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The History of Information: Lessons for InformationManagement

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Abstract
Information is a central yet difficult concept for information management. To understand the meaning of information today, it is important to understand its history. The goal of this paper is to provide an understanding of this history and to make explicit important lessons from this history for information management. First, a model of informationâ s history is presented that explicitly focuses on informationâ s relation with ontology and epistemology. Second, the history of information is described using this model. This history is then used to explicate lessons for information management today, as it has been unrealistically restricted by a narrow, objective understanding of information. The history of information provides several directions to change this embarrassing situation.

Keywords: information, history, information management, ontology, epistemology

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The History of Information: Lessons for Information Management

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Information is a central yet difficult concept for information management. To understand the meaning of information today, it is important to understand its history. The goal of this paper is to provide an understanding of this history and to make explicit important lessons from this history for information management. First, a model of information's history is presented that explicitly focuses on information's relation with ontology and epistemology. Second, the history of information is described using this model. This history is then used to explicate lessons for information management today, as it has been unrealistically restricted by a narrow, objective understanding of information. The history of information provides several directions to change this embarrassing situation.

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1. Introduction

The abundance and diversity of definitions of information makes this central concept of information management difficult to understand. There are many different concepts of information in different research areas and even in the same research area different information concepts are used. To cope with this confusing situation, we must know how information concepts are used and, if possible, why they are used with their specific meanings. One important step in this direction is to understand the history of information, i.e. to understand how information has been used in the past. It is my conviction that once we understand this history, we have a better understanding of today's information uses and meanings; not only in science, but also in our organizations and in the society at large. The goal of this paper is to provide this understanding of information and to make explicit important lessons from information's history for information management. This is done through a model by which different meanings in the history of information are compared.

Section 1 starts with the observation that the meaning of information is closely connected to its accompanying view of knowledge (epistemology) and reality (ontology). These elements, or variables, can be used to distinguish between the different meanings of information in different periods in its history. The variables and the different periods form two axis of a matrix which I call a model of the history of information. This model is elucidated in section 1. In section 2 each cell of this model is described in detail, i.e. the history of information is described for each period in terms of the two variables. In section 3 reflections are made on the question what the history of information could mean for information management today.

2. A model of the history of Information

The model of information's history presented here, consists of two axis: a vertical axis that represents important periods in which information has distinct meanings, and a horizontal axis that represents information's relation to ontology and epistemology. These axis are explained in this section.

Historical periods: vertical axis

On the basis of a variety of sources (for example Capurro & Hjorland 2003, Peters 1988) I distinguish between the following periods in the history of information (see Table 1).

PERIOD	
Name	***Time period***
Latin period	1st century BC - 11th century AD
Scholastics	12th-16th century
Rise of modernity	17th and 18th century
Rise of state bureaucracies	19th century
Rise of a modern information society	20th century until today
Reaction on modernism	End 20th century until today

Table 1. Vertical axis: historical periods

I admit that the boundaries between the indicated periods are debatable[1]. This is for one part due to my decision not to leave gaps between the periods and not to allow overlapping periods. One must keep in mind that I have chosen the periods in the context of the history of information. This means for instance that I held the Scholastic view of information dominant until the end of the 16th century. Another remark on these periods concerns the changing of information's meaning. At the beginning of each of these periods the meaning of information didn't change suddenly. The meaning of information transformed gradually, mostly because the context in which information was used, changed gradually. There are some important 'events' that had a huge impact on the meaning of information[2], but to reach full impact of these events, it took decades rather than years.

Finally, it is also clear that these six periods only give a global historical overview of information's meaning. This means for instance that not all theories related to information in the 20th century are described. However, I am convinced that this global history provides important background to understand the meaning and theories of information in our contemporary society.

[1] For example my choice for the 16th century as the ending century of the Scholastics period while the 15th century is more common. One can also argue that the rise of the state bureaucracies started in the middle of the 18th century as Peters does (1988;p14).

[2] For example Descartes' introduction of the 'doctrine of ideas' and the publication of the Information theory of Shannon in 1948.

Relation to ontology and epistemology: horizontal axis

Both ontology and epistemology play a crucial role for the concept of information, i.e. its meaning is defined by ontological and epistemological positions (see for example Burrell & Cooper 1988, Capurro & Hjorland 2003, Falkenberg e.a. 1998, de Mul 1999, Krippendorf 1993[3]). This strong relation with ontology and epistemology can already be found in the case of the Latin roots of information where information was used to translate Greek philosophical concepts (Capurro & Hjorland 2003), but also today, where information is seen as a metaphysical principle (for example Wiener 1961 in: Capurro & Hjorland 2003;p359). Information has always been closely connected to the reigning epistemologies and ontologies of their time. These relations make them perfect candidates for discriminating between different historical meanings.

The variable 'relation with ontology' refers to the meaning of information in terms of the processes that in-form matter and the philosophical concepts of form (for example the ideal form of Plato). The variable 'relation with epistemology' refers to the meaning of information in terms of the processes that in-form mind and its relation to knowledge. In the next section it is made clear that the meaning of information in different historical periods differs in terms of these processes, concepts of form and knowledge. It will also become clear that sometimes information's relation with ontology seems to be more important and sometimes its relation with epistemology.

