The 'Information' Concept in FRISCO Compared to Empirical Studies of Information in Decision Making

Jens Kaasbøll

Department of Informatics, University of Oslo

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Abstract: The Framework of Information System Concepts has been based on assumptions of rationality. Three findings from studies of people's use of information in organizations are presented: expertise, cognitive illusions, and information as signal and symbol. FRISCO with a few extensions could be used for describing these phenomena. When defining concepts concerning social affairs, each choice may bring in assumptions that influence how system developers used these concepts. Discussing different precise definitions of the same concepts may bring up preconceptions that otherwise might have hidden issues in a development project.

1. INTRODUCTION

FRISCO (1996) constitutes probably the most comprehensive attempt at building a conceptual platform for the subject of information systems. This subject was grounded on use of computers for administrative purposes and production control in companies. The inclusion of both human and computer issues has prevailed, and in recent years development of computer systems and organisations has merged to a greater extent than ever before.

Various debates have emerged over the issue of whether to base the subject in the scholarly worlds of computer science or in a humanistic discipline, and theories from both areas have been considered, without any one standing out as the obvious core of an information systems discipline.

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An early IFIP-definition defines “information” as “... the meaning that a human assigns to data by means of the known conventions used in its representation.” (IFIP-ICC, 1966). This definition points to a core of the discipline, being the relation between people and computers. Lots of research on information has been carried out since then, and the concept seems to remain a core one, since also FRISCO has put effort into its definition.

At least two reasons point to the need for precise definitions in our field. First, if the concept is going to be implemented on the computer, e.g., “entity,” “object” and “data,” precision is required. Regarding information as something on people’s minds, this reason does not apply. Second, the way people express themselves during system development may influence the design of the application. For instance, when a system developer asks whether a described system design satisfies a user’s need for information, both the developer and the user operate on the basis of their preconceptions of what information is and for what purpose it is going to be used. The developer assumes that information is an entity of which a user can know her or his needs, and the user who accepts the system description assumes that information is something that a computer system can provide. If any of these preconceptions are incorrect, the design process may provide a less desirable result. Therefore, clarifying assumptions behind central concepts may help system developers so that they avoid some sources of misunderstanding. “Information” seems to be such a basic concept in the discipline of information systems.

This paper will briefly review the current conception of information and data used in routine operations, and then present some empirical findings on information use. The material will be used for discussing FRISCO’s concept of information and the more general problem of bridging the worlds of rational ideals and descriptions of information use in the information system discipline.

2. SEMANTICS

The basic view that information is people’s interpretation and data is in the realm of computers has survived and been elaborated since the IFIP definition from 1966. Langefors (1966) emphasized the relation between data and its use in control of business operations. His ideas were operationalized in methods, put into practice in system development projects, and elaborated by many researchers. In a recent contribution in Langefors’s tradition, Goldkuhl (1995) regards data in a communicative setting with sender and receivers and with semantic and pragmatic aspects. The semantic aspect captures the fact that information is about something,

and this aboutness requires the appropriate context and conventions for interpretation.

FRISCO's definition is

Information is the knowledge increment brought about by a receiving action in a message transfer, i.e. it is the difference between the conceptions interpreted from a received message and the knowledge before the receiving action.

This seems to be in line with the view of information being a result of data being interpreted, while the aboutness is not explicitly mentioned. Nesting up FRISCO's definition of underlying concepts, we see that a conception is an interpretation of a perception, which is the result of observing a domain, which comprises parts or aspects of the world. A reasonable interpretation of this is that "information in the FRISCO sense is about parts or aspects," hence the aboutness is established.

3. INFORMATION FOR FORMALIZABLE DOMAINS

Goldkuhl (1995) argues that the main use of information in business is that a sender intends the receivers to act in some way on the basis of the information received, such that the sender should refer to the same semantic contents as the receiver. Information should therefore be considered both at the sender and the receiver ends of communication. Nilsson's reflection in the FRISCO report points to the same need.

FRISCO places information at the receiver end of communication only. In its model of communication, the term "conception of message" (p.71) is used where Goldkuhl uses "information."

