

INFORMATION SCIENCE NEEDS A THEORY OF 'INFORMATION ACTIONS'

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INTRODUCTION

Information science, seen as an academic discipline and not as a more or less irrelevant appendix to traditional information practice, currently seems to be undergoing change. Certain trends can be noted, at least in the UK and West Germany. Generally, information science is forming itself into some sort of a social science at the interface between such technical disciplines as cybernetics, computer science, telecommunications, technologically based subjects like mass communications, social sciences like sociology, and humanities like psychology.

Having not yet built a coherent corpus of ideas, models or theories or analytic-methodological tools, or a scholarly tradition, information science is still looking for its 'true destination'. This becomes obvious if we look at the published literature: there is no widely accepted 'handbook of information science'; the number of articles asking what 'information science' should be is by no means decreasing; the terminological confusions among terms such as 'information', 'library', 'computer', 'science' and 'studies' continue. Numerous journals try to become established with competing views of the field or subsections of the field. This seems to be one reason why 'information science' is still wide open to influences coming from the environment, whether from societal developments in general or from the academic world.

Some developments, which seem to put pressure on information science at present are as follows:

1. The 'theory discussion' in the social sciences and mass communications.
2. New developments in the technological field (e.g., information technology).
3. The general criticism of a science-based culture (note, for example, the discussions on atomic energy and pollution) and its implications for a 'new science'.
4. Certain failures and shortcomings in information practice.
5. New trends in artificial intelligence.

Though far from being exhaustive, this agenda can give us a relatively clear

picture of the problems and fields which information science has to tackle in the years to come. There can be no doubt that by doing this it has to draw its analytical and methodological tools, its models, concepts and theories from the variety of disciplines, shaping them in a new way.

In the search for a theoretical basis for information science, Roberts (1982) has made some proposals which are worth comment. One can agree with Roberts' harsh criticism of the shortcomings and deficiencies of empirical research in information science, especially in user studies. The implicit assumptions of these studies that 'information behaviour is rationally motivated and organized' (Roberts, 1982: 97) and remains relatively stable in time are, indeed, an analogy to economic man of the classical period. The transfer of the non-empirical concept of 'economic man' to information behaviour would not remove the faults of the former approach, especially the lack of empirical validity. The ideal type of approach is a normative one and, therefore, necessarily conflicts with the author's plea for empirical research; the normative approach is very weak in taking into account the subjective and non-rational aspects of information behaviour. In following Roberts' support of qualitative research to uncover, analyse and understand the facts of everyday life, the normative approach in particular would not be sufficient. That the empirically supported theoretical basis of information science, as far as users are concerned, is extremely poor, has been stated by numerous authors, of which Roberts is only one (for reviews *see* Windel, 1980; Plageman *et al.*, 1981). It is thus interesting to consider proposals to change this unsatisfactory state of the art.

To be brief: Roberts' suggestions all point in one direction: the building of a model of information man analogous to the concept of economic man developed by modern economics. This model is seen by Roberts to rest on some generalized assumptions about the information-oriented behaviour of human beings which conforms with information realities. The purpose of this complex model of information man, then, is to serve as a useful device in empirical research.

Contrary to the unrealistic and primitive model of information man employed in numerous user studies and bibliometrics, Roberts' information man is a complex and differentiated animal guided by rational and non-rational motives and behaviour. But what do these motives and behaviour look like? What are the structural and empirical elements of information man? Roberts fails to give the reader even the slightest hint of an answer to these questions. Instead he claims that 'ultimately, all information activity is reducible to individual motivations and actions' (Roberts, 1982: 98) and that, therefore, the central unit of study has to be the individual. From that we may be justified in concluding that information man is primarily a psychological construct.

But what about all those social, economic and cultural factors, which influence ongoing information processes? What about intervening variables like status, prestige and group dynamics? It seems to us that the model of information man which rests primarily on psychological grounds is too one-sided to give a full picture of what information behaviour really is; that is, in Roberts' words 'the complex, "interactive process that is summarized by the label" information behaviour' (Roberts, 1982: 96). If this holds true then information man, as depicted by Roberts, can only be one tool of analysis and has to be supported by others.

