Information Identified

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Abstract

We use the word 'information' numerous times each day. Information is all around us. We need information in our daily life. Information is also the new currency of business. Yet what we mean with the concept 'information' is not precisely clear.

Starting with the history of information and introducing a number of notions on the concept of information, this paper tries to emphasize that a single definition of information is not really possible. One of the most powerful definitions involves the relationship between information and the human mind. After all, we humans make sense of our environment by continuously applying meaning to data.

Introduction

Information. It is ever present in our daily lives. Many of us are barraged with it. Yet it is very hard to respond to the question 'What is information?' We all have a vague feeling about what comprises information. We communicate with one another every single day, exchanging lots of information. 'Information' is even part of the Institute's name.

Many words convey the idea of information; words such as 'data, 'knowledge', 'being', 'writing', 'sign', and 'symbol', to name just a few. But also objects like a name, a song, a picture, or an idea; all contain a shared quality called 'information.' Some information is more valuable than other information, typically because a person puts a higher value on it. Old information can become valuable in a new context, or when using contemporary technologies to make novel combinations.

Information is the glue that holds together most of our organizations. In today's turbulent business climates, information also acts as the lubricating oil to achieving competitive advantage. In the information age we have created technologies that give us access to huge amount of information (or should it be data?).

So what is this thing called information? We are so used to dealing with information in our everyday lives that we often fail to see the complexities involved. But to be highly productive with information, you have to know what information is all about.

History of Information

The word information is derived from the Middle English term 'enforme', derived from the Middle French term 'enformer', which evolved from the Latin term 'informare'. The Latin word meant to give form to, to shape, to form an idea of, or even to describe. Forming ideas is always on our minds. On the other hand, 'informare' is a composite of 'in' and 'form.' The last term finds its origin in the Latin forma, which means 'shape, mold'. The verb supplied action to the substantive, *forma,* which took varied, cognate meanings that depended mostly on context. The term 'in-' is used in combination mainly with verbs and their derivatives, with the senses of 'in, into, within'. Accordingly, 'to inform' would mean 'to form in', 'to form into', 'to form within' a person, a subject.

'Information' was used in English from at least the 14th century, but gained its current spelling only in the 16th century. Chaucer introduced the word 'information' into the English language in one of his Canterbury Tales, written somewhere between 1372 and 1382. In Gulliver's Travels (1727), Jonathan Swift applied a meaning to the word 'information' that appears as early as the mid-fifteenth century and sounds more familiar: 'It was necessary to give the reader this information.' Thomas Jefferson, in an 1804 letter, used 'information' as if it referred to a physical object: 'My occupations . . . deny me the time, if I had the information, to answer them.'

Information Technology is largely concerned with the technological aspects of information. The dawn of the Information Age and the rise of the Internet as the largest supplier of information, have contributed to our understanding of information. However, as I will show, information usage is essentially a human activity and can, and should, be separated from technology.

Notions of Information

A number of different notions on the information concept exist. These perceptions, the way of looking at information as a concept, have been studied in different disciplines. They relate to the way we talk about information: as a 'thing' (e.g., a document), as a process (e.g., consuming, using), as a science or as an academic discipline (e.g., information sciences), or its effects on people and organizations (e.g., impact, decision making). These notions help to improve our understanding of information.

One rationale for showing these notions of information is to have an unbiased view of information from a scholarly point of view. Once these ideas and views have passed your litmus test, the process can be started for a clear and concise definition of information. Several typologies are summarized here in order to show the inherent difficulty in establishing one single categorization.

Buckland (1991) identifies three uses of the term information:

1. Information-as-process
This notion refers to the act of becoming informed. It views information as a phenomenon of informing or altering. When someone is informed, what they know is changed. It is an intangible process. Information is often viewed here as reducing uncertainty.

2. Information-as-knowledge
This notion is used to denote that which is perceived in the 'information-as-process'. If we view information as knowledge, the key characteristic is that it is intangible. It can not be touched or measured in any direct way. Knowledge, belief, and opinion are personal, subjective, and conceptual. Therefore, to communicate them, they have to be expressed, described, or represented in some physical way, as a signal, text, or communication. Any such expression, description, or representation would need a medium and, hence, is the representation of knowledge.