Information systems have for long supported routine operations in business. In a work process one person completes her or his operation and enters this into the computer system. Others will be informed by reading the data and carrying out the appropriate task. When the domain is easily formalizable, as e.g., in simple cases of trade, companies successfully let the computer system transfer information by which business operations are controlled.

FRISCO defines:

An **organisational system** is a special kind of system, being normally dynamic, active and open, and comprising the conception of how an organisation is composed (i.e. of specific actors and actands) and how it operates (i.e. performing specific actions in pursuit of organisational goals, guided by organisational rules and informed by internal and

external communication), where its systemic properties are that it responds to (certain kinds of) changes caused by the system environment and, itself, causes (certain kinds of) changes in the system environment.

An “information system” is subsequently defined as a sub-system of an organisational system. Since the super-system of an information system is operating by pursuing goals guided by rules, information systems are assumed to operate the same way. This seems to be well aligned with information systems for easily formalizable domains.

4. EXPERT INTUITION

When people have become experts at interpreting data and making decisions, the relation between data and information may become unintelligible for others. This section will present empirical evidence of expert behaviour, and discuss FRISCO’s concepts in relation to these.

Psychology has found that for learning to occur, feedback has to be immediate, unambiguous and consistent (Balzer et al, 1989). Another relevant finding is that when learning concepts and classification, and hence prediction, learning cannot surpass theoretical knowledge for constructing well-defined categories.

Consider the following example by Perby (1987). The meteorologists at an airport base their work on observations, weather maps, satellite pictures, conversations with pilots and glances out of the window. From these different sources of data, they compile the “notion of the weather development in all three dimensions of the atmosphere over a period of time which stretches into the future” (p.217) which they call the “inner weather picture.”

Concerning the conditions for learning, the time period between making of the forecast and the actual weather conditions prevents an immediate feedback on the forecast itself. When the period is down to half an hour, the delay may be short enough for the meteorologists to remember their forecast and adjust their method of forecasting if necessary. The observation of the local weather is immediate, unambiguous and consistent through continuous local observations and looking out of the window. The categories used for local forecasting do not differ from those of the science of meteorology. The conditions for learning seem therefore mostly to be fulfilled. An indication that the meteorologists actually learn making better forecasts is found in a quotation where one of them speaks of a more experienced colleague: “It strikes me repeatedly that he knows more about the prevailing weather than he has really been informed about—and he is right.” (Perby, 1987, p.219).

From the point of view that information is what people who interpret data cognise, the inner weather picture seems to constitute the meteorologists' information of the weather. Also considering information as the basis for decisions, inner weather picture constitutes the information upon which decisions concerning forecasts are made, if not to say that the information also includes these decisions. The relation between data and information seems to be only for the expert meteorologists to establish and impossible to describe such that others can interpret the data in the same way.

Having established that some experts have the exclusive ability to establish some relations between data and information, system developers cannot describe the way these relations are made up. The conceptual basis for information systems should therefore allow the such relations to occur.

The core of FRISCO's information concept is a knowledge increment, i.e., an alteration of the person's mind. This knowledge increment is a result of receiving a message and the person's knowledge before the receiving. A message is data transmitted by a sender and intended for others to receive. Data is again representations of knowledge expressed in a language.

First, in the meteorologist case, reading the observations, maps, satellite pictures and talking to pilots seem to constitute receptions of messages, which again are representations of knowledge communicated to the meteorologist. These actions of receiving therefore seem to be covered by the information concept in FRISCO.

Second, the meteorologists need their expertise in receiving the data in order to obtain their inner weather pictures, and this prior knowledge is also mentioned in the FRISCO definition.

Third, FRISCO does not assume any specific relation between data and information, thus also catering for the meteorologists' way of doing it.

Forth, the meteorologists also look directly at the weather outside the window when building up their inner weather picture. This action of direct observation does not involve any reception of messages from another human being. Other studies of work (e.g., Benner, 1984; Kaasbøll, 1985; Wynn, 1979) have reported similar findings of people being informed also through observation without any communication taking place.

In summary, FRISCO's concept of information seems to cater for experts' information, except that the concept should also include actions of perception.

