

1996

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Recommended Citation

Nygaard, Kristen (1996) ““Those Were the Days”? Or “Heroic Times Are Here Again”?,” *Scandinavian Journal of Information Systems*: Vol. 8 : Iss. 2 , Article 6.

Available at: <http://aisel.aisnet.org/sjis/vol8/iss2/6>

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"Those Were the Days"? Or "Heroic Times Are Here Again"?

IRIS Opening Speech, 10th August 1996
With additions and also some improvements after the event

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Introduction

Bo Dahlbom has given me detailed specifications for this introductory event: It shall not be a lecture. In fact, in an e-mail he referred to our last meeting at a conference in Grimstad in Norway, where I gave a lecture and also participated in a panel discussion, contributing with a number of far-fetched guesses and highly questionable points. He stated strongly that he enjoyed my intervention in the panel much more than my lecture. And he would not at all see any slides. Nor any manuscript.

He also stated clearly that he wanted me to speak for two or three hours. "We now have all these stubborn bastards collected," he said, "and we have a golden chance of forcing them to listen, and this opportunity should not be missed." I begged for mercy on your behalf, how-

ever, and finally was allowed to speak for only one hour.

I should speak about the future, he said, since that is the subject of this IRIS conference. Or about the past, where I myself belonged. Or both, or something in between.

The event should be informal. To ensure this, the audience would be served champagne. But not too informal. To ensure that, the speaker would only be served a single glass.

The title of the speech, as it now stands, is added after the conference. It is ambiguous, as many parts of the speech itself.

I assume that you all by now have a clear idea about the content of my speech, and I will start reading from my manuscript without further ado.

Living in many different worlds

Some words about my own background that may be of some relevance to what I will say.

I have had the advantage of living in many different worlds. My mother's family were farmers, my father's family were city dwellers. My grandfather was an industrial lawyer, my father a painter who got his Master's in classical Greek, Latin and French, and later became a stage director at the theatre in Bergen. Much later Johanna and I for a number of years staged hand puppet theatre performances for our children, their friends and their parents.

In Bergen I had to fight in the streets all the time, since I was from Oslo and was not willing to be mobbed into talking the local dialect. I had to learn to fight and not give up even when treated rather resolutely. Apart from this, I liked Bergen. I attended a very good and inspiring Rudolf Steiner school, and I got friendly with the skippers and the crews of the fishing boats in the harbour. I soon understood that it was too tough for my mother and father to be told what I learned onboard about adult life.

The theatre in Bergen played an important role in the fight against nazism in Norway in the 1930s. The difference between nazism and democracy, and between aggressive nationalism and loving your country in a tolerant way was explained to us by our teachers. That they were right was demonstrated by the Nazis when they attacked Norway in April 1940. The drastic difference between independence and being dominated from the outside was demonstrated at the same time.

I lived in Oslo and was 13 years old at the time. I did not participate in any particularly heroic activities, but, as many, many others, I was thrown into situations demanding a choice. I will tell you about one such incident. In the spring of 1944 I met an older friend on the street. He was carrying two apparently rather light suitcases. After some chat, he asked me to help him with one of the suitcases. Yes, of course. The suitcase was extremely heavy. There could be no doubt, it was filled with guns and ammunition. We walked up to a house close to a German military camp within the city. Then my friend got the suitcase and disappeared into the house. I felt quite relieved.

The point in telling the story is this: It never occurred to me that I had the option of refusing to help him. I think nearly all my friends would have felt the same way. In the situation something was *right*, and something was *wrong*. Regardless of dangers. You chose the right alternative, period. I do not believe in any religion. The closest I get is exemplified by this *absence of choice* in critical situations, which is what I have experienced confronted with other important choices in my life.

Another aspect of the war was that work on my uncle's farm had priority over school. I had to participate in the production of the food we needed to survive. I always wanted to become a scientist, but I also know much about what it is to be a farmer.

What is the relevance of what I have said so far for becoming a researcher? Primarily that I am convinced that it is very useful to be exposed to a wide range of different ways of relating to the world. Also, I was extremely fortunate in al-

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ways being encouraged in my very diverse interests, without anyone trying to interfere when I did not want it. The adults were willing to listen when I wanted, and if not, they ended up in some corner, having to listen anyhow.

I started at the University of Oslo in 1945, with computing in 1948, programming around 1950, and with Operational Research (OR) in 1952. I got my cand real. degree in Mathematics in 1956, having worked at the Norwegian Defence Research Establishment (NDRE) since 1948. From 1956 on I had the task of building up the use of OR in the Norwegian Defence. I was active politically from 1945 on in the non-socialist but left-oriented party "Venstre" ("The Left", corresponding to e.g. the left wing of the British Liberals).

With this as background, I proceed to comment upon some aspects of my scientific and political work.

The Research Process

Inspiration

The second part of my speech will relate to the research process itself.