3. Information-as-thing

This notion refers to objects, such as data and documents, because they are regarded as informative, as 'having the quality of imparting knowledge or communicating information; instructive'. This is clearly a tangible entity.

Braman (1989) has developed a four level hierarchy of definitions of information in the area of information policy studies.

1. Information as a resource

Information, its creators, processors and users are viewed as discrete and isolated entities. Information comes in pieces unrelated to bodies of knowledge or information flows into which it might be organized. Information is clearly a resource for individuals as well as organizations. A resource is a source of supply or support, whether or not offered for sale. Also information is viewed as having no power in and of itself. Information as a resource metaphor is often used like information as water, necessary for sustaining life in an information environment.

2. Information as a commodity

The notion of information as a commodity incorporates 'the exchange of information among people and related activities as well as its use' and implies buyers, sellers and a market. The notion requires the concept of an information production chain which includes steps like information creation, processing, storage, transportation, distribution, destruction, and seeking. The notion also implies a more complex social structure comprising buyers, sellers and the organization in order to sustain a market. Information has economic power.

3. Information as perception of pattern

Information has a past and a future, is affected by motive and other environmental and causal factors, and itself has effects. In this view, concept of information is broadened by the addition of context. The concept of information and its processes is broadened so much so that information in this sense can be applied to a highly articulated social structure. Information has a power of its own although its effects are isolated.

4. Information as constitutive force in society

Information is not just affected by its environment, but is itself an actor affecting other elements in the environment. Information is embedded in a social structure, and information decisions are inextricably linked with culture and values. A large number of theorists and practitioners alike support this notion. Whether information constructs reality, or as a result of a discussion between human beings is a constitutive force, information is most potent as a basis for future action and organizational innovation.

McCreadie and Rice (1999) identify four different conceptualizations, derived from the literatures.

1. Information as commodity/resource

This notion refers to a message, a commodity, or something else that can be produced, purchased, replicated, distributed, sold, traded, manipulated, passed along, controlled. It assumes that the receiver makes of a message what the sender intends.

2. Information as data in the environment

This notion relates to objects, artifacts, sounds, smells, events, visual and tactile phenomena, activities, phenomena of nature. Information can be obtained from a range of environmental stimuli and phenomena, not all of which are intended to convey a message, but which can be informative when appropriately interpreted. Therefore, the communication of information in this view can be both intentional and unintentional. The discoveries one makes in the process of casual (non-goal-directed) browsing or the inferences another makes about an individual's character or performance based on observation of the individual's behavior when exposed to view, particularly when the individual is unaware of being observed, serve as additional examples of unintentional communication available when one attends to information as data in the environment.

3. Information as a representation of knowledge

This notion is concerned with documents, books, periodicals, some visual and auditory representations, and abstractions of information (e.g., citations, indexes). Information as a representation of knowledge tends to be conflated with its material carrier, or artifact, such as a document, book, or periodical. It might also be a video or audiotape, a CD, or a home page on the Internet.

4. Information as part of the communication process

Some disciplines conceptualize information as part of the communication process, as part of human behavior in the process of moving through space and time to make sense of one's world. This notion supports the view that meanings are in people rather than in words or data and human behavior is the basis of understanding of the process. Timing and social factors play a significant role in the processing and interpretation of information.

Discussion

Various authors have defined frameworks for understanding notions of information. All typologies make clear that there are many different perceptions to understand the information concept. In my opinion there is not one best typology. Obviously, there are similarities and these frameworks overlap one another.

There are different opinions about the notions mentioned above. A commodity has basically two meanings: (1) anything which can be bought and sold that is fixed in time and space, and (2) an object or set of objects of predictable uniformity. In both cases, price and cost are important factors. However, informational goods and services are not necessarily fixed in time and space. Furthermore, the idea of information-as-a-commodity implies that the management of objects could be easily transferred to the

management of information concepts. Yet information differs from oil and coffee in that it cannot be exhausted.

Similarly, if we view information-as-resource, it cannot be managed in the same way as other resources. Information is not a resource in the same sense as people, money, materials and facilities. Information has no intrinsic worth as people do; its worth is entirely subjective. Information does not vary in value because of external factors, as money does; its value is in the mind of the user. Information is not consumed in its use. Information is not physical in nature as are facilities and material goods.

