

THE NEED OF 'INFORMATION ANALYSIS' FOR INFORMATION SYSTEMS AND OUTLINE OF A HERMENEUTIC APPROACH TO IT

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Abstract: Requirement analysis for information systems development (ISD) results in a specification that represents a central reference point for subsequent stages of the development. But this stage is seen characterized by informality and uncertainty. One essential element in this is how the information that is required by the users in a domain is identified and formulated. In this paper, we give a summary on how well-known information systems methodologies handle it, and argue that an information analysis would seem to be needed. Such an analysis would require a certain approach, for which we suggest adopting Hermeneutics. We describe how Hermeneutics might enable us to look at the mechanism whereby information is created and information flow takes place in the context of information systems.

1 INTRODUCTION

Two basic assumptions seem to have been made in information system (IS) literature. The first one is that an information system is a means by which information is provided. The second is that an information system can only handle data, and data carry information. Based upon these two assumptions, approaches to IS development should emphasize analysis, and take the finding of requirements for an organization as its central task (Flynn 98, Mingers 92 and Loucopoulos 92). At the centre of the requirements determination and analysis is how required information is identified and formulated. But this phase is also known as 'characterized by informality and uncertainty' (Loucopoulos and Zicari 92), and 'the least well-defined phase in the systems development process' (Flynn 98).

In this paper, we present a summary of a literature review and then suggest that an 'information analysis' stage be included in ISD, and a mechanism for this stage be developed. This paper is organised as follows. In section 2 we give the summary. In section 3 we outline a Hermeneutics foundation for a mechanism that can be used for such a stage. We conclude this paper with a summary.

2 THE NEED FOR INFORMATION ANALYSIS FOR ISD

We look at how well-known IS methodologies handle the problem of information requirements in terms of three aspects, namely

- ◆ *The content of IS requirements by the user*

- ◆ *How required information is identified, and*
- ◆ *How data that an IS will actually store and process are identified.*

It would seem that the main problem in the aspect of 'the content of IS requirements by the user' is that the requirements are modeled by a variety of conceptual models (normally a semantic data model and a process model of some kind, for instance in DFD), and the information required by the agent or user is not captured by means of some workable definition, concrete format and systematic procedure.

In the aspect of 'how required information is identified', the main approach is that a variety of information related things, such as information category, information set, information flow, are identified by looking at whether they are necessary for an activity or process, or whether they are input or output of it, or processed by it. The main problem with this approach is that even all of them put together might still not be sufficient for an activity. Moreover these information related things are not necessarily the information that the agent really requires.

In the aspect of 'how data that an IS will actually process are identified', it would seem that the main problems are, first of all, a data schema is not derived from required information captured in a concrete format. As information and data are seen essentially the same thing despite different terms being used, to construct a data structure is a matter of data modeling through data consolidation, specialization, aggregation or step-wise refinement. That is to say, a data structure is not always explicitly derived from required information. Secondly as a consequence of the first one, these approaches do not address the issue of how data in a machine bear information that can be derived by a user from them. There is no clearly defined concept of and mechanism for looking at how data are structured to bear required information. Batini et al. (92) raises the question of the 'information content' of a data schema, but does not seem to have provided an adequate solution. Moreover this question is not well acknowledged in the literature.

To address these problems just identified, an 'information analysis' stage would seem desirable, which should be inserted between problem appreciation and conventional data modelling and process (or function) modelling. This stage would require a mechanism, which should be based upon a formal, useful and systematic treatment of the concept information. We suggest adopting

Philosophical Hermeneutics as an approach to it with which how information is created and information flow takes place in the context of information systems can be looked at.

3 A HERMENEUTIC APPROACH TO THE PROBLEM

Boland (1987) points out that how well the nature of information is addressed has profound impact to all aspects of information systems – the research, development and use of information systems, both in theory and in practice.

We suggest using results of advances in the research of 'information philosophy' in recent years thereby to formulate a new perspective for obtaining a better understanding of the discipline of information systems and for investigating the essence of information. That is, to look at the problem of information that is meaningful to its creator and its user by drawing on philosophical thinking on the notion of 'existence'. We believe that what we call meaningful information has to be approached from the point of view of the inter-relationship between information, data and meaning; and the inter-relationship can be understood through a process of 'inter-exchange'. That is, in the context of IS, information is normally carried (borne) by data organized in some way, which results in meaning for the receiver, and then the meaning that the receiver creates in her/his mind, which is attributable to the information that she/he has received, might produce new information if some reduction in uncertainty takes place; and the new information may be borne by new data. This would be the start of a new cycle. Such a process never ends. We also note that this takes place against and be influenced by the real world, and the latter is the ultimate source of information. We call such a process 'information-data-meaning-information-data...' cycle. We observe that such a process does not seem to have been well understood.