Considering that FRISCO includes "information" and "knowledge," there can be little reason to keep the concept of learning away from the framework. Since this section concerns learning taking place under the conditions mentioned above, the following definition is suggested, based in FRISCO's concepts:

Expertise is knowledge based on theoretical types (=“categories” in FRISCO terms), gained through repeated feedback in the forms of message reception or perception, which followed immediately after actions based on the knowledge was carried out, such that the feedback could be interpreted unambiguously and consistently.

This definition will be used in the next section.

5. COGNITIVE ILLUSIONS

Often the conditions for learning referred in the previous section are not met. In these cases, people use their general cognitive skills, which are strictly limited in a number of ways. Decades of psychological experiments unanimously point to weaknesses of people’s cognitive abilities, called “cognitive illusions” (von Winterfeldt and Edwards, 1986). These are defined as follows.

- **A formal rule specifies how to determine a correct answer.**
- **A judgement is made without the aid of physical tools.**
- **There exists a systematic discrepancy between the correct answer and the judged answer. Random errors do not count**

The systematic errors that people make include: ignoring information that seems less relevant, ignoring underlying statistical distributions, overestimating events that are easily recalled, ignoring sample size, underestimating combinatorial explosion and exponential growth, changing mind slower than data indicates, having overconfidence in covariance, exaggerating what could have been anticipated and exaggerating the quality of one’s own predictions (Kahneman et al, 1982).

When making decisions in organizations and the criteria for learning are not met, people confronted with a large number of data make the cognitive illusions errors. The information they obtain becomes dysfunctional for the decisions they are going to make. Decisions made through simple calculations based on the two or three most relevant predictors would have yielded better results (Dawes et.al., 1989). E.g., when admitting students, selections made on the basis of previous exams outperform selections where individual interviews and letters of recommendations are taken into consideration.

Since the myth of the human intellectual capacity over calculations in this respect seems to flourish in organizations, we will find numerous and systematically created cases where people’s information are erroneous or at least of inferior quality.

When considering the information concept, cognitive illusions trigger the need for separating a descriptive concept of people's information from a normative concept of what information people should have had. FRISCO mentions "false information" in note under the definition of information, but false information covers deliberate lies, while cognitive illusions are unintended.

Information systems are often created with the aim of improving the bases for decision making, which seems to be in line with FRISCO's assumptions. Whether a framework of information system concepts should cater for descriptive versus normative accounts of information is a question of how far one will go in pursuing issues relating to information quality.

Except for its motivation, the process of change of information systems seems to be outside the scope of FRISCO. Given the complexity of such processes, their conceptual framework would have been as voluminous as the FRISCO one. However, since the point of the work of information system specialists often is changing systems, an extension of the framework to include concepts for separating between existing and planned information system qualities could be beneficial. Then we could say that the current information in the system is cluttered, while a planned change supports decisions made on the basis on the most relevant data.

The concepts "decision" and "relevance" seem necessary to include to cope with cognitive illusions. FRISCO mentions that information is used by the receiver, and rational decisions constitute the normal aim for information. The concept "decision" can be defined with reference to other FRISCO concepts:

A **decision** is the choice amongst alternative actions, based on knowledge.

"Relevance" of knowledge for a decision can be defined based on its effect on the quality of decisions or on the way this knowledge has come to existence. The former introduces the need for evaluating quality of decisions, which may be an impossible target. The latter can refer to the two ways of providing the knowledge described in the current and the previous sections. With this background, the definition may go:

The **relevance for decision** of knowledge is its degree of significance as found through either expertise or research.

The reference to research leaves the issues of the degree of significance to the merits of the research methods employed.

6. INFORMATION FOR DECISION MAKING

The kind of business operation outlined in the previous sections may correspond to the major bulk of day-to-day operations of a company. Studies of information use in non-routine decision making reveals that decisions are made on grounds that may be all but rational and formalizable. In a survey of a large number of studies of decision making in organizations, Feldman and March (1981) summarized information use:

1. Much of the information that is gathered and communicated by individuals and organizations has little decision making relevance.
2. Much of the information that is used to justify a decision is collected and interpreted after the decision has been made, or substantially made.
3. Much of the information gathered in response to requests for information is not considered in the making of decisions for which it was requested.
4. Regardless of the information available at the time a decision is first considered, more information is requested.
5. Complaints that an organization does not have enough information to make a decision occur while available information is ignored.
6. The relevance of the information provided in the decision-making process to the decision being made is less conspicuous than is the insistence on information. (p.174)