Another possible candidate for a variable that discriminates between the different historical meanings of information is its domain of use[4]. I argue that the meaning of information cannot be separated from its (domain of) use, making it a poor candidate for a variable. That is not to say that the domain of use is not important for the meaning of information. Just because it is important, the next section on the history of information starts with a description of how and where information was used in the different historical periods; to provide the reader the necessary background to understand the history in terms of its relation to ontology and epistemology. Another candidate for a variable is the distinction between process and thing (c.f. Boland 1987, Buckland 1991[5]). The next section on the history will indeed show that important shifts in information's meaning took place in terms of processes and things. However, these processes and things can be related to ontology and epistemology, making the distinction between process and thing as a separate variable superfluous. A last possible candidate is

[3] He describes several differences (a.o. ontology of organization, philosophy) between four paradigms for information.

[4] One could for instance think about different sciences, each with their own object of investigation and the different associated meanings of information. However, not the object of science itself seems crucial for the way information is perceived, but instead the stance towards epistemology and ontology. The same kind of reasoning applies for different semiotic layers where information (or better signs) play different roles.

[5] Buckland (1991) uses the distinction between process and entity.

the distinction between tangible and intangible meanings (for example Buckland 1991). However, what is tangible and intangible starts with an ontological position[6], making this distinction 'only' secondary.

This leads me to conclude that the relation with ontology and epistemology are the most important variables to discern between the different meanings of information. These variables form the horizontal axis of the model (see Table 2).

Information's meaning	***Relation with ontology***	***Relation with epistemology***
	a. Process of shaping matter	a. Process of shaping mind
	b. Form	b. Relation to knowledge

Table 2. Horizontal axis: relation with ontology and epistemology

It is clear that information's relation with ontology and epistemology are related to one another. This is in general the case as the way reality is perceived is related with the view of how knowledge of this reality can or cannot be obtained. Concerning information's relation with mind and matter, the relation between ontology and epistemology is even more obvious when mind is perceived as matter. On the other hand when mind and matter are seen as sharply separated (for instance during the rise of modernity), the relation between the two variables is less obvious.

How we use information, i.e. what meaning we give to information, affects the way we see the world (Boland 1987;p365) and ourselves (Thayer 1993;p107), especially when we define the world in terms of information as many do today. But this also works in the opposite direction: a particular worldview asks for a suitable view of information. Information's meaning is shaped by how we see the world, or how we want it be[7]. In short information's meaning is defined by its relation with ontology and epistemology.

[6] See Buckland's remarks on knowledge which may be presented in a tangible way and on becoming informed as a tangible process.

[7] For example in a world viewed as only consisting of matter and energy some principle of order is missing and information, viewed as structure, has filled this vacant position (Borgmann 1999;p11). Day (2001) shows how information has been used in the 20th century by institutions and through the use of rhetorical devices for the purposes of ideological control. Peters (1988) shows that how we use information today is strongly related with an ideology of progress. And Braman (1989) remarks in a context of information definitions for policy makers that "the first decision that must be made is about the shape of the society that is desired" (p242).

3. The History of Information

In this section the history of information is presented by using the model described in the previous section. Each variable is described for the different historical periods. As it can be difficult to understand the different variables in the different historical periods, first a general description is given of the meaning of information for each period. Special attention is given to the context in which information was used. Table 3 presents a summary of the elaborated model; in this section each cell in this table is described.

Period	***Meaning***	***Relation with ontology*** a. Process of shaping matter b. Form	***Relation with epistemology*** a. Process of shaping mind b. Relation to knowledge
Latin period	Information is used to translate Greek (philosophical) concepts and means to impose a form on something (matter/mind), and different philosophical concepts related to this process	a. Imposing a form on matter b. Idéa & morphé	a. Imposing a form on the mind b. Forms as a potentiality for knowledge
Scholastics	Information is used in the context of scholastic hylomorphism and means the in-forming, the active shaping, of the universe	a. The active shaping of the universe b. Metaphysical form	a. Imposing a form on the mind b. Sense & Intellect
Rise of modernity	Information is used in the empiricist context of human, subjective, sensual experience and means the in-forming of the mind & senses	a. Relation with scholastic ontology becomes obsolete b. Obsolete	a. Imposing a form on the mind & senses b. Sense experience giving sensory knowledge
Rise of state bureaucracies	Information is used in the context of state control and bureaucracies and means thinglike knowledge outside humans reach	a. Obsolete b. Obsolete	a. Obsolete b. Thinglike knowledge without the human
Rise of a modern information society	Information is a scientific and technological notion used in all areas of life. It means thinglike knowledge and abstract essence; de-humanized, factual and quantitative	a. Obsolete b. Building block of the universe	a. Obsolete b. Thinglike, privileged form of knowledge
Reaction on modernism	Information is used in the context of the human world where multiple meanings abound. It is part of a continuous process of constructing meaning	a. Part of the process of shaping the social world b. Obsolete	a. Part of understanding b. May play a part in gaining knowledge

Table 3: The history of information: a summary

Introduction: general description of information's meaning

The English word 'information' comes from the Latin words 'informare' and 'informatio' (Capurro 1996, Callaos & Callaos 2002, Peters 1988). Informare meant to shape matter and mind in a philosophical, moral or pedagogical sense (i.e. to instruct, to educate) (for example Capurro 1996, Schement 1993). The word informatio is the noun that refers to this process and also refers to concepts related to this process, especially the concept of Form as a potentiality for knowledge. These words were used in two contexts (Capurro & Hjorland 2003); an intangible and a tangible context. In the tangible context informatio is used to strengthen the act of giving a form to something[8]. In the intangible context informatio was mainly used in a philosophical context. It appeared in translations and commentaries of Greek philosophical concepts like hypotyposis, prolepsis, eidos, idéa, morphé and typos[9].

