ON FOUNDATIONS FOR INFORMATION SYSTEMS SCIENCE - A TENTATIVE PARADIGM ANALYSIS

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Abstract

This paper is devoted to a thematic discussion (i.e. a paradigm analysis) of information systems science. The presentation is divided and done according to four different paradigm factors as ontology, epistemology, research methodology and general meta-scientific aspects.

In the ontological investigation a contextual and dialectical thinking is proposed. Information systems are conceived to be linguistic phenomena related to human action and interpretation. It is argued that information systems knowledge in the form of scientific explanations should exploit the concepts of modal logic. An analysis of relations between explanations and prescriptions are also performed. The ontological and epistemological character of information systems science leads to the use of interpretative research methods, which include dialogue-orientation, closeness to empirical phenomena and commitment of the scientist.

The paper is ended up with a discussion on the character of information systems science. An 'object science view' is rejected and an alternative view 'subject-object science view' is put forth. The need for a humanistic approach in such a science is emphasized.

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1. ANALYSIS OF INFORMATION SYSTEMS SCIENCE - A NEED FOR THEMATIC DISCUSSIONS

In the growing field of information systems science, researchers are looking for an identity of the discipline. Is it a formal or a technical or a social science or perhaps some kind of a new discipline (systems science)? The search for identity is important. There is a need for deeper understanding of the discipline in order to evaluate different research findings. From where shall we fetch criteria for evaluation of research results? The evaluation will probably be very different if we use criteria and perspectives from engineering science or from social science.

The search for foundations of information systems science can be characterized as a paradigm search. We are looking for the paradigms which are guiding the research work. The concept of paradigm (put forth by Kuhn, 1970) has implied a growing interest in the philosophy of science. Some of this interest has been directed towards the constituents of a paradigm. One can distinguish between
- ontological
- epistemological
- methodological and
- meta-scientific aspects (1)

The work with paradigm analysis is called thematic discussions (Törnebohm, 1976). In thematic discussions paradigms are articulated and critically evaluated. Through these thematic discussions paradigms can be transformed or perhaps newly formed, which is the case of a paradigm shift (Kuhn, 1970).

This paper is devoted to a thematic discussion on information systems science. The discussion will of course only be tentative. I will follow the four paradigm factors from above. The discussion will start in section 2 with an analysis of information systems work (in practice) which is our empirical field of study. This is the ontological factor. What kind of knowledge is possible to achieve in information systems science? What is the epistemological character of information system theories? This is treated in section 3. In section 4 I am dealing with methodological problems of information systems research. Section 5 will be some kind of meta-scientific conclusion and summary.

(1) Confer eg Törnebohm (1976) and Lindholm (1981)
Wegner (1976) has made an analysis of the paradigm development in computer science. He distinguishes between three phases of development, the empirical, the mathematical and the engineering phase. My paper can be interpreted as arguments for a scientific area (information systems science) besides computer science (1) and arguments for a "humanistic" paradigm in this science.

The initial purpose of this paper was to investigate the foundations of a contingency approach in information systems science. This analysis has been broadened to a more exhaustive (broader but less deep) investigation of the science of information systems. My main purpose with this paper is to stimulate to further thematic discussions.

(1) Of course partial intersections between the areas can and will occur
2. THE CHARACTER OF INFORMATION SYSTEMS WORK - A NEED FOR CONTEXTUAL AND DIALECTICAL THINKING.

In this section I shall try to investigate the ontological status of information systems work. This is an important and basic paradigm factor and it influences other factors. The ontological assumptions consist of basic definitions of what kind of phenomena there are in the empirical field for study. These assumptions are basic categorizations and conceptions (pre-understanding) held by the researchers and will govern their different scientific activities. This often means some kind of delimitation of the universe of discourse. What phenomena are defined to be in the universe and which are not (1).