THE INSTRAT APPROACH

As shown above, the concept of information man has severe shortcomings, so that it cannot be seen how, by employing only this concept, far reaching advances in the understanding of information behaviour can be reached. The INSTRAT approach (Plageman *et al.*, 1981; Wersig *et al.*, 1982) tries to combine those structural elements, which determine information processes (e.g., driving forces, strategies, models, actions). Though the models are highly theoretical constructs they are related to reality.

The key idea of this approach is that information processes and information behaviour can be described, analysed and understood as being segments of an underlying factor, i.e., a problem. From this it follows that it is the 'problem' from which analysis has to start. Information can then be seen as being only one element, though an important one, contributing to coping with that problem.

An approach is needed which avoids any isolation of one component in information processes, but tries to develop a basis which would be able to take account of all structural elements, including psychological, strategic, behavioural, cultural, etc. Roberts' approach leans too heavily on psychological factors (i.e., motivation); an approach which covers the whole range of intervening components has to include additional elements so that a model can be constructed.

This model can be imagined to consist of the following three structural components:

1. *The individual approach.* Insofar as every situation and action in information processes has to be reduced to individual actors and their personal conditions (traits, motives, values, etc.), psychological factors do play an important role, as Roberts points out correctly.
2. *The collective approach.* In information processes the actors often are not only individuals in their own right, but also representatives of collective units which influence the individual's performance. Information, seen as a mediation process, from the point of view of producers of knowledge, is often a process which takes place within a collective unit without firmly ascribed roles. In this case, for example, the specific kind and function of group dynamics has to be taken into account.
3. *The process approach.* This component covers the dynamics of an information process, whereby the dominant structural factors in any underlying information process are delineated. Unfortunately, this does not tell us where to start investigation of an information process and the behaviour of the people involved. Therefore, we have to look for the central element at the core of that process.

On the process of problem treatment

Generally speaking, the underlying 'force' which induces individuals and collective units to look for information, process, store and disseminate it, is a *problem* which can be defined as a state of uneasiness about any object in the world or the universe. So far, most models in this area have started with the notion of 'information need'. As Wilson (1981a, b) has pointed out, this category is:

1. Very unclear (and may remain so).
2. Not very realistic because in most cases manifest information needs can be related to more general needs.

'Information need', according to these suggestions, needs to be separated into primary needs (for which a sound typology would be required), which require the provision of some kind of information, and secondary information needs, which aim at something other than the provision of information by using information provision only as a means for the primary purposes. Examples of secondary information needs are the state gained by running an online search, meeting a nice librarian, overcoming the boredom of waiting for something, etc. From the viewpoint of 'information man' these activities would not be 'true' information needs; from the viewpoint of information agencies they may become even more important than primary information needs (under marketing aspects).

Typologies of this kind so far have failed, perhaps because at any time in real life the organism is in the state of a need situation: several different needs contribute to this situation (e.g., the need to move from one place to another is, of course, combined with the status need, a need for comfort, a need to have money, etc.). More interesting than the 'needs' is what is caused by a 'need situation' and this may be called the problem (or in earlier writings a 'problematic situation'). We propose that information science should start with looking at individuals (or collectives) where an unspecific need situation causes a problem.

Information science, especially its empirical branch, has now linked the concept 'problem' with the process of problem-solving. The underlying assumptions are (as in the concept of economic man):

1. The existence of a problem-solver, who acts purposively rationally (*zweckrational*—M. Weber).
2. The existence of a problem whose elements and alternative solutions can be sufficiently described.

It takes only a naive look at people coping with problems to see that these assumptions hold true only for some well-defined contexts. Instead, in reality people's behaviour towards problems is determined by other characteristics, e.g.,

1. The cognition of a problem is an individual matter and therefore personal solving strategies are chosen.
2. The cognition of a problem may not mean *eo ipso* its solution but may be eventually transformed in a manner which fits the respective person.
3. 'Solving a problem' can mean, not to 'solve' it, but to redefine it and to look for a more simple strategy of action, which makes the 'real' solution superfluous. (Freud (1965) has shown us how this is done.)
4. External knowledge, which has played the dominant role in information activities so far, may only have a secondary function. In respect of modes of action, provision of alternatives and their choice, internalized fragments of knowledge, as well as values and motives may consciously or subconsciously have a much greater influence.