3.1 Why is the 'Information-Data-Meaning-Information-Data...' Cycle a Problem of Hermeneutics?

Hermeneutics is the study of interpretation. Hermeneutics emerged as a concern with interpreting ancient religious texts and has evolved to address the general problem of how we give meaning to what is unfamiliar and alien (Boland,

1991). Gadamer argues that the problem of interpretation is fundamental to our everyday activity ----- also in the business world. (Hirschheim et al., 1995 , p.152)

Information in the context of IS consists of that of organizational environment, that of the operation of a business, that regarding how the user uses an IS, and so on. All these are normally represented by various types of data, such as user requirements, data models, data about the system, input/output of computer systems, data created in business operations. These are all data from which we want to obtain meaning through interpretation. Thus these data are in the position of the target, i.e., 'text' in Hermeneutics.

These data, information and meaning are in a state of co-existence. Information is borne by data, and meaning is created due to reception of information through looking at data.

The process of the 'information-data-meaning-information-data...' is equivalent to that of reading and writing, listening and speaking between two people. Thus, the inter-relationship between information, data and meaning through the 'information-data-meaning-information-data...' cycle embodies social exchanges, through which people obtain their understanding of the world in which they are, and in turn through the understand they obtain their existence. At the same time, through social exchanges the social world we are in changes as well.

The idea of tackling data in IS with Hermeneutics has appeared in the literature, for example, Gadamer was referred to. But the relevant work shown in the literature did not go the details, for example, why and how Gadamer can be applied to IS was not elaborated. Besides, as Hirschheim et al. 1995, p.154 point out, the importance of philosophical hermeneutics including the ideas of hermeneutic cycle, horizon, and bracketing for rule-based data modeling is far reaching, and therefore further investigation down this line would seem desirable and possible.

3.2 The General Process of 'Information Forming' Mechanism

The classical Hermeneutics put forward by Schleiermacher and Dilthey, and the General Hermeneutics theory by Betti, Hirsch and so on , take Hermeneutics as a common methodology of humanity, and also an epistemology (Zhang, 1985). On the contrary, philosophical hermeneutics by Heidegger (1962) and Gadamer (1975, 1976) take

that hermeneutic is concerned with the most fundamental problem of human existence, a problem of ontology. Ricoeur maintains that the existential ontology can only be achieved through the investigation of methodologies, and layers of epistemology (Zhang, 1985). This way, we not only retain the usefulness of the methodological studies of a long history and the unique insight of its epistemological aspect, but also take the notion of reflection of epistemology to the level of ontology. When we consider information systems, no matter whether they are seen as technological systems with social consequences, or as social systems that are technically and technologically implemented , they have a social aspect along with a technical and technological one. Therefore in order to draw on the vast resources of research on information systems based upon the view that takes information systems as technological systems, we adopt Ricoeur's Hermeneutics as the theoretical foundation for our investigation into the mechanism that enables the formation of information and information flow within the context of information systems.

Ricoeur combines ontological Hermeneutics with methodological and epistemological Hermeneutics through linking Hermeneutics with the text theory.

The general process of information and information flow formation (see Fig.1) may be seen as having three stages, namely the Semantics Layer, Reflection Layer, and Ontological Layer. Each of the layers is connected with the 'text' (i.e., data) of the information system. The transformations between the three layers embody those between objective meaning (in the sense of being independent of the receiver of information), inter-subjective meaning and subjective meaning.

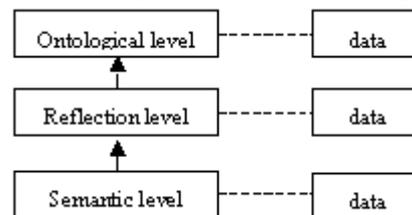


Figure 1: The general process of information.

