基于释义学和渠道理论的
信息实现过程
分析及建模

王素芬 著

The Analysis and Modeling
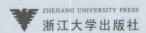of the Process of Information
Realization in Information Systems
based on Hermeneutics and
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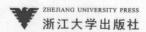# Realization in Information Systems
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基于释义学和渠道理论的信息实现过程分析及建模
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前　言

本书的研究来自对信息系统学科和应用研究中两个最基本问题"信息系统学科的特征身份是什么"和"生产率的悖论"的思考。

首先，"信息系统学科的特征身份是什么？"这是信息系统学科的发展过程中一直存在的一个问题。信息系统学科的特征身份是表征信息系统学科能否作为一个独立的学科存在的一个关键点(Benba-sat，Zmud，2003)。

一方面，由于信息系统是一个综合性和边缘性的学科，它有众多的参考学科。目前人们一致认为有组织科学、计算机科学、信息科学、管理科学、经济学、心理学等。由于信息系统的跨学科特点，信息系统研究人员来自于不同学术背景，他们以不同的理论为基础采用各种研究方法进行研究，使得研究主题各种各样。

另一方面，从20世纪80年代以来，许多信息系统研究人员企图克服信息系统领域过于狭窄的技术观点，尽力拓宽信息系统学科的研究主题。由于这两方面的原因，在过去的三十年中信息系统学科的研究主题丰富多彩。研究主题的广泛性一方面促进了信息系统学科的发展，而另一方面又产生了新的问题，也就是关于信息系统学科的特征身份的问题(Weber，1995)。

Weber认为信息系统学科的研究是关于信息技术制品的研究，且信息技术制品的表示是信息系统学科的基本点(Weber，1987，2003)。而信息技术制品表示的研究首先涉及了信息建模的问题

（Wang and Weber，1988,1990,2002）。而信息建模首先会遇到以下几个问题：信息是关于什么的信息？为什么要这些信息？这些信息会产生什么样的影响？这些问题的不同理解影响我们对建模语言和建模方法的选择。而上述这些问题就是涉及了信息、人与世界之间的关系，因此，信息技术制品表示的研究首先要从对信息、人、世界之间的关系的理解开始，而这些理解首先都与信息本质的理解及处理信息本质的方法有关。

其次，信息系统应用中的生产率悖论问题。信息系统应用中生产率悖论与信息系统开发失败的高比率有紧密的关系。文献中大量的研究结果表明许多信息系统开发的成败都与系统开发初的需求是否被完整和正确地确定有关（Davis，1982；Boehm，1981）（我们将完整且正确的需求称为"有效需求"）。但需求是关于信息系统所工作的世界或将信息系统作为世界的信息，而什么是完整的、正确的需求与系统开发的动机有关，而且这影响系统的结果。开发系统的动机反映了人们希望信息系统在组织中可能扮演的角色，而信息系统应用的结果反映了信息系统对信息系统所处的世界及世界中的人产生影响。所以，如何将信息、人与世界之间的关系反映在需求中就成为有效需求形成的一个重要的因素。同时，我们认为需求的变化是需求的最基本特征，因此，基于信息、人与世界之间关系的动态有效需求的理解是解决关于信息技术生产率悖论的基础。

同样，所谓正确和完备的需求的研究首先要从对信息、人、世界之间的关系的理解开始，而这些理解又与信息本质的理解及处理信息本质的方法有关。

从信息系统学科的特征身份到信息系统的应用问题也就是生产力悖论问题最后都归结为对信息本质的如何理解及处理问题，所以在信息系统领域中如何理解和处理信息的本质是信息系统学科的核心问题。本问题的深入研究和探讨，无论对信息系统学科的理论研究，还是对信息系统的成功实施，都具有特别重要的意义。

但是，在信息系统学科中一方面认为信息是信息系统学科最重

要和最基本的概念,对信息本质的理解有意或无意地指导和影响着信息系统的理论研究和实践应用;另一方面在信息系统领域中关于信息、数据和意义存在多样且混乱的概念和术语,而这些混乱又造成了现有关于信息系统研究的孤立不连接的且矛盾的知识混合体。目前,关于"信息本身难以琢磨的天性以及研究者没有办法在研究工作中处理信息本质"这个问题,信息系统学科范围内尚未给出系统、深刻的答案。所以,对如何理解和处理信息本质的研究和探讨,无论对信息系统学科的理论研究,还是对信息系统的成功实施,都具有特别重要的意义。