These ideas indicate that—much earlier than is realized by problem-solving approaches—a long internal process may take place in which a problem is

looked at for the best individual way to cope. The underlying needs, the motivations, the knowledge will influence this process (e.g., in the very early choice of alternatives, selection of strategies, directions of solution, defining the problem and related goals) and may be influenced by this process or other inputs into the organism which are caused by other ongoing activities as this process proceeds in time. The relation 'need-behaviour' is a rather static one, whereas the notion of 'problem treatment process' enables us to look at the stages which play an important role within the organism before any behaviour can be observed. And since everything could be changed in the course of this process the optimal field of activity of external sources could be widened enormously. To help people in treating their problems may mean even to help them define their problem and select their strategy at stages where so far they are left alone by formalized services which require as a starting point a rather late stage of the process where the person in the need state consciously takes an action.

Taking all these points into account, it seems to be more useful to replace 'problem-solving' by a more flexible, i.e., realistic, concept which we may call 'problem treatment'. The starting point of the concept 'problem treatment' is a human being at a certain time, who is influenced by the factors:

1. Present situation.
2. Past states of the organism (personal history).
3. System of preferences (values, opinions, attitudes, etc.).
4. Set of potentials (cognitive, affective, aesthetic, etc.).

These factors contribute to the actual state of the organism. A further assumption is that such an organism has a set of 'desires' or *aspirations* which are complexly interwoven and usually are not in congruency. The concept of 'state' is used in this context in a rather cybernetical sense, meaning a situation of the organism which is essential for the whole process, which could be considered as forming a stable pattern in an observable period of time and for which—in principle—a transition could be defined to reach another state. The following description constitutes the aspect of the state which is looked at as being essential (from the viewpoint of this presentation).

State 1 then would be the recognition of incongruity of the state of aspirations. This recognition should be connected with an analysis of the reasons for the incongruity.

State 2 would be the state where it is decided whether the reasoning/analysis is sufficient (if not, this may lead to external search behaviour (ESB)).

State 3: a sufficient analysis leads to problem recognition which usually should be related to a first effort—benefit assessment.

State 4 permits a first choice of direction in which a possible solution is searched for.

State 5 would be the validation of the solution direction (perhaps again leading to ESB) which offers at least three major alternatives.

1. Redefinition of the state aspiration.
2. Redefinition of the problem recognition.
3. Recognition of the possible goal.

State 6 is the validation of the goal—a type of some state or object to be achieved or acquired leading to a goal description (again perhaps requiring

ESB).

State 7 is the interrelation of goal description and a first treatment assessment (which may require ESB).

State 8 is a first analysis of possibly needed and perhaps accessible resources.

State 9 is an effort–benefit forecast for the specific treatment under consideration (again perhaps requiring ESB).

State 10 then would be a ‘decision’ how to go on:

1. Redefine state of aspiration, or problem recognition, or goal recognition.
2. Goal attainment.

State 11 is the goal definition, usually already in terms appropriate for treatment strategies (perhaps requiring ESB).

State 12 is the concrete treatment strategy the organism is undertaking to pursue (perhaps requiring ESB). The treatment strategy would be directed toward:

1. Resources.
2. Capabilities.
3. Operations (programmes).
4. Strategy redefinition operations.

For all external elements, strategies of acquisition have to be defined (by a procedure which could be analysed in a similar way). ‘Information needs’ (traditional) could then be regarded as those resources needed within the treatment strategy which are of an informational nature.

Clearly, there are—in this sense—many more needs to be considered:

1. Strategic needs are all needs which arrive in the process to complete the process.
2. Primary needs are those that are specified in the treatment strategy.
3. Secondary needs are those needs occurring to fulfil an ESB.

