MAPPING SITUATIONS WITHIN A SYSTEM DEVELOPMENT PROJECT

AN INTERVENTION PERSPECTIVE ON ORGANIZATIONAL CHANGE

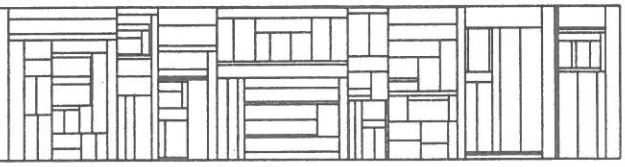
by

Giovan Francesco Lanzara
University of Bari
Italy

Lars Mathiassen
University of Aarhus
Denmark

DAIMI PB-179

Computer Science Department
AARHUS UNIVERSITY
Ny Munkegade – DK 8000 Aarhus C – DENMARK
Telephone: 06 – 12 83 55



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Abstract

In this paper we propose some new tools for mapping system development projects. Maps - as we propose them - contain descriptions and interpretations of project situations: they are helpful in collecting and organizing relevant, often neglected knowledge and experience. Maps are cognitive constructs containing pictures that actors make of the situation in which they are involved. They are typically made within the situation or transposed from similar situations and are used by the actors themselves as tools for exploring, for learning, for increasing awareness, for inventing solutions to problems, and for undertaking action.

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Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?

"Choruses from the Rock"
T.S. Eliot

1. Introduction

There is a growing awareness in the field of system development that the problems and failures exhibited by the implementation and the overall performance of systems are closely connected to the features of the methods and techniques employed, and ultimately to the ways in which activities within projects are carried out and evaluated.

It is puzzling and sometimes painful for the actors engaged in a system development project - be they designers, managers, or users - to be confronted with problems and events which arise unexpectedly in the course of a project. In such situations deviations from current project practices are required, or even - in some cases - a more radical restructuring of those practices. It is generally accepted that it is difficult for system development projects to be carried out on the basis of guidelines which are fixed from the outset (Mathiassen, 1981; Ciborra, 1984). But on the other hand, an effective project management requires a capacity for learning and acting which is far beyond what current techniques for updating descriptions and assessments can offer. The tools and techniques applied today to gain insight into the situation of a project all focus one-sidedly on the products or subproducts. The most well-known of them are inspections, structured walk-throughs, and reviews (Weinberg and Freedman, 1982).

What seems to be a crucial point related to the actors' learning skills and to their ability to identify and solve problems is how to get relevant information in a project situation. Selecting relevant information has to do with how project members describe the situation in which they are involved, with what they know about the situation. However, as some social scientists and organizational practitioners have remarked, current design and evaluation techniques tend to obscure much valuable insight from members of organizations, which therefore goes unrecorded and is lost most of the time (Argyris and Schön, 1978; Wynn, 1983).

In this paper we intend to bring this knowledge to the foreground of our attention, and to develop some tools and techniques to help the actors themselves to bring it to the surface. The approach has been developed in connection with a field research project on methods for systems development (MARS, 1984). This research project has studied eight projects in four different organizations employing the techniques and tools which will be presented in the following. These tools have a basically two-fold application: either they may be used by researchers in the analysis of system development projects, or they may be helpful to the project members themselves to map their own project situations and to intervene into them. In the second case mapping situations is seen as a relevant activity in practical systems development, that may offer insight into the problems and conflicts connected to both processes and products.

Our suggestions should also be seen as an attempt at designing a new conceptual framework for thinking about the development and the use of computer technology within organizations. We emphasize the cognitive and learning aspects of system development, in some ways taking a step away from the current literature on system development methods, which mainly focus on technical matters (Hice et al., 1978; DeMarco, 1979; Jackson, 1983; Yourdon, 1982).

Within our framework system development is seen as a process of intervention into an organizational setting with the purpose of transforming work processes and methods, and ultimately human behaviour and knowledge at the place of work (Lanzara, 1983). Looked at in this perspective mapping becomes a means for intervening into the system development process, which in turn is an intervention itself when seen with respect to other organizational relations. The relevant question to put here is: will mapping - as a strategy for understanding and changing work processes and organizational practices - have a positive impact on how people in projects and organizations think about current system development methods and techniques and how they operate with them?

We feel that this paper is somehow the tentative result of the merging of two different disciplinary domains and research interests, one focusing on organizations and human behaviour, the other on information system and system development methods. Independent of whether we have succeeded or not in this endeavour, we strongly believe that the marriage between the behavioural studies and the information sciences should generate new insights into both areas, and therefore it is devoutly to be wished.

We will present our viewpoints in the following way: Part 2 will contain a more detailed definition of maps and mapping. Part 3 will contain a case of intervention into a system development project. The intervention proved to have a limited effect, and on this background we will present a critique of the approach which was applied. In part 4 we will present our suggestions for tools and techniques for mapping project situations in the form of diagnostic, ecological, virtual, and historical maps. Each map will be presented and illustrated, and then - in part 5 - we will discuss how mapping may be seen as a first step towards a practical theory of intervention.

2. Maps and Map-making

Our interest in drawing maps of project situations only in part originates from the goal of analysing a project. We are also interested in identifying characteristic and recurrent patterns and relations in project situations. A better understanding of these patterns and relations will hopefully enable people to improve the way in which a project is carried out or an organization works. Our intention is in other words to help people (including ourselves) to describe what are the relevant features of a project situation, to see what are the problems at hand, to change patterns of action according to the requirements of the situation. Maps should help people to develop an awareness of where they stand in the situation and to interact in a more direct, articulate and creative way.

2.1. What are Maps?

A map is an interpretive description of a situation which provides insight into possible ways of acting on that situation or on similar situations. Maps are, like all descriptions, incomplete, but they contain some knowledge about the situation which might be useful for understanding and undertaking action. By drawing a map we choose to select and to attach meaning of some elements or events instead of others.

We always construct and use some sort of map in situations of action: mapping is a cognitive activity and, in a way, a form of action in itself. We construct our maps individually by interacting and communicating with other people. We often build up on other maps which we take for granted. We also test the consistency and relevance of our maps in our interaction with others.

Maps are cognitive phenomena in two senses: they reflect our cognitive processes - the way we look at reality - and they

allow us to build up further knowledge of our reality as we use them. As we have said earlier, maps are tools for undertaking action. We do indeed perform our maps in our behaviour (McCaskey, 1981).

Hence an actor's interpretation of a situation includes an understanding of where and how he or she can act to change (or maintain) that situation. We can call the set of perceived constraints and opportunities, defining somehow the boundaries of what the actor sees as feasible or unfeasible, the domain of action addressed by the map.

Each type of map presented in this paper provides a specific way of describing a situation, along various organizing principles; it suggests on which aspects of the situation one should focus and how these aspects relate to one another. These tools are, however, incomplete as guidelines for action and need to be completed by concrete action and choice. The maps produced address both product and process issues, they reflect dailylife thinking, and are typically formulated in natural language.

It is possible to distinguish among different kinds of maps. For instance, maps are said to be formal or informal depending on to what extent they rely on or reflect codified rules of language or behaviour; they are said to be individual or collective, depending on whether they belong to a single actor's or to a group's memory or cognitive equipment; they may also be distinguished between as private and public, depending on to what extent they are socially shared. Thus maps may contain information which everybody knows and tells explicitly, or else which everybody knows but would not tell openly in public. Private individual maps may contain information which only one person knows and keeps to himself even if requested, or that the person would share if requested, thus making it public.