We teach students very little about the production of new knowledge, and many believe that important new ideas somehow descend upon us through "inspiration". It is true that you may get euphoric when something suddenly is understood or created in your mind. I remember very, very clearly the exact moment, around two o'clock in the night at the desk in the bedroom at Nesodden, January 1967, when the concept of "inheritance" (or classes and subclasses) had been created. I realised immediately

that this was the solution to a very important problem Ole-Johan Dahl and I had been struggling with for months and weeks. I also realised that the solution introduced for the first time in a programming language a strong and flexible version of the notions of generalisation and specialisation, with all the power embedded in those concepts. And sure enough, inheritance has become a key concept in object oriented programming, and thus in programming in general.

But was it created at that desk, at that moment? Yes and no. Yes, because the idea was not there before two o'clock. No, because in my opinion it could not have been created without all the previous weeks, with discussion after discussion producing only half-baked solutions. Through that work Ole-Johan and I had built up:

1. a large amount of information useful in blocking unpromising avenues,
2. understanding of what criteria a solution would have to satisfy,
3. visualisation of what the implementation problems would be,
4. families of mental models that could be used for analysis of ideas.

I am certain that Ole-Johan have similar experiences from other parts of the SIMULA development

There are many techniques for use in the production process, useful for most researchers, but of course people are different. If you want to achieve results, and do so throughout your career, you must continuously try to improve your most important tools: yourself and your thinking equipment. In my opinion you should always keep a sharp, watchful, thoughtful and questioning eye on your-

self. This attitude is somewhat risky to expose openly, since it by most will be seen as a sign of an overdose of egocentricity. The danger is, of course, that this interpretation after a while may hold much truth. Despite this, I feel that it is more dangerous not to observe closely and reflect critically upon one's own way of working.

One example: The use of parallel processing. Most of you will have observed that in a brainstorming session you arrive at a stage when your creativity seems to have dried up. Then there is no point in continuing. You switch to another issue, and leave it to the "background processing" in your brain to work on the previous problem. Returning to that problem later, you will very often find that you quickly solve some of the difficulties not understood in the earlier session. Or you wake up at night with the solution, as I am certain that many of you have done. I always note down the new knowledge, but never have had the need to lean on the notes next day. I remember. You should be conscious about such processes and exploit this insight. I nearly always work on more than one major project at a time. In this way I may create and explore more ideas in a number of different fields, and I get a better use of the time resources by working with several teams.

In a research team the function of the executioner is important. The executioner in this context is a person (or persons) trying to kill ideas that are not robust enough. In many teams a new idea is cherished, cuddled and shielded so it may grow. Grow up to become a weak attenuated result or finding, being alive only through the fierce protection by its parents. New ideas should be confronted

with the executioner, with cruel attacks, with subtle attempts to prove them faulty or useless. Ideas surviving such a fight are worth building upon.

But. There is a "but". How many of you read science fiction? Do you read science fiction in order to become a better researcher? You should, and if you get unnerved and irritated by the impossibility of what is described, you should read on. You should read on and reverse your attitude: "If this is the truth, what are the consequences? What has now become possible on the next page?" The best science fiction employs the least amount of gadgetry, and explores worlds resulting from one or two crucial factors being different from what we are accustomed to. Ursula K. LeGuin's *The Left Hand of Darkness* is the best illustration that I know of, but Isac Asimov's *The Naked Sun* is perhaps more directly relevant to our field, when we discuss the impact of networks.

When you are brainstorming, ideas may turn up that are interesting in some respect, are fun, or are utterly different from those you have pursued till now, but ideas that obviously are wrong, in the sense of being incorrect, not corresponding with reality. A well behaved, realistic, no-fuss-oriented researcher will relegate such ideas to their proper place in the trash can, and quickly so, to avoid throwing away important time.

The science fiction reader is better trained and will behave differently, as described above: "If this is the truth, what are the consequences? What has now become possible on the next page?" The idea must of course meet the final test of correctness in the confrontation with the executioner, but only after having been played around with. "It is not

correct, but how could we modify it to become correct, and still keep its usefulness?" The willingness of keeping your mind open in such processes is an important asset in a research team.

Teams, Conflicts and Criticism

Most of the work that I have done that people seem to regard as useful, has been made in teams. I work best in teams, and I have tuned my research production processes to the setting of the team.

Many people have observed that the research teams in which I have been active, usually have contained people much younger than me. I have been asked if that is so because I prefer to work with young people. The answer is no. I prefer to work with people who believe that my newest ideas are worth while working on, and themselves have ideas that fit in. Older, more established people usually did not believe that, and don't. There are exceptions, like the people in the BETA team. In the EU battle I was working in many teams, most teams consisting of people from a wide age bracket. In research it has been different, as I have told.

Team work is a social process, in which career interests, conflicts and prestige frequently may be elements. You may feel more comfortable for a while by denying this postulate, but you will be better off by assuming the postulate as a matter of course. If this is done, you may arrive at well considered behaviour in conflict situations. Usually your response should aim at keeping the team in good shape. There is much to be said, but in this brief, one hour version of my speech, I will confine my remarks to the following points.

