people will take this up and I hope that people will take the publication of what comes out of this seminar as a starting point for keeping up, at the very least, a lively correspondence, but with contributions of a variety of different kinds from notes about methods to conclusions drawn from experiences. The amount of knowledge locked up amongst you which never comes out to be shared by others is enormous. We can do with it as practitioners of the profession, and we can do with it particularly in these changing circumstances in which we find ourselves. We have had a handful of new approaches here and questions relating to the enormous amount of new techniques and methods and experiences which have to be reported, so we very much hope that you will follow up what Peter Hammersley said.

Calls for papers

The Sixth International Conference on Very Large Data Bases will be held in Montreal, Canada on 1-3 October 1980.

Papers of up to 5000 words are sought on topics which include but are not limited to the following subjects:

Data base design, system implementation, and interfaces; Data model theory, Distributed data base and Office systems.

In addition, extended abstracts (two pages) that discuss various aspects of the data base life cycle are sought. These abstracts will be presented at special sessions that will provide a forum for practitioners to discuss and exchange views on various problems and experiences dealing with the design, implementation and operation of data bases.

Send five (5) copies of each full paper or extended abstract on the data base life cycle by **10 March 1980** to one of the two Program Committee Co-chairmen:

Dr Robert W. Taylor
IBM Research Laboratory
K53/282
5600 Cottle Road
San Jose, California 95193
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Professor Frederick H. Lochovsky
Computer Systems Research Group
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University of Toronto
Toronto, Ontario M5S 1A1
Canada

For further information on the conference, contact

Professor William W. Armstrong
Department d'informatique et de RO, CP 6128 Succursale 'A'
Montreal, Quebec H3C 3J7, Canada

The second International Seminar on 'Recent advances on boundary element methods', sponsored by the International Society for Computational Methods in Engineering, will be held at Southampton University on 25-27 March 1980.

Boundary solution methods offer important advantages over domain type techniques and have recently become very popular with engineers as only discretisation of the external surface, usually in a series of elements, is needed. This results in much smaller systems of equations and in a considerable reduction in the data needed to run a problem. In addition, the numerical accuracy of many boundary solutions is greater than that of domain techniques. Boundary element methods are also well suited to solving problems with infinite domains such as those frequently occurring in engineering, for which the classical domain methods are unsuitable.

The first meeting on boundary elements was also held at Southampton University, on 5-7 July 1978, and attracted delegates from all over the world. Like the first, this second conference aims to bring together those researchers who have been actively involved in the development of boundary element methods to exchange ideas and discuss recent advances.

For further information contact Dr C. Brebbia, Seminar Director, Southampton University, Southampton SO9 5NH.