2.1 THE CONCEPT OF INFORMATION SYSTEM

The concept of information system will be investigated as a start. What is the nature of computerized formalized information systems? Such systems are often conceived as technical system. They are also conceived to have different social consequences. This view "Technical systems with social implications" is not only taken by technically oriented researchers. It is also taken by some work sociologists who study the social impact of computerized systems. I would like to try to invert this view, i.e. to consider information systems as "social systems only technically implemented". This implies a difference in perspective, which I will try to clarify.

What kind of social system is an information system? It is a linguistic system for communication between people. Such a system comprise a formal language. The system consists of messages (sentences) and message processing according to a specified formal language.

Why and in what situations are such definitions favourable? It might be easier to define information system to be a technical system at first place. A computerized information system exists in its physical facticity. To consider it as a linguistic system is more abstract. In this case one has to go to the purpose of an information system (2). Such a system is used in order to inform some people about something (a topic) as a support to their action. I will not go into detail in definition of an information system. For different attempts to define information system using linguistic concepts confer Nissen (1976, 1981), Lyytinen (1980a) and Goldkuhl (1980a,b,c).

(1) Confer Kuhn (1970) and Törnebohm (1976)

(2) Nurminen (1980) has argued for the need to incorporate the purpose of information system in definition of such a system.
Going further along these lines it seems adequate to ask the question: What kind of wholeness is a formalized system part of? The environment of an information system has rather an unformalized and informal character. A formalized information system is part of social interpretation and action fields. It is part of social contexts (1).

2.2 INFORMATION SYSTEM IN CONTEXTS

An information system can be said to appear in different contexts. Some fundamental contexts seem to be
- specification
- implementation (2)
- use
- evaluation
- change

of information systems. These are different general contexts/situations (partly intersecting). Specific information systems appear then in specific situations of specification, use etc. The properties of information systems work in different specific situations are dependent on different factors and properties of these situations. The contents, structure and processes of information systems work are context dependent or in other words contingent on different situations. There has been a growing interest in contingency framework governing information system research (3). This direction of research is probably emerging from a dissatisfaction with a non-contextual approach. The contingency approach seems, so far, to be reduced to "objective" properties of information systems work in contexts. To make a further contextualization of this is to ask in what larger context these "objective" properties are constituents. I shall try to do so by using one of the general context (use of information systems).

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(1) The need to describe and understand a social phenomenon in context is well described by Törnebohm (1977) and Lindholm (1981)

(2) I mean organizational implementation here

(3) cf e.g. Whisler (1975) and Olerup (1980)
2.3 USE OF INFORMATION SYSTEMS

In section 2.1 above I gave a brief definition of a computerized information system. It is a linguistic system external to people, but created and used by people (figure 2.1).

The use of an information system is a dialectical situation where human subjects change the (contents of an) information system and where human subjects change by their use of the (object of) information system. This means that the human use of information system is part in and an example of ongoing dialectical processes between subjective and objective reality (1).

I present a short quotation from Berger & Luckmann (1967, p.78) for a description of this basic ontological conception.

"It is important to emphasize that the relationship between man, the producer, and the social world, his product, is and remains a dialectical one. That is, man (not of course, in isolation but in his collectivities) and his social world interact with each other. The product acts back upon the producer."

(1) These principles emanates from Berger & Luckmann (1967) and Blumer (1962). For application of these principles to the information systems field confer Goldkuhl (1980, a,b,c), Nissen (1981) and Boland (1979).
The users do not only react to the physical properties of an information system. They use messages from it, which they interpret. They assign meaning to the messages and act according to the knowledge gained through these interpretations.

Interpretation is based on the linguistic competence, conceptions and concept structure of the specific user. The acts performed by a user are performed according to his knowledge and intentions. Action is purposeful and meaningful behaviour. This is based on a certain ontological view (1). I will try to make further elaboration of this view in relation to use of information system. I have stated that an information system is a linguistic system. This means that it has a symbolic character. It consists of expressions of meaning. These linguistic expressions are interpreted, which is a human assignment of meaning to them. Using an information system is meaningful work. I claim that it is not possible to reduce information systems work from the concept of meaning.