Maps need not be explicit. That can happen for a variety of reasons: because we find it convenient to keep them as private maps, because we are so familiar with them that we store them in the back of our conscious cognitive activity, or because we may find it difficult or sometimes impossible to put our interpretation of a situation into words or diagrams even if we wanted to. We often use maps which are tacitly embedded in our cognitive skills, and these maps may be very important in helping us perform complex mental and manual tasks.

As they are presented here, maps should be used as tools to develop public and collectively shared knowledge within a project group, eventually starting from individual maps. In order to expect that, we assume that some minimal requirements are fulfilled at the outset of the mapping process, namely that all actors involved in a project situation share an interest in understanding and in taking action. We need not make assumptions about the identity or convergence of interests and about the absence of conflicts within a situation: in fact different or conflicting viewpoints may emerge even in a highly socialized project group. What we assume instead is that, irrespective of their views, actors share an interest in expressing those views and in undertaking some sort of actions, be it for public or private purposes. The proposed approach might lead to an improved shared understanding of what the project members actually do and think or, alternatively to the surfacing of the conflicting interpretations and interests that they may have.

2.2. Mapping Systems Development Projects

Traditionally the issue of collecting and structuring information within a system development project has been approached with a bias for formal maps of products and subproducts. Nearly all descriptions made during a system development project deal with the intended product, i.e., what is normally called "the system", and these descriptions are typically built up with artificial language

elements. This emphasis can be partly explained with reference to the technical environment of these projects and with the dominant technical skills of the system analysts. However, many practical projects fail in meeting requirements and deadlines (MARS, 1984) partly because formal descriptions have shown serious shortcommings (Briefs, 1983; Budde, 1984), and partly because the projects are managed without any thorough and up-to-date insight into the actual state of development.

Whenever a person steps into an organizational setting for the purpose of changing it, she may choose different perspectives of looking at the situations she is exploring. Depending on this basic choice of perspective, she will be likely to construct very different maps. Choosing one perspective she might put systems in the foreground and keep people in the background. Choosing another perspective she might put people in the foreground - as actors on a stage - and push the systems in the background of the action scene. Or she may even try to use both perspectives to produce a more complete description of what is going on in the organization.

If we take office work as an example, one familiar way of looking at it is to see it as a set of procedures and tasks which are executed by employees across a hierarchy of levels. Within this perspective we put into focus the system of functional components, while people in the office are just attending to the information-flows and procedures (Hammer & Ziesman, 1979). But taking a different view, one might see the office as a network of transactions and conversations among people (Wynn, 1979; Flores and Ludlow, 1979). Employees carry out activities such as researching, constructing, bargaining, deciding, making commitments, and these activities require a remarkable amount of problem-setting and problem-solving skills. Work procedures are, in this view, programs that employees apply to solve problems and change situations: they belong to the actor's cognitive equipment and are adapted to ever varying situations (Lanzara, 1983; Newman 1983).

We look at the activity of system development and, more generally at the whole field of organizational design, as related to professional practice in real-life situations. Hence our approach leans itself to the second perspective mentioned above; it attempts at mapping the real-life behaviour of the actors involved in organizational situations. In situations of practice, however, our approach can well be supplemented with more technical and systems-oriented approaches.

In our intentions a more reflective process of mapping should support all actors involved in a project in learning from their own experience as the project is being carried out. In other words, maps should ideally help project members in performing on-the-spot diagnoses of what is happening.

Maps could be helpful tools to improve the understanding of situations, to increase the capacity for inventing and producing alternative practices, and to provide a more effective dynamic regulation of ongoing projects.

In the actual practice of system development projects maps can be made by observing and recording which activities actors carry out throughout the project, or by recording what actors say they are doing or should be doing. In this case maps are detailed descriptive accounts of specific situations made by the actors themselves in an interpretive analysis, which we here prefer to call evaluation or appreciation. Maps are pictures of a situation, with some order in them, relating the main features and themes of a project situation at some level of generality.

3. A Case of Intervention

Mapping, as we propose it, is an essential activity in the behaviour of systems-oriented professionals and analysts. To emphasize this point we proceed by presenting and analysing a real-life situation where a university-based research group intervenes into an on-going

system development project which is being undertaken within company JCN (MARS, 1984). As we shall see more extensively in the following, the main issue of the intervention is the review of a project report conducted by both the project group itself and the research-based group. The intervention surfaces a mismatch between the official evaluation of the report by management and the pitfalls and problems that are surfaced in the course of the discussions.

3.1. The organizational context

JCN is a software house owned by several, mutually competing savings banks. The purpose of the project in question is to develop a computer based system which can be used in savings banks in the budgeting and accounting services for private customers. At present a large part of this service is performed manually, although with the aid of the general computer based account system of the savings banks.

During the period in consideration the savings banks are converting their existing computer based account system to new equipment. This conversion project is carried out by JCN, and has the following characteristics:

- it is by far the largest activity undertaken by JCN during the past five years;

- it gives the local savings banks more computer resources, hence the technical possibilities of new applications (that was the major reason for the conversion);

- there are technical problems in converting. Some savings banks, some individuals, and trade unions are developing a negative attitude towards the project - and consequently towards JCN.

The management of JCN wants the budget project to be a success to stop mounting negative attitudes and reestablish positive attitudes towards JCN.

The budget project team has been asked to follow the new JCN project model which only slightly resembles the old one. The project team is directly responsible to a steering committee which evaluates and accepts each phase of the budget project. Around the project there is an organization which connects the project to JCN and to the savings banks. It is difficult for the project team members - because of institutional arrangements - to have direct contact with the local savings banks and the bank employees. The information they can get is filtered by bank representatives, who are acquainted with formal procedures, but not with the actual operations and needs of the local savings banks, nor with the existing computer system of the savings banks. The representatives, however, are in charge of the decision about what should be done in designing the system.

The purpose of the project team - though it may seem superflous to say that - is to get the project completed at deadlines and accepted by the steering committee. They are requested to produce reports to the steering committee at the completion of each phase of the project.

The budget team meets regularly every fortnight with the university-based research group, the MARS group, to discuss reports and problems. The objective of the MARS group may, in relation to the budget project, be summed up as follows:

- they want to do field research to gain insight into how system development project are carried out in real life;

- they want to play an advisory rôle: giving advice on alternative actions;

- they want to help highlight project problems;

- they want to support the budget project team in the completion of their work.

The MARS group consists of two researchers from the university together with five practitioners from JCN.

3.2. The intervention situation

One of the meetings is dedicated to the discussion of a report from the budget project team to the steering committee. The report is accepted by the steering committee and is then read beforehand by all members of the MARS group. The situation with which we are concerned here is the discussion of the report which lasted about two hours.

Each actor participating in the meeting expresses his or her view on the report in turn; then an open discussion takes place. Criticism is raised by the MARS group members in the course of the discussion. The budget project team reacts with some passivity and defensiveness to this criticism and to the comments, though some find the discussion interesting. In the following we present a summary of the main critical points of the report as they are raised in the discussion.

Inappropriate frame for describing local computer system: the relationship between the local and the central systems may be illustrated as shown in fig. 1.

