IS THE COMPUTER A TOOL?

Edited by BO SUNDIN

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Tools and Practices in Systems Development

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Tools and practices

Some conceive of the world as an assembly of things and of facts. By "things" they mean the objects which are familiar to them from everyday life, like stones and pieces of wood, metal or plastic; by "facts" they mean for example the existence of a piece of metal with certain properties at some place and time. The "things" may also be considered to consist of components which are not familiar to us from everyday life, like atoms and molecules and their parts. The basic facts of the world might then be held to comprise the properties of the ultimate parts of the objects of the world and their distribution in space and time. This is roughly the kind of world-picture that empiricist philosophers have derived from the 17th century mechanical world view and from other natural sciences.

The introduction of tools into such a world causes trouble. Either you have to reduce tools to things, thereby losing the characteristics which distinguish tools from other things. Or else you have to take the characteristics of tools seriously, thereby undermining the foundations of the empiricist world-picture. It is significant that reflection on what we do with tools plays a part in Heidegger's analysis of the world we live in[1] as well as in Wittgenstein's reflections on the relation between language, action and reality.[2] A typical tool, like a hammer or a saw, is a thing which has been fashioned so as to enable us to do certain things with it. A tool is essentially connected with a form of activity or a "practice". A practice may be characterized as a rule-governed activity. The rules which govern our practices are normally implicit in what we do. We presuppose the rules when criticizing someone for a good or bad job; and in doing so, we might attempt to articulate some of the rules

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we presuppose. Our practices are based on "knowing how" rather than "knowing that".

In order to learn a practice, we have to acquire the relevant practical knowledge rather than theoretical knowledge. The apprentice follows the doings of the master, he makes his own attempts, and receives correction and advice along the road. The rules which govern the master's activities can only be taught by example. Similarly, when learning our first language, we have to learn the rules from examples. Having mastered one language, we can then speed up the acquisition of other languages by learning the explicit rules to be found in grammars. But examples are still necessary to make the grammatical rules understandable.

Our linguistic practices do indeed provide us with a good model of what is involved in all practices (tool-using or not). Our ability to use a language presupposes that we have been able to abstract a very complex set of rules from the limited number of examples we have been exposed to. Linguistic performance presupposes linguistic competence, i.e. mastery of a sufficient number of rules and examples belonging to the language in question. Taking part in any practice (rule-governed activity) similarly requires a certain competence which can only be acquired through socialisation. The competence required to take part in a practice is normally a complex phenomenon, consisting of motoric, cognitive, perceptual and linguistic skills. (Think of what is required in order to be able to play chess, paint with a brush or read a newspaper.)

Tools are thus embedded in human practices, which demand that a certain level of competence has been reached by those who take part in the practices. Human practices are again embedded in wider social contexts, which we might refer to as cultures or forms of life. Against this background, it is easy to see why the question "What do we do with our tools?" must be supplemented with the question, "What do our tools do with us?" The introduction of the mechanical clock did not merely mean an improvement upon earlier time measurement techniques. The mechanical clock opened up new developments in science, technology and social organization which have radically transformed our form of life.[3] Granted that there are similarities between computers and some of our tools (there are dissimilarities as well, as Thomas Tempte stressed in his contribution to the symposium "Is the Computer a Tool?"), we are led to ask what computers do with us. How will computers affect our practices and ultimately our form of life?

A new perspective on systems development

In order to be able to answer such questions, nothing less than a paradigm shift will be required within the field of systems development. The dominant perspective on systems development from the 1940's to the present has been drawn from the cybernetic tradition, which again belongs to the scientific tradition known as "positivism". In the positivist tradition, the exact natural

sciences are considered as a model of all science. All sciences, irrespective of subject matter are held to use the same "scientific method", including the same kind of explanations (hypothetico-deductive method and deductive-nomological explanation).[4] The difficulties of accounting for human purposes and other aspects of the social world in a positivist perspective lead to a strong emphasis on the technical aspects of systems development, which again leads to technocratic planning: "cybernation is about the regulation of society and this is what computers are for".[5]