The interpretation process is governed by and dependent of the concept structure, values and earlier conceptions of a user. This means that the use of an information system is highly dependent of the subjective knowledge of the users (2).

The purpose of information systems is, through message processing and messages, support to people in their action. People are not only acting by the influence of their environment (which in this case is information systems in an organizational context). People have the possibility to define their (work) situations and to create intentions as a basis for their action. People act in order to achieve some purpose. Use of information system is purposeful work. I claim that it is not possible to reduce information systems work from the concept of purpose (3).

Many information systems are created with types of messages that prescribe certain action by the users. In these cases the actions of the users mean to follow a rule (4). The concept of a rule is very important when defining information system as a linguistic system. Searle (1971) defines linguistic behaviour as intentional, rule-governed behaviour. This has further implications for definition of information systems use.

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(1) This ontological view is based on e.g. Weber (1964), Schutz (1970), Silverman (1970), von Wright (1971) and Searle (1971)

(2) On the relations between subjectivity, subjectivism, intersubjectivity and objectivity confer Goldkuhl (1980c)

(3) Confer Nurminen (1980)

(4) 'Rule' is a very important concept in social sciences, confer e.g. Wittgenstein (1953), Winch (1958), von Wright (1963) and Searle (1971)
An information system has been defined to comprise a formal language. What kind of messages and what inferences there will be in an information system are specified through the meta language (i.e. an information model) for that system (1). This meta language acts as rules for the information system processing. Use of information system means in this perspective performance of linguistic acts including inferences. The people behind (the rules of) an information system then show (2). Linguistic acts are always performed by human beings. This is the case even if people sometimes use computers as means for their linguistic action.

2.4 CONCLUSION

Information systems work means a socially constructed reality and not a naturally given reality. Information systems appear in different general and specific contexts. There is a need for contextual thinking when defining information systems work. Properties of information systems work are however not only of objective character. Such work is dependent of subjective reality (interpretations, conceptions, concept structure, values, intentions etc) and subjective-objective-dialectics. The ontology of information systems work should build on and include certain important concepts as context, language, meaning, rule, interpretation, conception, intention and action.

(1) Confer Nissen (1976), Lyytinen (1980a) and Goldkuhl (1981)

(2) This is a claim by Nissen (1976, 1981) and Goldkuhl (1980a,b,c)
3. THE CHARACTER OF INFORMATION SYSTEMS KNOWLEDGE - A NEED FOR MODAL CONCEPTS

The scientific activities performed by information systems researchers are leading to different kind of knowledge (theories, methods, etc). The nature of the scientific knowledge is dependent of the ontological field. The epistemological problem can be divided into several subproblems; as e.g. the source, the nature and the validity of knowledge. In this section I shall try to focus mainly on the problem of the nature of information systems knowledge. This can however not be treated independent of the source and the validity of this knowledge.

3.1 INFORMATION SYSTEMS WORK AND SCIENTIFIC KNOWLEDGE

Research around information systems work can lead to different kind of knowledge. These can be knowledge for description, explanation, prediction, prescription and understanding (1). The aim of the actual scientific enterprise will determine the kind of knowledge. An old philosophical controversy is between explanation and understanding (2). In this paper I will take the following position. There are different epistemological status of explanation and understanding but they may not be in conflict. Explanations can be used to mediate understanding (3). I would like to put it even stronger: Explanations are probably a necessary prerequisite for understanding.

Information systems work consists of intentional acting human beings performing their professional activities in social contexts. The concept of intentional action is hard to combine with mechanistic and deterministic explanations. Such explanations have been used for long time in science and can be useful for certain purposes. This kind of explanation is intimately related to the concept of causality.

The philosopher David Hume (1902) has made a classical analysis of the concept of cause. A is a cause to the effect B if certain conditions are fulfilled. If A occurs then B must occur and B cannot occur if A has not occurred.