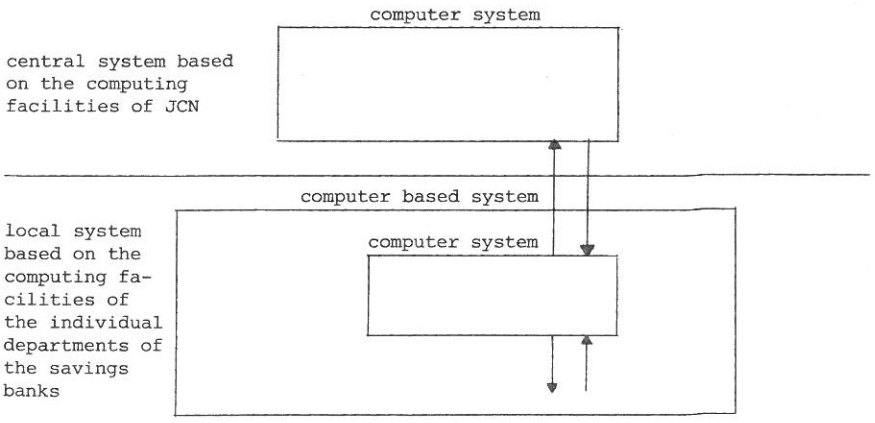

Fig. 1. Relationship between local and central systems

Both the local and the central systems are described with a flow oriented system description tool (DeMarco, 1979). The central computer system is structured in a way which makes such a flow oriented frame of description appropriate.

The future local computer based system, i.e., the local computer system and the functionally related parts of the individual savings banks, however, is not basically structured as a flow; it includes a very important element - the clerk/customer dialogue on budgeting. Hence, by choosing a flow oriented description of the local computer system, it becomes very difficult to relate this to a structured description of the computer based system.

The report lacks coherence: the various descriptions of the future local computer system within the individual departments of the savings banks and the description of local events related to budgeting, do not relate to each other in any clear and understandable way. This relates to the first point mentioned.

Structured description of the local computer system: the future local computer system is described by: data flow diagrams, mini-specs, and examples of outputs (paper, screen images). From a technical point of view these descriptions are fine, except for one very important pitfall: there is no description of the data dictionary (as there should be according to the applied method). This means that it is difficult to get a clear understanding of what information is available from the system and of the means by which this information is structured.

Unstructured description of local computer based system: the only description of the future local computer based system, apart from the technical description of the local computer system, is a list of events related to budgeting within a savings bank. There is one list of events initiated by customers. And there is one list of events initiated by the bank employees.

The report is not suitable as a basis for decision making: the above-mentioned criticism implies that it is not possible to evaluate the product (a new tool for budgeting). Furthermore, the report offers no information on the present status of the project, nor any plans for future development. One fundamental problem is that the report does not deal with the distance between the situation now (within the savings banks, within JCN), and the situation after the implementation of the new system. For these reasons the report is not suitable as a basis for a steering committee decision on the project's future development.

3.3. Diagnosing the project situation

The report seems to show two basic weaknesses which are perceived as problems by most of the people involved in the situation.

Firstly, there are incoherent descriptions of the system which prevent a clear understanding of the functionality of the system once it gets implemented. Each description is incomplete in itself: the flow oriented description of the computer system lacks the data dictionary, and the description of clerk/customer events does not take account of the structure and frequency of dialogues. The description of events is a simple checklist of possible questions and answers, and is of little relevance. The incoherence between the descriptions is not simply a technical matter, but has to do with how analysts frame the reality of the problem. The two decsriptions pertain to two different levels of reality. From the descriptions contained in the report it is difficult to infer what the situation will be, and that also makes it difficult to establish criteria for evaluating the computer system. This point is concerned with method of analysis and quality of the product.

Secondly the report is weak in the planning and evaluation functions, and it is not good as a basis for future decisions. This makes it difficult to have an efficient, dynamic regulation

of the project. How will the steering committee make decisions on project development? The report does not contain the clues and statements relating the project's present situation to the initial situation and to the envisioned final situation. This point has to do with organization of the project and quality of process.

There are, of course, underlying behavioural dynamics taking place in this situation: There are people from the university and MARS group, people from JCN and MARS group, and members of the budget project team.

All these different affiliations make the dynamics rather complex. One clear pattern, however, emerges. Most of the criticism comes from JCN's employees not participating in the budget project. Project members, on the other hand, are rather passive: they find the discussion interesting - except the project leader who takes a defensive stance, advocating the achievements of the project.

One major reason for this pattern to emerge is the following: Project team members identify the problems and the defects of the report and of the project, but they fail in searching for an explanation for them, in relating them to their own actions and choices and to the existing conditions. Particularly the budget project members, who should account for their own behaviour and choices, do not express their views explicitly.

Only one participant in the meeting tries to identify causes. He picks up two relevant points for diagnosis, but he fails to connect problems and defects in the project to observable human actions. The actor - who is not a member of the budget project team - on one hand makes an effort to provide a more articulate diagnosis, but on the other uses conditions as explanatory causes for the project outcomes and problems. But conditions do not explain in themselves why some specific actions have been

undertaken, and why some have not. His account for the problems considers other domains of action than the one defined by the actual situation. In fact, by not invoking human actions but only external conditions as a source of problems, he does not assume or attribute responsibilities for the events, thus protecting himself and others from possible negative consequences of such events. A consequence of this mode of reasoning and behaving is the almost self-fulfilling conclusion that if the conditions are such and such (i.e., if the causes are somewhere else and out of reach), then there is nothing that we can do (or nothing different that could have been done).

According to this actor's map the project is poorly carried out, but defects can be traced back to causes out of reach of the project members' action: the "typical" dynamics of a project explain delays, incompleteness, and lack of evaluation and control; the environmental relationships explain the lack of commitment and communication. But then - where do human action and responsibility come into the picture?

One other major actor - namely the budget project leader - tends, in our view, to take contradictory stances towards the project: on one hand he states that he agrees with most of the points made (hence admitting that the project has defects, and the criticisms are right), on the other he emphasizes the project team's and his own competence. The arguments he puts forward are:

- project model prescription was correctly followed;
- steering committee accepted the report;
- they worked under time pressure.

In the project leader's explanation, formal, objective evaluation criteria, where no explicit human actions are involved, are used to advocate the project. This is clearly a symptom of lack of commitment: this actor does not seem to consider himself

as part of the situation in which he is involved, and which he helped produce. He does not seem to share a feeling of personal causation and responsibility with the situation.

Other actors show a good sense for the problem at hand - criticism is sharp and articulate - but they only perform limited inquiry into the problems: they are identified, but not accounted for. The discussion stops where it should have started: asking why specific defects and failures of the project report are there, what makes them be there, what are the consequences of those pitfalls and features for the success of the project, what can be done about the situation, how could the situation be reshaped.

It is the joint surfacing and discussion of the causal or conditional loops connecting assumptions to actions and to outcomes, and these in turn to alternative options and assumptions that is missing here. People involved fail to make their private maps public, to surface and concert information, to discuss dilemmas and conflicts, etc. But only by performing this joint diagnostic activity, one may hope to proceed to new interventions later on. It is only by becoming aware of what happened and why, that one can be in a better position to see other options ahead, or at least to see what could have been done instead.

3.4. Some consequences of limited inquiry

Limited inquiry into the problem leads to poor awareness, and this, in turn, to reduced competence at reframing. But limited inquiry into each other's perspective also leads to mistrust and defensiveness, and these, in turn, to reduced commitment at correcting defects and at reframing.

There is, in a few words, no joint construction of a collectively shared perception of reality, of a common awareness of the problem, and of a joint commitment to action. No collective map of the situation is surfaced for which people can take joint responsibility.