First, if you are a man, which in research from a statistical point of view is highly likely, then learn from most women that it is better to confront and solve conflicts immediately along the road, as they turn up. Don't do what men usually do: wipe conflicts under the carpet, and get the big explosion later. The female behaviour is more tiresome in the short run, but more safe in the long run.

Secondly, a main contribution to reducing the effects of conflicts is to dissociate your prestige from silly factors like seniority, rank, faultlessness, etc. And as you grow older, show in practice that you listen to criticism, all criticism, and also from younger people, and adapt to it visibly when you think it is right.

It is often said that criticism is worth its weight in gold, but then it must be a positive, constructive criticism. My own experience is on this point completely unambiguous: Nearly all criticism that I in retrospect can see that I really learned from, I felt as negative and destructive, and as deeply unjust, when I got it.

When a new member joins a team, or you get a new student to tutor, you must immediately find out how she/he reacts to criticism. It is obvious that criticism may hurt, may be regarded as unjust, or outright invalid. The person criticised may well be right in these reactions. However, if the person then becomes secluded, angry, vengeful or stubborn, you (and the team) have a problem that must be remedied. The person must carefully and gradually, but inevitably be exposed to a treatment that will harden her/him to the life conditions in a successful team. Those who cannot endure this process, should not work in teams.

Both the sender and the receiver ought to have the basic attitude that crit-

icism first and foremost should be useful, not just or correct. You should use it as a resource, and be happy that you may consider it within the team. If your work is really interesting, you will receive plenty of criticism to handle anyway after your results have been published.

Solutions Are Always Related to Objectives

Informatics (computer science) and Operational Research (planning research, OR) emerged as sciences in the wake of the last world war. For me informatics and OR have always been closely related, and I tend to see many tasks in informatics from the perspective of OR. I left OR in the mid-1960s, however, mainly because the OR community in my opinion became too obsessed with optimisation and too little with decision support, and because it failed to realise that a thorough knowledge and mastery of the computer is a necessary part of competence in OR.

A main and, at the time, largely undebated assumption in the development of the post-war culture was that “technological progress happens, it is politically neutral—and *good!*”. (The concern about atomic weapons was one of the exceptions.) In Operational Research, however, the situation was somewhat different: The task was to find the best use of men and equipment, *dependent upon a stated set of objectives*. If the objectives were modified, the “best use” changed. Also, the development of new equipment had to be fine tuned to a proper understanding of the objectives of the decision-makers. And those objectives could be highly political, particularly in the military field. The application of OR techniques to conflicts between interest

groups *within* organisations was an idea dear to an OR researcher.

Responsibility

The Role of Science in Decision-Making

The Norwegian Defence Research Establishment was the cradle of both informatics and operational research in Norway. I had the fortune of arriving there in 1948, and was the first assistant of Jan V. Garwick, the founding father of Norwegian informatics. He was brilliant in programming and applied mathematics. He also to some extent was interested in observations and facts, since he needed them as input to his calculations. To experiment, collect and evaluate observations, to “get inside” the systems analysed, however, he thought was boring. In the defence, we had the officers to do such tasks for him, in his opinion. This attitude resulted in some surprising results, and contributed to the NDRE decision to ask me to switch from computing to OR in 1952.

My ambition was to build up OR as an experimental and theoretical science in Norway. In 1956 I was asked to build OR groups both for the Army and for the Air Force. I wanted our groups to be reckoned as being among the top groups in the world in three to five years, and selected jobs and job strategies accordingly. That was risky, but I said openly that if we did not succeed, that would be no tragedy. It only meant that another mediocre group did not make it.

In 1960 The International Federation of Operational Research Societies asked the Norwegian OR Society (which I chaired) to arrange the third international

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OR conference in Oslo in 1963. I think most people regarded that as strong evidence of international recognition. The strategy had turned out to be successful. I tried it later, at the Norwegian Computing Center, and it worked out once more. This time I gradually was forced to realise that I could expose myself to the perils and rewards of such a strategy, but that I did not have the right to put my younger team members' professional career at stake. Since then I have become much more careful to create research strategies that are more safe, but still ambitious.

Our OR success created an unexpected conflict. I wanted OR to be a science and our work to be research, providing support for decisions made by those having the responsibility for the activities we analysed. I discovered that many in the military establishment were only too happy to have the researchers point out "the correct solution" to some of the hot issues, and that my Director at the NDRE was even more happy to see a development that gave more power to his institute. I tried to counter this by being very careful in pointing out which conclusions could be validly drawn from our work and also the factors that we had not taken into account. I felt that unless we did, both OR as a scientific activity and the decision structure in the defence would be undermined.

The military people appreciated this attitude after some clarifying discussions. The conflict with the Director developed further. He wanted to introduce a variant of OR that we today would label "OR Light", named at the time "systems analysis", staffed with people that I felt did not share my views on responsibility structures and validation of results.