(1) Confer Reynolds (1971)
(2) Confer von Wright (1971)
(3) Ibid and Lindholm (1981)
This means a double necessity. A is a necessary condition for B and B is a necessary effect of A. Such circumstances seem to be seldom in hand in the socially constructed reality of information systems work. The ontological character of social interaction and human action in information systems work reduces the applicability of this cause concept. There is a need for less deterministic concepts. Such concepts can be found in modal logic.

3.2 CONCEPTS OF MODAL LOGIC

Modal logic deals with the concepts of necessity, possibility and impossibility (1). Let 'M' stand for possible and 'p' for same arbitrary state of affairs. 'Mp' means that it is possible that p. Let '-' stand for not. '-Mp' stand for that it is not possible (i.e. impossible) that p. '-M-p' means that it is not possible that is not the case that p, which is that it is necessary that p. These different cases can be summarized:

- Possibility = M
- Impossibility = -M
- Necessity = -M-

This fundamental logical insight can be transferred to other types of logic, e.g. deontic logic (normative logic), that deals with permission, prohibition and obligation (ibid).

3.3 DIFFERENT MODAL STATES OF EXPLANATIONS

An explanation can be given the following fundamental form:

If condition (influencing factor) then effect (influenced factor, consequence)

This means that some factor(s) influence(s) the occurrence of some other factor(s). The concepts of modal logic can be applied both to conditions and effects. A condition can be necessary, possible or impossible for a certain effect. And a certain effect may occur by necessity, possibly or impossibly from a condition.

The case of possible conditions should be further investigated. What does it mean that a condition is possible for a effect. Does it mean that this condition support the effect without being necessary? There will be certain conditions that support or facilitate effects. On

(1) For the concepts of modal logic see e.g. von Wright (1968)
the other side there can be factors which are obstacles for certain effects without being impossible. These conditions hampers effects. This division of possible into facilitating and hampering (1) seem adequate only for conditions and not for effects.

The following cases might then appear:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Necessary</th>
<th>Facilitating</th>
<th>Hampering</th>
<th>Impossible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Necessary</td>
<td>If (-M-) then (-M-)</td>
<td>If (Mf) then (-M-)</td>
<td>If (Mh) then (-M-)</td>
<td>If (-M-)</td>
</tr>
<tr>
<td>Possible</td>
<td>If (-M-) then (-M-)</td>
<td>If (Mf) then (-M-)</td>
<td>If (Mh) then (-M-)</td>
<td>If (-M-)</td>
</tr>
<tr>
<td>Impossible</td>
<td>If (-M-) then (-M-)</td>
<td>If (Mf) then (-M-)</td>
<td>If (Mh) then (-M-)</td>
<td>If (-M-)</td>
</tr>
</tbody>
</table>

This can be stated in the form of a matrix where the different modal states of explanations are expressed (figure 3.1). An interesting point here is that causality (as it was described in section 3.1 above) is a special case of modal logic. It is the case 'If \(-M-\) then \(-M-\)'. The other extremes including impossible can be interpreted as some form of causality (at least determinism).

Figure 3.1 Different modal states of explanations (\(Mf\), \(Mh\) stands for the expanded modal category of possibility. (\(Mf = Facilitating\), \(Mh = Hampering\))

(1) Confer social field theory of Lewin (1947)
The if-then-clauses in the matrix are not complete as I have left out the 'state of affairs'-part. The matrix is the maximum amount of "theoretically" possible modal combinations. I have not investigated the applicability of the different combinations. Some combinations will probably after a "test" show to be inadequate. I would also like to point out that my arguments here are not towards a specific formalism of modal logic but instead towards the concepts of modal logic.

In many explanations of information systems work the modal categories of possibility will probably be used. The ontological assumptions of man as an intentional acting being imply the use of the modal category of possibility in many effect clauses, i.e. possible consequences and not necessary consequences. Another ontological assumption e.g. the stimulus-respons-model of man in behaviourism would be possible to combine with knowledge expressed in a strict causal and deterministic form.