A limited inquiry and the particular behavioural dynamics at work also prevent the actors from being able to reformulate the problem and to connect it to other relationships in the organization. If we, as an example, take the issue of "system description" this is defined by the actors as a matter of inaccuracy, incoherence, incompleteness: they see it as a technical problem which can and should be faced and solved within the technical or instrumental domain. Actors do not seem to appreciate that the flow-oriented description (procedures) and the actor-oriented descriptions (dialogues, conversations) are embedded in two different frames of organizing reality, frames which discriminate what is relevant, and what is irrelevant, what is in the foreground of attention, and what is in the background, what is to be modelled and described, and what is not.

Describing a system of flows means to be more concerned with the internal efficiency of the computer system; describing a set of dialogues means to be more concerned with the effectiveness of the banking service, with what really happens in the real-life clerk/customer interaction. Actors are caught in this dilemma between system's efficiency and service' effectiveness, but the dilemma is not brought to the surface of awareness and is not discussed by the actors.

Making this dilemma explicit through inquiry into the technical problems of descriptions would presumably help the actors to relate the description issue to other problems as users' participation or communication with users and, in turn, to the institutional setting, and to the system of values and norms regulating the interorganizational relationships.

It would also help the actors to inquire into the adequacy of the project model, and into JCN's project-policy. An attempt at reframing project-policy could, for instance, start by asking this question: is the new project model really adequate for our purposes? Does it need to be adapted or changed? How can we enact

an organizational situation which is appropriate to the issue? Proceeding through these questions and answers requires not only skill at correcting errors, but also competence to relate to current frames and norms for action, to evaluate whether they are appropriate or not, and eventually to change them. Finally, inquiry into one's own and other's behaviours and assumptions would help actors to relate positive and negative consequences to personal actions and to take responsibility for the occurences - be they positive or negative.

4. Tools and Techniques for Mapping

We present here some basic types of maps which we believe useful for project analysis and evaluation in the course of intervention. Each type of map focuses on a specific dimension of reality and is of course appropriate for particular purposes. However, comprehensive intervention should be able to produce all types of maps. We have distinguished between:

- Diagnostic maps
- Ecological maps
- Virtual maps
- Historical maps

In the subsequent sections we will describe the basic pattern of each of these types of maps. These patterns describe ideal types of maps and they represent possible mapping behaviours. They are not procedures to be followed. On the contrary, they have been designed on the basis of our own experiences with the intention of communicating the idea of intervention and with the expectation that the suggested patterns would be picked up, eventually adapted, or even changed in practical use.

4.1. Diagnostic maps

The purpose of diagnostic maps is to relate project situations specifically perceived as problems (anomalies, failures) to

sources and to more general organizational or behavioural features. Diagnostic maps locate and describe existing problems and dis-functional responses in the project or the organization as they are perceived and accounted for by the actors. The basic pattern of a diagnostic map is shown in fig. 2.

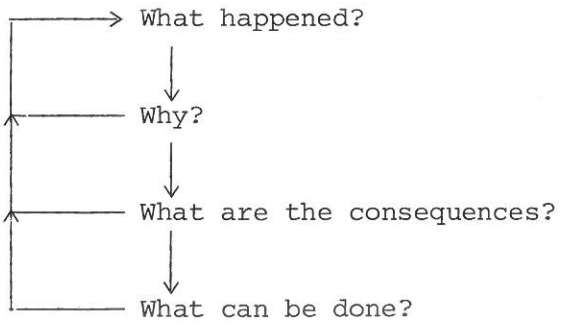

Fig. 2. Basic pattern of diagnostic map

The questions the interventionist may start asking when he or she intervenes into a project situation that needs to be diagnosed are:

What happened? Actors identify problems, failures or anomalies. They see the situation as problematic and attempt at defining what the problem is. A key feature of the diagnostic map is in fact that the actors are forced to see the situation in a specific, simplified way - as a problem. The problem might be reformulated several times, even on the basis of the other questions. However, the interpretation of the situation expressed through the problem should be seen as the focus of the analysis to which possible causes, consequences and alternatives are then related.

Why? Actors formulate general or specific theories about what happened in the project situation. They inquire about possible causes and provide their explanations. Actors may:

- list acknowledged or perceived causes or actions that might have been sources of the problem;

- check and assess to what extent a perceived cause or action is relevant to the problem;

- check for incoherence or inconsistency between different sources;

- provide evidence for what they account for as a source of the problem.

In this process actors produce their own explanations, they might surface individual maps, and this in turn might bring to the actor's awareness conflicts and dilemmas embedded in contradictory explanations.

What are the consequences? Actors assess the consequences of the problem, that may be actually observable in the situation at hand or may occur in the future. This is a way of evaluating the chosen interpretation of the situation: Is it a serious problem? For whom is it a problem? One possible outcome of this process is to drop the chosen problem and return to a new interpretation of the situation. Evaluating the importance of the problem this way is a valuable step before undertaking whichever correcting and restructuring action.

What can be done? Actors attempt to restructure the situation by designing options for action. They project the existing situation into a desired one; they go from evaluation of consequences of existing problems to positive statements about a possible future. The process starts with the conditions and possibilities within the actors' domain of action, and addresses the desired goals and future states that can be achieved through active intervention on the situation.

Fig. 3 summarizes an instance of a diagnostic map. This map has been developed by the JCN members of the MARS group on the basis of the situation discussed in section 3. The map illustrates how a diagnostic analysis could have been performed in the situation in question with the purpose of developing both a collectively shared awareness of what the problem is, and a joint commitment to action.

As the figure illustrates, the situation is interpreted as problematic very much along the lines of section 3.2. However, this map provides explanations for the shortcomings of the descriptions. The problem is now related to the actions and choices of the project group (e.g. no baselines are set, no reviews are performed)

What happened?	Why?	What are the consequences?	What can be done?
· the various system descriptions are incoherent · it is not possible to obtain detailed knowledge about the new system from the descriptions · the descriptions are unfinished and defective	· meeting deadlines is given high priority · time schedule produced before anything is known about the degree of change involved · new methods are applied, but no time for experimenting with them · the description tools are inappropriate for describing dialogues · no reviews have been performed · many replacements of project members · no baselines are set up to indicate subproducts and criteria for evaluation of sub-products	· new activities are initiated on a defective basis · at some point of development deadlines can no longer be met · the savings banks know too little about what they will get. A number of changes can be expected after implementation · project members are often frustrated and unmotivated · difficult for new project members to work efficiently	· quality control should be improved during the early activities · reviews should be performed with the participation of both programmers and direct users · time schedules should be based on descriptions of the degree of change involved · time schedules should be changed as soon as the conditions on which they are based change · versioning should have been applied as the basic strategy of the project · different types of descriptions addressing different target groups should have been developed during the early stages of the project · there should be time for experiments when new methods are taken into use

Fig. 3. An example of a diagnostic map - the JCN case

and to the existing conditions (e.g. meeting deadlines is given high priority, new methods are applied). Moreover the chosen interpretation of the situation is evaluated by clarifying the consequences for the project group (e.g. project group members are often frustrated and unmotivated, difficult for new project members to work efficiently) and the consequences for its environment (e.g. the savings banks know too little about what they get). If this analysis had been carried out within the situation, the actors could have developed an understanding of what could have been done about the situation (e.g. performing reviews and quality control, demanding time for experiments within projects using new methods). By performing this joint diagnostic activity, they might eventually come to share a common understanding of the situation and of possible actions, and on that basis they might proceed to new interventions later on.