One such study I saw at the time contained a table from which you could read that under the assumption of 30 bombers attacking Oslo, and a given strength of the missile defence, 32 bombers out of the 30 would be shot down.

I did not want my groups to join this new department. The director wanted that. I did not give in. He did not give in, and he was the boss. As a consequence I left the NDRE in 1960 to build up the Norwegian Computing Center as a research institute in computing and OR. My six best researchers followed me, leaving a very big bang and a not very pleased director. The director, by the way, was very influential within the power elite in the Norwegian military-industrial research complex.

The conflict also made me aware of corresponding problems in keeping democratic control in the planning processes in Norwegian politics, both at the local and at the national level. As a result, a debate was initiated among planners about our professional role, and I once more went into party politics. At the time when SIMULA was finished, I was the chair of my party's Strategy Committee. Soon after I became a member of the 5-person leader group of the party whose parliamentary group then participated in the Norwegian coalition government.

Object-Oriented Programming

The building up of the Norwegian Computing Center went on as planned. I started developing the SIMULA language, and Ole-Johan Dahl joined me. That development—and the history of object-oriented programming—is described elsewhere (R. L. Wexelblat (ed.), *History of programming languages*, Academic Press, 1981). The main problem in intro-

ducing advanced information technology in Norway was, however, that we did not possess a very large and modern computer. We were forced to order an excellent medium-sized Danish computer, named GIER, which would secure that Norway would stay in the second division among nations in relations to information technology for many years to come.

In May 1962 UNIVAC invited about a 100 European computer people to the US to have a look at the new UNIVAC 1107 computer and some other models. We had bought a computer, so instead I brought with me the first version of SIMULA to sell to UNIVAC. The outcome of the tour was that UNIVAC offered the one 1107 computer it had set aside for a show stand in Europe to the Norwegian Computing Center, at a 50% discount, on the assumption that SIMULA would be made available on the 1107 computer, according to a software contract. When I returned from the US and told this, people thought that my megalomania had taken a turn for much worse.

However, in August 1963 (after rather dramatic conflicts) we got the UNIVAC 1107 to the Norwegian Computing Center, at the time by far the most powerful computer in Northern Europe. (Only the German Secret Service had a more powerful machine in Europe.) We had very important industries and institutions as customers. SIMULA was ready in January 1965, and Norway made its "long jump forward" in the use of information technology. These are the kind of results that give you many enemies. Power structures had changed, important people had lost battles, other people had become more powerful. As for myself, I was at the end of the fight overworked,

had to have three months leave of absence to recover, and had lost a considerable amount of money in terms of expenses incurred that the NCC board on beforehand had promised to reimburse, but never did.

SIMULA had full support within the Norwegian Computing Center and in its board, and almost nowhere else in Norway. What was wrong? Four main points:

1. There would be no use for such a language as SIMULA.
2. There would be use, but it had been done before.
3. Our ideas were not good enough, and we lacked in general the competence needed to embark upon such a project, which for these reasons never would be completed.
4. Work of this nature should be done in countries with large resources, and not in small and unimportant countries like Norway.

Being Engulfed in the Research Jungle

From 1963 on I was very unpopular in the research-industrial power elite and the research bureaucracy. I believe I must keep the Norwegian record in number of refused research applications. I have a number of interesting anecdotes to tell in this area. And when I occasionally got funds, it could be the result of arm-twisting, e.g. when I was subject to treatment these people did not want exposed. A problem within the modern research administrative structures, public or private, is that their decision-making is semi-secret. They are not obliged to defend their decisions openly, but the system is wide open to the spreading of rumours about those not supported. All

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the results I have participated in producing that today are regarded as reasonably useful, have been achieved against the wishes of the people in power. The top research administrator even called our largest (and conservative) newspaper at the time and warned them against criticising the Council for Scientific and Industrial Research, because "that would give support to Kristen Nygaard and the left extremists at the Norwegian Computing Center". The journalist, however, exploded with anger and never since got a call from the director. But you may be sure that many other calls were made.

Some people believe that scientists lead a noble life, aloof and relieved from conflicts, escaping annoying decisions, only guided by the quest for new discoveries and truths, so different from the tumultuous and hazardous existence of a businessman. Other people, like myself, would rather state that being engulfed in the research and development jungle, one is sometimes longing for the peace and safety of the marketplace.

Maybe I am conveying to you an impression of my life as depressing, entangled in endless conflicts, suffering from lack of recognition. This is not the truth. Very much of the time was spent in doing research, the most exciting activity there is. When I think back upon those years, what I first remember are the ideas and the solutions coming to us, the understanding created, the excitement, the friendship and the cooperation in the teams. In order to prepare you for the research jungle, however, I have to tell you about the conflicts. Without being alert, without ability to fight and dedication to the task, you are not likely to achieve much. Particularly if your work contrib-

utes to changing important thinking patterns and power structures in your field.

Why Are Pioneering Project Proposals Turned Down?

