

A Hermeneutic Approach to the Process of Information Realizing in the Context of IS

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Abstract: - Existing studies about information in the fields of information systems (IS) seem inadequate and lacking of sufficient depth. We draw on ideas of philosophy and believe that only through exploring the relationship among information, data and meaning from the viewpoint of “which information *qua* information ‘can be said’”, can the essence of information be engaged with. It seems that the most vital point for furthering theoretical studies is that new meaning is created through specific activities and behaviour of interpretation. We draw on Heidegger and Ricoeur’s interpretivism and systematically analyze the process of meaning attainment in the realizing process of information, and propose a semi-structured model for such a process. We also show how this approach may facilitate the identification of information requirements for information systems development.

Key-Words: - Essence of Information, Hermeneutics, Philosophy of Information, Information Systems

1 Introduction

In the research of information systems (IS) as an academic discipline, there appear two fundamental problems, namely “productivity paradox” and “the identity of the IS discipline” [1]. In IS practice, the productivity paradox is closely related with the high failure rate of information systems development. In the literature, a plethora of research results and practice reported indicates that the success of information systems development (ISD) is highly dependent upon whether the requirements that are

identified are correct and complete at the beginning stage of ISD [2], [3]. The essential element of the requirements is information that the system is expected to provide. Weber points out that the research of information systems is concerned with IT artefacts, and the representation and expression of IT artefacts is fundamental to IS [4], [5]. Moreover, the problem of the representation of IT artefacts is firstly concerned with information modelling.

Both of the two above-mentioned fundamental problems are related to information in IS. Research in information systems seems to have been hampered by the elusive nature of information and the lack of well established methods and techniques for handling the essence of information [6]. In the research of IS, on the one hand, information is regarded as one of the most important and fundamental concept; On the other hand, there are various forms about such key concepts as *information*, *data* and *meaning* ([7], [8],[9],[10], [11]). These concepts and terminologies are often isolated, disjoint, and form an often contradictory amalgam of knowledge and cause confusion in research. Therefore, 'How to understand and to deal with the essence of information' would seem to have become an important and tough problem for the discipline of IS [12].

We aim to tackle this problem. We introduce current approaches to information in the context of IS, analyze and put forward a new approach to this problem in Section 2. We suggest and explain the general process of information realization based on Hermeneutics in Section 3. In the final section, we give some concluding remarks and explain implications of this approach to information requirement identification.

2 The exploration of a new perspective for understanding and engaging with the essence of information

2.1 Major approaches to information in the context of IS

There appear three major approaches to information in IS. The first is represented by the work of Davis, who might be seen as one of pioneers of field of IS. This approach is generally regarded as being objectivist. This approach is traditional and seems still dominant. With this approach, information is taken as 'data that has been processed into a form that is meaningful to the recipient and is of real or perceived value in current or prospective actions or decisions' [9].

The second approach may be seen as represented by the work of Checkland, who puts forward the well-known *soft system methodology*. This approach may be regarded as being subjectivist. Boland maintains that 'information is the meaning or inward-forming of a person that results from an engagement with data' [6]. Checkland gives the formula: 'information = data + meaning'. Because

an individual has his/her own values, beliefs and expectations, different people obtain different information from the same data. That is to say, information is produced through adding meaning to data ([8], [7]).

The third approach seems embodied by the work of Stamper [10] and Mingers [11]. They try to avoid the limitations of pure objectivism and subjectivism in approaching the problem of information. Stamper does not take information as the primitive concept of IS, and takes instead the notions of 'sign' and 'norm'. Thus for him, to study information in the context of IS, the best tool would be organizational semiotics. Stamper and Mingers emphasize that the world is socially constructed based on communication, and meaning is inter-subjective. Mingers discusses the disadvantages of objectivism and subjectivism in approaching information and draws on Stamper's work among others, and gives a detailed analysis of data, information and meaning, and the inter-relationship among them, including the notion of 'levels' of meaning. For Mingers, meaning is produced from information that is carried by data, and meaning in turn produces further information.

Therefore the literature seems to indicate that the most important and fundamental concept in the IS discipline, namely 'information', has been approached with various somewhat confusing conceptions and terminologies, information can be discussed in various forms, and different forms seem to suit different application domains. This may justify the existence of these different forms. However, the various forms may be related with one another, and this is not accidental [13]. Hence, how various talks about information may be connected together, which may lead to a new perspective for understanding and engaging with the essence of information is an interesting question.