Figure 1 gives a first impression of how a problem treatment process may be looked at. Of course, it is possible to think of further complexities. In nearly all states a loop could go back to all other states. On the other hand, simplifications are possible (‘expressways’) by using factors like instinct, habit, experience.

However, this would not change the general value of the model:

1. ‘Problem-solving’ clearly appears to be only one possibility which requires a rather late state (perhaps it would only be applicable at State 12).
2. Information may play a role but not necessarily a central one. Most decisions are early states where a treatment direction is selected (State 4).
3. Problem treatment is a process in which information could be of help in almost all states, whether it is consciously sought for or not.
4. The information which could be of help changes in form and content from state to state.

This makes dynamic the relation between ‘problem’ and ‘information’. A specific problem does not require a specific set of knowledge but each individual and each single process may require at each state very different knowledge

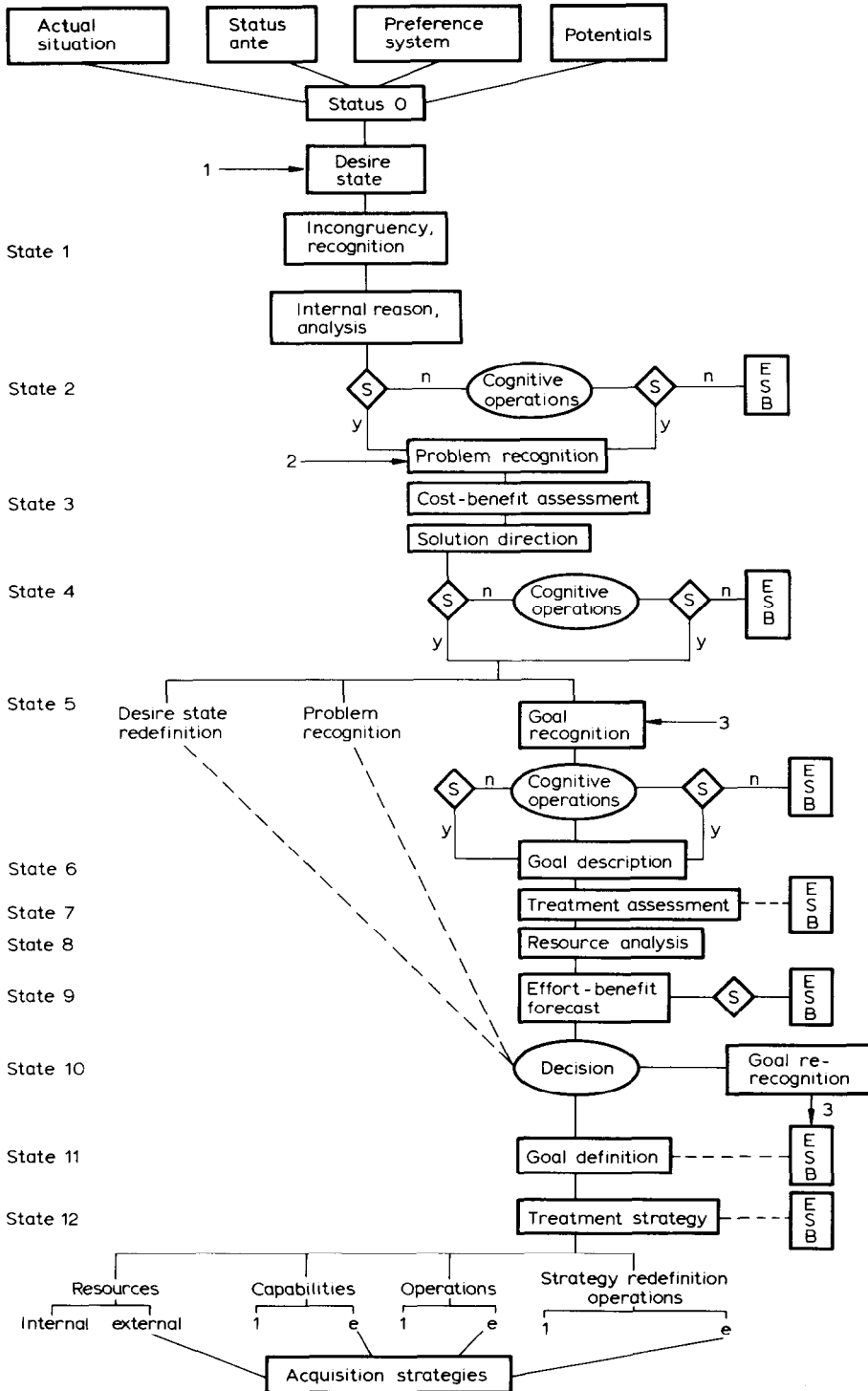


FIG. 1. A model for problem treatment

which perhaps is only loosely related to the 'need' as stated by the individual. If information services could know about the states of the treatment process, about the nature of the problem, about resources available to the person they could try to help this person in formulating problems, strategies and goals, thus perhaps improving the treatment itself instead of later trying to provide information which is felt to be needed after a wrong or suboptimal strategy has been chosen. Obviously they do not know and the only possibility for them to know is by looking for some kind of overt behaviour or action by the so-called 'user'. But we know that before users direct their actions towards information services they often in earlier stages of the problem process contact external sources, other people, etc. Contacting an information service under these conditions could be regarded as an act of desperation.

If we consider the problems of people as the basis of information science and the general frame of reference towards which information services have to be directed, we have to admit that:

1. Information behaviour is only one indicator of a state in the problem treatment process where external information may be of help (and perhaps at that stage of problem treatment habits not even the best one).
2. Document or knowledge provision is only one of a whole range of provision mechanisms of interest to the person in the problematic situation.