The strength as well as the weakness of the diagnostic map is very much related to its idea of causation: causes (why?) lead to problems (what happened?) which in turn lead to consequences (what are the consequences?). On one hand this strictly sequential idea of causation is very simple, and in fact it can be difficult to distinguish causes, problems, and consequences. On the other, diagnostic maps force you to see a given situation as a specific problem, and hence it provides you with means for surfacing and structuring information about the situation - relative to the problem. This problem then could in turn be seen as the cause or the consequence of other problems within the framework of other maps. To put it another way, diagnostic maps are practical because they provide you with criteria for relevance and with means of structuring information. Diagnostic maps are, however, simple, and they should be completed with other maps of the same situation.

Fig. 4 contains practical hints for developing diagnostic maps.

- take one problem at a time and stick to it;
- dig deeply into the situation and try to surface as much information as you can;
- be confident that you will go a long way: problems are all nested together in organizations;
- go back in loops and test previous formulations;
- search for new evidence;
- take another problem ... and repeat.

Fig. 4. Practical hints for diagnostic mapping

4.2. Ecological maps

These maps describe what we refer to as the ecology of a given situation of intervention. They connect the situation to the overall organization. They show in a time-independent manner the relationships between relevant domains of action. Ecological maps describe how perceived problems or issues in the situation can be connected to conditions in the landscape we are exploring. The basic pattern of an ecological map is shown in fig. 5.

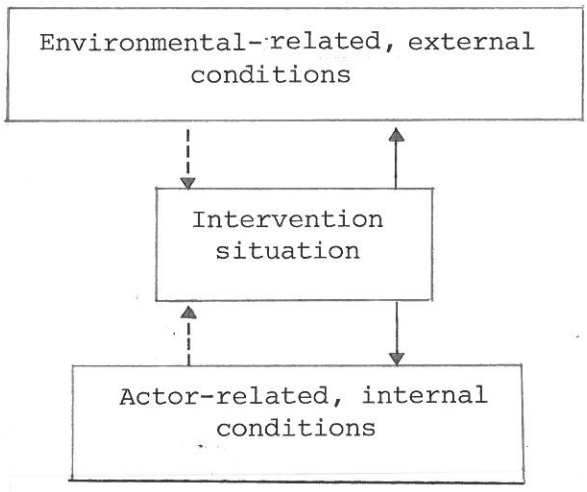

Fig. 5. Basic pattern of ecological map

The ecological maps are strictly relative to the situation we are actually intervening into. If we intervened into another area of the organizational setting, or in a changed situation, the resulting maps would also be modified, e.g. what was once perceived as external could become internal, or viceversa.

Internal conditions refer to the behavioural world of the actors involved in the situation. They are characteristics of the situation that are primarily produced and reproduced through the behaviour of the actors. External conditions, on the other hand, refer to environment-related characteristics of the situation, i.e., to characteristics that are primarily produced and reproduced through processes in which the actors of the situation are not engaged.

The arrows in fig. 5 indicate how the conditions shape and restrict what happens or what can happen in the given situation, and how the behaviour of the actors have or might have consequences for the intervention situation. Internal and external conditions, as perceived in ecological maps, have influence on the performance of a project and they are in turn influenced by actions undertaken within the project. Ecological maps allow an understanding of how problems relate to conditions, and a reflection on which are the relevant domains of action and on which relations hold between two or more domains of action.

Fig. 6 summarizes an instance of an ecological map. Again this map has been developed by the JCN members of the MARS group on the basis of the situation discussed in section 3. The headlines, i.e., the general types of conditions, have been developed on the basis of several diagnostic and ecological maps produced by the group.

External Conditions

Relations to savings banks

- difficult to get access to internal savings bank routines
- JCN management wants the project to be a success
- no savings bank representatives within the project

Project practices at JCN

- maintenance assignments are given higher priority than projects
- little continuity of participants during project activities
- during the early activities participants have to finish other assignments
- JCN has no tradition concerning quality control

Guidelines for project work

- new methods are applied
- few guidelines for quality control

Existing equipment and system

- project based on new equipment
- new systems strongly depend on existing systems

Special conditions

- time schedule and requirements specified in advance
- none of the participants took part in specifying time schedule and requirements

Situation of budget project at JCN

Internal Conditions

Values and norms

- participants do not acknowledge the necessity to experiment when using new methods
- disagreement to what extent the system should be based on existing programs
- quality of products is identified with steering committe acceptance

Working practice

- one-shot strategy as opposed to versioning
- mainly formal contacts with savings banks
- defective short term management

Fig. 6. Example of ecological map

There is a close relationship between diagnostic and ecological maps. Typically, one can describe conditions in ecological maps on the basis of causes and consequences in diagnostic maps. In fact this is the way the ecological map of fig. 6 was developed by the MARS-group. When intervening into a system development project one should begin with developing diagnostic maps which interprete the situation in various ways. On that basis ecological maps may be developed quite easily with the purpose of producing an overview of the situation. Diagnostic mapping leads to an awareness and understanding of single problems, whereas ecological mapping, fostering an awareness of the whole setting, leads to a clearer perception of the bridges and gaps between individual problems and relevant domains of action.

Fig. 7 contains practical hints for developing ecological maps.

- begin with the intervention situation and stick to it;
- build bridges and establish linkages between the problems at hand and the surrounding domains of action;
- bring to the surface external and internal conditions relative to the intervention situation;
- develop a couple of diagnostic maps before proceeding to ecological mapping;
- use causes and consequences from diagnostic maps as sources of inspiration;
- attempt to categorize the various conditions with the purpose of clarifying relevant domains of action.

Fig. 7. Practical hints for ecological mapping

4.3. Virtual maps

Virtual maps represent future situations which are possible or desirable. Virtual maps are pictures constructed to represent actions which we can simulate and test, and eventually choose to enact later on. Virtual maps help us in assessing the consequences of our actions and choices and may be useful as projective tools in intervening and producing intervention that would change the present conditions. These maps allow us to compare and test different assumptions and hypotheses about a future situation. By drawing virtual maps we perform what could be called the invention leap, a projected transformation of a situation into a desirable one: "how do we go from here to there?", or: "how would it feel beeing there?"

It is worthwhile to remark that analysts have dedicated very little time and attention to the issue of what consequences will be generated by their own actions and by other people's actions. Virtual maps contain images of ourselves and our own actions. They state: "If we do such and such, we shall be likely to obtain such and such", or: "What would happen if we did such and such?"

A basic pattern for developing a virtual map is illustrated in fig. 8.

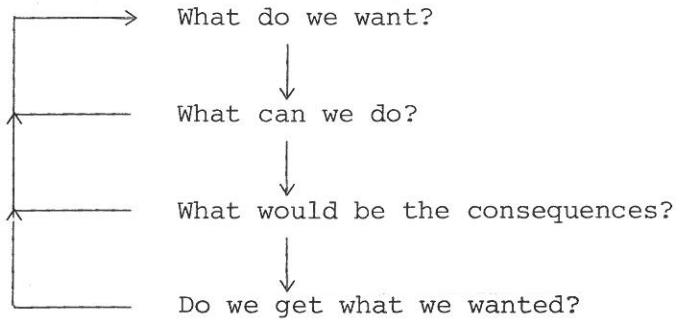

Fig. 8. Basic pattern of virtual map

The questions the interventionist may start asking to construct virtual maps are:

What do we want? Actors envision future situations or worlds. They start out with the problems and conditions they perceived as related to the situation in question, and from there they attempt to envision how it could be different. In constructing possible future situations actors do not start from scratch. Usually they transpose and rearrange features and themes of actual or experienced situations in a new pattern. Most of the time inventing consists of being able to see old things in a new way.