Why are so many projects among those that in the end produce really significant results, turned down by review boards, even when the review board bears no grudges against the research people applying? I think the explanation is very simple, and does not necessarily imply that the reviewers are stupid or in other ways incompetent.

Review boards may be qualified for evaluating proposals that are well within the current framework of a science. Proposals for projects that, if successful, will change or importantly extend the existing framework, probably will not be understood by the review board. (Lack of review board understanding cannot be used as a criterion for support, sadly enough, since many crazy proposals also will satisfy that criterion.) If a proposal is well understood, this is a strong indication that the new insights produced by the projects are mainly extensions within the earlier known framework. There is no remedy for this kind of situation, except to greatly reduce the funding of projects after reviews by evaluation boards, and to increase the amount of money to be used by research institutions according to their own internal fuzzy decision procedures. Maybe more useless projects will get support that way. On the other hand, it will improve the chances for support of really new ideas. And that is an important consideration for a country's research.

This being said, I can tell that I have some almost incredible horror stories about third and fourth rate review boards

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members. Why this state of affairs? One must understand that first rate people prefer to use their time on producing new research results.

Research administrators, industrialists and reviewers in Norway are similar to their counterpart in USA in one respect. In the US, these people will reason: "The project ideas in this proposal originate from the USA. This is a strong argument for giving support." In Norway, people will reason the same way. Verbatim.

Are You Responsible for the Uses of Your Own Research?

When the first version of SIMULA (SIMULA I), was made available in the spring of 1965, it was immediately used in a series of jobs in Norway and, even more, in Sweden. It was of course fascinating to see the tool we had developed being put to practical use and influencing the design of organisations and production facilities.

It was evident that the SIMULA-based analyses were going to have a strong influence on the working conditions of the employees: job content, work intensity and rhythm, social cooperation patterns were typical examples. The impacts clearly tended to be negative. Not surprising, since the analyses were founded upon a Tayloristic view of management.

My own sympathies were with the employees, and the question was unavoidable: Should I continue to support the propagation of a tool that to a large extent was used against those whom I wanted to show my solidarity?

As I have told, it was not at all a new experience for me that research had implications in politics. But these had

mainly been consequences from one world into another, relating to commonly hailed democratic ideals. I was active in the research world and in the political world, but they were separate.

Now matters were different: The demand I had to make was that analyses should be made as in Operational Research. The "best use" of labour and equipment ought to be evaluated *both* from the objectives of management *and* from the objectives of the employees, taking into account that these objectives normally were at least partially conflicting. The alternative "best" solutions should then, in my opinion, be communicated to *both* management and labour.

I realised of course that this demand would not be accepted by the users controlling the resources for the applications of SIMULA in business and production planning. When I tried to state my views to representatives for the employers, I was not taken seriously, as expected. The question then became: Could more realistic alternatives be created?

The Iron and Metal Project

Trade Union Contacts.

Politically, the end of the 1960s were quite eventful for me. I started doubting my engagement in traditional party politics, and left the Liberal Party when I realised that I had become a socialist. I was the chair of the committee on environment problems within the Norwegian Association for the Protection of Nature for a couple of years, and I worked closely with socially outcast alcoholics in an alternative institution experiment. Both

tasks showed me other realities, very different from those I had known before.

From 1967 on I became a member of a Trade Union discussion group on information technology. It is interesting to note that a large fraction of the young trade unionists in the group since became top leaders of the Norwegian trade unions.

The group members came from a wide range of sectors in the society: Job shops, chemical plants, transportation, white collar work, hotels and restaurants, the public sector. I was the only researcher in the group and had for that reason special functions in our work. But the other members had their own areas of competence, equally important for the task.

We first discussed possible consequences of the imminent introduction of information technology in various sectors, then how we should build up our own competence. We never considered building that competence by teaching to union members the curriculum used by programmers, engineers or managers. Knowledge is organised for a purpose and reflects the world view of the authors in terms of corporate values, power structures, objectives to be achieved etc. Uncritical acceptance of such material would make us brainwash ourselves. What we needed was a re-examination of information technology based upon the world view of the union members, emphasising solidarity, industrial democracy, safe employment, safe working conditions, decent wages etc.

The Project Is Established

Since no such exposition of information technology did exist, we concluded that it was a research task to produce one. In

Norway the Royal Norwegian Council for Scientific and Industrial Research (now a part of the Norwegian Research Council) was supporting a wide range of projects in information technology, and the Norwegian Iron and Metal Workers' Union decided on its convention in 1970 to apply for money to "evaluate planning, control and data processing, based upon the perspective of organised labour" and to ask the Norwegian Computing Center (where I was working) to carry out the project.

This was the first project application of its kind to the Research Council. It was handed over to its Committee for the Mechanical Industry which, no surprise, had its offices in the building of the association of the employers in that industry. Their responses, internal discussions and attempts at getting control of the project have recently been published in a research report. They are interesting, but the end result was that the Iron and Metal Workers' Union got the funding and the Norwegian Computing Center got the contract.