The individual (or group) in the need state and the possible external provision mechanisms, therefore, have to be looked at as an action system in which information activities as we are used to think of them form only one aspect which is embedded in a much larger context. To deal with this situation it seems to be unavoidable for information science to develop a kind of theory of action which allows one to localize and describe 'information action' more properly. The initial attempts that have been undertaken are outlined below.

The main idea is that 'action' and 'behaviour' are closely related concepts but are used for different purposes and are therefore distinguished more by the criteria the analyst applies to them than by their nature. When we are concerned with 'behaviour' we concentrate on what is observable, whereas when we talk about 'action' we presuppose that behind the action there is an intention of the actor to achieve something and this intention makes the action 'meaningful' at least for the actor. In looking at 'actions' we are always faced with the question of understanding the underlying sense.

A restricted 'theory of action' (which seems at this stage satisfactory for information science) has to be concerned with the internal mechanism of the actor or—to put it the other way round—with the condition under which 'actions' in this sense may be originated. Obviously this is a very complex task (which perhaps could never be fulfilled for descriptive purposes) but nevertheless has to be solved to some extent for analytical purposes.

We assume that 'action' is a result of the interaction of very many different components where the components could be described on different hierarchical niveaux (or 'layers' if an analogue to layer models is preferred). Each niveau is seen as forming an n -dimensional space out of which by differentiating dimensions of the superordinated niveau more specific n -dimensional spaces could be differentiated. Each niveau constitutes specific potentials of 'action' in a way that a specific action would have to be located by vectors in each niveau.

This space model of action is developed according to the following lines of consideration: each system able to act has available several potentials which make action possible for all. These potentials constitute the *action space* where dimensions (i.e., the factors constituting the space), play a role, e.g.,

1. Complexity of actor (e.g., individual, group).
2. Purposes of action (e.g., goal, attainment, integration).
3. Modus of action (e.g., instinctive, instrumental).

Actions could relate to different states of actors. From above it follows that actions related to problems are most important for our considerations. The dimensions related to problems create a *problem space* which is characterized by, e.g.,

1. Types of actors according to problem treatment.
2. Problem-related purposes of action.
3. Modus of problem-related action (e.g., routine problem treatment, action in crisis).

Other space on this niveau could perhaps be a habitual space, a game space, etc.