What can we do? Actors formulate actions to be undertaken to realize what they want. They investigate how they can go from present situations to the desired ones. In these two first activities actors invent and explore possible worlds and actions to realize them, for instance by removing or releasing conditions, or by designing new sets of conditions and opportunities.

What would be the consequences? Actors assess the likely consequences and impacts of undertaking the envisioned actions. They evaluate what would happen if they did such and such. From the envisioned actions they generate possible new sequences of processes and outcomes, e.g. what would the impacts and counter effects be, and what would one face trying to act as envisioned.

Do we get what we wanted? On this basis the actors then evaluate whether the suggested actions really lead to the desired situation, and whether the strategy represented by the suggested actions would have any reasonable chance of realizing what was desired. The insight gained into possible actions and consequences is used to evaluate how it would feel to be in the projected situation.

Diagnostic and ecological maps can be applied when developing virtual maps. The appreciation of specific problems and conditions related to the intervention situation should be used as the basis for envisioning alternatives. In the JCN case one might envision a situation where descriptions are developed in close cooperation with savings bank employees who have practical insight into the routines, traditions, and problems related to savings bank practices. In this situation savings bank employees should play an active rôle in analysing the existing situation and in evaluating proposals of new systems.

Furthermore both the actions suggested in diagnostic maps as well as the possible domains of action described in the ecological maps are useful sources for exploring how one can go from the present situation to the desired one. On the basis of the diagnostic map in fig. 3 one might ask: should different types of descriptions be developed addresssing the same subject from various viewpoints? Should versioning be applied to support the cooperation with savings bank employees? How and when could savings bank empoyees review and influence proposals for new systems? And on the basis of the ecological map in fig. 6 one might explore which conditions for systems development projects would have to be changed in order to obtain the desired situation.

Fig. 9 contains practical hints for developing virtual maps.

- pick up one or more points which you think are central, and try to restructure them;
- in restructuring go forward from the old to the new situation, and backwards from the new to the old, in loops;
- look at the new situation in terms of the old one, and then at the old in terms of the new;
- test: if what we had was bad, is what we get good enough? or, is something missing?
- as you proceed in restructuring and reframing, check if secondary or peripheral themes and features fit into the new picture.

Fig. 9. Practical hints for virtual mapping

4.4. Historical maps

We need maps which allow us to trace the project's history from a starting point to a terminating point. These maps have time as their main dimension, divided into units depending on how detailed a descriptive account we want. These maps should not only record events or issues, but also actions, and conditions perceived as yielding events and problems in specific situations.

System development handbooks are full of prescriptive schemes and diagrams on how a project should be carried out. What system development projects lack, however, is a kind of historiography which should allow people to track the development of the project - as it is actually taking place. We need to reflect and discuss what happened in the past at different points of time, and to learn from there what might be important for future activities or projects.

A list of events in a time sequence without relating them to actions and conditions would be of little use for such purposes. That is why historical maps should catch the most relevant "events-actions-conditions" loops of causal or quasi-causal relationships. Historical maps should, in other words, organize past experience in a time sequence, and at the same time help one to see how events or issues are related to actions or conditions. Historical maps contain knowledge about what happened in the course of the project, and help in answering the basic questions: how where the various activities of the project actually carried out? This knowledge is essential - we believe - for effective dynamic regulation and control. The basic pattern of a historical map is shown in fig. 10. (Enderud and Borum, 1981; Mathiassen, 1981).

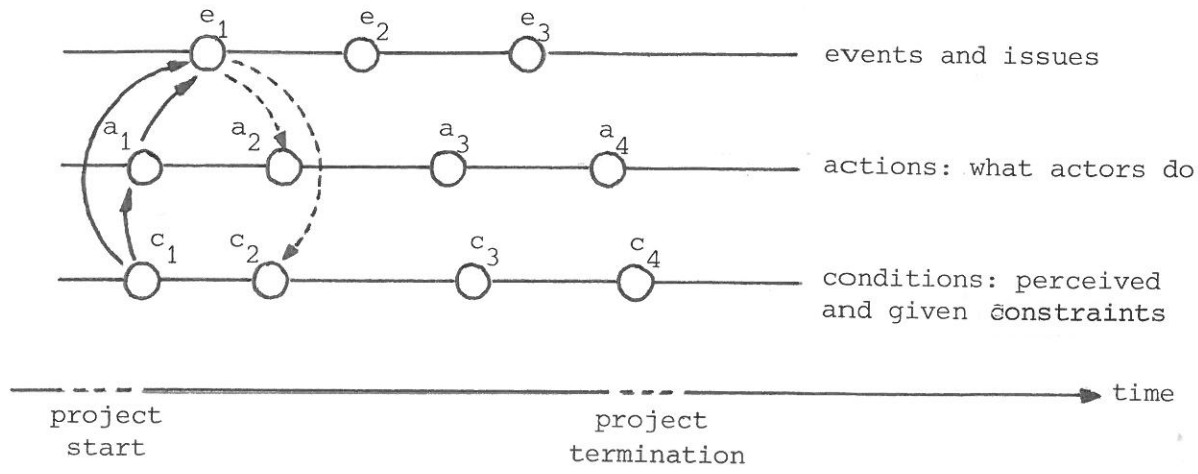

Fig. 10. Basic pattern of a historical map

A project is described on three levels. First, important events and issues are described. What is seen as important depends on the interventionist and on his or her intentions and interests with the analysis. Generally, one can distinguish between failures, i.e., events where a deviation from what was intended or planned is acknowledged in the project, and successes, i.e., events where an intended or planned situation has been successfully achieved or established. However, it is not always possible in practice - on this concrete level of description - to identify events, i.e. to date a given observation. Some observations may be expressed in more general terms as issues of the project. These specific issues might be prevailing for a shorter or longer time, and they might have surfaced many times rather than just at one particular time. They are recurrent events, or more stable characteristics of the development of the project. For instance:

- The programming language chosen in the project under analysis is not suitable for the design of the interactive programs to be produced within the project: hence, recurrent failures tend to become a characteristic of the project.

- The project is initiated on the basis of a contract with extremely unrealistic deadlines: hence, the project group is constantly forced to give less priority to the quality of the system in question, and at the same time they try to postpone the deadline in various ways.

Secondly, the actions in the project are discussed. Actions are what each actor involved in the project actually did, and how they are related to identified events and issues. We put under this item what originates from explicit human choices in the course of the project. For instance:

- The use of a certain description language results in communication problems between system developers and users, and this is perceived as an important event.

- The project is organized around a project group, a steering committee, and procedures for reporting and decision making. The project group spends a lot of effort following these procedures (action). However, they very rarely get any feedback on the quality of their reports, and they often find themselves in a situation (event) where they have to report according to procedures, although they are not ready to do so, seen in relation to the status of the project.

Finally, the conditions, as they are perceived and acknowledged by the actors involved, are described, and their relationship to actions and events are spelled out. The conditions (or the context) of a project may have decisive influence on which problems and conflict surface during the project, and on how these problems and conflict may be handled. We consider time (deadlines) to be one of these conditions, or available human and financial resources, or technical options, or existing legislation and agreements, or else the overall interorganizational relations and the structures of power and interests.