2.2 A new perspective on the essence of information

We suggest using results of research in 'information philosophy' ([13], [14]) in recent years thereby to formulate a new perspective for approaching the problem of 'information'.

Based on the three major approaches discussed above to information in IS, we find that different understanding on the relationship between information, data and meaning can contribute to and reflect different understanding of the essence of information. Moreover, there could be two fundamentally different ways of engaging the essence of information, namely from 'what

information is' or from 'why information is called information in the first place'.

We therefore suggest a new perspective, namely to understand and engage the essence of information from 'why information is called information in the first place' through investigating the relationship between information, data and meaning. In particular, new meaning is created through a specific type of activities and behaviour, called *interpretation*. That is, we observe that in order to understand the essence of information we adopt a perspective that information in IS can only be created through practice and being engaged through interpretation. This is the pivotal point of the ideas that we develop in the paper.

We believe that information is carried by non-empty, well-formed and meaningful data [14], and an information system is a social system making use of IT. Thus the relationship among information, data and meaning can only be explored through communication and negotiations between humans. It is conducted within the never-ending cycle of 'information is carried/embodied/projected by data; meaning is created from information through interpretation of data; then further information may be created due to the *intention* of a human agent, which is again carried by data' Through communication and negotiations between them, people obtain understanding of the world around them and of themselves. So, 'why information is called information in the first place' must be considered from the viewpoint of human's existence.

The process above is that of information (impact) realization, and the associated mechanism is that of information realization. On the one hand this process captures the relationship between information, data and meaning. On the other hand, this process is accomplished through the interaction between the three. We believe that information is independent of informees (the receivers of information), borrowing Floridi's term [14]. But we also believe that the impact of information, which is concerned with the reason why a piece of information can be seen as such, namely due to its capability of informing, can only be materialised through the interaction between the three, i.e., information, data and meaning. This entails the involvement of human agents within the process, or the interpretation/creation of meaning. Information realization is concerned with how people use information, and how information supports people who need information. Therefore the process of information realization becomes a process of meaning interpretation and realization.

The informing process through accessing information is that of interpreting the meaning of information for the informee in the sense that what the information means to him/her. It would seem that this has not been adequately addressed. Furthermore, exploring meaning would seem a basic problem for hermeneutics. In the sections that follow, we will put forward a proposal on how a mechanism for exploring meaning might look like by drawing on hermeneutics.

3 A hermeneutic approach to the problem of information in IS

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.

Gadamer argues that the process of interpretation is not an esoteric problem that is only relevant to the translator of ancient texts, but a basic problem of how we 'exist' in a social space. The world must be interpreted by us in order for our intentional action to become possible. Hence the problem of interpretation is fundamental to our everyday activity and also in the business world [15].

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, and 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 understanding they obtain their existence. At the same time, through social exchanges the social world in which we are changes as well.

The idea of tackling data in IS with Hermeneutics has appeared in the literature, for example, Gadamer's work was referred to. But the relevant work shown in the literature did not go to the details, for example, why and how Gadamer's work can be applied to IS was not elaborated. Besides, as Hirschheim et al. point out, the importance of philosophical hermeneutics including the ideas of hermeneutic cycle, horizon, and bracketing for rule-based data modeling is far reaching [14], therefore further investigation down this line would seem desirable and possible.

3.2 The choice of hermeneutics theory

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 [16]. On the contrary, philosophical hermeneutics by Heidegger [17] and Gadamer ([18], [19]) 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 [16]. 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, 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 realization of information and information flow within the context of information systems.

3.3 The general process of 'information realizing' mechanism

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

The general process of information and information flow realization (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.

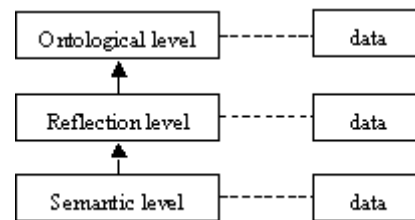


Fig. 1 The general process of information realization

3.4 An analysis of various elements in the 'information realizing' process

3.4.1 Data analysis

With Hermeneutics, data in information systems are read and interpreted as texts. We give data here slightly different characteristics from those that appear in more 'general' research of information systems. There are various definitions about data that can be found in the literature: Hirschheim et al. [15] define data as invariance with potential meaning to someone who can interpret them. Mingers defines data as a collection of signs brought together because they are considered relevant to some purposeful activity [12]. Floridi classifies data into four subclasses: primary data, metadata, operational data and derivative data [14].

