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Notions of Information: A Review of Literature

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Abstract
For IS researchers it is important to know and understand the different notions of information, their assumptions and the consequences of using them. The goal of this paper is to inform the reader which notions exist in literature of various disciplines. An overview is given of different information notions and approaches to information. On the basis of this overview four basic notions are proposed, which I consider to be the most important notions used in literature. These notions are information-asthing (information is treated as if it is a thing), information-as-process (a mental process of informing/altering), information-as-social construction (the shared, constructed information base of social systems) and information-as-probability (the probability of a message being sent). Traditionally information management is only concerned with information-as-thing. I argue that information management must consider information in all its perceptions.

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Notions of Information: a review of literature

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Abstract: For IS researchers it is important to know and understand the different notions of information, their assumptions and the consequences of using them. The goal of this paper is to inform the reader which notions exist in literature of various disciplines. An overview is given of different information notions and approaches to information. On the basis of this overview four basic notions are proposed, which I consider to be the most important notions used in literature. These notions are information-as-thing (information is treated as if it is a thing), information-as-process (a mental process of informing/altering), information-as-social construction (the shared, constructed information base of social systems) and information-as-probability (the probability of a message being sent). Traditionally information management is only concerned with information-as-thing. I argue that information management must consider information in all its perceptions.

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Introduction

Our perception of information management depends on our perception of information (Kirk 1999). Although this is not a shocking statement, it raises some interesting questions and research opportunities. E.g. how do we perceive information and information management? What are the assumptions, limits and consequences of these perceptions? Can these perceptions be related and why? I believe that answers to these questions are important for our understanding of information management. This paper focuses on how we perceive information.

Perceptions of information[1] not only influence our view on information management but also our perception of information systems (Klein & Hirschheim 1987, Carvalho 2000), our perception of communication (Mokros 1993, Schement 1993), the role of the IS-field (Boland 1987) and the conduct of research (Newman 2001, Schement 1993). This means that perceptions of information, which I prefer to call notions of information or information notions, have a profound influence on the IS-field. Because of this IS-researchers have an obligation to know at least which notions of information exist. This paper is an attempt to attribute to the fulfilling of this obligation. It will give an overview of important notions of information and approaches to information in literature of various disciplines. In addition four information notions are proposed which I consider to be the most important notions in literature. These notions are called basic notions.

The concept of information fascinates many scientists from different fields like biology, psychology, computer science, sociology, economics, business and management, political science, artificial intelligence, statistics, philosophy, communication and information studies (e.g. Mokros 1993, Newman 2001, Ruben 1993, Schement 1993). In all of these fields information is an important concept but at the same time none of these fields can claim information as only relevant for their discipline. Because of this we must view information as an interdisciplinary concept. This means that notions of information must be studied in different disciplines. It also means that notions of information are not only relevant for the IS-field!

On the interdisciplinary concept of information no interdisciplinary agreement has emerged, and no unified theory appears imminent (Schement 1993). Instead we often perceive information as a dangerously vague term, which too often appears to serve a rhetorical function (Newman 2001). When information is defined "the abundance and diversity of definitions of information bewilder." (Braman 1989, p.233). A tempting conclusion is that the meaning of information depends on context and purpose and leave it at that. At the same time many argue that we are in (desperate) need for a theoretical perspective on information (e.g. Devlin 1999, Haefner 1999, Newman 2001). In this paper I do not

[1] *The distinction between a definition and a perception, is that a definition says what the phenomenon defined is, whereas a perception (of a concept) is a way of looking at the phenomenon. By accepting the idea of a perception one becomes free to look for a useful perception, rather than a universally true definition (c.f. Belkin 1978, p.58).*

provide a theoretical perspective on information, but instead I present different information notions in different disciplines, as well as an analysis of these different notions. As argued before, it is important to know which information notions exist. A sound theoretical basis must be able to explain (may be even integrate) these information notions.

Structure

To get a first impression of how information is used in various sciences, a short introduction to different approaches of information is given in chapter 1. This is done on the basis of Newman (2001).

Apart from Newman, also other researches have taken the effort to compare different information notions in different disciplines. On the basis of these comparisons some of them made a synthesis and explicitly proposed a grouping of information notions which reflects the notions they analysed. In chapter 2 six of such groupings are presented, viz. groupings of Belkin (1978), Braman (1989), Buckland (1991), Gelepithis (1999), Ruben (1992) and Schement (1993).

In chapter 3 I reflect on these groupings and propose four information notions which I consider to be the most important notions in literature. These basic notions are: information-as-thing, information-as-process, information-as-social construction and information-as-probability. Important to note is that I use as a basis for an overview of information perceptions, the work of others who already analysed different notions in various disciplines. Of course I base my basic notions in this chapter also on the work of other (important) researchers.

In chapter 4 I share some of my ideas on the use of the basic notions in IS-research, e.g. their relation with perceptions of Information Management. These ideas are not fully developed and, because of that, they may serve as a basis for further research.

In the conclusion a summary is presented, as well as many unanswered yet interesting questions.

Chapter 1 – Introduction to Information Approaches

This chapter gives a short introduction to different approaches to information in various sciences. An article of Newman (2001) is used as a basis for this introduction. Newman's description of different information approaches is also used in an example in chapter 4.

1.1 Information approaches

Newman describes a variety of approaches to information in different sciences. These approaches are:

1. Probabilistic approach
2. Information Processing approach
3. Ecological approach
4. Social and organisational approaches

The main insight of the Probabilistic approach is that events of low probability represent high information content. An important example of this approach is the Information Theory of Shannon and Weaver (1949) (in: Newman 2001). In this theory a mathematical representation of the transmission of a message is presented, where information is a measure of the predictability of the signal (or the number of choices open to the sender). From other scientific backgrounds, e.g. logic, cybernetics and philosophy of science, other scientists also relate information to probability (e.g. Fisher 1934, Carnap and Bar-Hillel 1952, Popper 1965, MacKay 1969 in: Newman 2001. See also Borgmann 1999 p.132). These approaches differ on several important aspects, e.g. regarding interpretations of probability and the semantic function of information. With respect to the semantic function of information most approaches see information as the reduction of uncertainty.

The Information Processing approach (or cognitive approach) focuses on (human) thinking and is common to AI and Cognitive Psychology. In this approach thinking and information processing are seen as analogous. Information is the product of thinking (=information processing). It increments knowledge (or enhances the representations) about something. The modelling of cognitive processes and internal representations are of primary concern in this approach. A well-known example is the model of memory as two discrete storage systems which posses different retrieval and decay characteristics. Interesting to know is that many exponents of this approach endorse the principle of 'bounded rationality'.

According to the Ecological approach information is not created, but just present in the world; it is immanent in the environment, in a situation. Organisms 'pick up' this information actively from the world. An important extension to the Ecological approach is the Situation theory. In this theory, which builds upon a mathematical basis, a clear distinction is made between information itself (content or 'items of information') and its representation. These items of information are recognised as a new kind of abstract entity or mathematical object. Information content is also separated from truth; depending on the

situation information can be true or not. Newman regards the Situation theory as "an exciting development in our understanding of information" (p.161).