The research group to which we belong—the PAAS project—has for some years been working towards a new perspective on systems development.[6] The efforts have proceeded in four directions: (1) The philosophical and theoretical presuppositions of the dominant perspective have been criticized, and attempts have been made to work out an alternative perspective based on Wittgenstein's later philosophy and on current work in the social sciences and the theory of science. (2) Some cases of computerization have been studied in detail for several years. We regard an intimate knowledge of the development within some selected fields as a necessary condition for finding the central themes and matters of concern. Along with the empirical work, we have also paid a considerable amount of attention to the researchers' role in ongoing development, and we have arrived at a position which might be regarded as a modification of what is sometimes referred to as "action research". (3) Attempts are being made to make research more effective by using combinations of traditional scientific methods and art. This explains the unusual composition of the research group. Besides computer specialists and a philosopher, the group includes an artist, a photographer and an artisan. We do not regard the visual arts as a mere supplier of illustrations to the products of research, but as providing supplementary ways of exploring reality.[7] (4) The essential connections between rules and examples, practices and cases, which were outlined in the first section of this paper, have also led to an increasing interest in the historical aspects of systems development. A professional historian has been affiliated with the project for full-time work on the history of the Swedish social insurance system, and several of the project members have made longer or shorter excursions into the historians' territory.

Computerization, professional competence and quality

Learning to use a tool means learning a practice. As long as the makers of tools were identical with the users of tools, the practicians were in full control over the practices. With increasing division of labour, the influence of the practicians over their own tools tends to diminish. In Ivan Illich's terminology, our tools tend to get less and less "convivial", more and more controlled by others.[8] The instrument makers at the first Swedish factory for surgical instruments in Stockholm maintained a close relationship to the practicians, the surgeons, throughout the 19th century. (The manager of the factory,

Mr Stille, eventually became a member of the Swedish Society of Physicians.) Computers are not convivial. In the first place, the makers of computers are not identical with the users of computers. In the second place, the planners of computerization seldom include the individuals who are going to operate the computers. The practices of an increasing number of individuals are heavily influenced by outside activities over which they have no control. What happens when a practice is computerized without consulting the practicians? This is the first question we are going to consider in this section. Secondly, we shall give some glimpses of a project which attempts to reverse the received order of events in the field of computerization. Central to our research project is the study of the effects of computerization in the field of forestry evaluation in Sweden. The computer analyst responsible for the introduction of the computer system in this field is now a member of our research group. He has described his own experiences in the following terms:

"During the years 1968–1979 I was responsible for the development, introduction and maintenance of a computer system for valuation of forest land. The system was introduced with local computer terminals, working in Time-Sharing (TS) in the first TS-system that was started in Sweden (1968). During those ten years the system has developed, but not always as planned.

The system contains much more than the computers, the terminals and the programmes—the people involved have also to be regarded as parts of the system, making this a living thing, moving in time with the changing relations between the participating humans, in ever varying forms, consisting of everything from bitter conflicts to smooth cooperation. One major experience is that the computer analyst often finds himself in an invidious position between the higher echelons of power who issue the orders, and the real users of the system, situated in lower positions in the local offices, far away from the centre of power."[9]

Most of the foresters responsible for forest evaluation greeted the computer as a welcome aid to their daily work. The computer relieved them of long and tedious calculation work, and made it possible for them to concentrate on more qualified tasks. When the system had been in operation for two–three years, however, some problems began to emerge. In the first place, it turned out that the foresters' interest in more qualified tasks had led to the totally unforeseen consequence that the calculation tasks had been handed over to unqualified office personnel (low-paid women operators). The original plan was that the foresters themselves should operate the computers, thus following the entire calculation process more or less in the same way as they had been wont to before the introduction of computers. The introduction of computers in this field thus led to a double process of qualification and degradation of work, making some jobs more interesting by transferring routine tasks to other people. We venture the hypothesis that qualification and degradation processes of this kind are bound to occur in all fields of this kind undergoing computerization, unless active countermeasures are taken from the beginning. As one of the employees of the Swedish national insurance system puts it: "It seems to be an invisible law that tasks are dropping down from higher officials to lower employees to the same extent as the

degree of computerization increases." From the point of view of the employees, the effects of computerization on the organization of work emerges as a central issue which tends to get neglected by those responsible for computerization at the present (management bodies and commercial enterprises).