The Iron and Metal Project turned out to be very different from other projects. Not only did the shift from a managerial to a labour perspective generate a range of new observations and insights, even the basic criteria for achievement had to be reconsidered.

Associated with the project were four local unions at four companies, distributed over the country. They were intended to function as reference fora, sources of information and criticism. The group at the Norwegian Computing Center consisted of two researchers (Olav Terje Bergo and myself), and we had a very active and helpful contact person in the na-

tional union offices (Jan Balstad) acting as our most important advisor.

The Meaning of the Term "Result"

In our first plan for the project we intended to examine the planning systems being used in the four companies, interview the local union members about what they wanted (and did not want) from the systems. Then we would examine the possibilities for modifications of the systems to make them conform better to union objectives. From this we wanted to extract guidelines both for system design and for trade union policies relating to new systems.

During the summer 1971 I felt more and more uneasy about this plan, but I could not spot what was wrong. Gradually it dawned upon me that our strategy would produce some reports about systems, and two researchers who had knowledge *on behalf of* the union members. The reports and the knowledge would not be linked directly to the action possibilities of the local unions, and no action strategy would be developed and tested by the unions themselves. No comprehensive learning process was incorporated, and the interviews would be of limited value when no serious knowledge had been built among the members.

The reorientation was painful, but eventually we chose to tell the steering committee that we had to completely change the project plan. I hope that similar choices will not turn up too often in the future.

The key decision was the acceptance of the following statement:

In most research projects the results of the project may be said to be what is written in the project reports. In this project another definition will be

applied: We will regard as results actions carried out by the trade unions, at the local and national levels, as a part of or triggered off by the project.

The statement was even, at the insistence of the researchers, made subject to vote and passed unanimously.

The immediate consequence was that the local unions got a new and pivotal role. The task was to create knowledge-building processes locally, and to initiate action relating to the local situation, supported by analyses made by the researchers and working groups of local union members and elected shop stewards. The researchers became consultants and participants in a mutual learning process.

Each of the four local unions formed working groups. Approximately 30 members participated at each site, split into groups of 6-8 members. Each local union selected tasks they wanted done, and the results of their work appeared in reports, to a large extent also written by the unionists. The reports were presented at meetings with the rest of the members, and important decisions were subjected to ordinary decision-making procedures.

One of the unions made a "Company Policy Action Program", concentrating upon the planning of work within the union itself. Another made a comprehensive study of a production control information system, and succeeded in modifying the system in a number of important ways. The other two unions also produced interesting results, according to the above definition.

The main result of the project was a self-sustaining process which did not depend upon the presence of external researchers and project money. In 1975 an agreement (the "Data Agreement") was signed between the Trade Union Con-

gress (corresponding to e.g. AFL/CIO) and the National Federation of Employers, stating the right for the trade unions to be informed and participate in the development and introduction of computer-based system impacting upon their working conditions. They got the right to elect specialised shop stewards ("data shop stewards") to work with information technology issues.

The "Conflict Strategy"

For me the project was a part of a wider, more far-reaching strategy for building up trade union power in Norwegian industry. I wanted the unions to place themselves in conflict situations, by carefully selected actions, that demanded more insight and improved strategies. This would trigger new actions, and so on. The main objective was to enter a spiral of moves, each move increasing the insight and the power of the workers.

I used the term "conflict strategy". That was used by the conservatives in the unions, telling everyone that Kristen Nygaard wanted to launch a series of wildcat strikes around the country. I quickly had to rename the strategy the "action strategy".

By the beginning of the 1980s, the situation in the unions changed, however. The important consideration became to keep the jobs, not to improve them. And associated with this, other issues became in my opinion more urgent politically.

After the Project

After the Iron and Metal Project it became important to make what had been understood about the system development process and the societal implications of information technology a part of

academic teaching and research on information systems. As a part of that process I ended up as a university professor (there were additional reasons) working in teams with students - many now colleagues - trying to build up an alternative curriculum in system development. Including insight from the social sciences was an important part.

I also decided that I would have to stay active both in traditional informatics (the BETA programming language) and in system development, and also acquire and keep updated "hands-on" familiarity with important new developments (workstation hardware and software). If I succeeded, everyone would have to admit that we at least had some real qualifications. (In addition all three areas are great fun.) Or, more seriously: My work in languages could be used to legitimise our work on system development. This may sound silly, and perhaps it is. But it has worked.

Conflicts and the IRIS Audience

How many basic choices were really made during these years, from 1958 to 1988? How many were difficult? When I try to remember, I feel that most choices were consequences, and that those remaining seldom were difficult. I had been careful to burn bridges behind me. As a result, few options for retreats were available—a remarkably good strategy for keeping yourself in shape under pressure.