Social and Organisational approaches fall into two strands of work; work associated with the concept of Information Economy and work associated with Information Systems. In both categories, as well as approaches related with Information Processing, the pyramidal model of information is often used. In this model data must be processed to produce information and information must be processed to produce knowledge.

An important ingredient in the first category (Information Economy) is the quantification of 'information work' and 'information goods', used among other things to show the importance of the 'Information Sector'. In the well-known attempt of Porat (1977) (in: Newman 2001) it is clear that information is not associated with uncertainty reduction. IS research (second category) focuses on information processes in organisations and information needs of managers and other users of information systems. Fulfilling these information needs may result in uncertainty reduction, which leads to better decision making (c.f. Schement p.5).

On the basis of these different approaches Newman identifies three dimensions of similarity/difference in the way information is used and defined:
1. Information is produced OR is immanent.
2. Understanding information requires modelling of cognitive processes and structures OR not.
3. Uncertainty reduction is a defining characteristic OR not.
These dimensions are discussed in more detail in paragraph 4.1.

Chapter 2 - Groupings of Information Notions in Literature

Apart from Newman in chapter 1, several other researches have taken the effort to compare different information notions in different disciplines. Some of these researchers proposed a grouping of information notions which summarises the use of information in various disciplines. In this chapter six of such groupings are presented, viz. groupings of Braman (1989), Buckland (1991), Schement (1993), Ruben (1992), Belkin (1978) and Gelepithis (1999). In the following chapter I reflect on the notions presented here.

An important question is why I have chosen these groupings of information notions. This is because these groupings are based on the use of information in various disciplines and I am not aware of any other of such groupings in literature[2]. All of the researchers presented in this chapter viewed information notions from a wide variety of scientific fields, although I admit this is less obvious in case of Ruben and Gelepithis.

The majority of the researchers presented in this chapter comes from Communication and Information studies (see table 1 for the background of the researchers). This could be expected since information is central to these studies. Although one may argue that the notions presented in this chapter are biased to Communication and Information studies, these notions are still based on various fields. I make this point for each researcher in the subsequent paragraphs.

Researcher	Background
Braman	Policy making
Buckland	Communication and information studies
Schement	Communication and information studies
Ruben	Communication and information studies
Belkin	Information science
Gelepithis	Cybernetics

Table 1. Background of researchers

2.1 Information notions of Braman

Braman (1989) suggests a hierarchy of definitions to group different definitions of information which are used in the context of policy making. Although the focus is on policy making, the hierarchy is based on perceptions of information from a wide variety of fields, e.g. economics, law, mass communication theory, cybernetics, information theory, social psychology, sociology and mathematics.

[2] *Any suggestion for literature is more than welcome.*

The hierarchy is based on three dimensions: level of scope (how broad a range of social phenomena is incorporated into the concept), level of complexity (how finely and variously articulated is the social organisation that appears through the lens of a particular definition) and associated power (which is granted to information and its creation, flows and use). Distinguished along these dimensions, information definitions fall into four groups: information as a resource, as a commodity, as perception of pattern and as a constitutive force in society (see table 2). Information as a resource is associated with the lowest level of scope, complexity and power, while information as a constitutive force is associated with the highest level along these three dimensions.

Information Notion	Description
1. Information as a resource	Discrete isolated entity
2. Information as a commodity	Entity that can be exchanged
3. Information as perception of pattern	Pattern with context
4. Information as a constitutive force in society	Actor that changes context

Table 2. Information Notions of Braman

Information as a resource treats information, like its creators, processors and users, as "discrete and isolated entities. Information comes in pieces unrelated to bodies of knowledge or information flows into which it may be organized" (p.236). Associated with this view, is a limited scope of phenomena covered and a simple view of the social structure (e.g. the discrete entities). Also information is viewed as having no power in and of itself.

Information as commodity focuses on the process of information exchange among people. This notion requires the concept of an information production chain, through which information gains in economic value. The chain includes steps like information creation, processing and distribution. This implies a more complex social structure “comprising buyers, sellers and the organization in order to sustain a market" (p.238). Information is viewed as a resource that can be traded, and therefore has economic power.

Information as perception of pattern broadens the concept of information by adding context. Information "has a past and future, is affected by motive and other environmental and causal factors" (p.238). Compared to information as commodity, the scope of phenomena covered by this notion is broadened. Information can be applied to higher articulated social structures. Information in this view also has effects, although these effects are isolated compared to information as a constitutive force in society. The simplest definition that belongs to this group is information as uncertainty reduction.

Information as a constitutive force in society grants information “an active role in shaping context." (p.239). Information is an actor in itself, affecting the environment and creating the social structure. "Definitions that treat information as a constitutive force in society are at the top of this definitional

hierarchy - they apply to the entire range of phenomena and processes in which information is involved, can be applied to a social structure of any degree of articulation and complexity, and grant information, its flows and use an enormous power in constructing our social (and ultimately physical) reality." (p.241).

2.2 Information notions of Buckland

Buckland (1991) identifies three "principal uses" of the term information: information-as-process, information-as-knowledge and information-as-thing. These uses, which I call information notions, are based on the Oxford English Dictionary. In addition Buckland refers to researchers from different disciplines, although most of them from information science. The three information notions of Buckland are depicted in table 3.

Information Notion	Description
1. information-as-process	The act of becoming informed
2. information-as-knowledge	That what is communicated
3. information-as-thing	Things which are informative

Table 3. Information Notions of Buckland

Information-as-process refers to the act of becoming informed. When someone is informed, what he/she knows is changed. Information-as-knowledge refers to that which is perceived in information-as-process. It is the knowledge that is communicated. Buckland views information as uncertainty reduction as a special case of 'information-as-knowledge'. He comments that sometimes information increases uncertainty. Information-as-thing refers to things that are regarded as being informative, things from which one becomes informed. He analyses different things with this quality (e.g. data, text, material objects, events) and concluded that everything is, or might be, informative. He then argues that the virtue of being information-as-thing is situational and depends on subjective judgements. For some objects (in particular situations) the consensus of judgement is so strong that the status of these objects as being informative is unquestioned (e.g. telephone directory).

Buckland summarises the three principal uses of information in terms of two distinctions:

1. Between entities and processes
2. Between intangibles and tangibles

These distinctions yield four different aspects of information, see table 4. So Buckland distinguishes four aspects of information, while he distinguishes only three *principal uses of the term* information. The fourth aspect of information is information processing. This refers to the handling, manipulating, and deriving of new forms or versions of information-as-thing. This is not a mental process as in the case of information-as-process.

	Intangible	Tangible
Entity	Information-as-knowledge	Information-as-thing
Process	Information-as-process	Information processing (not an information notion)

Table 4. Aspects of information & Information Notions according to Buckland

2.3 Information notions of Schement

Schement (1993) reviewed 22 definitions of information from different fields, e.g. economics, IS-field, physics, information and communication studies. Although his focus is on the information and communication studies, his analysis is still interdisciplinary because definitions of different fields are compared. On the basis of these definitions Schement distinguishes "fundamental themes which outline current thinking on the nature of information" (p.7). These themes are depicted in table 5.