During the Middle Ages, the Latin words informatio and informo became to be used by the scholastics in the context of the doctrine of hylomorphism; things consist of form and matter. The form informs matter, the matter materializes the form[10]. This idea served as a master principle in much late medieval religion and science. Information refers to the order and structure of the universe; of matter that gained its identity by the forms or essences that imbue it. It was part of a "world of animated essences and living forms quite divergent from our own" (Peters 1988;p11)[11]. When the English words informe and informacioun emerged at the end of the 14th century (Bawden 2001, Callaos & Callaos 2002, Schement 1993), they also appear to have been conditioned by the reigning Aristotelian doctrine of hylomorphism (Peters 1987;p10).

During the rise of modernity, medieval ideas and institutions fell into disrepute. In early modernity the context in which information was used shifted from the world at large to the human mind and senses (Peters 1988). At first information did not play such an important role as other words like impression and idea, but it was soon deployed in empiricist philosophy because it seemed to describe the mechanics of sensation: how objects in the world in-form the senses. Information came to refer to the in-formation of the senses, the process by which the world impresses itself on the senses. The context in which information was used shifted from objective, intellectual forms to the subjective, sensual

[8] The prefix 'in' is used here to strengthen some act; the act of giving a form to something. This prefix can also be used in a negation.

[9] These concepts were also translated by using other Latin words, for example eidos has been translated as 'idea' or 'forma' (Callaos & Callaos 2002;p4) or 'species' (Capurro 1985;p4).

[10] As Borgmann (1999;p9) puts it "information was the companion of materialization".

[11] Peters gives several examples, cited from the Oxford English Dictionary, to illustrate information's concern with order and animated essences. One example is a play of George Chapman of 1605, in which Chapman provides hylomorphic accounts of vegetation, astronomy, color, love, virtue and beauty. Information here has everything to do with the embodiment of form and the active shaping of the world. Even man is, according to Aquinas, a union (or in-formation) of matter and soul (anima); the soul informing matter (Capurro 1985;p4).

experience of empiricism12. "Information, like the early modern world view more generally, shifted from a divinely ordered cosmos to a system governed by a motion of corpuscles." (Peters 1988;p13)

The 19th century is characterized by the expansion and acceleration of the social-economic system together with a transformation in capacities to process information[13]. At the level of modern states, governments and citizens were faced with the problem that the state and its citizens were out of sight and out of grasp. To deal with this problem, large state bureaucracies arose. Statistics[14] was the necessary ingredient for these bureaucracies. It arose as the study of something too large to be perceptible for an individual, for example rates of birth, crime, economies etc., and secondly as a set of techniques for making these things visible, interpretable, factual and manageable (Peters 1988). Peters (1988) calls this a new kind of empiricism; instead of the individual, the state became the knower, the bureaucracy its senses and statistics its information. The site of information shifted from the individual to the state and came to be related to knowledge. It ceased to be a process of informing, but instead it became "thinglike" knowledge used in the context of state control.

In the first half of the 20th century information was a relatively unknown notion for the general public (c.f. Schement 1993). Only in the second half of the 20th century information moved to center stage (c.f. Borgmann 1999;p9). The birth certificate of information, as Borgmann (1999) calls it, as a prominent word in our society is the Information Theory of Shannon and Weaver in 1948. This theory provided information with a mathematical definition[15]. It excited many people and had a huge impact on various scientific fields[16] [17]. Fuelled by the exciting scientific and technological developments[18], it became fashionable in English and other languages (Capurro & Hjorland 2003;p390). Information lost its connection with the context of state control, instead information was reborn as a scientific and

[12] The problem with sense experience is that without some ordering, experience becomes chaotic, scattered and profuse. How then could scientific knowledge be obtained on the basis of sensory experience? Empiricists like Locke and Hume provided different solutions to this problem.
[13] New techniques and technologies related to information were developed for example the electrical telegraph, Morse code, steam-powered printing press, photography, mechanical calculators and typewriters. In a century of growing organizational complexities formal recognition began to be given to the importance of administrative information systems (Black 2001;p65). Black (2001) calls Victorian Britain of the 19th century an early information society.
[14] It originally meant the comparative study of states.
[15] In its simplest form: information = - log p(i), where p(i) is the probability of signal i.
[16] "The theory may have seemed so exciting because it showed how to make something already familiar through the bureaucratic institutions of everyday life into a lofty concept of science and technology. It offered an indirect way to transfigure bureaucracy, to give it a halo." (Peters 1988;p18).
[17] In several sciences information became a central concept. For some scientists (for example Devlin 1991 in: de Mul 1999, Gelephitis 1999) information is so fundamental that it is regarded as a basic property of the universe in addition to matter and energy.
[18] Together with developments in cybernetics and technological theories, information theory built the foundations for developments in computer science and information technology.

technical notion and came to be applied, through its general applicable quantification, in all areas of life, for example the human mind, society and even life itself are explained in terms of information. Information became a crucial building block of the universe and in this universe humans are mere information agents, entities through which information passes on[19]. Information became more and more equated with factuality, which helped raise it to a privileged form of knowledge.