And the pressures will be there if you try to go against the power structures. You have to build a defence and a self defence. A defence against others trying to stop you or destroy you as a researcher. My wife was in 1963 told by people in power that they were opening up a most

interesting and rewarding position for me in the US. She got very angry, since she knew that the completion of the SIMULA work was my main concern. You also need a self defence against yourself and the temptations to choose a comfortable but wrong way out in critical situations. But compromises may be necessary. The greatest danger then is not the acceptance of a dubious compromise, but in not being cynical and honest about it. Your mental processes will try to justify your actions to yourself, making the compromise the desired solution. And you will change yourself, if you are not very honest and astute.

Bo Dahlbom asked me to talk about the Iron and Metal project. Why? Many people do not know it properly, he said. And some have forgotten those aspects that ought to disturb them as their environment is pushing them softly - to the right. Perhaps I should ask some questions to those in the audience who believe that they have been influenced by that project and its successors:

Has anyone resented the content of your work recently? If not, what is your excuse?

Have you had any real conflict in your research activities lately, or does such conflicts only belong to your now romanticised, glorious radical past?

Will your recent research to any extent increase the power to influence their own fate for people with whom you feel solidarity?

I am afraid that I personally have to answer "No" to these questions. My excuse is that I have been engaged in other, political activities that in my opinion to a very large extent have produced these desired results.

I could go on, but since this is a friendly occasion, I only want you to get the gist of the kind of questions that ought to be asked—and demonstrate to my pupils and colleagues that I still am able to be rude. (Being an optimist, I assume that you realised that I was rude a few moments ago.)

The Future

Is the Information Gap Widening?

A very frequently repeated warning, even from rather establishment oriented people is that the gap between the "information rich" and the "information poor" is widening, and that this makes the situation for the latter even more gloomy. How should this gap be bridged? Ambitious plans are discussed to educate the "information poor". I think these plans mostly are an excuse for not addressing the real problem: the deplorable and increasing poverty of an increasing percentage of the population. Poor people need more food, well paid jobs at sensible working hours, improved health services, in short: a better living. These resources must be taken first from the rich and the criminals, who must be made much less rich in order to reduce their power in the society, but mostly from people in the middle income brackets, who must be willing to reduce their present excessive consumption. Given improved living conditions, "information poor" people will start building the surplus that later will give them resources to become "information rich."

The Environment

We use the term sustainable development for a development that may go on without depleting the resources of the world for future generations and that is not destroying the ecological balance, either locally or on a global scale. Or rather, we used the term that way many years ago. Now the politicians have decided that the definition is dangerous, because it is correct. When applied, it tells us that even the promises of the politicians will not bring us much closer to sustainable societies, and the policies the politicians practice even much less so.

Thus, the definition has been doctored. Instead they talk (in the Maastricht Treaty) about "a sustainable and non-inflationary growth that pays respect to the environment". Even the notion of sustainable growth, not development, is (in the Maastricht Treaty) made contingent upon price stability. This is very, very different from sustainable development. Why is this done? Because we, the voters want something we realise is necessary for survival. Our politicians want to be reelected, and at the same time do not believe that we really are willing to pay the high costs for what we say we want. They feel that it is necessary to make us believe that we may get both growth and sustainability in order to get our votes. The sad point is that they may be right.

In the developing countries no such deceptions are even attempted. The poverty is so appalling and the demand for a decent living so pressing that ecological considerations are not understood by voters, unless it relates to changes in production structures that may benefit large groups.

We now see the effects of globalisation in many ways, e.g. through species

(including diseases) crossing boundaries. The effects of a ruthless capitalistic agro-industry, with the use of food cosmetics and, soon, large scale genetic manipulation of organisms, all create new, poorly understood but possibly very serious health risks for entire populations. At the same time fertile soil is taken out of production or is rendered infertile.

In addition, we have the effects of aggressive nationalism, ruthless multinational capitalism and the rapid expansion of large scale organised crime infiltrating also the hitherto non-criminal sectors of business. These are the real problems of the future. We know it, and we all know that we are not addressing these problems, except in uncommitted terms.

For this reason, the EU battle did consume all my political efforts for six years. I stopped working with the trade unions on industrial democracy and my research in system development (but not in languages) because the EU battle was more important, also for trade union members, and because I, as the leader of "No to EU," could do something to secure a victory.

Looking forward, we have of course to maintain the operation and routine expansion of our current economies and societies. But this is only postponing the day when no further delay is possible, if we will survive as a civilised species. There is a very real chance that we will not make choices that may save us.

The most important consideration now, when deciding upon where to invest one's political energy, is to contribute to the saving of a civilised world for the next generations.

Very serious such catastrophes have already happened, with Rwanda and Bosnia as grim examples. And we are

not even generating and examining seriously scenarios that may become a nightmarish reality any year. How would we handle three successive years of very low wheat harvests in the world? What about a major nuclear reactor disaster in France, making food produced in Western Central Europe impossible to eat? What about major social upheavals in Germany, France and Belgium caused by reductions in living standards, resulting from government attempts to enforce the so-called convergence criteria on the economy, necessary to introduce the Economic and Monetary Union?