Problem treatment in modern societies is characterized by a trend towards rationalization of action, where 'rationalization' is understood in the sense of Habermas (1981) that an action is open for discourse on its rational basis which could be framed by empirical-analytical (scientific), moral-practical or aesthetic-expressive arguments. This leads in our culture to the assumptions of a *rationalization space* where dimensions play a role, as, for example,

1. Relation to values.
2. Relation to aesthetic rules.
3. Relation to knowledge (about objective, social, subjective or transcendental world segments).

Rationalization in this sense could influence different types of action. In our framework the treatment of the problem is most relevant: this is represented by a *treatment space* where dimensions such as the following are important:

1. Type of actor.
2. Purpose of action.
3. Modus of actions which are necessary to get the respective rationalization arguments (internal generation, direct interactor communication, mediated interactor communication, networked communication, objectified communication via 'documents').

If rationalization arguments are not generated internally they have to be provided externally. This opens a *provision space* where rationalization arguments are sought for and provided externally. There the following dimensions play a role:

1. Modus of action (passive, reactive, interactive).
2. Representation function of provided arguments (referential, representational, alternative, evaluative, reflexive).

This will open a set of spaces such as receptive provision space, reactive provision space and—most important in our frame of reference—*interaction*

space. The interaction space is characterized by at least two very important dimensions:

1. Modus of interaction where predicates are most important like:
 - (a) Telescopic (ability to relate itself to the rationalization degree of the other actor).
 - (b) Diacronic (ability to place itself relative to the state of problem treatment of the other actor).
 - (c) Maieutic (ability to help the other to define actions in all aspects of the different spaces).
2. Quality of interaction where at least three aspects play an important role:
 - (a) Variety (ability of actor to act on a broad spectrum of modes to improve the quality of a sequence of interactions).
 - (b) Reflexivity (ability of actor not only to interact but to reflect the interaction and to learn from the reflexions).
 - (c) Subjectivity (ability of actor to participate with its personality and subjectivity in the interaction).

The whole model is shown in Figure 2.

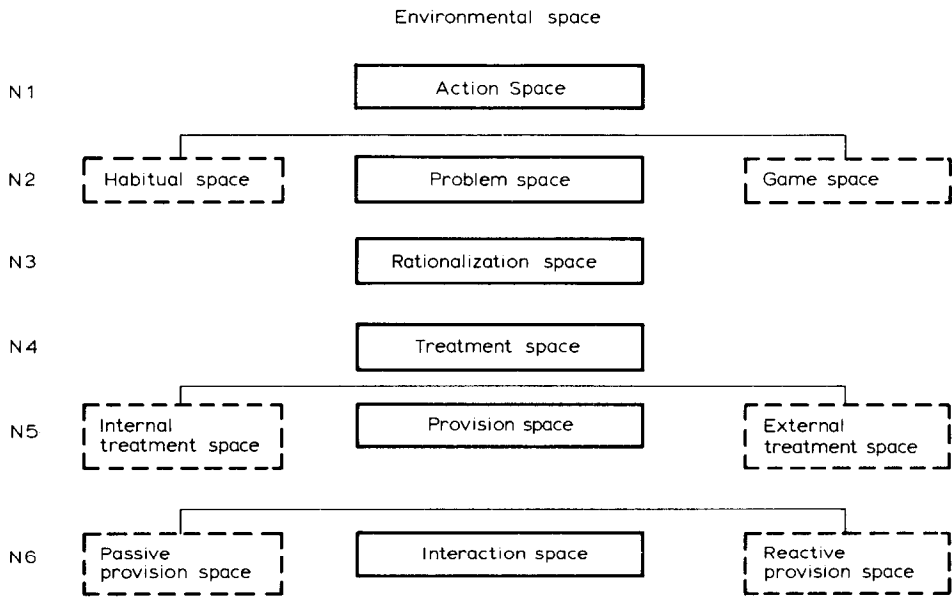


FIG. 2. A spatial model of information action

‘Information action’ in this respect could then be understood as consisting primarily of those actions which deal with the treatment of problematic situations and make use of the provision space. Secondary are actions which stem from other superordinate spaces than the problem space but require the provision space (e.g., during games).