Feldman and March provide some instrumental and some cultural for these findings. The instrumental ones are summarized here:

- **The cost of collecting information is underestimated, because collecting usually occurs in other parts of the organization than where cost is accounted for.**
- **It is safer for decisions makers to have information that is not needed than not to have information that might be needed.**
- **Organizations are monitoring their environment for surprises, which could constitute new alternatives or changes in the world. The gossip gathered is often irrelevant, and the relevance cannot be specified in advance.**
- **Communication in organization happens in a context of conflicts and with consciousness of possible decision consequences. Actors produce information for persuading others, and competition turns persuasion into a contest in most unreliable information.**

The two former reasons given do not indicate information use that transcends FRISCO's definition of knowledge increment through message receiving. The third reason points to that the act of actively collecting information is at least as abundant as that of passively being informed.

These three reasons indicate that relevance of information is a concept that often has to be used, and that much information is irrelevant regardless of decisions, and that degree of relevance often cannot be determined or at least can only be determined after the decisions has been made.

The latter reason given indicates that FRISCO's note concerning false information and dis-information may deserve more attention in a conceptual framework where the information concept is a central one.

In the ongoing power games in organizations, people try making sense of what is happening in their own ways (Weick, 1995). Being in power is related to producing the most convincing information, based on the situation that people recognise. This points to the problematic side of labelling some information true and other false. People may be convinced that information that they had considered intentionally false or unlikely actually constitutes the most appropriate information concerning a particular subject.

More important than the instrumental reasons are, according to Feldman and March, the symbolic and signalling values of information. Referring to information symbolizes intelligent choice, and this there is no value closer to the core of Western civilization than this which symbolizes correct behaviour. Information also signalizes legitimacy of decisions.

Feldman and March do not tell precisely whether by the term "information" they mean data or "information in the head." If meaning data, and assuming that much of this data has been interpreted, their explanations nevertheless have the same substance.

The symbolic and signalling values of information pose the same challenge to information relevance as mentioned under the instrumental reasons above.

For the FRISCO concepts of information and data, one question raised is whether FRISCO concepts can be used to say that "information" and "data" can symbolize competence, status, wealth, power, etc. Looking at FRISCO's concepts, nothing seems to prevent that anything can represent, or symbolize, anything else. The relation between the representation and its meaning is determined by the person interpreting the representation.

7. THE BEHAVIOURISTIC ARGUMENT

The finding from cognitive illusions that data in addition to the two to three most relevant ones clutters up information, points to another challenge for FRISCO. Since information is defined as a cognitive quality, the unreliable method of introspection must be used in order to get hold of it. When people who read "Singh: Age 38" respond to the question of what information they received, and they respond: "Singh is 38 years," introspection may seem pretty OK. However, if the age constituted the

fourteenth factor that the receiver added to her or his knowledge when considering admitting Singh for a Master's program, the receiver may have much more trouble explaining how this fact altered her or his aggregate impression of the candidate. According to the findings of cognitive illusions, the receiver would be well beyond the level of sensemaking, although she or he would probably try to express her or his impression in a perfectly rational manner.

Similar shortcomings can be found in the realm of non-routine decisions. Few people would admit that they collect information in order to strengthen their status and power.

The shortcoming of introspection has also been noted by Stamper in his reflections in FRISCO, and he refers to an alternative approach. Behaviouristic alternatives can be found in psychology, pedagogy and other social sciences.

A problem with purely behaviouristic descriptions is that they often become superficial, while when dealing with people and information systems, system developers have to come as close as possible to an emphatic understanding of other people.

Material phenomena and behaviour can be observed and measured. This gives an outside view of cultural phenomena. (Pike, 1967). Knowledge of intentions, meanings, values, rules, etc., has to be inferred from the behavioural patterns. The way to test whether or not an outside description is adequate, is to relate it to observations of people's behaviour, without asking them about their own opinion of the descriptions. When studying behaviour as seen from persons inside the culture, the researcher has to interact with the people in the culture, in order to learn about their own accounts of their plans, goals, values, meanings, etc., and their own explanations of their behaviour (Pike, 1967, p.37, Harris, 1990, p.53). The evaluation of whether an inside description of people's thoughts is adequate and accurate depends on the opinion of the people themselves (Harris, 1975, p.159). The combined inside and outside perspectives provides a richer picture of users' knowledge than if only using one of the two perspectives (Kaasbøll, 1995). Whether this richness provides valuable insight or clutters up clear information remains to be seen.