I will give an example (1) in order to illustrate the double modal relations in explanations.

An explicitly formulated model of user information needs is necessary (=condition) in order to enable an efficient datalogical design of information systems (=effect).

The if-clause (condition) has the modal state of necessity. An information model is necessary for an efficient design. The then-clause (effect) has the modal state of possibility. An efficient design is possible from an information model.

The reader may conceive this double modality to be another way of expressing necessary and sufficient conditions. I have however avoided to use the concept of sufficient conditions since I have experienced it too ambiguous and I did not want to complicate the analysis too much.

The use of modal concepts and analysis of explanations seems to be especially important when applying a contextual/contingency approach. Different factors are context dependent. How are different factors influencing human work with information systems in different contexts? Which factors are necessary and which are facilitating? Which factors are obstacles and which must be avoided (impossibilities)? What combinations of factors may have influences? What effects are necessary, possible or impossible from different influencing factors?

(1) This hypothesis is used only for illustration purpose. I will not define any concepts of it or discuss its empirical tenability.
3.4 EXPLANATIONS AND PRESCRIPTIONS

Much research efforts in information processing is devoted towards development of methods. Especially methods for analysis and design of information systems (systemerering) are developed. What is the character of such methods? One interpretation is that information system development methods are prescriptions for human action. They are rules for how to act in systemerering situations (1).

Are these prescriptions/methods related to explanative theories? And if they are, in what ways are they related? This problem is part of an old philosophical problem; the relation between 'is' and 'ought' (2).

In one sense prescriptions can be said to be derived from explantive statements (3). A prescriptive statement can be given the following principal form:

If one wants to attain this goal
then follow this prescription

The relation between explanations and prescriptions can be expressed in the following way:

Explanative statement: If condition then effect

Prescriptive statement: If goal then prescription

This means that prescriptive statements are inversions of explanative statements. If an effect is desired then it becomes a goal and the condition becomes the prescriptive part. A derivation of methods can be performed in the following way: Explanative theories on information systems development are examined. Goals are stated with desired properties of development and use of information systems. If an effect (of an explanative statement) is equivalent with a specified goal, then one has found a prescription in the condition-clause of that statement. The prescription acts as a development method which should lead to the specified goal (4). This implies that it is not possible to escape from goals and values in information systems methods research. Such research

(1) Confer Goldkuhl (1980c,d) and Lyytinen (1980b) for these interpretations.

(2) Confer von Wright (1963) and Searle (1971). These authors have treated the is/ought-problem in a partly different way than I will do.

(3) I have described this in an earlier paper, Goldkuhl (1979). Confer also Goldkuhl (1980b).

(4) A more thorough description of this explanation-prescription relation is found in Goldkuhl (1979)
cannot be value-free.

I will give an example of this explanation-prescription relation for illustration. I will use the proposition from section 3.3 above. An analysis of and a derivation from this statement will lead to the following prescriptive statement:

If an efficient datalogical design of information system is to be performed (=goal) then an explicitly formulated model of user information needs must be used as a basis (=prescription)

Do the different modal states of explanations affect the form of the prescriptions? Is there a need for strict causal explanations? This was a (not elaborated) assumption in my earlier work (ibid). At that time I was not especially aware of these different modal states. Now I state that there is not necessary to have a causal relationship. Other types of modal relationships will work also which I will show below.