At the end of the 20th century voices that put the discourses of modernity into question grew louder and louder, especially how we can know reality. This has important consequences for the status and meaning of information. The idea that information is a building block of an objective reality that exists somewhere outside us, is abandoned in favor of a view where multiple realities exist and where each reality cannot exist without people's perceptions. The idea that information is something factual, contains true knowledge of reality, is abandoned as true knowledge of reality does not exist anymore. Instead it is replaced by constructs of meaning and systems that produce meaning like language. These reactions on modernism lead in the second half of the 20th century to several endeavors which together weave, what I call, a subjective view of information as opposed to the objective view of late modernism. In these endeavors the concept of meaning seems to be of particular importance for information. There no longer exists an objective, external and true meaning outside us, that could be found in information (Stamper 187), but instead meanings are seen as always ambiguous and multiple; they can only be found in 9 active *human*[20] involvement in day-to-day living (Wittgenstein 1974 in: Boland 1987). Interpretation, language and the social context are seen as important elements in the continuous search for meaning, and information came to be used in relation to these human contexts (for example Introna 1997, Choo 1998, Braman 1989).

[19] This makes equating humans and computers easy, for the materiality needed for information looses its meaning (c.f. Hayles 1999).

[20] Meanings are *human* artifacts (Thayer 1993;p112) and the search for meaning is a *human* endeavour (Boland 1987;p377, Checkland & Holwell 1998;p92/97, Stamper 1987;p48). Information is thus a *human* phenomenon (c.f. Machlup 1983 in: Capurro & Hjorland 2003;p358).

In Table 4 the meaning of information is presented for each of the six periods in the history of information.

Period	***Meaning***
Latin period	Information is used to translate Greek (philosophical) concepts and means to impose a form on something (matter/mind), and different philosophical concepts related to this process
Scholastics	Information is used in the context of scholastic hylomorphism and means the in-forming, the active shaping, of the universe
Rise of modernity	Information is used in the empiricist context of human, subjective, sensual experience and means the in-forming of the mind & senses
Rise of state bureaucracies	Information is used in the context of state control and bureaucracies and means thinglike knowledge outside humans reach
Rise of a modern information society	Information is a scientific and technological notion used in all areas of life. It means thinglike knowledge and abstract essence; de-humanized, factual and quantitative
Reaction on modernism	Information is used in the context of the human world where multiple meanings abound. It is part of a continuous process of constructing meaning

Table 4. The history of information: description of meaning

Relation with ontology

In this section, for each historical period the relation with ontology is explained i.e. the meaning of information is explained in terms of the processes that in-form matter and the philosophical concepts of form.

In the Latin period information was used to translate essential concepts in the Theory of Forms of Plato (427-347/8 BC)[21], like eidos and idéa. These concepts were used to designate the universal forms; they refer to immaterial unchanging realities in the intelligible world. Aristotle (384-322 BC) used the concepts eidos and morphé in opposition to matter. For him it was the essence that determines the specific nature of a thing; it is the potential aspect of the object, as that by which the object acquires its actual shape (Weizsäcker 1974 in: de Mul 1999;p79). Information not only referred to these different philosophical concepts, but more importantly to the process in which things are giving shape and form, the process of in-forming and shaping matter.

[21] Plato believed that every object in the world is just a poor copy of the ideal forms.

In Scholastics information gained an even stronger relation with ontology and especially the ontology of Aristotle. The universe was entirely ordered by the metaphysical forms and information referred to that order; of matter that gained its identity by the forms or essences that imbue it. "Information referred to the processes by which a form (or idea or essence) entered into something material and gave it a specific shape or character, thus in-forming it" (Peters 1987;p10).

During the rise of modernity information was stripped from the metaphysical baggage of the Scholastics. The meaning of information shifted from providing a form to matter, to the informing of the senses. Although the senses themselves were seen as a kind of substance, a substance that is in-formed, it is important to note that information lost its connection to scholastic ontology. This (high-level) ontological meaning became unusual and the epistemological meaning remained (Capurro 1996;p2)[22]. During the rise of state bureaucracies the relation with ontology becomes obsolete.

From 1948 we witness a revival of the ontological meaning. Information became to be related with structure again. It became to be seen as independent from senders and receivers and reflecting a real world's structure. The world that consists only of matter and energy seems to miss something, some principle of order or structure. In this world information seems to be the needed ingredient (Borgmann 1999;p11). Information, being neither matter nor energy, establishes itself as a metaphysical principle[23], and is still "something which can be stored in a neutral medium and can exist in the absence of a subject" (Nunberg 1996). The idea of information as a third metaphysical principle, has a similar status as the platonic eidos and Aristotelian form (c.f. Capurro 1996, Capurro & Hjorland 2003). In other words, the ancient and forgotten ontological meaning of information revived. However, information in the 20th century did not refer to the (ontological) *process* of shaping something, but instead it only refers to *things*, i.e. building blocks of the universe.

At the end of the 20th century the premises related to the modern ontological meaning of information are abandoned. Information is no longer a building block of the universe, something outside us, something that exists apart from people's perceptions[24]. True, objective and external truth is not longer to be found in information. Instead human reality is understood as a socially constructed reality; society is made by men and makes men in an ongoing historical process (Berger & Luckman 1976).

[22] This shift from ontological to epistemological use can for instance be witnessed in the famous English dictionary dated 1755 of Samuel Johnson (1709-1784) (Capurro 1985,1996).
[23] For example information is a basic property of the universe in addition to matter and energy (for example Devlin 1991 in: de Mul 1999, Gelephitis 1999). And Wiener remarks that: "information is information, not matter or energy. No materialism which does not admit this can survive at the present day" (in: de Mul 1999;p83).
[24] This resembles what Capurro (2003) calls the 'cognitive turn'.