In the second place, some foresters began to feel worried about the possibilities of maintaining the professional competence necessary to ensure a high quality of work. One forester commented: "Computerized models can become 'super-supervisors' of the ongoing work. New foresters never learn the theoretical and practical foundations of forest evaluation in the same detailed way as with manual calculation. They will become slaves of the system."

Another forester expressed doubts about the quality of the service to the public: "More centralized governing. Adaptation to local conditions will become more rare although the possibilities exist. It has become much more difficult than before to make our clients understand how the evaluation takes place and how we arrive at the end result. In my opinion this is the greatest disadvantage of the computerization of forest evaluation within the government boards."

From the study of the computerization of forest evaluation in Sweden, three issues emerge as central ones: the effects of computerization on the organization of work (degradation and qualification), the maintenance of professional competence, and the question of quality. Of these three issues, the question of quality is certainly the most delicate one, leading straight to the conflicting interests that lie behind computerization. In the field of forest evaluation, there is a conflict between the interest in national uniformity leading to standard procedures defined by the central government bodies, and the interest in local adaptation based on a detailed knowledge of local affairs. Joseph Weizenbaum has proposed the hypothesis that computerization serves to conserve and strengthen the existing social and political organizations which favour central government interests rather than local interests.[10] As an example, he mentions the erection of "an enormously large and complex computer based welfare administration apparatus" which creates an interest in its own maintenance. This leads us to another of our case-studies, viz. the Swedish National Social Security system.

The National Social Security system in Sweden has a two-fold background. One of the sources of the present system is the voluntary insurance system which grew up on local initiative from the 1870's onwards. These associations were small, usually having not more than one hundred members. The administration was simple: if one of the members fell ill and should have ten crowns a day, the sum was divided between all the members who accordingly had to pay ten öre (1 crown=100 öre) per day. The other source of the present system is the general accident and pension reforms at the beginning of our own century (1902, 1913). The accident insurance and general pension systems were introduced by the government and parliament, and consequently administered by the state bureaucracy. The democratic elements of self-rule, which were characteristic of the voluntary associations, were lacking

in these areas, and the bureaucrats administering the accident insurance and pension systems lacked the close contact with the people insured which characterized the "one-hundred men associations". The bureaucratic and self-governing traditions were fused in the fifties and early sixties, when the various parts of the social security system were assembled in one huge state-administered organization.

The growing number of cases administered by the National Social Security system and the addition of new welfare measures led to the computerization of routine procedures from 1968 onwards. In 1977, the government decided that the computerization process had to be speeded up, and set up a commission to inquire into the future organization of computer-based data processing within the National Social Security system. In the directives given to the commission, the Minister of the Department of Social Affairs stated that the alternatives to be investigated by the commission should be studied from various points of view: technical and economic aspects, speed, security, consequences for the personnel. The government commission in its turn contacted the research institute at which our project is based, the Institute for Working Life Studies, and asked for help with the issues concerned with "consequences for the personnel". We decided that this was an important area which could provide our project with interesting material and that we should take the opportunity to influence the development in this field. To keep our hands free, we formulated an independent research project which should run parallel to the activities of the government commission and provide the insurance unions with counter-expertise.

When entering the field of computerization within the National Security system, we had some hypotheses in mind which had been drawn from previous case-studies, i.a. the following ones:

- Implementation of advanced data-technical systems can result in consequences of an unexpected nature in the division of labour and organization of work. The rise of new occupational groups with a middleman function and a degradation of work become important points to observe.
- Implementation of advanced data-technical systems in branches characterized by structural changes can reinforce a threat to the existence of some qualified occupational groups. Employment aspects are important points to observe.
- A systems development with permanent changes of an unexpected nature in the form of new service occupations must, when taking in consideration a new division of responsibility, give this occupational group training in the basic principles of valuation methods in order to guarantee the quality of the completed computations and to improve the job content for this new group. A work valuation of the new job assignments must be carried out and serve as a basis for negotiations regarding job position and wage level.

In short, we wanted to keep a close eye on aspects which we had reason to suspect would not be sufficiently studied by the state commission. The instructions given to the commission put an emphasis on the technical aspects of computerization, and the work so far carried out by the government commission has tended to go in that direction. In a preliminary report dated

April 1979, the government commission stated that computer-based information processing is an essential aspect of total activities, "an administrative instrument", a "tool", which has to be adapted to the tasks given to the insurance system. At the same time, however, it is clear that already established organizations and machinery will influence the alternatives which the government regards as feasible. The Minister of Social Affairs said in his instructions that the commission should attempt to preserve the effects on local employment which had been intended when computer-based processing was centralized to the city of Sundsvall. The inertia of the existing establishment becomes noticeable. The existing machinery is not only a tool which can be adapted to future needs. The practices of the future are also going to be shaped by the existing tools.