The example from above had the following modal state

<table>
<thead>
<tr>
<th>Explanative statement:</th>
<th>Prescriptive statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition = Necessary</td>
<td>Goal = Possible</td>
</tr>
<tr>
<td>Effect = Possible</td>
<td>Prescription = Necessary</td>
</tr>
</tbody>
</table>

In a more concise way, it can be expressed like this (1)

If \(-M-C\) then \(ME\)
then \(-M-P\)

This is not a causal case. The effect is only possible. The condition is, however, a necessary one. This has also been expressed in the then-clause of the prescriptive statement by the (modal) verb 'must'. The different modal states of the conditions can in prescriptions (then-clauses of prescriptive statements) be translated to modal verbs in the following way (2):

- Necessary C ---\(\rightarrow\) must perform C
- Facilitating C ---\(\rightarrow\) should perform C
- Hampering C ---\(\rightarrow\) should not perform C
- Impossible C ---\(\rightarrow\) cannot perform C

(1) Let Condition =C, Effect =E, Goal =G, Prescription =P

(2) This leads to a direct relation with deoptic logic. Confer section 3.2 above and von Wright (1968)
The transformation from explanative to prescriptive statements can be summarized as below:

Goal: To attain E with \[
\begin{align*}
\text{Necessity} \\
\text{Possibility} \\
\text{Impossibility}
\end{align*}
\]

Prescription: One \[
\begin{align*}
\text{must} \\
\text{should} \\
\text{should not} \\
\text{cannot}
\end{align*}
\]
perform/establish C

The case of impossibility in the goal-clause can be expressed in a better way: To attain -E with necessity or to avoid E with necessity.

3.5 CONCLUDING REMARKS

Do I claim with my investigation on different modal states that this is an exhaustive definition? Have I stated all possible cases of explanations? My description has been around 'influence explanations'. There are other important explanations in social science like explanations of meanings and intentions (1). These are needed in order to make expressions and actions intelligible and understandable (2). Explanation of meaning interprets the meaning behind symbolic expressions and objects of different kind. Actions are described by the intentions behind them (3).

Are explanative theories of information systems work descriptions of invariant social circumstances? Lindholm (1981) argues against invariances in social science. Important scientific tasks are to find out what can be otherwise and thus changed, (ibid p.182). Contingency approach and modal concepts make explanations less "invariant" through their contextual orientation and non-determinism.

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(1) These different explanations will probably in many cases be overlapping.

(2) This will be treated in section 4 below

(3) Confer von Wright (1971) about practical inference.
Ontological and epistemological presuppositions determine to a large extent what kind of research methods that can be used. Research methods in a scientific enterprise must be chosen/design according to a specific research purpose (i.e. a stated problem, an articulated perspective and a specified need for knowledge) (1). There is anyhow a possibility to discuss some general principles of research methodology (following the general principles of section 2 and 3 above).

4.1 INTERPRETATION OF SOCIAL PHENOMENA

Information systems work is meaningful behaviour as was stated in section 2.3 above. Is it possible to create scientific information systems knowledge without taking into account the meanings of the actors on the "empirical stage"? Schutz (1970), Blumer (1962) and Silverman (1970) among others state the importance of building on concepts and conoeptions held by the actors studied.

A phenomenon studied by a natural scientist is meaningless until the scientist imposes a meaning upon it. The scientific knowledge of such phenomena is an "external logic". Social phenomena has an "internal logic" (2). Social activities include and build on meanings. A social scientist must work with and understand the internal logic of social life. Meanings are created, expressed and recreated through the social dialectical processes (3). Meanings are expressed and objectivated in linguistic sentences and other human action and different cultural objects. To grasp the meanings of the objectivated social world is not unproblematic. A specific meaning can be expressed in several different ways. An expression/object can be interpreted in different ways, i.e. one can assign different meanings to it. Meaning-expression relations are often ambiguous.

These circumstances will lead to a particular methodological attitude of an empirically oriented information systems scientist. To grasp the meanings of information systems work there is a need to check alternative interpretations. This implies a closeness to empirical phenomena. This implies also use of dialogue oriented research methods.