Another distinction is that information can be formal (explicit knowledge or information-as-thing) and informal (implicit knowledge or information-as-knowledge). Formal types of information can be referred to as information infrastructure, which includes libraries, services, the processes, technologies, and human resources used in information handling and acquisition. Informal information comprised of other types of information that are not easily captured to form an established information system. This includes knowledge possessed by individuals and knowledge that is transferred between them.

Before considering a definition of information, we need to consider the differences among several related terms.

Data – Information – Knowledge – Wisdom

However basic it may sound, it is important to emphasize that data, information, knowledge, and wisdom (sometimes referred to as intelligence) are not interchangeable concepts. Defining these concepts is not to argue the meaning of words, but to develop an understanding of the distinctions that are useful to arrive at a more useful definition of information.

The terms data, information, knowledge, and wisdom are often described in a hierarchy and visually portrayed as a pyramid with data as the base and wisdom as the pinnacle. We already see that this visualization has important implications how people perceive the various terms. Information is derived from data, and knowledge from infor-mation, and thus we are reminded that data has enormous potential far beyond just being represen-tative of a transaction. Information has character-istics, particularly of human interpretation, above and beyond data. Knowledge has something more than information, per-haps some kind of learning. Wisdom as applied know-ledge is the ultimate goal for most organizations and its employees.

Data

Data is the plural form of the Latin word *datum*, which means 'something given.' Data is a general term used to describe the raw material. Data is about facts, or more precisely, the representation of facts about things and events. Given the prevalence of IT, some people would argue that data has come to mean numeric or other information represented in ways that computers can process. As a consequence, data is in a highly structured form and consists mainly of numbers and codes.

But data is everywhere, not only in information systems. Data is what newspapers, reports, and information systems provide us. Data on its own, however, has nothing to teach us. Turning data into meaningful information involves the human mind. To differentiate data from information we must look at its context. Without context, information cannot exist, and the context in question must relate not only to the data's environment (where it came from, why it's being communicated, how it's arranged, etc.), but also from the context and intent of the person interpreting it.

Information

The next level in the pyramid metaphor is information, which is aggregated data interpreted by the human mind. The person is the crucial element in this definition. If data does not change the knowledge state of the individual, they remain at the data level. Information is meant to change the way the receiver perceives something; it should have an impact on his judgment and behavior.

If data is the raw material, information is a finished product. Information is data in context. Take for example something as simple as the telephone number +31 (0)900 400 4040 (which is the telephone number of the Tourist Office in Amsterdam, the Netherlands). It includes the plus sign for outside the country, the paid service number 0900, and the actual number, 400 4040. This strings of numbers and a symbol is defined according to international and local standards, and in a format that is understandable to a person in need for the telephone number. Hence, anyone visiting Amsterdam in the Netherlands could add value to this string of numbers. The visitor acquires the telephone number and fits it into an overall reference framework of previously acquired information regarding telecommunication.

Knowledge

Most people have an intuitive sense that knowledge is broader, deeper, and richer than data or information. We acknowledge that knowledge is closely related to an individual. Knowledge worker is a common word in most organizations nowadays. Some people believe that knowledge can be stored in computerized systems and can be extracted by coworkers to make - renewed - knowledge out of it. Others take the approach that knowledge resides in the minds of employees and that people will use cultural means to encourage knowledge sharing and communication; for example, encouraging face-to-face communication and the use of expertise systems. Knowledge involves an interpretation

from a human mind and, at the same time, adds significance to the receiver of information.

One could say that the distinction between information and knowledge is artificial. But some clear differences can be highlighted. First, knowledge differs from information in that it is predictive and can be used to guide action while information merely is data in context. Knowledge is closer to action while information could be seen as documentation of any piece of knowledge. Secondly, information is basic to knowledge, the latter is more connected to values, belief, and action. Thirdly, knowledge is not just information known, but *information in context.* Knowledge means understanding the significance of the information. Fourth, knowledge is the value added to information by people who have the experience and acumen to understand its real potential. Knowledge has value only to the extent that people are empowered to act based on that knowledge. In other words, knowledge has value only when acted on.

Machlup (1983) takes the useful point that 'information is acquired by being told, whereas knowledge can be acquired by thinking'. Through our inner experience of thought, we can form new knowledge without taking in new information from the external environment. Information implies *transfer,* says Machlup, while knowledge is a *state* ('knowing').