A singular act may in such a model be described as one state of the spaces (using the mathematical analogue: as the sequence of vectors defining that act in all spaces), but 'action' has to be understood as a sequence of acts which stem from one state of Niveau 2 (here: problem space) and may be characterized either by different states within one space or by using different spaces.

Of course, such a model has to be developed further and validated empirically. But even in this state of development it opens the eyes for a realistic view of the information paradigm. Information science basically deals with existing actors of varying degrees of complexity which are in action states to treat problems (or other states) requiring provision of external rationalization arguments. These actors have a full range of options to contact sources for external provision. Sources which are called upon in the interaction mode frequently by one actor or often by several actors may be named 'information agencies'. Since in interaction they become actors themselves, they have to fulfil the requirements of the model of action as well, in particular those already mentioned for the interaction space. These characteristics of interacting actors have to be followed by professional information agents (like information centres) and machine-supported information systems.

The processes of 'rational-cognitive treatment of problems by communication' as are outlined above constitute the 'information field of action' being the central focus of attention for information science. In this respect we need a far better understanding of the whole complex of 'rationalization' in its empirical realization and not the elevation of only one aspect of rationalization which would never be realizable as such like the 'information man'.

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RESPONSE

'The discipline is in constant quest of itself', wrote Hounsell, and one can only hope that this is true. Whoever attended IRFIS 5, the International Research Forum of Information Science, which was held in September 1983 in Heidelberg should have some doubt about that statement. If we overemphasize some

critical remarks made at that conference one could say that the discipline is in quest neither of itself nor of anything else of interest.

From a German viewpoint information science is in severe danger of fading away before it has started to flourish. As a discipline, it becomes more and more clear that neither methodological principles nor construction of systems or services are serious enough to distinguish information science from either library education or computer science. If the discipline tries to remain and to find its location in the whole area of disciplines dealing with aspects of 'information' in general, it should try to develop its own viewpoint of information reality and generate a serious body of theory which may convince other scholars that this is a field that can contribute to the emergence of what one may call 'information society' and 'information culture'.

Therefore, we do not believe that—from the viewpoint of the life struggle of a discipline—it is enough for information scientists (as was said in some statements) to do research work and not to care for model building, theory and so on.

In this sense, we feel very sympathetic towards Norman Roberts and his idea of strengthening the notion of theory in information science—and this is one of the reasons for replying to him (it would probably not be worthwhile to reply to pure empirical searchers, technique applicers and computer freaks). We respond to him as a hopeful further step towards the generation of a more general theoretical basis for information science.

As everyone knows, theory does not come out of the sky. The approach Norman Roberts takes may look so as well as ours did. But when talking about 'information' we all have a lot of resources available—experiences of our own and our beloved research results, etc. We are all either 'information men' or 'information actors'. Therefore, any of these models (and we are simply talking about two different kinds of models) could be considered in the light of how near they come to what we know, what we experience, what we feel, if we look at ourselves as prototypes. If 'grounded theory' (as Wilson points out) has some sense then it has to ground first in ourselves because we never come nearer to reality.

And here is the very point of the controversy. We still do not believe that the reality of actions with regard to information could be touched by the one-dimensional 'information man'. People are not searching for information because they are 'information men' or because there is an in-built mechanism for information searching or because they are fully rationalized but they are acting in their environment because there are discrepancies to be dealt with. One aspect of this treatment may be knowledge but knowledge very often could be replaced by some other source of actions like values, aesthetics, feelings, etc. If we give 'information' such a broad range, there is no 'information man' but 'man'; if we restrict 'information', the concept of 'information man' constitutes some reality of its own (and therefore is not 'grounded in reality', but rather far away from it).

This, very briefly, is why we still feel that 'information action' is a more comprehensive, more realistic, and more powerful model than 'information man'. This is the very heart of the controversy which we hope will be public before all of us have been overrun by new developments. In fact, we could in our latest reports at least indicate how this theory could be expanded to ground a whole complex of theoretical models on it, how this approach could apply to the latest developments in theories of communication, action and society. We can

use it to explain why some services are not used, and to assess future developments; thus we feel its power at least for our own work.

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