8. DEFINING INFORMATION

Including the option that people get informed both by receiving messages and by observing the world, FRISCO's information definition can be extended to cover this:

Information is the knowledge increment brought about by a receiving action in a message transfer or by perception, i.e. it is the difference between the conceptions interpreted from a received message or from a perception and the knowledge before the receiving action.

Expertise was defined in section 5. Based on the definition of information suggested above, it may be redefined as:

Expertise is knowledge based on theoretical types, gained through repeated information, which followed immediately after actions based on the knowledge was carried out, such that the information was obtained unambiguously and consistently.

Building further on FRISCO's definitions, rational decision making could also be easily catered for. This indicates that FRISCO can be easily extended as long as the domain covered corresponds to FRISCO's basic worldview.

The empirical studies referred point to two levels of ambition for defining information. First, information can be defined regardless of its quality and use. This corresponds to FRISCO's stance, where the definition relies on the way information came about. Second, qualities of the information can be regarded, including the relation between information and what it represents and the purposes and use of the information.

8.1 Introspective inquiry into information

For information systems to add value, the systems have to respond to people's requests for data, so that their needs for information are be satisfied. The concepts of data provision and information needs could therefore also be included in FRISCO.

Since the definition of information in FRISCO is based on people's previous knowledge and what they receive or perceive, each person will be informed in her or his own way, and there is no way of knowing how others get informed. The definitions of information and expertise do therefore not point to any easy ways of determining needs for data when designing computer systems.

Another way of determining which data to support through computerization is to supply data to people and ask whether they get informed according to their needs for information. An operational way of defining needs is therefore:

Information need is a human actor's knowledge of her or his lack of information.

Satisfaction of information needs occur when human actors state that their needs are satisfied by the data provided.

Data provision is the sum of data available to a human actor.

Satisfaction of data provision occurs when human actors' information needs are satisfied.

A practical consequence of these definitions is that people do not have to state their intentions and use of information when determining whether their needs are satisfied. Considering people's decision making behaviour and power struggles, being able to state needs without revealing reasons may ease the acceptance of computer systems and also support the existing behaviour. The cognitive illusions are also given ample opportunities when people already receiving lots of irrelevant and disturbing data are determining their needs for more.

This way of defining and operationalizing information through introspection helps the system developers to understand people's needs for information. Even so, when avoiding requesting their reasons for their needs, people's information behaviour can be preserved.

8.2 Information as a social entity

The consequence of the definition of information needs above points to the option of defining information needs based on socially available characteristics, e.g., tasks to be performed or status to be achieved. The definition could be

Information need is the socially accepted knowledge of the lack of information of those who have to use this information for achieving their socially known goals.

By stating that information needs should be derived from socially known goals, people would be required to discuss goals and intentions that they unlikely reveal. This requirement would therefore probably make the discovery of information needs very difficult, except for goals rooted in organizational tasks. If information needs stemming from goals like power games or culturally unrecognised goals were considered, people have a tendency to fake reasons that are more aligned with the organizational culture.

9. CONCLUSION

FRISCO defines information as a conceptual event which takes place when people receive messages from others. Information is therefore not going to be implemented at any computer system, so no precise definition is needed for this reason.

The other reason for considering the concept is that getting to know people's needs for information is of central concern when developing information systems. FRISCO was extended in two attempts so that it also covered need for information. On the one hand, basing information needs on people's subjective conceptions without requiring insight into their goals will hide people's poor ability to judge their needs when they already have too much information. On the other hand, having to state goals make people fake rational reasons when their goals are likely to be judged as anti-social, counter-productive or otherwise not acceptable.

Discussions of central concepts may be effective in order to increase the awareness of future system developers on such issues. Instead of refraining from attempts at defining the concepts precisely, the implications of different definitions need to be considered. Developers may realize more of their prejudices when being confronted with choices which are based on different assumptions and have implications on the fulfilment of their tasks.

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