3.3 The Analysis of Various Elements in the 'Information Forming' Process

3.3.1 Data Analysis

Data in information systems are read and interpreted as texts. There are various definitions about data that can be found in the literature (Hirschheim et al.,

1995 , p.12; Mingers, 1995; Floridi, 1999). We give data here slightly different characteristics from those that appear in more 'general' research of information systems.

We think that data links information and meaning, which enables the communication between people. Through communication, people acquire self-understanding. Thus data should have the following characteristics:

(1) Data are fixed life expressions by being written. They have "dual-meaning" or "multi-meaning". There are literal meaning, sender's meaning, hidden and latent meaning produced by various factors, such as the multiple traits of the literal meaning, the knowledge background and psychological factors of the sender and so on.

(2) There is a dialectic relation between the sender's meaning and the meaning that may be seen as inherent to the data. They are inter-dependent, which shows the relation between data and information. The structure of data determines the average quantity of information that data can carry (Dretske 81). The stipulation or protocols of encoding about signs used in data determines which events data can express and therefore what particular information a data item actually carries. For example, we might flip a coin in order to decide whether Miss Wang would be on duty today. We may pre-arrange that if the coin were 'face up', then Miss Wang would be on duty. Therefore, the data 'the coin is face up' would carry the information that Miss Wang is on duty today.

(3) The meaning created through the information that is carried by data and the importance of data are derivate from the dialectic relation between data and its receiver. The dialectic relation embodies the relation between information and meaning, and the relation is realized by jointing data and meaning. The meaning and the importance are achieved through the increase of the receiver's understanding of the world under the influence of the information carried by data, which is characterized by the reduction in the uncertainty of the receiver's understanding of the world. If such reduction in the uncertainty does not take place, then the information carried by data would be meaningless to the user of the data. For example, if I already knew that Miss Wang is on duty today, then the data that 'the coin is face up' would be of no meaning to me in the sense that it gives me nothing except perhaps annoying me.

(4) Data is not limited by their direct references; data enable people to enter a possible world from a given world, i.e., the data world. The references here are

not only positivist meaning or scientific meaning in their general sense, but also metaphoric meaning. For example, the data 'the coin is face up' carries the information that Miss Wang is on duty today, then it can further be known that Miss Wang is not at home today.

3.3.2 Semantic Analysis - The Analysis of Information Content

The analysis of the information content of data, through interpreting the data, we can obtain objective information content carried by the data. The objective information content is taken as the meaning that the sender of the data wishes the data to carry. So 'objective' here means being independent of the receiver of the data. Data may have various meanings. For example, the data that 'the coin is face up' has the literal meaning that the coin is face up. Under a pre-defined encoding rule for communication, the data also carry the information that the sender of the data want to express, namely 'Miss Wang is on duty today'. There could be other implied information content such as 'Miss Wang is away today'.

Literal meaning is the direct and basic meaning, and the others are called indirect, second or metaphoric meaning. These indirect meanings are nested within the direct meaning. This is similar in a way to information nesting (Dretske81).

We begin with interpreting data that have multi-stipulations. But every kind of interpretation is based on its own frame of reference in order to seek agreement with the rich and multi-vocal meanings of data. The interpretation process of data is illustrated in Figure 2.

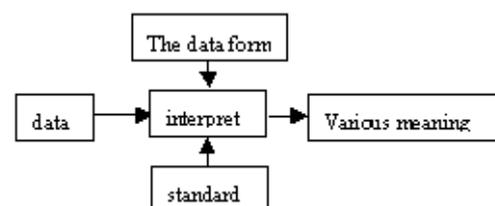


Figure 2: Interpretation procedure.

The analysis of information content, namely data interpretation, must follow two principles of the hermeneutic cycle. The first principle is concerned with the relationship between parts and the whole and the second principle between understanding and experience. The relationship between parts and the whole is this: parts can only be ones in a whole rather than being independent of the whole; We can try and understand the whole through looking at the

parts; But this understanding is approached by looking at how the parts behave within the whole. The relationship between understanding and experience is this: on the one hand data wait for an interpreter to be interpreted, and on the other hand the interpreter can only understand those that his experience allows him to see. This is a process where known and experienced things are used as a tool for the interpreter to reveal the existence of the unknown. In a word, this is concerned with how to connect the known with the unknown, which is much larger than the known. In addition, it is the background that gives meaning to those that are known.

3.3.3 Reflection Layer

The information forming process embodies the communication between people by means of the inter-relationship of data, information and meaning. Its goal is for people to achieve understanding of themselves by communicating one another.