本书的基本观点是:要构建信息系统学科多样而有序的知识体,首先必须基于信息哲学的新思想从哲学层面思考信息本质,指导信息系统学科对信息本质的理解和处理,同时实现现代信息理论在信息系统学科的应用。所以,本书的主旨想从现代信息哲学和信息理论中吸取养分,寻找合理的信息实现机理的理论基础,探索信息实现过程的形式化表示形式,研究信息系统学科领域中的信息理解和处理问题,实现跨学科的知识融合。

全书共分九章。具体各章节的介绍内容如下:

第一章——回顾了信息哲学、信息理论、信息系统三学科领域现有的信息观点综述。

第二章——分析信息系统学科中各信息观点所直接或间接引用的哲学观点,吸收信息哲学的新思想,探索理解和处理信息本质的新视角。

第三章——基于释义学的信息实现一般过程分析,包括:信息实现机理作为释义学问题的背景分析、信息实现机理理论基础的确定、信息实现一般过程分析。

第四章——信息意义及其表示研究。基于海德格尔的哲学思想分析精通信息的知识工作者存在结构的三元素和两个本质特征,从而构造精通信息的知识工作者的半结构化模型,分析主体间性意义和主体性意义的本质及信息意义的基本形态和解释学视阈。Galois

格和形式化场景表示基于数据的信息意义。

第五章——信息意义勾连形态分析。基于形式化场景和信息意义格分析；基于数据的信息意义的四种勾连形态及其物理意义；基于Dretske语义信息理论分析信息意义的四种形态的信息提供能力，解释这四种形态与四类知识概念之间的关系；最后分析上述四种形态在粗糙集理论中的表现形态，从而获得较为全面的信息意义基本形态的理解。

第六章——信息实现过程形式化建模。主要包括：基于数据特点的多层信息意义、基于符号学的信息实现过程分析，最后应用信息渠道理论形式化信息实现过程。

第七章——信息实现过程应用研究。首先论述了信息实现机理作为知识工程本体研究的理论基础，分析了本体交互和进化中的主体间组合信息内容多对一解释过程，通过实例实现和展开了"基于释义学的信息实现机理和基于信息渠道理论的信息实现过程基本结构"的应用。

第八章——总结和展望。在第二、三、四、五、六章的基础上总结本书已取得的研究成果，以及本研究的局限和未来的研究展望。

本书的创新点：

1. 通过分析各信息观点的哲学基础，提出：从"信息何以被称为信息"出发通过信息、数据、意义三者之间的关系，才能真正理解信息的本质和处理信息的本质。特别是，由经解释的具体活动和行为而得以创生新意义的，或者可实践创造的信息本质论，是新信息本质理论的关键点，这些都体现在信息的实现过程中，信息实现的过程也是信息意义解释的过程。

2. 通过分析信息系统中信息实现过程的基本特征和基本假设，选择利科释义学思想和海德格尔释义学思想相结合的释义学理论作为信息实现过程的理论基础，抽取了信息实现过程的半结构化模型，突破了释义学理论在信息系统中的应用，也进一步系统化地展现和实现了Mingers的有关信息与意义之间的模拟数字化过程。

3. 从海德格尔的此在的分析出发理解信息意义、主体性意义和主体间性意义,完成现有信息本质研究中有关意义的论述,补充和完善了 Floridi 和 Mingers 的信息研究。

4. 以符号学为中介分析信息实现过程的基本问题,连接了基于释义学的信息实现过程半结构化模型和信息渠道理论间的关系,从而实现了信息实现过程的形式化建模。

5. 基于信息实现机理,构建了主体间组合信息内容多对一的解释过程,进一步扩展了本体进化和交互的研究。

基于释义学和渠道理论的信息实现过程分析及建模

Abstract

The notion of 'information' is probably the most important and the most fundamental one for the discipline of information systems. Whether realising it or not, people's understanding of this notion guides and affects their theoretic study and application of information systems. However, there appear many inconsistent and often conflicting views and terms for information, data and meaning in the literature Such a situation seems to have resulted in the body of knowledge in this field being an inconsistent and confusing mixture. Thus far, there does not seem a systematic and convincing solution to the problem that the nature of information is elusive and extremely hard to handle. Therefore, any serious investigation into the nature of information would seem highly desirable and important both for theoretic research and practice.