(1) Confer the problem-knowledge-method triade of Edfeldt & Jansson (1978)

(2) About the distinction between external logic and internal logic see Silvermann (1970). See also Goldkuhl (1980c)

(3) Confer e.g. Berger & Luckmann (1967)
In the introductory notes of this section I stated the need to choose and design research methods in accordance to the scientific problem statement and the knowledge objective. Certain methods like participant observation and interviewing seem adequate following the ontological assumptions from section 2 above. Other methods like laboratory studies and questionnaires can also be used if they are applied within a meaning framework (1).

Some problems of these methods are that they are usually applied in standardized fashion. Each instance of investigation should be performed in the same way as others. This means often an insensitivity to the empirical situations. This strive for standardization of the empirical gathering falls back on an "external logic fallacy". One tries only to impose an external logic on the situation without taking into account the internal logic i.e. the meanings in the studied social situation. This fallacy includes usually an exhaustive use of operationalized definitions and hypotheses. This means often a pre-categorization of a social reality, which probably will be harmful for getting concepts and conceptions of the studied actors. This will be an empirical "measurement by fiat" (Cicourel, 1964) (2).

Language is a key to understanding in social sciences. Through dialogues with actors on our empirical stage we can interpret conceptions, values and intentions behind their actions. There is also an inherent logic of language (3). This logic (i.e. meaning structures) can be a very important aid in our understanding processes.

To understand information systems work it is perhaps necessary not only to study the situations at hand. Systemeering methods in practice can be interpreted as social institutions (4). The understanding of social institutions needs often a historical investigation (5).

These remarks have implications for the purpose of empirical investigations. Such investigation should lead to a reconstruction of social meanings. But that is not all. This reconstructed internal logic must be put in a wider scientific framework. As a social scientist one must take the positions of the studied actors. But that cannot be all. This is the empirical part of the research.

(1) This is stated by Cicourel (1964) and Silverman (1970)

(2) Besides ibid confer also e.g. Schutz (1970), Silverman (1970), Blumer (1962) and Winch (1958)

(3) Confer Israel (1979)

(4) Confer Goldkuhl (1980d)

(5) This is stressed by Berger & Luckmann (1967)
The empirical findings will be used in theory construction. The meanings of the studied social interaction will be used when creating a scientific theory, i.e. a meaningful understanding of the empirical field.

I have claimed the importance of interpreting social phenomena, i.e. getting at the meanings behind symbolic expressions. This is contrary to registering physical phenomena, which is adequate in computer science as e.g. measurement of computer systems performance. The human specification of information systems and the use of linguistic messages from such system, and actions performed based on these messages; all this kind of work needs interpretative research methods (1).

4.2 COMMITMENT OR NEUTRALITY?

One, sometimes stated, ideal of science, is that of the researcher as neutral observer. Is this possible or is it even an achievable objective? Is it possible to be a detached, neutral observer when one tries to interpret the subjective conceptions and intentions behind the acts of some studied actors?

Here, I claim, that it is only possible to accomplish empirical scientific undertakings if one does commit oneself in the empirical situations (2). It is through a personal commitment that I, as a researcher, can gain a deeper understanding of the empirical situations. This does not mean that I am, all the time, committed to the empirical situation. Sometimes I must change my commitment to my theoretical work and have a distance to the investigated situation.

The ideal of scientific detachment is rejected by Polanyi (1958) who emphasizes the personal commitment of scientists.

"Theories of the scientific method which try to explain the establishment of scientific truth by any purely objective formal procedure are doomed to failure. Any process of enquiry unguided by intellectual passions would inevitably spread out into a desert of trivialities" (Ibid p.135).

Commitment and creativity are seldom treated in the literature of scientific method. They are either ignored or taken for granted. It is, anyhow only by a scientific commitment, that I can be creative enough to establish any interesting results. Creativity cannot be controlled but it can be facilitated by my attitude and action. Rogers (1961, p.216f) writes about the creative scientist:

(1) Confer e.g. Filstead (1970) about qualitative empirical methodology in social science

(2) In this claim I am following Polanyi (1958), Rogers (1961, 1969) and Pirsig (1975).
"He senses the field in which he is interested, he lives it. He does more than 'think' about it - he lets his organism take over and react to it, both on a knowing and on an unknowing level. He comes to sense more than he could possibly verbalize about his field, and reacts organismically in terms of relationships which are not present in his awareness."