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 multiple meanings and multiple layers of meaning. There are literal meaning, sender's meaning, hidden and latent meaning produced by various factors, such as the multiple traits of 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 [19]. In such a case, data is seen messages that carry information. The stipulation or protocols of encoding about signs used in data determines which events data can express and therefore what particular information a piece of data actually carries. In such a case the quantity of information that a piece of data can carry is unlimited [20]. For example, we could encode signals such that a '1' carries the information that the square s_2 on a checkerboard happens to have the marker placed on it through a random process, and s_2 is only one of the 64 squares of the same size altogether on the checkerboard [20]. Then the signal '1' carries 6 bits of information, which is termed 'surprisal' of this event.

(3) Meaning is created from information carried by data and the relevance of data is derivative from the dialectic relation between data and its receiver. The dialectic relation underpins that between information and meaning, and the latter is realized by jointing data and meaning. Meanings and the relevance of data are achieved through the increase of a receiver's understanding of the world under the influence of the information carried by data. This process is characterized by the reduction in uncertainty in a receiver's understanding of the world. If such reduction in uncertainty does not take place, then the information carried by data is meaningless to the user of the data. For example, if I already knew that square s_2 has the marker, then the signal '1' 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 one, 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 signal '1' carries the information that s_2 has the marker, then it can further be known that either s_2 or s_3 has the marker, which is merely a logical consequence of 's2 has the marker'.

Therefore, the process of information realization is a process of interpretation of multiple layers of meaning and that of realization of multiple meanings. This in turn enables data to have their complex characteristics as just discussed.

3.4.2 Semantic analysis

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, such as the literal meaning, which may in turn refer to a particular event. For example, the data that 'the coin is face up' have the literal meaning that the coin is face up. Under a pre-defined encoding rule for communication, the data may also carry the information that the sender of the data want to express, for example, 'Miss Wang is on duty today'. There could be other implied information content such as 'Miss Wang is not at home today'.

For another example, the fact that t is a freshman means also that t is an undergraduate, which in turns means that t is a student.

Literal meaning is the direct and basic meaning, and the others are indirect, second or metaphoric meaning. These indirect meanings are nested within the direct meaning. This is similar in a way to information nesting [20].

We begin to interpret 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 Fig. 2.

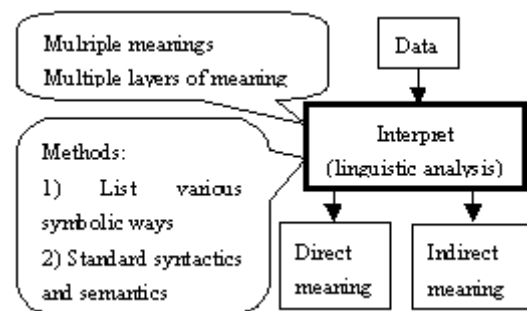


Fig.2 The process of linguistic analysis

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 within 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' to be

interpreted by the interpreter, and on the other hand the interpreter can only understand those that his experience allows her/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.

3.4.3 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 with 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 a new creation according to the requirements 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 utterances, and reading as new utterances (See Fig. 3). Ricoeur makes use of Gardmer's 'fusion of horizons' to refer to the widening of the understanding of the subject after she/he has entered the world of data.

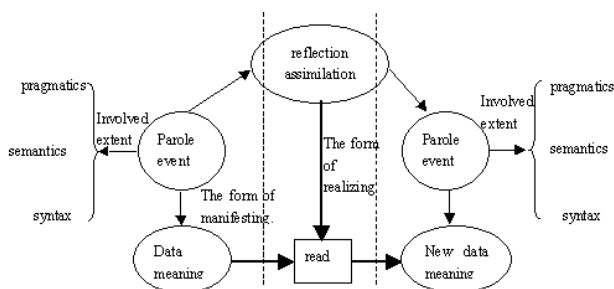


Fig.3 The process of reflection - the process of assimilation

We place data at the position of a production medium. Through the interpretation cycle, more meaning is obtained; and through 'fusion of horizons', self-understanding is achieved.