These conditions are of course not fixed. An important event may result in further processes, which again may result in a change in actions and in prevailing conditions. An action yielding undesired events can be corrected. A phase or project deadline can be postponed, and interests can be shifted. As a further example:

- The project group may acknowledge that it will find it difficult to meet deadlines (important event). Therefore they try to give less priority to testing available equipment, and instead give more priority to the design of the new system (modified action). At the same time the project group tries to change the users' expectations concerning how big a part of the system should be ready at the agreed upon deadline (modified condition).

Historical maps are the most comprehensive type of maps presented. They are made and used retrospectively to evaluate projects either during the course of the project, or when the project has terminated and has become history. The historical maps relate in a very direct way to the ecological maps as well as the diagnostic maps. Ecological maps describing external conditions related to the intervention situation corresponds to the third level of consideration within historical maps describing perceived and given constraints. Diagnostic maps can be seen as a vertical segment of a historical map: the perceived problem of the diagnostic map corresponds to the event and issue level of the historical map, and the causes and consequences of the diagnostic map corresponds to the action as well as to the condition level of the historical map. Hence, diagnostic and ecological maps are helpful tools in developing historical maps.

Before concluding this paragraph, it is worthwhile to remark that historical maps, as the others which have been presented, are not rigorous in the scientific sense of the term. They

have a special kind of rigor which is very much connected to their practical relevance and use. Historical maps help debating, learning, and reflecting the most important historical and causal features of a project. They are constructed by the actors involved in the project reflecting what they think of the project, what they consider to be relevant. If properly used, historical maps give insight into projects and situations that have been lived through, an insight which can be turned into a helpful resource when preparing for future cases.

5. Towards an Intervention Perspective on System Development

An implicit argument which runs through this paper is that current system development methods fall short in at least two respects: (1) they provide very few tools for evaluating the practical consequences of the proposed designs; (2) they do not deal much with the crucial issue of invention or what we have called the invention leap, with how one goes from the analysis of the existing system to the concept of the new one. Both weaknesses perhaps originate from an underestimation of the causal texture connecting actions and consequences in a situation of action as a system development project actually is. Though this texture may well be loose and fuzzy, it is indeed there, and it plays an important rôle in the performance of the project. But current methods and techniques do not help people very much to trace consequences and outcomes back to their own actions and to existing conditions, or even to see relevant events as an unintended consequence or by-product of specific action. In the JCN case, for instance, we have noticed that project members are in trouble when requested to surface the causal or conditional web of their project situation. Maybe that happens because they rely very much on method and technique as the basis to justify or explain action.
A method is itself a program for action which somehow reduces basic inferential structures of the type "if ... then ..." to

a set of instructions in a sequence: "do this, then do that, then something else, ... , finally complete with that". In this reduction the perception of the linkages between antecedents and consequents of action is sometimes lost or weakened.

On the contrary, maps, as we have developed them, are designed to make people actively go from thinking about situations to enacting new ones. In our intention they should improve the cognitive and learning capabilities for performing effective intervention. We claim that they help produce and convey knowledge which is not rigorous but certainly relevant. Maps reflect human constructs and interactions as they emerge in a real life project, and because of that they cannot have the same kind of rigor as formal schemes, though they might indeed have their own kind of rigor (Argyris, 1980).

Another basic argument underlying this paper is that system development can be usefully seen as a process of intervention into an organizational setting, characterized by situations of uncertainty, conflict, and change. This process yields intended and unintended changes in the information processing technology used by an organization, in the work processes, and in the nature of work itself, in the network of economic transactions among members, in the power relationships, in the cognitive and learning modes, and in the behavioural patterns of people. To intervene means to enter into an ongoing set of relationships for the purpose of changing them (Argyris and Schön, 1978).

The idea of intervention draws on a theory of action. Recent systems development approaches mainly rely on theories of systems and system's change. On one hand this emphasis has led to more appropriate frames and methods for the dynamic regulation of projects, but on the other it has put aside aspects concerning how human action yields organizational change. We think that system development methods could be healthily rejuvenated by a merging of theories of systems' change and theories of action.

Our frame for intervention assumes that there are no reasons to think that work activities performed in developing a system should be of a different nature than the actual work currently being performed in organizations. It is the same kind of work, and the idea of intervention applies both to the activity of developing a system, and to current every-day work in organizations. Either one involves some sort of intervention in situations that are never totally defined or clear. To work - be it a secretary's or a manager's work - is to intervene into situations, and to intervene is to make oneself part of the situation in order to change it. Thus the work performed by an analyst who analyses a project is basically of the same kind as the work performed in the project, and it is also the same work performed by the prospective user of the project's final product, the system.

That is why a practical theory of intervention applies to multiple domains, namely to the project evaluation domain (research work), to the project-proper domain (design), and to the products and work processes resulting from the project (computer-based work). Map-making initiates intervention in each domain: it contemplates the same kind of practice.

A major consequence of the intervention perspective is that it helps to break, or at least to reduce, the sharp distinction between development and use of technology that most systems development methods take for granted. Analysts tend to see system development as a process running from one established state of the organization to another established state, where the products designed are finally plugged into the organization and put into use by the users. That often creates situations in which it is difficult to implement the system and get the users to behave according to the system's specifications and prescriptions. Naturally designers and users blame each other: the users are accused of being incompetent or resistant to change, or even of being irrational; the designers on the other hand are accused of being unconcerned with the user's needs and all wrapped up in their formal models.

The recent interest in designing and testing systems' prototypes or versions can be seen as an attempt to reverse the pattern "from development to use", and to let practical applications and behaviours deeply shape the design process itself. By prototyping the designer tentatively creates simplified but typical work situations in order to test them and subsequently to transpose them into real situations of practice. That would hopefully help prevent undesired consequences and ease the merging of the new system into the organization (Budde et al., 1984). Prototyping and versioning are, in other words, conscious attempts to bring the learning dimension into the design process by reducing the distance between the designed system and the system-in-use.

In many respects the logic of intervention differs from the logic of analysis. It limelights and focuses on the situations as they are experienced by the actors: systems, functions, procedures, and technical equipment are not just wiped out as irrelevant, on the contrary, they are necessary elements of the actors' situation contributing to shape it, but they lay - so to speak - in the background of the situation. People use them, apply them, perform with them, talk about them, sometimes even play with them or talk to them: they are used as tools and programs to do work, but the work itself is made of punctuated sequences of situations which actors experience as meaningful.

Thus practical intervention is concerned less with analysing and choosing - though it does not deny their importance - and more with understanding situations by enacting practical experiments in a context of action, by surfacing latent conflicts of interests and by shifting and reframing problems as they are surfaced in the actors' experience. Contrary to some previous views on intervention put forward by socio-technical theorists (Bostrom and Heinen, 1977), intervention is here to be understood as an inquiry in the cognitive and learning domain rather than in the technical-instrumental domain (Argyris and Schön, 1978).

Here we come to another basic issue for system development. By intervening into a situation the interventionist - designer, analyst, manager, or user - contributes to the shaping of the situation as anybody else involved in it. But it is unreasonable to think that he can unilaterally control the situation. Regulation is in most cases a question of coordination of different instances and actors, none of which can exactly predict and control the behaviour of the others. In organizations there are no such things as established situations that can be fully controlled. Situations, in a way, are always emergent, i.e., they display properties and features which are changed by the very attempt at determining, predicting, and controlling them. Then the real challenge for an interventionist is not the question of how to control the system or the process, but the question of how one can modify a situation when being inside it, of how one can make the intended course of events come about when his actions are part of those events. A "good" intervention cannot be entirely planned in advance, expecting that the outcome will be exactly as planned. An intervention is not only, or not so much, a way to achieve pre-fixed objectives, as rather a way to construct and discover them through a process of inquiry.