As Wilson (2002) states, whenever we wish to express what we know, we can only do so by uttering messages of one kind or another - oral, written, graphic, gestural or even through 'body language'. Such messages do not carry 'knowledge', they constitute 'information', which a knowing mind may assimilate, understand, comprehend and incorporate into its own knowledge structures. These structures are not identical for the person uttering the message and the receiver, because each person's knowledge structures are, 'biographically determined'. Therefore, the knowledge built from the messages can never be exactly the same as the knowledge base from which the messages were uttered.

Wisdom

On the top of our pyramid we have wisdom, also called intelligence. Wisdom is applied knowledge. Wisdom is the ultimate level of understanding in which we understand enough patterns that we can use them for ourselves in novel ways and situations in which we didn't learn them. Wisdom is deep inside us and as with knowledge it is very hard to share if not next to impossible. Because wisdom is so very personal, we have to make use of the complete stack from data up to and including wisdom, like a sequential value-chain. Acquiring wisdom is a process of many years of experience, involving contemplation, retrospection, interpretation, and a reflective mind to create wisdom.

Human beings absorb information in much the same way. They are, however, not equally good at building knowledge and wisdom from data and information. Furthermore, we may be outstanding in some respects, while limited in others. Wisdom

essentially refers to human attributes. Some people are enormously talented in one activity without showing unusual ability in other areas of knowledge.

Reflection

It is unclear exactly when the transformation is made between the varying levels of the pyramid. Many conceptual overlaps exist between all these terms. One could even contend that 'information' describes all the elements. People also might wrongfully put more value on the wisdom level of our pyramid metaphor. Yet even data can have a huge impact if the right (or wrong) people can get hold of it.

Obviously, the amount of human involvement increases as we move along the continuum of data-information-knowledge-wisdom. Computers are well-suited for helping us manage data, less so for information, and even less for knowledge and wisdom. It seems that information is not only more fundamental than knowledge. It might also be easier to get hold of. Data and information are two sides of the same coin: data is the objective side of the coin and information is its subjective side. Data and information can be managed, but knowledge can never be managed, except by the individual information worker and, even then, only imperfectly.

Alan Greenspan put the difficulty of exchanging information between people in his famous quote: 'I know you believe you understand what you think I said, but I am not sure you realize that what you heard is not what I meant.'

The Medium and the Message

One of the most common misunderstandings on the subject is the confusion of information with its representation. Many scholars have emphasized that it is important to make this distinction: information as content and the representation of information. The first one is often referred to as an intangible entity, or a non-material thing; the second is material and informative. Paper, clay tablets, walls, or other objects give us plenty of room to write our thoughts down. There are many storage devices, even things such as the knot in one corner of your handkerchief. Almost anything can be used to store information. All it takes to store information by means of some object - or more generally, a configuration of objects - is a convention that such a configuration represents that information (Devlin, 2001). Contemporary information technologies likewise give us numerous devices that can store representations of information.

However, information is distinct from the medium on which information is recorded. In fact, one of the characteristics of information is that it can be transferred between media without any significant loss of content. A hand-written sentence might subsequently be typed, wordprocessed, printed, photocopied and so on, while retaining unchanged information content.

Often people view the representation of information, such as a book or DVD, as the information itself. Although it can be very convenient and even useful for some

purposes, it can be misleading and dysfunctional in other contexts. These two concepts, 'information' and the 'representation of information' are often confused in everyday usage, but they are different and have different properties. For example, information can be both retained and given away. One cannot do that with the physical surrogate without creating a second physical manifestation.

However, information can be treated as a physical object. The fact that a person can read from a book while physically holding it in his or her hands proves that information can be configured to the characteristics of a physical object. When information is recorded onto a physical medium, such as paper, tape, celluloid, plastic, or metal, the medium allows the information to be treated as a physical object.

Badenoch *et al.* (1994) distinguish these two different concepts as (1) *epistemic* information, where information is considered in the context of human knowledge and understanding, and (2) *systemic* information, where information is studied in the context of a particular means of physical representation.

A straightforward distinction can be made with information as content, the *message*, and information as representation, the *medium*. However, the medium is *not* the message, though it may strongly affect the message. Having a radio, or a subscription to a daily newspaper, or even access to an e-mail system does not guarantee that a person has read, seen, or heard the message, and understood it. The corollary is that having more and better information technologies will not necessarily improve the state of information for the receiver.