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

3.4.4 Ontological layer

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. Then on the ontological layer, the receiver expresses his/her own utterance with new data. Through such a never-ending cycle, human exchange is achieved, which in turn enables us to increasingly understand ourselves (see Fig. 4).

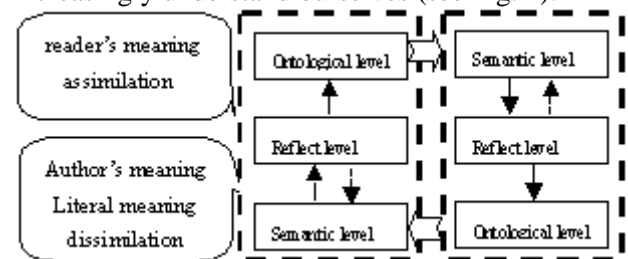


Fig.4 The communication pattern between subjects

3.5 Formulating the notions of Items of Information and Information Flow

In a process of information realization discussed above, we observe that the most primitive element is the *items of information*, and a basic mechanism is *information flow*. We now formalize them both.

3.5.1 Items of information

The content of information in comparison with the amount of information may be taken as a *state of affairs* among a number of them, which are all possible. A state of affairs can be seen as made up of one or more primitives, which can be expressed as a number of individuals having or not having certain relationship or property at a temporal location and a spatial location. So information is made up of items, each of which consists of two parts – a statement that certain given individuals possess a certain property or relationship, and a

context within which the statement is true. These all are intuitive terms. We will formalize them in turn.

First, we will use a formal concept ‘*infun*’ (After [21], Devlin 1991, p22) to model the ‘statement’ by using a *predicate*:

$$r(a_1, \dots, a_n, l, t, 1),$$

which means that individuals a_1, \dots, a_n have property or relationship r , at temporal location t and spatial location l . The last argument 1 in the above predicate expression is one of the two possible Boolean values that the polarity may have. For example,

$\text{makesenquiry}(\text{Jane Smith}, 04/03/2008, 1)$

is an infon, which means that Jane Smith makes an enquiry about leasing a property on 24th March 2008.

The elements in an infon are called *arguments*. When all arguments are constants or bound variables, the infon is said a ‘parameter free infon’, otherwise a ‘parametric infon’. The latter is a template for the former. For example,

$\text{makesenquiry}(\text{client}', 04/03/2008, 1)$

is a parametric infon as client' in it is an unbound variable (we will always use a ‘ $'$ ’ to indicate a variable in this paper). An unbound variable can be assigned a constant (called ‘anchoring’ by Devlin ([21], p134)) in a particular situation.

Second, an infon is only true in a certain context - a perceived real situation. For example, the above infon is only true in the situation where a client makes an enquiry about properties for lease in March 2008. We will use the formal concept ‘abstract situation’ (‘situation’ for short) to model the term ‘context’. An *abstract situation* is the context in which a set of infons is true. If the above infon denoted with, say, σ , is true in a situation s , then we write

$$s \models \sigma$$

The relationship between a real situation and its corresponding abstract situation is:

$$s_a = \{\sigma \mid s_r \models \sigma\}$$

where s_a is an abstract situation, s_r is a real situation, and σ is a set of parameter free infons. Moreover, we will use the formal concept ‘situation type’ to formalize the intuitive term ‘a set of situations’, and ‘situation’ to formalize ‘an instance of a situation’. For example,

$S1 = [s1' \mid s1' \models \text{makesenquiry}(\text{client}', \text{C\&F}, \text{enquirydate}', 1)]$,

is a situation type, which is a collection of situations in each of which a client makes an enquiry at the Cleland and Fleming Company. We suggest using the term ‘info unit’ to refer to the combination of a

situation and the infon(s) that are made true by the situation.

3.5.2 Information flow

We will use ‘information flow’ to formalize the intuitive term of ‘an agent receives information from a signal or event,’ and ‘an agent obtains information from some other information.’ The latter means that an agent obtains some information that is nested in the information that he/she already possesses. We will formalize an information source by using a situation type. The content of information received and obtained is a state of affairs (we said this earlier), which is an instance of a set of situation. Moreover a signal is also a state of affairs, so it can also be formalized to be a situation type. Therefore, the mechanism for information flow to take place can be seen as a directed connection between two situation types, which we call *info connection* (also called ‘*constraint*’ by Barwise and Perry ([22], p119) and Devlin ([21], p12)).