Information became to be related to social constructions. For example Braman (1989;p240) remarks that "to social psychologists, information creation and flows literally construct reality". Another example is Dervin & Nilan (1986 in: Taylor 1996;p96) who argue that a shift is taking place in the study of information needs towards a view of information as a social construction. Information became a part of a continuous process of social construction of meaning. From semiotics the same picture arises; semiotics take reality not as having a purely objective existence independent of human interpretation. Instead reality is seen as a system of signs, where information and meaning are not contained in the world, nor transmitted to us. Information is part of the person who gives it meaning and acts upon it (Liebenau & Backhouse 1990;p3). Reality, meaning and information are understood here as constructions (see also Chandler 2002).

In Table 5 the relation between information and ontology is presented for each of the six periods in the history of information.

Period	***Relation with ontology*** a. Process of shaping matter b. Form
Latin period	a. Imposing a form on matter b. Idéa & morphé
Scholastics	a. The active shaping of the universe b. Metaphysical form
Rise of modernity	a. Relation with scholastic ontology becomes obsolete b. Obsolete
Rise of state bureaucracies	a. Obsolete b. Obsolete
Rise of a modern information society	a. Obsolete b. Building block of the universe
Reaction on modernism	a. Part of the process of shaping the social world b. Obsolete

Table 5. The history of information: relation with ontology

Relation with epistemology

In this section, for each historical period the relation with epistemology is explained i.e. the meaning of information is explained information in terms of the processes that in-form mind and its relation to knowledge.

In the Latin period information not only referred to the shaping of matter and to concepts that are related to this process (i.e. the ontological meaning) but also to the shaping of the mind or soul, of providing a form to the mind or soul. This is the epistemological meaning and it includes the pedagogical sense of instruction and education (c.f. Capurro 1985;p3). Another relation with epistemology can be found in the forms themselves as they are seen as a potentiality for knowledge.

Information in Scholastics had a strong relation to metaphysics. Also the epistemological meaning starts with the metaphysical notion of hylomorphism. For example the workings of the senses[25] were understood as a hylomorphic phenomenon. The senses were a kind of matter or wax, referring to the well-known metaphor of Plato and Aristotle of a ring seal that leaves a stamp or shape in the wax. Information was also used in the sense of instruction, the shaping of the mind (c.f. Bawden 2001;p94).

During the rise of modernity there is a shift from ontological use to epistemological use; the process of informing shifted from matter to mind (Peters 1988;p12). Information became to refer to the shaping of the mind by human senses or reason. Especially the relation between information and the senses was strong.

During the rise of state bureaucracies the techniques of statistics made it possible for man to 'see' something intellectually they could not see sensually. It became possible for man to know something and never experience it for themselves[26]. Information became a new kind of knowledge: knowledge that no mortal could have before, knowledge without the human body, knowledge beyond the range of one's experience (Peters 1988). Information no longer needed a human; it refers to facts, to knowledge separated from a person in-formed.

In the 20th century this meaning grew more powerful as information became more and more equated with factuality. According to Day (2001;p2) information and its connotations of factuality and

[25] For Aquinas understanding is a unity of sensible and intellectual understanding: informatio intellectus and informatio sensus.

[26] This can be related to what Borgmann (1999) calls indirect knowledge (as opposed to direct knowledge) and to Bertrand Russell (in: Borgmann 1999) who calls this knowledge by description (as opposed to knowledge by acquaintance). Information in the 19th century became a powerful adversary of direct knowledge.

quantitative measure helped raise information to a privileged form of knowledge. Information became a rival of knowledge[27] and even a king over knowledge, as Peters (1987) calls it.

At the end of the 20th century the premises related to the modern epistemological meaning of information are abandoned. Information is no longer something factual, nor does it contains true knowledge of reality. Reality cannot really be known as we are always imprisoned by language; instead reality is constructed. There are different opinions on how radical one must take this. Hermeneutics[28] makes the assumption that a 'text'[29] does in some minimal way refer to a reality (Introna 1997;p71) and that we understand this reality. Introna (1997) presents a view on information based on hermeneutics (especially Gadamer) and Heideggers view on understanding. He views information as hermeneutic understanding where information makes explicit what already is understood as part of being-in-the world. When interpretation breaks down it must be worked out as an active and ongoing negotiation with the text and the referential whole. In this context Introna also talks about sense making, a concept made popular by for example Dervin (1992) and Weick (1995). Sense making is used for example by Choo (1998) to emphasize the importance of the use of information in organizations to make sense of changes in its environment. The related principal information process is the interpretation of information (Choo 1998;p3) and information is viewed here as a subjective construction that is created internally by people (Choo 1998;p39). Information's relation with knowledge in these views can be described as information playing a *possible* and *partial* role in processes of gaining of knowledge[30] [31].

[27] One manifestation of this is that information and knowledge are defined in terms of each other, for example in the Compact Oxford Dictionary [htttp://www.askoxford.com/], and are used interchangeably (Stenmark 2002;p3).
[28] As elaborated by Introna (1997), who mainly refers to Gadamer.
[29] A text could be for example written or spoken consisting of symbol(s), word(s), sign(s) etc.
[30] For example Huizing (2002;p114) "… information *can* contribute to people's knowledge through learning." (emphasis added).
[31] Note the difference with the previous period where information was a synonym for or even a king over knowledge!