Virtually all systems development up to now has been in the hands of experts on the technical and financial aspects of systems development. We decided to try to introduce other aspects into the discussion and concentrated our efforts during the first year of the project on working out a study course for the insurance unions. 98 % of the employees of the National Insurance System in Sweden are organized in the National Union of Insurance Employees. Together with representatives of the union, we set out to work out the material needed for the members themselves to articulate their own demands with regard to future computerization.

The basic idea behind this effort is that the only chance for the personnel to influence the organization and contents of their own work is through *long-term competence building on a broad base*. In the writings of the leading executives of the National Union of Insurance Employees, we found a vivid awareness of the conflict between the two traditions within the Swedish National Insurance system and a clearly formulated will to preserve the democratic tradition associated with the popular movement of voluntary associations. The union leaders need help to find the technical solutions which best fit in with their own hopes and ideas. One part of the task of our project consists in providing this technical expertise on computer development. But above all, the union leaders need the support of a well-informed body of members.

This study material has now been worked out and will form the basis of small-group work throughout the country during the next few months. The material gives some information on technical possibilities, but above all it is intended to make it possible for the employees to formulate their own demands with regard to the future development of computer-based information processing in the insurance sector. A rather long chapter is devoted to the history of the existing system. This historical survey is intended to make the employees aware of the conflicting interests within this field: the bureaucratic interest in national uniformity, efficiency and economy; democratic interests in self-rule and local adaptation; commercial interests; and the interest of the employees of the insurance system in having meaningful jobs. The possible effects of computerization on the organization of work are il-

lustrated by findings from other areas of work, the possibility of increased control and higher tempo is discussed, and the problems of maintaining high quality are outlined. The problems of giving good service to the general public have become accentuated through the diversification of the Swedish population during the last few decades. About one million of the country's eight million inhabitants are immigrants, often with a scanty knowledge (or no knowledge at all) of Swedish. The problems raised by this category of clients are of a rather different order from the technical problems of data-processing which tend to dominate the discussions of systems development.

The interest of the government authorities in keeping the costs down is understandable when we bear in mind that some 75 % of the total cost of the administration of the welfare system is spent on salaries. With increasing personnel costs, it becomes tempting to replace men with machines. But in the service-oriented fields of activity with which we have been concerned, men can only be substituted by machines up to a certain level without jeopardizing the quality of the interaction with the general public. In the attempt to strike a balance here, we believe that it is essential not to neglect the considerable amount of know-how that exists in the form of tacit knowledge amongst those who are directly responsible for carrying out the work from day to day.

Notes and References

1. M. Heidegger, *Being and Time* (1927).
2. L. Wittgenstein, *Philosophical Investigations* (1953).
3. Cf. Joseph Weizenbaum's brilliant discussion in *Computer Power and Human Reason* (1976), pp. 23 ff.
4. Cf. H. von Wright, *Explanation and Understanding* (1971), Ch. 1.
5. Stafford Beer, Managing Modern Complexity in *Computers and People*, Vol. 23, No. 4, April 1974, p. 20.
6. Cf. the presentation of the project in Åke Sandberg, ed., *Computers Dividing Man and Work. Recent Scandinavian Research on Planning and Computers from a Trade Union Perspective*, Arbetslivscentrum, Stockholm (1979), pp. 131–137.
7. Cf. Bo Göranzon, ed., *Ideologi och systemutveckling* (Ideology and Systems Development), 2nd ed. (1978) and other publications by the PAAS (Perspectives on Administrative Development) group.
8. Ivan Illich, *Tools for Conviviality* (1975), Ch. II.
9. Per Svensson, The middlehand function of the system engineer, in *Villkoren för förändring i arbetslivet—ett forskningsprogram* (Conditions for Change in Working Life—a Research Programme).
10. Joseph Weizenbaum, *Computer Power and Human Reason* (1976), pp. 30–31.