Information Notion	Description
1. information-as-thing	A (non-material) thing
2. information-as-process	A phenomenon of informing or altering
3. information-as-product-of-manipulation	A thing that must be manipulated in order to exist

Table 5. Information Notions of Schement

The notion of information-as-thing treats information as though it were a (non-material) thing. According to Schement this notion is the most used of the three notions. Two examples of this notion are:

> "Information is an entity; but a thing that exists without mass or energy" (Diener 1989 in: Schement 1993)
>
> "Information is a coherent collection of data, messages or cues organized in a particular way that has meaning or use for a particular human system" (Ruben 1988 in: Schement 1993)

Information can also be a process. This notion of information-as-process views information as a phenomenon of informing or altering. An important subtheme of this notion is the view of information as the reduction of uncertainty, a common view among economists and computer scientists.

The last notion, information-as-product-of-manipulation, views information as though it is a thing but a thing that must be manipulated in order to exist. An example is:

> "Information' is data produced as a result of a process upon data" (Hayes 1969 in: Schement 1993)

According to Schement these perceptions of information are connected with different perceptions of communication. He argues that these two concepts are intrinsically bound to each other.

2.4 Information notions of Ruben

Ruben (1992 and 1993) provides different propositions to "provide the foundation for the advancement of an interdisciplinary approach to the information-communication relationship" (1992 p.22). One of these propositions is concerned with information notions. According to Ruben three distinct concepts of information should be differentiated (see table 6). It is not clear how Ruben made this classification and he did not refer to any example of these notions in the literature. Still Ruben makes it very clear that he views information as an interdisciplinary concept. His focus is however on the relationship between information and communication. Here he draws explicitly from a wide variety of fields, e.g. biology, economics, cybernetics, mathematics, sociology, information and communication studies.

Information Notion	Description
1. information$_e$	Environmental artifacts and representations; environmental data, stimuli, messages or cues
2. information$_I$	Internalized, individualized appropriations and representations
3. information$_s$	Socially constructed, negotiated, validated, sanctioned and/or privileged appropriations, representations and artifacts

Table 6. Information Notions of Ruben

Information$_e$ (or first order information) is the order of information that has potential significance for a living system, but that potential is not yet actualised. It is yet to become attended to and utilised. Information$_I$ (or second order information) is Information$_e$ which has been transformed and configured for use by an individual. It refers to (1) the often transitory, internalised, idiosyncratic appropriations, representations, or constructions of Information$_e$; and (2) the long-term "artifactual" consequences of this process, variously referred to as cognitive maps, cognitive scheme, semantic networks, personal constructs, images, rules or mind. Information$_s$ (or third order information) comprises the shared information/knowledge base of societies and other social systems.

2.5 Information notions of Belkin

Belkin (1978) surveys several contributions to an important problem in information science: the question of a suitable concept of information for information science. Different approaches to information concepts for information science are discussed. Although Belkin discussed information concepts used in information science, several of these concepts originated from, and/or are used, in a variety of other fields (c.f. p.82). In table 7 I present the notions of Belkin. Where possible, I used the most general description (as given in Belkin) of these notions.

Information Notion	Description
1. As fundamental category	Such as matter (p70,71,82)
2. As property of matter, and as property of consciousness	Objective external information and subjective internal information (p.70)
3. As social, scientific information	Relational system of scientific facts, theories, hypotheses, laws and publications, which are the results of humankind's observation of nature and of itself (p.71, 77)
4. As an event	That which occurs within the mind upon absorption of a message (p.74)
5. As structure	The resulting structure of an informative event (p.79)
6. As probability of the occurrence of an event	The amount of information is associated with the probability of that message being sent (p.66)
7. As data of value in decision making	To reduce uncertainty (p.76,77)
8. As knowledge	What is meant to be communicated (p.79)
9. As uncertainty reduction	In a state of knowledge (p.82)
10. As the message itself	Not described clearly; the contents of a message (p.83)

Table 7. Information Notions of Belkin

Information as fundamental category views information as something that is essential for the existence of the universe, like matter, but a category different from matter. Of course this is a philosophical position and a position that differs from materialism. Information as property of matter and consciousness, does not view information as a special category, but distinguishes two kinds of information: objective information which is a property of matter, and subjective information which is the reflection of an individual (a property of consciousness). Information as social, scientific information is based on a classification by Mikhailov, Chernyi and Giliarevskii (1975: in Belkin). This classification divides a broad intuitive idea of information into social and non-social, social information into semantic and non-semantic, and semantic information into scientific and non-scientific. An important difference between social and non-social is that social information is of public nature and non-social information is defined only in individual terms. According to Mikhailov, Chernyi and Giliarevskii, information science should limit itself to social, scientific information. Information as an event views information as the alteration of the image (in the mind) which occurs when receiving a message. Information as structure views information not as an event, but as the resulting structure of this event. E.g. information is the resulting structure in the mind of certain sense-data or some experience. Information as probability of the occurrence of an event comes from the Information Theory of Shannon and Weaver (see also chapter 1). The remaining information notions need no further explanation, except the last notion; information as the message itself. This notion is not described clearly. It is however associated with the "contents" of a message (p.66).

2.6 Information notions of Gelepithis

According to Gelepithis (1999) information is the central notion for the communities of Information Science and Information Systems. A considerable number of disciplines concerned with 'information' and 'information systems' has led to the development of other concepts closely related to information (e.g. sign, symbol and meaning). Gelepithis focuses on the clarification of these concepts and the consequences for the fields of Information Science and Information Systems. Although his purpose is not to present a summary of different notions of information in different disciplines, Gelepithis mentioned briefly seven "major viewpoints" of information (see table 8).

Information Notion and description
1. Information in terms of the probability of a signal
2. Information as order
3. Information in terms of knowledge and meaning at a mentalistic level; and, more strongly, as a mental not a material entity
4. Information in terms of the notion of sign as a primitive
5. Information conceived in terms of the Popperian conception of the three worlds
6. Information in terms of truth conditions
7. Information as a basic property of the Universe

Table 8. Information Notions of Gelepithis

The problem with these notions is that their descriptions are very brief. The description in table 8 is all there is, except for one or two references for each notion.

I will explain shortly what is meant by notion 4 and 5 because I will refer to these notions later. In relation to notion 4 (sign as primitive) Gelepithis refers to Stamper (1985). Here Stamper proposes semiotics (theory of signs) as a suitable theory of information. He argues that the idea of a sign is "a suitable primitive on which to base a science of information" (p.195). Signs can be described as physical things - objects, events or properties of objects and events – which are able to play a role in human behaviour. Information is in fact a measure of a property of a sign. Measures differ from each other (e.g. entropy measure and subjective measure) and therefore information has different meanings. These meanings can be related to different areas of semiotics: pragmatics, semantics, syntactics and empirics.

Notion 5 in table 8 refers to the 'Popperian conception of the three worlds'. On the basis of Popper & Eccles (1977) I will explain shortly what is meant by the 'Popperian conception of the three worlds'. Popper argues that we accept things as real if they can causally act upon, or interact with, ordinary material things. He distinguishes three realities or three worlds:

- World 1: World of physical objects and states

- ✍✍World 2: World of states of consciousness (e.g. subjective knowledge, experience of creative imagination)
- ✍✍World 3: World of knowledge in the objective sense (e.g. products of the human mind, theoretical systems, scientific problems)

According to Popper these worlds interact with each other. However it remains unclear what Gelepithis meant by information conceived in terms of these three worlds.