Thus our interpretation of data is not just the understanding of the information content that is carried by the data, but also the meaning of the sender of the data. The purpose of this is, through understanding the sender's meaning, to ascertain what world we ourselves are in, and make sure of what 'I' am, and what I should do. This is self-understanding, to achieve which there has to be a process of reflection.

Reflection is of course self-reflection, and not a concrete reflection on a particular event. Reflection is a process of transforming the 'otherness' of the data into an 'utterance event' for me. The receiver's 'utterance event' is a new event, that is, it is not the repetition of the "utterance event" that created the data in the first place, but is new creation according to the requirement of 'speaking'. This way, the interpretation of reflection is completed. Thus, self-understanding is realized through reflection.

Reading links two incidents of speaking: data as utterance, and reading as new utterance (See Figure 3). Ricoeur makes use of Gadamer's 'fusion of horizons' to refer to the widening of the understanding of the subject after she/he has entered the world of data.

Reflection process is completed through reading data and conversing with data, and reading through 'fusion of horizons' and game-playing.

3.3.4 Ontological Layer

After reflection, self-understanding comes into being according to the form in which it can exist, and it

creates new data. This is not an end, but the beginning of a new cycle. This process of information and information flow formation constitute a basis of exchange between human being.

3.4 Concluding Remarks

Through semantic interpretation of the semantic layer, the receiver obtains the information content of the data sent by the sender. Much of the information content exists in the form of being implied and implicit, through obtaining which the receiver obtains her/his understanding of the sender. Through assimilation via reflection, the receiver strives to find the way to further understanding her/himself, namely to make something 'alien' to be of his/her own. On the ontological layer, the receiver expresses his/her own utterance with new data. Through such a never-ending cycle, human exchange is achieved, through which we increasingly understand ourselves (see Figure 4).

We identified the three problems in the previous section concerning requirements of IS, namely,

- ◆ The content of IS requirements by the user,
- ◆ How required information is identified, and
- ◆ How data that an IS will actually process are identified.

These can now be looked at within such a never-ending Hermeneutic cycle. The content of information requirement from the point of the view of the user would now be what is needed for her/him to understand her/himself in the context of using an IS to approach and complete her/his tasks and the meanings that are subsequently produced. The required information should be identified through the stages of semantic understanding, reflection and ontological realization. Finally, the data that an IS processes should be among the original set of data and the new data. To work out the details of how a mechanism for analyzing information and information flow within the context of IS would require much more work and it is therefore beyond the scope of this paper.

4 SUMMARY

In this paper we have presented a summary of a literature review to support our observation that an 'information analysis' stage for information systems development would seem to be needed, in which the information that an agent in a domain requires is identified and formulated. Such a stage would need a

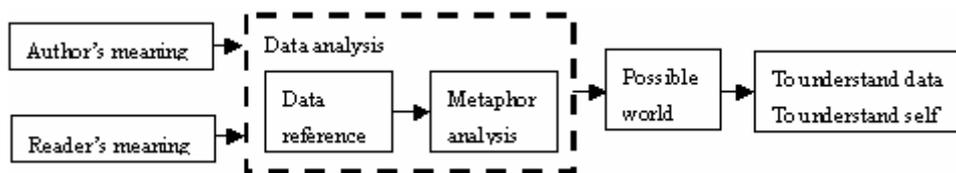


Figure 3: Reflection process.

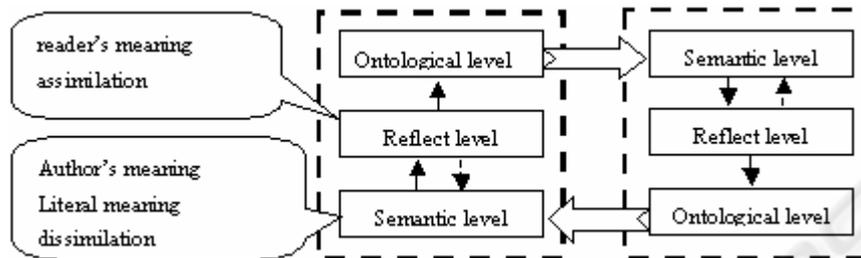


Figure 4: The communication pattern between subjects.

mechanism. To develop such a mechanism, we suggested using Hermeneutic as the foundations and we outlined a Hermeneutic approach to information in information systems.

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