A Definition of Information

In the previous section we reflected on the inherent difficulty involved in separating information from related concepts. It has been estimated that there are more than 400 definitions presented by researchers from different fields. Some of the confusion around the various meanings of the word 'information' come into view when the term is used in compound phrases such as information technology, information literacy, information management, and the like.

Because I take the human-centered definition of information, it does not cover all the ways in which academics and practitioners define information. Some phenomena might even not be completely covered in the analysis of the information concept. But even the human approach involves a number of mental representations, decision-making, human learning, judgments about the relevance of information, and the communication process.

A definition of information should, in line with Case (2002), at least have the following requirements:

- allow for common sense notions of information used in everyday discourse;
- allow for unintentional origins of information (e.g., observations of the natural world) as well as for purposeful communication among people;

- allow for internally generated information (e.g., memories, constructions) as well as externally generated information (e.g., reading a text);
- allow for types of information beyond that needed for 'solving a problem' or 'making a decision';
- admit the importance of informal sources (e.g., friends) as well as formal sources (e.g., data or documents); and
- involve the human mind, either in the creation, perception, or interpretation of information.

The human-centered approach emphasizes meaning and use of information as a concept. Therefore, a real objective nature of information is not possible. Most people agree that information has no meaning except when it has impact on a human being. Information can be seen as potential knowledge and for it to be converted into knowledge, there must be integration into an existing knowledge structure, usually the memory of the human being. Information received affects the prior state of the recipient. Taken into account that a lot of information is received via natural language, the receiver should have prior knowledge of that language. The meaning of the words communicated can thus only be understood in the socio-cultural context.

Information can only be evaluated with an awareness of the context in which it is being interpreted. The receiver of the information, not the sender, appreciates the information in his personal context. The receiver derives (or attempts to derive) information from a message that was sent. For example, the beauty of a book or a piece of music is that the actual interpretation of the words, lyrics, or sound varies according to the individual as she interprets it in her personal knowledge structure.

The consequence of this is that the sender has to have the receiver in mind to predict the effect of information on a particular user. Extensive information sent is just plain data if the potential receiver was not properly addressed, even if it was sent specifically to that person. Thus, for information to be valuable, the knowledge of the recipient of the information should be part of the definition.

This elaboration leads to the best definition that information is (Bateson, 1972):

Any difference that makes a difference to a conscious, human mind

This definition emphasizes (1) that data can come from anywhere and anything, even the internal mind of the receiver, (2) the broad scope of coverage, (3) that the intention of the sender is not necessary for the receiver to apply meaning to data, and (4) a perceived difference, emphasizing the personal experience of the receiving human being.

The latter point assumes that information does not exist independently of a conscious mind. Information is intrinsically meaningless on its own and remains so unless it is interpreted by a human being. We can send information and try to provoke a response,

but we can never be sure how receivers are likely to interpret the information they receive from us. Moreover, we do not know the mood they are in when receiving the message, nor do we know precisely their interests, motivation, beliefs, attitudes, feelings, sense of relevance and so on. Hence, it is not the meaning we put into the message as a sender but the meaning the audience puts into the message that matters.

Conclusion

Information remains an elusive and ill-defined concept. Despite an ever-expanding body of investigation on the various aspects of information, there remains much to be understood about information, at individual, organizational and societal levels. Information and its definition will, by definition, change over time as we understand what precisely makes the differences of the information resource that we have such a hard time understanding.

Apart from the definition of information, we are also interested in the characteristics and peculiarities of information. These will be addressed in another issue paper of the Institute for Information & Innovation Productivity.

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The techniques for measuring performance today, from factory floors to the delivery of services to the outcomes of innovation, often fall short because they do not consider the value of new technology or provide meaningful indicators to determine tradeoffs among multiple investments. The Institute for Innovation & Information Productivity was formed in 2006 to break through outmoded, industrial-age biases and redefine knowledge economy measurements for individuals, teams, firms and nations. The IIIP develops new measurements and best practices to better understand the factors affecting business and organizational performance, studies the impact of technology, and encourages a global dialogue on improving operational results.

The IIIP is a mutual benefit, non-profit corporation. The membership and focus are global; the headquarters are located in San Francisco, California, USA. An elected board of directors, who are representatives of member companies, governs the Institute.

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