Chapter 3 - Reflections: towards basic notions

In this chapter I reflect on the information notions presented in the previous chapter 2. I propose four information notions which I consider to be the most important notions in literature. These notions are called basic notions.

3.1 Obvious similarities

The information notions described in chapter 2 share some obvious similarities. These similarities are discussed in this paragraph. Based on these similarities, which are in turn based on analysis of information notions from different fields, I present four basic notions of information: information-as-process, information-as-thing, information-as-social construction and information-as-probability.

Information-as-process

Both Schement and Buckland identify the notions of information-as-process. Also the descriptions of Schement and Buckland are almost identical. This description is also very similar to the description of information-as-event of Belkin. It refers to a mental process of informing or altering.

Information-as-thing

Both Schement and Buckland identify the notions of information-as-thing. However their descriptions differ. Buckland includes only tangible things while Schement only includes intangible entities. Nevertheless, Schement notices that information-as-thing can be encoded in material objects, of which Buckland would say that these are informative things. So it seems that Buckland focuses on the physical representation of Schement's intangible entities. Although it is not exactly clear what these intangible entities are, they seem to refer to what is often called content. This content can be represented by a material (or physical) thing. So we have here two variations of information-as-thing:

1. A non-material thing (content)
2. A material thing that is informative (representation of content)

In literature it is often noticed that it is important to make a distinction between the information content and its representation. E.g. Devlin (1999) argues that "One of the most common misunderstandings is to confuse information with its representation" (p.27). Ruben (1993) remarks that viewing a representation as information is "convenient and even useful for some purposes, it can also be misleading and dysfunctional in other contexts" (p.225). Buckland notices that the representation is often viewed as if it is information. So information as material thing (representation) seems to be an important notion.

Philosophical issues

As one may have noticed in chapter 2, researchers struggle to position information as something material

or non-material (see also Atmanspacher 1999 and Fuchs-Kittowski 1999). The distinction of reality in a material and a non-material[3] category is a major philosophical issue.

Most researchers seem to position information as something material or something related with human's mind (something mental). Of chapter 2 the following notions view information as something material: information-as-thing (Buckland), information$_e$ (Ruben, on the basis of Ruben's explanation of the 'environment'), information as property of matter (Belkin). In the following paragraph I will argue that the notions of information as commodity and information as resource are basically variations on information-as-material thing. Although it seems that several researchers agree that information at the material level does not really exist (c.f. Haefner 1999), still Buckland's observation holds that we often use the word information as if it is a material thing.

Of chapter 2 the following notions view information as something mental: information-as-knowledge (Buckland), information$_i$ (Ruben), information-as-property-of-consciousness (Belkin), information-as-knowledge (Belkin), information in terms of knowledge (Gelepithis). Another example is Anderson (1980) (in: Newman 2001) who described information as mental objects operated on. In this view information is often equated with knowledge. According to Miller (2002) this is also a habit in most literature on Knowledge Management. He warns us for such a view because information in itself, he claims, has no intrinsic meaning. Information can only provoke or evoke meaning in others[4].

There are also researchers who explicitly relate information to something different than matter and mind. An example is Devlin (1999) who describes his position as "Whereas information is not physical, it is not purely mental either: Our thoughts are locked inside our head, but information is 'in some sense out there'. Whatever it is, information exists somewhere between the physical world around us and the mental world of human thoughts." (p.23). "It is both reasonable and useful to view information as some kind of 'substance' that exist in the public domain" (p.152). In chapter 2 notions of Gelepithis and Belkin are also referring to something different than matter and mind. Gelepithis presented a notion where information is a basic property of the universe and Belkin presented a notion where information is a fundamental category, such as matter. Another example is Fuchs-Kittowski (1999) who argues that "information is neither matter nor mind, but the link between its material physical carrier and the ideal contents carried by it." (p.344).

One may criticise or comment on these views[5], but instead I summarise the possible views concerning the position of information, found in literature:

[3] *Descartes is known for his clear cut between mind (non-material) and body (material). This is sometimes called the Cartesian cut.*
[4] *Sveiby (1998) points out that a lot of scientists in experimental psychology and the information sciences see information as meaningful in itself, that information has a meaning independent of the user. Miller (2002) claims that if we lose sigth of the essential truth that information has no intrinsic meaning, "humanity could well be subsumed enitirely within technology in the years ahead to its unfathomable cost".*
[5] *E.g. it may look strange to view information as 'in some sense out there'. On the other hand in our daily life we (sometimes or often) perceive as if information is somewhere out there, e.g. when we actively search for information. A real life example comes from police officer Paul*

1. Information as material object
2. Information as mental object
3. Information as abstract entity (It is neither material nor mental; it is "out there"[6]).

I consider these positions as variations of information-as-thing; information is treated as an object, an entity, a thing. Three variations can be found in literature: a material thing that is informative, a mental object and an abstract entity both referring to the content.

Two basic notions – and its critics

Based on the described similarities between the groupings of information notions, I conclude that information-as-thing and information-as-process are basic notions of information. Apart from the researchers presented in chapter 2, others also discuss (and often criticise) these two notions. E.g. Boland (1987) is well known for his critique on the notion of information-as-thing. He argues that this view with its associated fantasies must be rejected "because they deny the fundamental importance of interpersonal dialogue and the search for meaning through language in a human community" (p.377). He rejects that information is an object, a resource, a commodity but instead, he claims, it is a process of inward-forming, a change in the knowledge, beliefs, values or behaviour of a person. It is clear that Boland sees information as a process and rejects information as a thing.

The famous biologist Maturana (in: Bausch 2000, Murray 1994) criticises both information-as-thing and information-as-process. Information, he argues, is neither a thing or representation in our minds, nor can our nervous system pick up information and process it. Information is a matter of internal construction rather than external instruction.

Also Mokros (1993) criticises the view of information-as-thing. He analyses the consequences of this 'every day' view in two contexts: within the context of psychiatric evaluation & diagnosis and in research of nonverbal and interpersonal communication. In both contexts this view of information creates a problematic misunderstanding of human agency, because information is seen as an unproblematic mapping of reality. This view leads to "a discounting of the inherently relational, constructivist, socially based, or communicative nature of information." (p.58).

Information-as-social construction

The constructed character of information is also present in Braman's notions 'perception of pattern' and 'constitutive force in society'. Also Ruben's notion of information$_s$ refers to the (socially) constructed character of information. Information$_s$ comprises the shared information/knowledge base of societies and other social systems. This resembles the description of Belkin's notion of information-as-social scientific

Broadbent, who said in the BBC television program Crimewatch UK (6-6-2002), that he was sure that "there is a lot of information out there" concerning some unsolved crime.

[6] Apart from Devlin also Dervin (1981: in Callaos & Callaos 2002) uses the phrase 'out there'.

information. Belkin's notion refers to "a relational system of scientific facts, theories, hypotheses, laws and publications, which are the results of humankind's observation of nature and of itself". When we remove the restriction to scientific information, we get an even greater resemblance with Ruben's $information_s$. Also Popper's World 3 (notion 5 of Gelepithis) seems to refer to this information notion (see also Tully 1985 p.206). On the basis of these researchers I suggest a third basic notion of information; information-as-social construction. This notion refers to the shared and constructed information base of social systems.