4.3 A NOTE ON ACTION RESEARCH

Following the ontological, epistemological and methodological discussions above, action research (1) seems to be an interesting approach. In actions research the theory-empiric cycles are faster and more frequently occurring. The action research approach can be used in systemeering methods research. The scientist participates and acts in real systemeering work where his methods are used by the participants. Now and then the methods can be extended or modified by the scientist himself or in dialogue with systemeering participants. The systemeering methods are successively evaluated and changed (2). The empirical situation is both a source for knowledge and used for testing knowledge.

An action research approach includes closeness to empirical phenomena and thus good possibilities for interpretation. The scientist is in dialogue with the systemeering participant during the empirical work. Commitment to the empirical situation is probably difficult to avoid in an action research approach.

(1) See e.g. Clark (1972) about action research

(2) I have used this kind of research approach when working with methods for information analysis (Goldkuhl, 1980b)
5. THE CHARACTER OF INFORMATION SYSTEMS SCIENCE - A NEED FOR HUMANISTIC APPROACH

During the earlier sections there has been some implicit assumptions of the research territory of information systems science. What delimitations of this territory can be made?

One assumption of information systems science and its empirical research area is to consider as an object science. In such an approach we will study computers and their use for formalized information systems. People are regarded as a disturbing element on the empirical stage and should be disregarded as much as possible (confer figure 5.1). There are other sciences (as e.g. psychology and sociology) dealing with human aspects.

![Figure 5.1 Information systems science as an object science](image)

Building on the performed thematic discussions of this paper the object science outlook must be rejected. A subject-object science view is put forth as an alternative (figure 5.2).

![Figure 5.2 Information systems science as a subject-object science](image)
This view emanates from the ontological assumptions of information systems work as meaningful and purposeful human/social activities. In this science not only objects like methods, models and information systems are studied. People are studied and scientific knowledge is created about people in regard to their roles as information system users and developers. One is studying human subjects as "infological beings". This means human properties in regard to information systems work. Examples are human ability to formalize knowledge and language and human ability to create, use and change systemeering methods. One can also study cooperation, communication and conflicts during systemeering.

The "infological objects" (methods, models and information systems) are studied as socially created utility products.

This approach means a dialectical definition of the research territory. This territory is constituted by the dialectical processes between human subjects and their produced objects. (Goldkuhl 1980c).

This means also that information systems science is considered as a social science. It is a social science including linguistic, formal and technological problems and aspects. These different kind of problems cannot be reduced from human intentionality. In such a case one is reifying (1) language, formalism/logic and technology.

This paper has been an analysis of different paradigm factors and arguments for a humanistic approach. Such an approach includes
- interpretation and understanding of the empirical world
- considering the subjective world of human beings (interpretations, conceptions, concept structures, values, intentions, etc)
- considering human products as such (not reification)
- considering the subjective-objective dialectics.

My analysis has been eclectic, i.e. it has been influenced by different humanistic schools as symbolic interactionism (e.g. Blumer, 1962; Hewitt, 1976) social phenomenology (e.g. Schutz, 1970; Berger & Luckmann, 1967; Cicourel, 1964; Silverman, 1970), hermeneutics (e.g. Lindholm, 1981; von Wright, 1971; Ödman, 1979 (2)), dialectics (e.g. Lindholm, 1981; Israel, 1979), analytical philosophy of language (e.g. Wittgenstein, 1953; Winch, 1958; von Wright, 1963; Searle, 1971) and humanistic psychology (e.g. Rogers, 1961).

(1) About reification see Berger & Luckmann (1967)

(2) Confer also classical works as Heidegger (1962) and Gadamer (1975)
I hope that this paper of mine can stimulate to and be used for further thematic discussions on information systems science.

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