The main topics that have been investigated and are to be reported in this thesis are as follows:

1. A new and helpful perspective and some crucial elements for understanding and processing information have been developed or identified. We absorb research results in information philosophy and take how to link various approaches to information as a starting

1

基于释义学和渠道理论的信息实现过程分析及建模

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point of our work. We analyze the basic philosophical foundations of these approaches in terms of relationships between *information*, *data*, and *meaning* and approaches to the nature of information, which constitute a two — dimension conceptual framework. This helps us further understand the state of the art of this field and arrive at a fundamental insight, namely the process of information realization is also a process that a knowledge worker takes to obtain meaning from what she/he observes through interpretation. The revelation of the mechanism whereby the impact of information is realized appears to the key to understand the nature of information.

2. We have chosen appropriate theoretical foundations for investigating this aforementioned mechanism and discovered the general process of information realization. The process of information realization is a process of interpretation, which results in meaning, and such a process belongs firmly to Hermeneutics. Moreover, such a process is also that of communication between people during which people understand one another and themselves. The process of communication is also that of understanding. Understanding between people embodies relationships between information, data and meaning, and at the same time, the latter enables the former. The existence of Information is independent of its receiver, but at the same time the reason why something is taken as information is because it has the potential to inform the receiver in that it would result in the reduction of some uncertainty that is relevant to her/him. And this can only be realized through certain relationships of information to data and meaning. That is, information is fundamentally associated with people. Based on this view, taking into account the basic characteristics of information systems, we choose hermeneutic thinking as the theoretical foundation for our investi-

gation. As a result, a general process including its elements and stages is identified and a semi-structured model developed.

3. We have investigated basic forms of the meaning of information. How to obtain meaning through interpretation is the key to understand and process information. If meaning is created through interpretation, which is what we mean by 'information realization', then how does it happen? What is the nature of inter-subject meaning and subject meaning? We have not found systematic study in the literature on these questions thus far. We observe that meaning is only valuable to the interpreter, whom we call *knowledge worker* who is skilled in handling information. Interpreters, i. e., people, are of the topic of "Existence and Time" by Heiderger. We draw on Heiderger's work on 'being' to investigate the structure and essential characteristics of information realization with which to understand the essence of inter-subjective meaning and subjective meaning, to analyze links between information and data, and finally to use *Galois lattice* and *formal context* to visualize the meaning of information.

4. We have further discussed the meaning of information that is based on data, and we have analyzed the relationship between data, information and meaning. We analyze four basic relationships between information and dada based by using *formal context*, namely, *fully matched*, *the first partly matched*, *the second partly matched* and *unmatched*, and obtain physical signification and their manifestation in meaning lattices. Dretske observes that an essential component for the notion of 'to know' is *information provision*. Following Dretske, we analyze information entropy of the four types of meaning. Then using the information entropy obtained, we look at how data convey information content, and how the types of

meaning relate to different concepts in knowledge. Finally, we realize that uncertain knowledge is involved in all the above, therefore we further express the four types of meaning (i. e. , four types of connections between information and data) by using Rough Set, which deepens our understanding of uncertain knowledge.

5. How the information realization process may be modeled formally was investigated. The *semantic layer*, the *reflective layer* and the *ontological layer* of the information realization process are all carried out on the basis of data. Hence relationships between multiple layers of the meaning of information and the information realization process are analyzed in terms of the characteristics of data. We analyze the information realization process by using semiotics, and take the view that the meaning of information be a *double interpretative entity* and has a systematic structure. How to interpret multiple meaning and multiple layers of meaning of information in an information realization process is transformed into questions that information theory covers, therefore we choose Barwise and Seligma's *channel theory* to model information realization process formally, and discuss formal representations of the meaning of information, four types of meaning, multiple meaning and multiple layers of meaning from the perspective of *distributed systems*.