In Table 6 the relation between information and epistemology is presented for each of the six periods in the history of information.

Period	***Relation with epistemology*** a. Process of shaping mind b. Relation to knowledge
Latin period	a. Imposing a form on the mind b. Forms as a potentiality for knowledge
Scholastics	a. Imposing a form on the mind b. Sense & Intellect
Rise of modernity	a. Imposing a form on the mind & the senses b. Sense experience giving sensory knowledge
Rise of state bureaucracies	a. Obsolete b. Thinglike knowledge without the human
Rise of a modern information society	a. Obsolete b. Thinglike, privileged form of knowledge
Reaction on modernism	a. Part of understanding b. May play a part in gaining knowledge

Table 6. The history of information: relation with epistemology

Concluding remarks

The preceding descriptions of the meaning of information and its variables, summarized in Table 3 at the beginning of this section, makes clear that the meaning of information changed in several important ways during the different historical periods, of which the changes in relation to epistemology and ontology are the most important. An important aspect of the changes in meaning concerns the shift from processes to things and back to processes again.

In the Latin period information referred to both the process of in-forming as to the concepts that could be related with these processes (for example the forms). Although the emphasis was on the processes, one can safely say that from the Latin period to the Rise of modernity information referred both to processes of in-forming and to things (i.e. the forms) that in-form. During the rise of modernity information's meaning changed gradually from process to thing. Peters (1987;p10) notes this shift from information being a process, a process by which the world impresses itself on the senses, to mean simply the product gathered. The mind is no longer 'shaped by' the forms, but the mind/senses receive 'reports from' the world. These reports were soon regarded, particularly by rationalists such as Descartes and Leibniz, as something to be stored and processed (Capurro 1996;p6). The perspective

which equated information with a (material) thing had gained acceptance by the middle of the eighteenth century (Schement 1993;p179)[32]. During the rise of state bureaucracies the techniques of statistics led to a quantification and objectification[33] of information. It had no connection anymore with the processes of shaping mind or matter (Peters 1987). Instead it became a thing that contains knowledge; information became reified knowledge. During the rise of the modern information society 'the thinglike sense of information' as Schement (1993;p180) calls it, has been pushed to a new level through its general applicable quantification. Also information became a thing with an important economic connotation; it became a thing to buy and sell. In the modern information society the processes of shaping matter or mind are forgotten: "...we allowed an image of information without in-formation to become the central, defining image of the modern world" (Boland 1987;p364). Reactions to modernism revived the processes associated with information. But because the strong influence of the modern world view it is difficult not to see information as a substantive but as a process. It is may be best explained by using the term 'in-formation', i.e. a process of informing, an act, an action and not a thing (for example Carvalho 2000 and information-as-process of Buckland 1991). In-formation also denotes that this process emerges largely *from within* (c.f. Krippendorff 1993, who refers to Varela on this matter).

The differences between the meaning of information in the last two periods are striking. The view on information as thinglike knowledge and abstract essence may be called the *objective* view of information. The view on information as part of a continuous process of constructing meaning may be called the *subjective* view of information (c.f. Capurro & Hjorland 2003). The differences between these views have several consequences for sciences and practices which take information as a central concept, for example information management.

The history of information gives many opportunities for reflection. A first starting point is the relation of the history of information with the history of other concepts. For example Schement (1993) makes clear that the history of information is closely connected with the history of communication. Other obvious opportunities are the implicit assumptions and consequences of particular views on information and related concepts. Such assumptions and consequences could and must be critically approached. The history of information makes it possible to put such critical remarks in a historical

[32] Schement gives several examples of this perspective, for example from the Johnson's dictionary. Another example is from Thomas Jefferson, who wrote a letter in 1804 to the economist Jean Baptiste Say (in Schement 1993;p178): "My occupations … deny me time, if I had the information, to answer them.". Here information seems to be an asset.

[33] The word to objectify in the Compact Oxford Dictionary [http://www.askoxford.com/?view=uk] is described in the first entry as to 'express (something abstract) in a concrete form'. In relation to information one can say that the abstract metaphysical form became to be expressed in a concrete material form.

perspective (c.f. Day 2001, Peters 1987,1988). In this paper I have chosen to reflect on what the history of information could mean for information management today.

4. Reflections on Information Management

Information management is and was an important component in the rise of the modern information society. It is therefore no wonder that information management today is primarily concerned with the modern i.e. the objective meaning of information; it refers both to some abstract essence outside us (ontological meaning) and thinglike knowledge (epistemological meaning). Information management traditionally views information as thinglike knowledge outside us that can be produced by ICT[34] (c.f. Maes 2004). What does this restricted view on information mean for information management? And what lessons can be learnt from information's history?

From the summary of the history of information (see Table 3 at the beginning of the previous section) some interesting inferences can be made. First of all one can say that information's meaning during the rise of modern information society is a clear continuation of information's meaning during the rise of state bureaucracies. In other words: how information is used today in information management is rooted in a time where information was used in the context of state control and bureaucracies. It is also striking that these two periods are the only periods in Table 3 where information's meaning is restricted to things. Processes of shaping mind and matter are no part of information's meaning. These and other observations give ample room for reflection.