A traditional and well-known approach to the issue of control is functional specialization of work and division of labour. In organizations there are people who do things, many different things, and people who think about how things should be done. The latter also monitor the way things are actually done. This is a typically managerial view of how work is organized in organizations: knowledge and cognitive equipment are supposed to be concentrated at the top level, whereas going down the hierarchical ladder one should find increasingly stupid and routinary jobs. On the contrary, we claim that cognitive skills are perhaps the most diffuse resources among people in organizations, irrespective of where they sit in the hierarchical ladder. Furthermore, even people who do things with

their minds often do not reflect on what they are doing: that happens to top managers as well as to secretaries. We should put the managerial spectacles aside for a moment and realize that human beings performing cognitively-based work cannot be very distant in their cognitive resources. As we said above, a practical theory of intervention points to a view of work as "intervention-into-situations", where there are no substantial differences in the cognitive skills needed to understand a situation. The difference is rather to be found in the domain of action addressed by the intervention.

To make a final point, the tools which have been developed and presented in this paper address the key-issue of how relevant knowledge is constructed and used in practice in system development projects. We cannot help thinking that an interesting extension of the "mapping" approach could be in the broader domains of organizational design and organizational change. System development is, after all, an instance of organizational change. We have the feeling, as other authors do (Wildavsky, 1983), that information gathering and processing in organizational settings often are overestimated to the detriment of an inquiry into the knowledge base of competent action. And competent action is what is most needed in organizations to foster effective change. But we feel that a great deal of knowledge relevant for action often is lost in rigorous but irrelevant or unusable information. A necessary condition for competent action is then also lost. Not to speak of wisdom. But we shall leave that for some other time.

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INTERVENING INTO SYSTEM DEVELOPMENT PROJECTS: TOOLS FOR MAPPING SITUATIONS

Giovan Francesco Lanzara
University of Bari
Italy

Lars Mathiassen
University of Aarhus
Denmark

5. Second Case of Intervention

The basic types of maps presented above are incomplete as guidelines for action and need to be completed by concrete action and choice. To emphazise this point, and to report on some practical experiences in mapping situations within system development projects, we proceed by presenting and analysing a real-life situation where a project group uses mapping as an intervention technique. The intervention takes place half way through the project and it addresses the overall status of the project at this time of development.

5.1 The organizational context

The project in question takes place in a private software house. The purpose of the project is to develop a computer based directory system to a foreign telephone company. The project group consists of eight persons, and the project is estimated to last for one year.

Both the project group and management want to develop and test new working practices and organizational forms, and therefore the project is designed as an experiment. The experiment covers system description issues, several project management issues and the organization of project meetings. Among other things the project group decides to spend one day evaluating the overall status of the project both at the end and half way through the project.

5.2 The intervention situation

The situation with which we are concerned here is the meeting taking place half way through the project. Each of the eight participants have prepared an overall evaluation of the project emphasizing at least two positive and two negative statements. The first two hours of the meeting are spent presenting these evaluations, each participant giving his or her points of view, the others listening and asking questions for clarification. During the next hour the various statements are discussed and compiled to the following list of main points:

Positive statements

- the process has been transparent,
- the project meetings have been well organized,
- it is fruitful to experiment with working habits,
- attempts to exercise joint management have worked well,
- the edp-based documentation system is good,
- the working climate has been stimulating.

Negative statements

- too little progress, responsibility and initiative,
- working practices outside project meetings have not changed very much,
- the product is not transparent,
- the detailed planning is insufficient,
- many decision processes have been slow.

Throughout these three hours of presentation and discussion one person is acting as referent writing down the main statements on the blackboard. From this point two negative statements are selected and starting from these, two diagnostic maps are produced. Approximately two hours are spent producing each map. In each case the blackboard is divided into four columns corresponding to the basic pattern of a diagnostic map (cf. fig. 2). Again one person acts as referent writing down the statements, evaluations and comments in the proper column. The discussion of each of the two problems is open - except for the structure imposed by the four columns on the blackboard. After several iterations and corrections, and after two hours of intensive discussion, the first of the two maps is produced:

What happened?

Too little progress has been made. Several facts provide evidence that this is a real problem:

- reports show that less time is spent on the project than is available according to plans,
- the time spent on the project has resulted in less progress than planned,
- in long periods very few technical and organizational problems surface.

Why?

Among the possible explanations the following are considered important:

- lack of initiative and responsibility in relation to the project;
- much of the work consists in modifying existing hardware and software modules and this type of work is not so challenging as development of new systems;
- too little attention is paid to the design and establishment of activities, typically this task is left to the initiative of the individual participant;
- many interruptions due to external factors;
- no systematic configuration management;
- lack of responsibility in relation to joint agreements and decisions.

What are the consequences?

Evaluating the importance of the problem the following consequences are expected:

- the contract with the foreign telephone company cannot be kept;
- reinforcement, the project becomes less challenging, the participants become less committed, even less progress is made, etc.;
- management demands that the participants start working overtime.

What can be done?

The situation can be restructured along the following lines:

- the participants should change the old habit and tradition that the formal project leader is responsible for all management activities;
- a more even distribution of checkpoints will make everyone more aware of the actual status and progress of the project;

- systematic configuration management;
- joint effort on designing and establishing new activities;
- more realistic plans, also taking into account interruptions due to external factors.

In a similar way another map is produced, and then the meeting ends. All the material, that has been written on the blackboard, is copied and distributed to all eight participants after the meeting. At the next regular project meeting decisions are taken as to which actions to initiate.

5.3 Diagnosing the project situation

In this situation we see a project group surface a shared perception of the status of the project for which they can take joint responsibility. They use the pattern of diagnostic maps, but basically they use the idea of mapping to design their own intervention: each participant prepares negative and positive statements, these are presented to the group, a joint list of statements are compiled, etc. They complete the idea of mapping by concrete action and choice.

The project group chooses to start from individual maps and from there they try to develop public and collectively shared knowledge about the status of the project. Clearly they succeed - partly because the whole project is designed as an experiment to develop new working practices. The actors have committed themselves to understand, criticize and change established traditions. All the actors share an interest in understanding and in taking action.

At the meeting the actors identify characteristic and recurrent patterns and relations in their project. For instance they agree that too little progress is made; they agree that in this way, the project becomes less challenging, they themselves become less committed, and this in turn leads to even less progress. From the joint understanding of such patterns the actors design new ways in which the project should be carried out: joint effort on designing and establishing new activities, systematic configuration

management, a more even distribution of checkpoints, etc. In this way the participants develop an awareness of where they stand in the project and they interact in a quite direct, articulate and creative way.

The project from our first case of intervention (part 3) was delayed by more than 100% in relation to the plans of the project. This last project succeeded to meet the contract. We will not - and cannot - argue that this important difference has to do with the ways in which the two intervention situations were designed and handled. The two examples do, however, support our basic thesis that effective project management requires a capacity for learning and acting which is far beyond the established traditions of the field - and they also support our suggestion that the idea of mapping can be used to design effective interventions into system development projects.

Computer Science Department
AARHUS UNIVERSITY
Ny Munkegade – DK 8000 Aarhus C – DENMARK
Telephone: 06 – 12 83 55