Now we will use the following scenario to illustrate the concept of ‘information flow’:

When a worker at Cleland and Fleming Company sees that the name ‘Jane Smith’ is in the enquiry list and the enquiry date is 4th March 2008, the worker knows that Jane Smith makes an enquiry about leasing a property on that date. That is, the former state of affairs carries information about the latter, and the worker gets it.

We wish to formalize the above process. There are two situation types. For the information source, namely a client makes an enquiry, we can have

$S1 = [s1' \mid s1' \models \text{makesenquiry}(\text{client}', \text{C\&F}, \text{enquirydate}', 1)]$.

For the signal, namely a name appears in the enquiry list, we can have

$S2 = [s2' \mid s2' \models \text{inenquirylist}(\text{clientname}', \text{enquirydate}', 1)]$,

which is a collection of situations in each of which a client name and enquiry date appear in the enquiry list. We then define an info connection, i.e., a *constraint*

$$S2 \Rightarrow S1,$$

which is a mechanism for the C&F worker to obtain the information. This info connection can exist because of how the job is done at C&F, which establishes an *informational relationship* between the two situations, and the worker in question can make use of it. This mechanism works like this: $S2$, if an individual situation is found as the worker

does in the above scenario where *clientname*' anchors to the name 'Jane Smith', and *enquirydate*' to 4th March 2008, which gives a certain state of affairs, then a certain affairs of the information source will be found where *client*' in S1 anchors to Jane Smith, and *enquirydate*' 4th March 2008.

4 Discussions

4.1 Implications for Requirements Identification for Information Systems Development

Two basic assumptions seem to have been made in information system literature. The first 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 ([23], [24], [25]). At the centre of the requirements determination and analysis is how required information is identified and formulated ([26],[27],[28]). But this phase is also known as 'characterized by informality and uncertainty' [25], and 'the least well-defined phase in the systems development process' [24].

We observe that the following three aspects are essential for any IS development methodology to handle the problem of the identification of information requirements:

- ◆ *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.*

None of these is trivial. We suggest that these be looked at within such a never-ending Hermeneutic cycle. The content of information requirements 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. We illustrate these points in Fig.5.

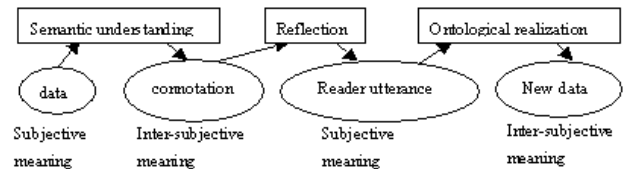


Fig.5 How to identify the required information through the stages of semantic understanding, reflection and ontological realization.

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.

4.2 Reflection on the proposed approach

Having described our approach in detail, we wish now to reflect on the contributions that our work makes through referring back to the three main approaches to information in the context of IS that were identified in Section 2. We observe two points. One is concerned with philosophical stands in terms of whether information is taken as an objective commodity or something created subjectively and whether information or sign is the most primitive notion. We believe that information is independent of the recipient, whose actions may create further information through reducing uncertainty. The other point is concerned with whether there is a well formed mechanism for handling information. Stamper's (97) gives a framework whereby to investigate properties of signs, which according to him correspond to information at various semiotic levels[10]. The other two approaches discussed in Section 2 do not seem to have given an explicit mechanism for this. As for our approach, we take the view that inter-relationships between information, data and meaning is a problem of Hermeneutics, and that the three are involved in a never-ending cycle. We proposed a structured mechanism, which is made up of three stages. Furthermore, we formulated the otherwise intuitive notions of 'items of information' and 'information flow'. Therefore we believe that our approach is philosophically sound, and may be methodologically more workable and applicable than those discussed.

5 Conclusion

The phenomenon and the notion of 'information' is important but elusive in general, and is highly relevant for IS in particular. We observe that the status quo of the study of information in IS has much left to be

desired, and our work seems to show that philosophical Hermeneutics can shed much needed light on it in terms of formulating conceptual frameworks and developing applicable methodologies.

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