6. The semi-structured model based on Hermeneutics and the formal model based on information channel theory about information realization process were combined and then applied to the problem of ontological interoperability and evolution. By using Heidegger's ontologism, we obtain the relationship between ontology and Hermeneutics, analyze the phenomenon of ontological interoperability and evolution in knowledge engineering. We observe

that the problem of ontological interoperability and evolution is that of communication, and communication is realized through people's interpretation and attainment of information content from data. Thus the mechanism of information realization based on Hermeneutics is a theoretic foundation for ontological evolution, attainment and realization in knowledge engineering. We use the semi-structured model of information realization process, we apply information channel theory to the analysis of ontological interoperability and evolution, which are based on many-to-one correspondences of information content between human subjects, we obtain a formal framework about communication between human subjects and the modeling steps about an interpretation process of many-to-one correspondences of information content between human subjects. Finally, we describe a case study where the semi-structured model and the formal model of information realization process are applied to knowledge engineering.

The main contributions of the thesis:

1. By analyzing the philosophical bases of various views of information, we conclude that through understanding relationships between information, data and meaning, we can truly understand the nature of information. Especially, new meanings are created through interpretation activities, behavior or by practice, which are crucial points of this thesis. We demonstrate that the process of information realization is also that of interpretation of the meaning of information.

2. By analyzing basic characteristics and assumptions of the process of information realization, we choose Heidegger's Hermeneutics combined with Ricoeur's Hermeneutics as the basis and for-

5

基于释义学和渠道理论的信息实现过程分析及建模

mulate a semi-structural model of information realization. This represents an extention of current application of the hermeneutical theory to information systems. This also systematically elaborates the digitalization process that underlies the transformation from information to meaning as obversed by Mingers.

3. We have achieved a better understanding of the meaning of information, subjective meaning and inter-subjective meaning by drawing on Heiderger's analysis of 'being'. We expand the study of meaning in contemporary studies on the nature of information, which we believe, supplements and improves Floridi's and Mingers' studies on information.

4. We analyze the fundamentals of the process of information realization by drawing on principles of semiotics, which serves as a link between the aforementioned semi-structural model of information realization and the information channel theory. As a result, we have arrived at a formal analysis of information realization.

5. Based on the mechanism for information realization that we have formulated, we have built a 'many to one' interpretation process for combing information content, which we believe extends current research reported on ontology evolution and interoperability in knowledge engineering.

目 录

第一章 绪 论

　　信息概念已成为现代生活的中心话题,信息概念影响我们对所生活着的世界的思考方式,我们命名我们生活的时代为信息时代。所以正如当初海德格尔提出技术问题已成为一个哲学问题一样,信息的概念也进入了当代哲学的中心,信息问题也成了哲学问题。牛津大学哲学家弗洛里迪(Floridi)在 1996 年提出了"信息哲学"的概念,而 2002 年在《元哲学》上的论文《什么是信息哲学?》使得弗洛里迪成为当代信息哲学的创始人(Floridi,2002);2005 年的《语义信息是有意义的数据吗?》促进了信息哲学对信息系统学科及信息科学学科中信息问题的分析(Floridi,2005)。所以,现有的信息哲学的研究成果对信息系统学科如何理解和处理信息本质有重大的促进作用(Floridi,2004)。

　　信息又是信息理论的重要研究主题,信息理论中关于信息的研究成果往往有意或无意、直接或间接地影响着信息系统学科的相关研究。无论我们假设信息系统是具有社会影响的技术系统还是基于信息技术的社会系统,技术在信息系统的研究中具有不可否定的重要地位,信息理论的研究在一定的基础上构成了信息系统中关于信息研究的技术数理基础,所以理解信息理论中的相关信息的研究成果及研究趋势对于整个信息研究现状的理解具有重要的作用。

　　所以本章从信息系统领域、信息理论和信息哲学三个角度分析信息研究的现状。