Information-as-probability

Both Belkin and Gelepithis distinguish a notion of information related to probability, and they both refer to Shannon. In Shannon's formulation, an information source selects a desired message out of a set of possible messages. The amount of information associated with the selected message is related with the probability of that message being sent. Expected messages do not result in information[7].

Shannon's information concept has been applied to many fields other than that for which it was originally proposed: telecommunication (see also chapter 1). At the same time the use of Shannon's information notion is widely criticised (c.f. Belkin 1978, Borgmann 1999, Bryant 2001, Callaos & Callaos 2002), e.g. for being a very limited view on information[8].

Sveiby (1998) points out that Shannon was unhappy with the word 'information' in his theory and that he was advised to use the word 'entropy' instead. For Shannon information is equal to entropy, i.e. chaos. This contradicts with Wiener (1948: in Sveiby 1998) according to whom information is equal to structure (negative entropy)[9], i.e. "a structured piece of the world" (Sveiby 1998 p.4).

Although Shannon's information notion is widely criticised it has also been widely used as several researchers point out. Therefore I consider Shannon's notion a basic notion of information. The notion of information-as-structure, which seems to contradict Shannon's notion, has been found by Belkin and Gelepithis (see chapter 2). This notion is discussed in par 3.2, because I do not consider this a basic notion.

Four basic notions

To summarise, I suggest the following four basic notions of information (see table 9):

[7] *In more general terms one could say that information is only information if it is something new. One step further is to say that information must make a difference; "information is a difference that makes a difference" (Bateson in: Bausch 2000 and in: Sveiby 1998). Information-as-probability is also seen as 'potentiality' (Sveiby 1998); a message exist as a source of potential information.*

[8] *Shannon was not concerned with meaning and the semantic aspects of communication. Instead he focussed on the engineering problem (see e.g. Sveiby 1998).*

[9] *According to Bryant (2001) this contradiction disappears once the realisation comes to light that that Shannon (together with Weaver) focussed on the potential performance of technology for passing signals, and Wiener focussed on the human participants. Apparently entropy is important in the context of engineering and telecommunication, while structure is important in the context of social interaction.*

Basic Information Notions	Description
1. information-as-thing	The content or its physical representation (a material thing, a mental thing or an abstract thing)
2. information-as-process	A mental process of informing/altering
3. information-as-social construction	The shared, constructed information base of social systems
4. information-as-probability	The probability of a message being sent from a set of possible messages

Table 9. Basic Information Notions

I consider these notions the most important of the information notions presented in chapter 2. However some information notions of chapter 2, especially some notions from Gelepithis and Belkin, are not discussed until now. Examples of these notions are information as structure/order, information as resource/commodity, and information as uncertainty reduction. These and other notions will be discussed in the next paragraph. When possible they are related to one of the four basic notions.

3.2 Non-basic notions

3.2.1 Information notions related to information-as-thing

I argue that the following notions presented in chapter 2 can be related to information-as-thing: information-as-product of manipulation (Schement), information-as-resource, information-as-commodity (Braman), information-as-data and information-as-the message itself (Belkin). These notions are explained in this section.

Product of manipulation

I view Schement's notion of information-as-product-of-manipulation as an instance of information-as-thing. Remember his description of this notion: "a **thing**[10] that must be manipulated in order to exist". With this thing a process can be associated; in this case a process of manipulation.

Resource and commodity

From the description of Braman it can be concluded that information as a resource and as a commodity can be viewed as instances of the information-as-thing notion (see also Lauer 2001, p.43). She describes information-as-resource as an entity and information-as-commodity as a resource with economic power[11]. According to Braman the focus of attention of information-as-commodity is on the process of information

[10] *Emphasis added*

[11] *Treating information as a resource or commodity has giving rise to many discussions in economic literature (e.g. Babe 1994, c.f. Belkin p.64/5, Braman 1989 p.238).*

exchange. In other words, when we see information-as-thing we can still focus on process aspects associated with this thing.

The message itself

Belkin proposes an information notion as "the message itself". This notion is not described clearly, but seems to refer to "the contents of a message". In terms of the basic notions this means information-as-non material thing (e.g. mental or abstract object).

Data

Belkin proposes information "as data in value in decision making". The description of this notion (see table 7) refers to the effect of this information; a reduction in uncertainty, which I consider as an example of information-as-process (see par. 3.2.2).

The notion of information-as-data is a common view in the IS field. In this view information is data with meaning attributed to it (c.f. Checkland and Howell 1998 p.95) or simply put: information = data + meaning [12] [13](c.f. Devlin 1999 p.33). While it seems logical to think that this meaning is given by humans, Checkland and Howell (1998) points out that some definitions of information in the IS-field implicitly assume that machines attribute meaning. This suggests that there is only one single meaning related to information. Boland (1987) warns us for such a view where information has only one single immutable meaning, a meaning given by a machine. In this view information is associated with a (material) thing that can be produced by machines; information is data that must be processed or structured (information-as-structured data) by some machine (e.g. an information system) to produce information.

When humans give meaning in the above definition, information is associated with a mental thing (c.f. Callaos & Callaos 2002 p.2). Sveiby (1998) points out that such a distinction between data and information is problematic, "because meaningful information for one user in a specific situation might be devoid of meaning for another user in another situation. What can be defined as information in one context becomes data in another. … A definition of this kind does not bring any further understanding." According to Stamper (1985) the definitions associated with information = data + meaning, treat information as a 'mystical fluid'. This description resembles an abstract thing. He argues that this notion of information is inadequate for scientific investigation.

From these considerations I conclude that information-as-data can be related to information-as-thing (a material, mental or abstract thing).

[12] *I always wonder what common (physical) unit the two operands have in this formula.*
[13] *In this view information has an intrinsic meaning!*

3.2.2 Other information notions

Uncertainty reduction

Uncertainty reduction is often related with the notion of probability. Most probabilistic approaches view uncertainty reduction as the semantic function of information (see chapter 1); the effect of information is a reduction in uncertainty. This reduction depends on the probability of the message being sent.

Belkin's notion of uncertainty reduction views uncertainty reduction as *one particular* effect of information; it changes the state of knowledge. Braman, Buckland and Schement see uncertainty reduction as an *instance* or *example* of one of the notions they propose. Braman views uncertainty reduction as the simplest definition which belongs to information-as-perception of pattern, Buckland as a special case of knowledge and Schement as a process of informing. From these explanations I conclude that the same phenomenon is described but that different aspects are highlighted, viz. the process of altering beliefs (Schement), the knowledge that is changed because of this process (Belkin and Buckland) and the context from which this phenomenon cannot be isolated (Braman). All these aspects seem to me necessary in understanding uncertainty reduction. Solely based on linguistic association I see uncertainty reduction as a mental process, and thus the notion of information-as-uncertainty as a special case of information-as-process.