Reducing information & knowledge to bits

Objective information is governed by its ontological meaning. This sense completely pervades its everyday use of information as thinglike knowledge[35]. Because information today is in itself a platonic form, an abstract substance, it is first and foremost a thing outside us. In contemporary society these things must be made explicit and accessible, i.e. quantified and traded on markets. The information things are valuable because they contain knowledge that has potential value for our companies. In this ICT is important because it makes quantification and transactions (also of information) possible. In this we assume that all information we use, could in some way be reduced to bits. These bits are the ideal platonic forms; we take the bits as real and factual, and we believe that from these bits everything can be made possible and explained. Romm (1997 in: Capurro & Hjorland 2003;p387) shows that defining something as factual as opposed to meaningful has serious ethical implications as

[34] ICT can relatively easy handle de-humanized, factual and quantitative things.
[35] In terms of Nunberg (1997): particularistic information has become a subtype of abstract information.

"it authorizes a picture of the world - rather than inviting debate". In reducing information (i.e. thinglike knowledge!) to bits, in its slipstream also knowledge is reduced to bits. A knowledge worker in this perspective seems nothing more than a processor of information, i.e. bits. Anyone, but in particular an information manager, must ask critical questions on this view of information and knowledge. A good start is of course the famous question from T.S. Eliot's poem *Choruses from The Rock* (1934): Where is the knowledge we have lost in information? Or should we ask, where is the knowledge we have lost in bits? Another start could be to question the well-known hierarchy of data, information and knowledge. What are the implicit assumptions present in this hierarchy? Do these assumptions hold and how do they relate to views on information and knowledge?

Information as a higher form of reality

A manager often wants facts meaning figures, i.e. bits (c.f. Hoebeke 2003). Information is seen here as a model, a representation of reality. These models are taken for reality and acted upon as if they are reality. In terms of Plato's allegory of the cave, the people who experience reality directly are the prisoners in the cave; they don't have access to ICT and information. The people who look at flickering screens are enlightened, they are freed from the cave and have access to a higher form of reality. In treating information this way, people have lost the capacity to be empiricists, i.e. to use their own sense of sight, to experience reality directly (Hoebeke 2003). The history of information tells us of an important empiricist meaning of information during the rise of modernity, of subjective, sensual experience. Such a notion makes one more modest in what we can know through information. In our society however, where information and its technology is king, there seems to be no place for such modesty. The empiricist meaning seems to be lost and forgotten, but is it not the responsibility of an information manager to remember?

ICT: clouding and displacing reality

What has ICT to do with the contemporary ontological meaning of information? According to Hoebeke (2003;p4) ICT is nothing more than Plato applied; it makes information a metaphysical form and it relates us, enlightened us, with reality. But reality itself gets ever more deeply buried under all the information we have about it (Borgmann 1999;p218). Information made abundant and disposable by technology can lose its bearing on reality, and signs proliferate without regard to the things they refer to. Information technology has loosed a profusion of signs, clouding the things they refer to in reality. It overflows and suffocates reality (Borgmann 1999;p211,213). We act as if there are no things anymore to be discovered beyond the signs, as if the signs themselves are the real reality. But can we really understand things without a direct relation? Can we really understand through information alone? Can information about reality be understood in only one way? To be processed by ICT, information must be detached from the things it refers to (only if it refers to itself). But this could lead

to a clouding and displacement of reality, for instance in terms of 'the computer says this, so it is true, whatever you say'. To what extent does ICT cloud and displace reality in our organizations? Do people have problems with understanding through information alone and if so, what are the consequences of and solutions to these problems? A manager always seem to be distanced from the origin of information, from the 'form of life' from where it originates (Introna 1997;p62). The information the manager receives is decontextualized through computer and other forms of processing. The manager is then faced with the problem of translating the information from one form of life (for example shopfloor-speak) to another (for example manager-speak). But is this in principle possible? What if the language-games (as Wittgenstein calls them) of both life forms are incommensurable? Are asking and trying to answer such questions not tasks and responsibilities of information managers?

Information for control

During the rise of state bureaucracies information became related to state control. Its site shifted from the human to the state. It became possible to know without direct experience. But information without the things it refers to, could lead to dangerous detachment of reality. For example Stalin commented that one death is a tragedy, a million deaths a statistic (Peters 1988;p15). Besides in the context of state control, this detachment with direct experience is also found in the context of control in organizations. "As long as we remain in a cocoon of virtual reality or behold and control actual reality chiefly through information technology, the world out there seems light and immaterial." (Borgmann 1999;p221). The more one is detached from the direct experience, the more he seems able to be in control of reality and to take the right decisions. Experience of a place is called subjective, while objectivity means to be very detached of the affairs one wants to influence. This means that people in the head office can control reality without being in touch with it (Hoebeke 2003). But is this really so? Is it possible and desirable to control from 'without'? Controlling the organization from without leads to limiting its variety and in doing so it limits the ability of an organization to influence its environment. There is no escape from this management control paradox, at least not in first-order cybernetic management (Introna 1997). But how many efforts in information management and technology in organizations are geared to this type of control? What are the alternatives for this type of control? What is the role of information in these alternatives? Does the objective meaning of information fits this role? What is the role of the manager in these alternatives? Should information managers not lead the way in dealing with these questions?