What Next?

I am seventy years old in seventeen days. During the EU battle I had to work even harder than at any time earlier in my life. I did not check my health during those six years, for obvious reasons. My doctor is puzzled, because he afterwards did not find any significant damages. I intend to work until I become senile, and even longer, since I hope that my colleagues will have the decency not to tell me when I have arrived at that stage.

What should the remaining years be used for?

I am now assembling a reasonably powerful multimedia workstation, and I am busy teaching myself multimedia technology. I feel that it is necessary in order not to get outdated. It is fun, and I may link it to one of my main hobbies: photography.

In straightforward research in informatics, I will work on some language ideas that originally date from the late seventies and early eighties. They are supplemented with ideas that I came up with in projects in which I unsuccessfully participated around 1990. There was

no interest at that time. They will now be used together with other ideas from the members of a new team being built at the Department of Informatics at the University of Oslo. We have applied for research money, but since I believe that the ideas are rather powerful, I do not think we will get any funding. Which once more leaves me with the task of getting money from other sources. And this is probably getting more and more difficult, since funding agencies now have an additional argument for refusal: I am too old.

As you well know, the winners write the history. You may regard this insight as resulting from observations of the past, or as an obligation towards future generations. The latter interpretation implies that I have to write the book about the EU battle in Norway. Consequently I am now very busy at this task. Bo Dahlbom and Lars Mathiassen are rather insistent that I should write a book about my own research when the first book is finished.

Will I in the future return to the political aspects of system development, in the sense of the content of the Iron and Metal Project? Only if I find a way of relating this activity to what I just have labelled "the real problems of the future." Just now I may feel that I have all the time I need ahead of me. But I have at least become old enough to be very careful with the use of my time. I know that certain tasks must be finished and thus have priority.

Some Words on Politics—at the End of the Conference

Some people misunderstand the nature of the political content of system development. I remember a lecture about the

Iron and Metal Project, around 1974, for a group of very promising and very career-oriented executives in their mid-thirties. The atmosphere was reeking of hostility, and I got the question: "Does not what you have done belong in politics rather than in science?". "This question may be answered with "Yes" or with "No", I said. "If you regard what you have learnt at the Norwegian Institute of Technology in Trondheim and the Norwegian School of Business Administration in Bergen as belonging to politics, then what I have told you also belongs to politics, and the answer is "Yes". If you do regard what you have learnt there as science and not politics, then what we have done also belong to science, and the answer is "No". Please pick the answer you want." I must admit that the answer was not appreciated.

People feeling at home in the IRIS environment do not need to share political views. They may be socialists, believers in the benefits of the market forces, or people in intermediate positions. We share the insight, however, that information systems will impact upon the interests of people affected. We agree that the evaluation of the impacts will depend upon the evaluators' perspectives on the system and its context. These perspectives may differ considerably, e.g. between management and labour. Also, the perspectives entered into the development process may significantly influence the properties of the finished system.

We also agree that a choice of perspective or perspectives to be entered is a necessary and legitimate part of any system development process. The choice of a management perspective is, e.g., from a scientific point of view, just as legitimate as the choice of a labour per-

spective, and vice versa. Consequently, the agenda of system development research must include the creation and the evaluation of methods for system development, including tools, techniques and methods of organisation, based on a range of different relevant perspectives.

To deny these points of view we regard as unscientific.

Our own political views or the views of the organisation for which we are working may also legitimately influence our own research agenda and the methods we prefer to use. It is important to be aware of the perspectives one has chosen in a given situation or project. One should also be open about them. The scientific standards for evaluation of research results will, however, be independent of the perspectives used in the research. The IRIS community should have no problems in accommodating researchers coming from more conventional management oriented environments, as long as the newcomers accept and adapt to what I have said just now.

The IRIS community has its roots in the trade union-related Scandinavian projects, starting with the Iron and Metal Project in 1971-73. Participatory Design (PD) has as a result been at the centre of interest for many researchers in our community. The agenda and conditions for revitalisation of PD and related research is now being discussed. That is an important discussion. My hope is that such a discussion will consider a wider range of concerns than those addressed at the inception of PD around 1970.

Music in the Air

IRIS 19 is finished. The Scandinavian School has convened. It has, sometimes reluctantly but often boldly, considered

the Future, and it has paid tribute to its Past. The Past is delighted by all the warm words from the Present and by the friendly reception by the Future, that is by all the young people at the conference.

Sounds from hit tunes of the past have been hanging in the air. Claudio Ciborra mentioned "Those were the days", and we all understood the allusion to primeval times, when the Scandinavian school was born in famous battles now remembered with awe and nostalgia. Myself, I felt the conference humming "Hello Kristen, welcome back Kristen, it is good to have you back where you belong". As the conference gained pace, criticism got more pointed and suggestions more constructive, a feeling of optimism caught momentum. And now, listening, we seem to hear people in our near future singing happily "Heroic times are here again."

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