Information-as-structure

Belkin distinguishes information-as-structure and Gelepithis distinguishes information-as-order. Because Gelepithis does not provide us with a description, it is unclear what this notion is. I assume that order and structure refer to the same thing. According to Belkin (p.80) the one notion common to most uses of information (in information science) is that of structure being changed. It refers to an effect of information, i.e. a change in structure. This change in structure can occur in various "systems" or "conglomerates" (p.79), e.g. the mind (or the image structure of the recipient). In case of structure of the mind, this notion refers to something mental; a mental thing or a mental process. From Belkin's description it remains unclear what is meant by structure of other ''systems" or "conglomerates".

Important to note is that this notion has no relation with Wiener's information-as-structure (c.f. Belkin p.79), who described information as "a structured piece of the world". This description of Wiener seems to view information as a thing. Sveiby (1998) points out that as a consequence of Wiener's notion, it is often suggested that by "adding value" or by selecting, interpreting and updating information, a higher form of information (e.g. knowledge) can be obtained[14]. Often a hierarchy is proposed where information

[14] *The relation between knowledge and information is a highly debated issue in literature, esp. in literature on Knowledge Management (e.g. Al-Hawamdeh 2002, Wilson 2002). One problem is that different perceptions of knowledge exist.*

is seen as *structured* data. In this view information is produced or created by structuring (or processing) data[15]. I relate information-as-(structured)-data with information-as-thing (see previous section).

Truth conditions

Gelepithis proposes the notion of "information in terms of truth conditions". It is not clear what he means by this. Because other researchers do not describe this notion, I do not consider it to be very important and therefore not as a basic notion.

Sign as primitive

In chapter 2 I explained shortly what is meant by sign as primitive and its relation to information. Information has different meanings, dependent on the area of semiotics. On the basis of Stamper's description of these areas (Stamper 1985) I argue that information-as-probability is an important notion for empirics. Information-as-data (which I related before with information-as-thing) is an important notion for syntactics. For semantics I suggest that information-as-mental process is important and for pragmatics I suggest information-as-social construction as an important notion. So the 'notion' of information-as-sign as primitive is in fact not a single notion; it is a basic principle of semiotics, and a framework for organising various ideas concerning information.

Popper

Gelepithis also proposes the notion of "information conceived in terms of the Popperian conception of the three worlds". In chapter 2 I explained shortly these three worlds, and remarked that it is not clear what Gelepithis means by this notion. Although this is still true, it is remarkable that three basic notions can be related to these three worlds of Popper. Information-as-thing in its material variation belongs to World 1, information-as-thing in its mental variation and information-as-process belong to World 2 and information-as-thing in its abstract variation and information-as-social construction belong to World 3. Only for information-as-probability I am not certain where to position it.

3.3 Concluding remarks

In the previous paragraphs almost all the notions presented in chapter 2 are related to the four basic notions. Some notions however could not be related to the basic notions, because they were not described clearly enough (e.g. information as truth conditions). Also some notions are used in various ways (e.g. uncertainty reduction) and could be related to more than one basic notion. Because almost all the notions of chapter 2 could be related to the basic notions, I argue that these basic notions reflect (or present or summarise) the information notions of chapter 2.

[15] *This contradicts with the Data Processing Theorem of Shannon and Weaver, which states that data processing may transform data to a more useful form, but it cannot create information. In fact data processing destroys information that was available in the data before processing. However the processed data is more usable for humans because of the limited bandwidth of human perceptual and cognitive apparatus. In other words; information-as-structured-data takes into consideration the human cognitive apparatus while the Data Processing Theorem, and its*

I also argue that the basic notions reflect the most important uses of information in literature. The main argument is that the notions presented in chapter 2 (on which the basic notions are based) are in my opinion a sound and comprehensive reflection of the ways in which information is perceived in the literature. The researchers presented in chapter 2 have analysed - most of them in a transparent way - information notions from a wide variety of fields. In addition I used several other important researchers (different from the ones in chapter 2) to make my case for the basic notions.

To conclude, I consider the four basic notions to be the most important notions in literature[16].

related notion of probability, do not. This resembles the contradiction between information-as-entropy (related with probability) vs. information-as-negative entropy (related with structure). See par 3.1.

[16] *This doesn't mean I am not open for discussion.*

Chapter 4 - Four basic notions: so what?

The previous chapter ended with the conclusion that the four basic notions are the most important notions in literature. In the introduction of this paper it was stated, that it is important to know which information notions exist, because of their influence on the IS-field and on our perception of information management. But how are these basic notions useful for IS-research? And could there be a relation between the basic notions and various perceptions of information management? In this chapter I share some of my ideas concerning these issues. These ideas are not fully developed and, because of that, they may serve as a basis for further research.

My first idea is that the way information is used (e.g. in an article) could be translated into terms of the basic notions. In the first paragraph of this chapter an example is given; the description of different information approaches (as described by Newman in chapter 1) is translated into terms of the basic notions. Such a translation may become useful once we understand the different assumptions of the basic notions and the consequences of using them. In the second paragraph I comment on these consequences and share some ideas concerning the use of information notions in IS research. In the third paragraph I relate different perceptions of information management with the basic notions. I end this chapter with some remarks on the strong relationship between information (notions) with philosophical issues.

4.1 Newman in terms of basic notions

The purpose of this paragraph is to show an example of how basic notions can be used to describe the use of the term information. In this case the basic notions are used to describe the use of the term information in the various information approaches of Newman (see chapter 1). In the first section (4.1.1) I make some remarks on the dimensions of Newman. In the second section (4.1.2) Newman's information approaches are described in terms of the basic notions.

4.1.1 Dimensions of Newman

Newman identifies three dimensions of similarity/difference in the way information is used and defined (see chapter 1). Newman also relates these dimensions with the different approaches to information, by means of table 10.

	Information is produced/immanent	Cognitive models required	Uncertainty reduction is fundamental
Probabilistic	Immanent *	- **	Yes *
Information Processing	Produced	Yes	No
Ecological	Immanent	No	- **
Social/ Organisational	Produced	Yes	No (information economy) Yes (IS research)

* valid for most approaches, ** issue is ignored by approach

Table 10. Approaches to information and dimensions

The first dimension of Newman, produced vs. immanent, is related with the problem mentioned in chapter 3 about the difficulty to position information as part of the material or non-material (mental or non-mental) world. If information is immanent ('out there'), it is an abstract entity. If information is produced it is something mental (when meaning is given by people) or something material (when meaning is given by a machine). Because it seems natural to view meaning given only by people, it is logical when information is produced, cognitive models (second dimension) are needed to understand information. This relation is present in table 10.

Concerning the third dimension, uncertainty reduction, I view this as an example of a mental process (see chapter 3). It is therefore surprising that the probabilistic approaches, which consider uncertainty reduction as fundamental to information, do not consider cognitive models. A possible explanation is that they assume a very simplistic cognitive model or that they focus on a small aspect of the phenomenon of uncertainty reduction, viz. the non-mental process that occurs before the altering of beliefs. In other words, they focus on the transmission of signals and not on the mental process that follows.

4.1.2 Newman's information approaches in terms of the basic notions

I have tried to relate the information approaches, as Newman describes them, with the basic notions. The result of this attempt is given in table 11, but first I will explain my choices.