Information as a thing: de-humanization and bureaucratization

The history of information shows us that the meaning of information shifted from a process to a thing in modern information society. But what did we lost in this shift? For Boland (1987) information is a process of inward-forming, a change in the knowledge, beliefs, values and behavior. It is a process that is related to interpersonal dialogue and the search for meaning through language in a human community. The shift from process to thing, combined with the rise of modern information society, leads to the degrading of knowledge, language, meaning etc. These things became to be defined in terms of information and became mere tools in modern information society. Is it not a task and responsibility of information managers to be critical about this de-humanization and search for alternative meanings of information? Peters (1988) remarks on the shift from processes and things during the rise of state bureaucracies: information became "a thing, a noun, a reified stuff separable from processes of informing. It shows up in various shapes and sizes -as news, research, data, intelligence, evidence, intellectual property- in different bureaucratic contexts. It still has something to do with forms. But not forms that fill us, but that we fill in: application forms, medical forms, insurance forms, tax forms, records, files, folders, reports, diplomas, billings and other mounds of bureaucratic paper (not to mention the forms that get filled in about us)." (Peters 1988;p16). This bureaucratization is still a major feature in today's society. Is it not a task and responsibility of information managers to be critical about this bureaucratization and search for alternative meanings of information?

Information management: interdisciplinary science and practice

Information management is concerned with a variety of topics and uses theories from a variety of sciences (for example Macevičі & Wilson 2002, Schlögl 2005). It must therefore look how information is perceived in other sciences. Today, in linguistics, sociology and social psychology, the use of the subjective view on information is clearly more apparent than in the natural sciences and economics where the objective view on information is still dominant (Stamper 1987, Babe 1996, Truijens 2004)[36].

[36] In other sciences like Information Systems & Information Science there seems to be a shift towards using a more subjective view on information, but these sciences seem still strongly divided in the use of objective and subjective meanings (c.f. Checkland & Holwell 1998;p40, Bates 2005).

Also in the everyday practice of for instance politics and organizations the objective view on information seems dominant. However, these domains are in the first -and only- place a part of the *human* world; a world where multiple meanings abound[37]. These domains perfectly fit the context of use of subjective information! Therefore it seems a fruitful direction to try to incorporate a subjective view of information in these domains. However, in taking on such a challenge the question must be raised if the objective view of information must be entirely abandoned. I don't think that is a fruitful direction as an objective view has brought both scientific and practical advances, most notably in the realms of information technology (see for example Borgmann 1999). I prefer a view that accounts for both objective and subjective perspectives. For example information may be viewed as a four-folded notion as Callaos & Callaos (2002) propose: subjective information, objective information, and the two processes that relate them i.e. perception and action. Bates (2005) proposes an evolutionary framework that allows for both subjective and objective interpretations of information. Capurro & Hjorland (2003) propose the concept of interpretation or selection as the bridge between objective and subjective approaches to information. The importance of the relation between reified objects and continuous meaning negotiation is apparent in Wenger's communities of practice (Wenger 1998). These perspectives all seem to work towards an integration of objective and subjective meanings of information. They also raise new questions especially when and how different manifestations of information must be used. These are fundamental questions for sciences and practices that take information as a central concept.

The vulnerability of subjective information

Information in its subjective meaning is part of a continuous process of constructing meaning and may lead to knowledge. Compared to the objective meaning of information, i.e. information as thinglike knowledge and abstract essence (de-humanized, factual and quantitative), the subjective meaning of information gives information a more modest role. Such modesty makes the subjective meaning vulnerable; the objective meaning leads to the seductive promise of explaining everything in terms of information. Such a promise seems far more appealing than modesty and can easily overshadow and drown it. This observation leads me to conclude that we must face the serious possibility that information remains to be used in general to refer to an objective meaning. But there is an important danger in doing that, as we define the world in terms of information "our images of information affect the way we are able to think about the world we live in" (Boland;p365). This includes how we are able to think about information management today.

[37] Stamper (1987;p44) argues that solving semantic problems is a major business activity.

5. Concluding Remarks

The goal of this paper was to provide an understanding of the history of information and to make explicit important lessons from this history for information management. Before I conclude this paper some remarks on this history must be made. First of all I used indirect sources; I did not for instance read Thomas Aquinas myself. This is of course a weakness[38]. On the other hand the sources that I used, point to the same directions and meanings of information in the various periods. Another remark is about the reasons why the meanings of information changed as they did. Although the history in this paper makes the obvious connections to important changes in the worldview, relations with for example the shift from an oral to a writing culture and political agendas were not described. For example Day (2001) links the changing meaning and context of information in the 20th century to Cold War motivations. I see such relations as opportunities for further research. Another interesting research opportunity is the analysis of the history and introduction of information in other languages and cultures.

Bawden (2001;p96) remarks that information management has been unrealistically restricted by a narrow understanding of information. This narrow understanding of information, i.e. an objective meaning, leads to a reduction of information and knowledge to bits, a degrading of direct experience, a clouding and displacement of reality, an overemphasis on control, and to de-humanization and bureaucratization. To deal with this situation, an information manager must understand that he/she is a manager of a concept with a history; a history of changing meanings and shifting contexts. An information manager ought to understand this history, because in understanding its history the meaning of information today becomes more clear. The history also provides partly forgotten meanings and it gives an idea of the direction for the future; a direction that is certainly not without trouble if we continue to use exclusively an objective view on information. The history of information hints at a possible remedy; it gives the information manager a responsibility to avoid one-sided views on information and to lead the way in the search for other views that could be fruitful. In the end we all share this responsibility in (re-)constructing and participating in the history of information.

[38] In this respect I think that the meanings of information in the Latin period could have been made more clear especially in relation to knowledge (c.f. Table 3).

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