The Probabilistic approaches use the notion of information-as-probability and see uncertainty reduction as a fundamental property of information. It should be noted that the last observation is not valid for all probabilistic approaches (see table 10). The Information Processing approach views information as the product of thinking, in other words as a mental thing. It also focuses on information processing as mental process. The Ecological approach views information as a new kind of abstract entity, which is immanent, in other words as an abstract thing.

Some of the Social and organisational approaches view information as uncertainty reduction. They also view information as the product of data processing. Newman does not explain this any further, but a common view is that information is data with meaning attributed to it (see par 3.2). Information as data with meaning can be seen as information-as-thing (see again par 3.2). When information is viewed as data with meaning given by humans, one may argue that this is not done in isolation but in dialogue, through language in a human community. Therefore some social approaches (c.f. Braman 1989 p.240) view information as a social construction. Because Newman does not mention this, information-as-social construction is not present in table 11.

In table 11 the use of information in the various information approaches, as Newman describes them, is interpreted in terms of the basic notions.

Approach to information	Basic notion used in approach
Probabilistic approach	-as-probability
	-as-process (viz. process of uncertainty-reduction)
Information Processing approach	-as-thing (variation: mental)
	-as-process
Ecological approach	-as-thing (variation: abstract)
Social and organisational approaches	-as-thing (all variations)
	-as-process (viz. process of uncertainty-reduction)

Table 11. Information approaches and Information notions

This paragraph has served as an example of how basic notions can be used to describe the use of the term information. Such a description may become useful once we understand the different assumptions of the basic notions and the consequences of using them.

4.2 Basic notions and IS-research

All notions are important

In my opinion it is important for an IS-researcher to be aware of different information notions. It also seems to me that there is no ground to say that one notion is more important than another. Several researchers (e.g. Callaos & Callaos 2002 p.5, Ruben 1992 p.25) warn for a one-sided view on a notion of information, esp. information-as-material thing. Also information-as-probability is widely criticised, e.g. for being a very limited view on information. From this criticism one may conclude that this notion is not well suited for fields where social communication is relevant (e.g. IS-research).

I think that in IS-education and IS-research no significant attention is given to the notions of abstract-thing and social-construction. Concerning information-as-abstract-thing, it is said before in chapter 1 that Newman regards the Situation theory as an exciting development in our understanding of information. In Situation theory information is viewed as something abstract which is out there. An interesting book for IS-researchers, which is based on the Situation theory, is InfoSense of Devlin (1999).

A link between notion and research paradigm

When doing research, it can be fruitful to choose one information notion, especially if the notion aligns with the underlying paradigm of the research. It is important to explicate this link. To do this Callaos & Callaos (2002) and Krippendorff (1993) can be of help. Callaos & Callaos (2002) relate two main conceptions of information, an objectivist and a subjectivist conception[17], with Empiricism and Rationalism respectively. I relate the notions of information-as-probability, as-material thing and as-abstract thing with the objectivist position (truth is in the object) and the notions of information-as-mental thing, as-process and as-social construction with the subjectivist position (truth is in the subject). Krippendorff (1993) describes four paradigms of information, on the basis of Maruyama (1974 in: Krippendorff 1993); hierarchical, isolationistic, homeostatic and morphogenetic. I relate these paradigms with information-as-thing (material), as-thing (mental), as-process and as-social construction respectively. For each paradigm the following elements are described: a particular ontology of organisation, a notion of causality, pattern of reasoning, philosophy, individual values, and a primary stimulus of social development. E.g. information-as-material thing is related with absolutism and a deductive, axiomatic, theological pattern of reasoning.

Consequences of a notion

When choosing an information notion for research (and also a corresponding paradigm of research), we must be aware of the consequences. E.g. because other information notions are left out, conclusions of the research does not automatically apply to these excluded notions. As said before several researchers warn for a one-sided view on a information notion. The best example is Boland (1987) who criticises information-as-thing. With this notion he relates different fantasies, e.g. information is power, information is intelligence and information is perfectible. He also remarks that information-as-thing assumes a simple one-for-one mapping between words in a language and objects or conditions in the world.

Another possible consequence of choosing a particular information notion is the (often implicit) choice of a particular notion of related concepts, e.g. communication. E.g. Mokros (1993) relates the notion of information-as-thing with the so called conduit (or pipeline) metaphor of

[17] *The objectivist position views information to be "conceived as completely independent from their senders and receivers, and as a neutral reflection of real world structure or order" (p.5). According to the subjective position "information is generated inside the mind of a person, a subject." (p.3). Callaos & Callaos view these conceptions of information as opposite, but not as contradictory. They propose a systemic notion of information based on a distributive notion of truth. This places truth in the subject (Rationalism) in the object (Empiricism), in the action of the subject on the object (Pragmatism, as in the Systems Approach of Churchman 1971) and in the action of the object on the subject (e.g. in terms of empirical sensations). In other words the distributive notion of truth places truth in the subject, the object and what relates them.*

communication[18]. This metaphor views communication as the "placement of ideas, viewed as objects, into words, viewed as containers for ideas that are then sent along a conduit to a hearer who then takes the objects (ideas) out of their containers (words).… Basic to the conduit metaphor is the notion that real, thinglike objects are exchanged in communication, objects which are increasingly referred to as information" (p.62). The assumption that communication involves intentional and efficient message exchange is "an extension of the basic thingness assumption of information in that it presupposes a view of communication in terms of a one-to-one correspondence between some reality and the symbolic representation of that reality in communicative messages." (p.65). This view denies e.g. the possibility of unintentional, unconscious or irrational communication.

The importance of metaphors

Luhmann (in: Bausch 2000) claims that the conduit metaphor is the common metaphor for communication in our society and Lauer (2001) points out that the conduit metaphor is commonly used in the IS-field. Both Luhmann and Lauer point to the dangers involved in using this metaphor. Lauer argues that pervasive use of this metaphor in the way we conceptualise information and communication leads to confusion and problems e.g. "the expectation of trouble free communication with little effort. If the requisite information has been properly packed in a message, only someone who is deficient could fail to get it out. This partitioning of responsibility between the sender and the recipient often results in reciprocal blaming for communication failure." (p.43).

Lauer (2001) proposes theories of metaphor from the cognitive sciences as a basis for understanding basic concepts, like information[19]. Also Bryant (2002) points to the importance of metaphors. Metaphors are not "merely some form of linguistic baggage that illuminates or obscures reality; they are crucial in constituting that reality" (p.10). Mokros (1993) suggests that "a focal aim of research is to unpack the assumptions we hold. The most important are implicit… Before we may unpack them they must be stated and this is in and of itself is no easy proposition…" (p.77).

Notions are related

It seems logical to think that the information notions are in some way related to each other. Several researchers who propose different information notions also argue that their notions are related (e.g. Ruben 1992). Callaos & Callaos (2002) relate different notions of information by proposing a systemic notion of information. They distinguish two main conceptions of information: objective and subjective information[20]. In their systemic notion, information should be considered four-folded: subjective information, objective information, and the two processes that relate them.

[18] *Also Luhmann (in: Bausch 2000) relates the conduit metaphor with information as thing.*
[19] *One of the metaphors he discusses, is information as a resource. He concludes that this metaphor retains "the assumption that information is an object that can be manipulated in some manner and then transmitted. The majority of effort goes into the production of information with the assumption that usage (understanding) is trivial." (Lauer 2001 p.43).*
[20] *I've already related the basic notions with these two conceptions.*

In any situation, where we speak of information, all information notions seem to play a role, although in a particular situation some information notion(s) may be more important than others. E.g. an article may be called information. The paper itself is information-as-material thing, a representation of the content. The content may be viewed as an abstract thing out here. The reader of the article is (hopefully) triggered to change his beliefs; he gives meaning to the information (information-as-process) individually and in dialogue with others. An article is also information-as-social construction; it is shaped by the context (e.g. literature, in dialogue with others, writer's background and intentions) and it may change the context (e.g. accepted standards, values and norms)[21].

Research on a unifying framework/theory

Several researchers from a wide a variety of disciplines have started a search for a unifying framework or theory of information (e.g. Hofkirchner 1999). Stamper (1985) argues that semiotics, "with a two thousand year history" (p.195), provides such a theory.

Although one may question the possibility of a unifying framework, research in this direction is relevant for understanding information, and thus relevant for IS-researchers. One of the issues discussed here is concerned with the different levels on which information can be analysed. Several researchers propose various levels of analysis in different variations, e.g.

- Empiric, syntactic, semantic, pragmatic level (e.g. Haefner 1999, Liebenau & Backhouse 1990, Stamper 1973, Stamper 1985)
- Physical, biological, individual (e.g. psychological), organisational, societal level (e.g. Haefner 1999, Heng 1995, Ruben 1992)

A good understanding of issues like these can deepen our understanding of the way information is used and are therefore relevant for IS-researchers. I think it is possible to relate the basic notions with different levels on which information can be analysed.

4.3 Basic notions and Information Management

According to Choo (1997) information management (IM) is often equated with the management of information resources and the management of information tools and technologies (see also Bryant 2001 p.18). This view focuses on production and provision of the resource 'information'; it mainly uses the notion of information as material thing. Its purpose is to provide the right 'information-thing' to the right person, in the right place, on the right time. Information is a thing and its creators, processors and users as "discrete and isolated entities" (Braman 1989). It is clear that ICT plays a prominent role in this perception of IM, because the processes related to production and provision of this information-thing, are well suited to be supported by ICT.

[21] *An article as information-as-probability is difficult to envision; I did not choose this article out of a set of possible articles.*

This focus on information-as-thing seems to me very one-sided. Stamper (1985) argues that the range of problems related to the use of information for business and social purposes calls for "the broadest vision of information." (p198). I've argued that the information notions are related in some way and that all information notions are important, although information-as-probability is less useful for IS-research. In my opinion it is therefore necessary for IM to be concerned with more than one information notion. So, besides information-as-thing, IM must also be concerned with information-as-process and information-as-social construction. For instance the way information is handled by individual people and groups of people are important issues for IM. It is clear that language, meaning, dialogue and social communities play a major role in understanding these issues and are therefore also important objects of study for the IS-field. These issues are by no means simple, e.g. Korn (2001) and Stamper (1973) describe a vast variety of ways in which humans use information.

To summarise, I distinguish the following two perceptions of information management:

1. The narrow view: management of information as a thing (a resource) with heavy focus on ICT. Information management equals information resource management.
2. The broad view: management of information in all its perceptions

To conclude, I agree with Kirk (1999) who claims that "If information management is to influence the development of the organisation then it should recognise as many categories of information as possible" (p.12).

4.4 Basic notions and philosophy

It is remarkable that several philosophical issues arise when dealing with information. In chapter 3 the philosophical problem about the relation between mind and matter was mentioned. Also research concerning a unifying theory of information pays heavily attention to philosophical issues, e.g. on the question what is reality? How do we know reality?

The basic notions I propose are not based on a philosophical basis. Because the basic notions are only a reflection of how information is used, this is not strictly necessary. However, to understand information, it is in my opinion necessary to be concerned with philosophy[22]. It is particularly useful to learn from philosophers who try to describe the essence of information. One of them is Borgmann (1999), according to whom the relation with reality is fundamental to information. He proposes three different manifestations of this relation; information can illuminate reality (information-about-reality), transform reality (information-for-reality) and displace reality (information-as-reality). The central structure of information consists of the relation between a sign, a thing (in a certain context) and a person (with certain intelligence)[23]. I consider Borgmann's perspective useful in understanding information and it is not too difficult to relate Borgmann's perspective with the four basic notions I propose.

[22] *This means for instance that information related courses must pay attention to philosophy.*
[23] *This resembles the systemic notion of Callaos & Callaos (2002): Objective information is positioned at the thing or the sign. Subjective information is positioned at the person. The processes that relate these two refer to the relation with reality.*

Conclusion

Our perception of information management depends on our perception of information (Kirk 1999). Because of its strong influence on the IS-field, it is important to know which perceptions of information exist in literature. The primary goal of this paper is to inform the reader how information is treated in literature of various disciplines. On the basis of this literature, I propose four basic notions:

1. Information-as-thing: three variations exist in literature; a mental object, an abstract object both refer to content) and a material thing (the representation of content)
2. Information-as-process: a mental process of informing/altering
3. Information-as-social construction: the shared, constructed information base of social systems
4. Information-as-probability: the probability of a message being sent

In my opinion these basic notions are the most important uses of information in literature. They may serve as a kind of summary of how information is treated; they make visible the important differences in the use of information and can be used to analyse these different uses. However not all details of variations in the use of the concept information could be made clear by the basic notions. Still, in my opinion it is important to understand the basic notions, their assumptions and the consequences of using them. I am aware of the fact that these assumptions and consequences of using them were not analysed in detail in this paper. This is because the focus was on the question which notions are most important in literature.

Concerning information management I argue that traditional information management is only concerned with information-as-thing. Because this is quite a narrow view on information and because this notion is related to other notions, I argue that information management must consider information in all its perceptions.

Still a lot of questions remain unanswered. The following questions are in particular interesting and well suited for further research:

1. Questions concerning the basic notions of information

What exactly are its assumptions, limits and consequences? How exactly do these notions relate to each other?

Can these notions related to different perceptions of other concepts, like communication? In this paper these issues are only discussed briefly.

2. Questions concerning perceptions of information management

What does it mean to manage information in all its perceptions? E.g. how do we manage information-as-social construction? Which perceptions of information management exist in literature? What are its assumptions and consequences? How exactly do these perceptions relate to information notions and why?

Can perceptions of information management be related to other concepts? Kirk (1999) proposes that perceptions of information management are also dependent on perceptions of organisations and the work of managers; "Information Management has multiple meanings. Its meanings are shaped by different perspectives on information, on organisations and on the work of managers" (Kirk 1999 p.14). In this paper only two perceptions of information management are shortly proposed, but an extensive analysis of information management in literature is needed to extend, ground and detail these perceptions.

3. Questions concerning practical opportunities

How are information and information management perceived in organisations? Considering these perceptions in the field, are there any differences between different organisations and/or different parts of organisations? If so, why? This paper does not give an answer to these questions. It is however important to note that a deeper understanding of information management may (hypothesis!) lead to better performance. In turn a deeper understanding of information management starts with a deeper understanding of information.

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