

## The concept of information and its impact on information systems and information society

Panel at the EuroSIGSAND symposium on 5.6.2007 in Gdansk/Poland

Wolfgang Hesse, Dirk Müller, Aaron Russ, University of Marburg/Lahn

### Extended abstract

In this project panel (or: mini-workshop) we present and want to discuss first results of an interdisciplinary project dealing with the genesis, use and evolution of metaphors in the information processing field and their impact on the paradigmatic idea of man.

#### *Information processing in history and nowadays*

Human beings have been "information processing entities" ever since but their means of communication and information processing have been subject to continuous change and further development (cf. Tab. 1).

Information "technology"	Idea of Man (paradigmatic)
Cave drawings	Hunter-gatherer
Papyrus letters	Free citizen (e.g. Athens)
Book printing	Godly believer / obedient citizen
Telescope, Mercator map	Discoverer, "conquistador", enlightened human
(+ hand loom / steam engine	Industrial worker)
Typewriter machine	Office worker
Computer	Mental worker / Business man
Internet	World citizen / Frontier crosser
<i>Ubiquitous computing, "internet of things"</i>	???

*Tab. 1: Stages of information technology and the corresponding idea of man*

In the Computer Science field, a first serious attempt to formally define the phenomenon of *information* (and to measure it) was undertaken by Claude Shannon in his *Theory of Communication* from 1948. This theory deliberately focuses on the technical and statistical aspects of exchanging messages through wired channels – using the well-known *conduit* metaphor [CMH 94]. While Shannon - being aware of these limitations – hesitated to use the term "information", his theory has deeply influenced the field as a whole and has laid the ground for wide areas of what we now call *information technology*. However, the limited scope of Shannon's theory has challenged many researchers and philosophers until now – with the aim to complement its pure syntactic approach by corresponding semantic and pragmatic dimensions.

## **Exemplary definitions of the term information**

In order to show the bandwidth of possible definitions for “information”, we cite three exemplary definitions:

**Definition 1:** In connection with computing *information* is an aggregate (n tuple) of binary elements.

*Translated from. W. Händler, Lexikon der Datenverarbeitung, cit. cf. [Sto 03]*

**Definition 2:** Information (from lat.: *informare* = forming, giving a form) is a potentially or actually usable (or used) pattern of matter or some energy form being relevant for some observer within a certain context.

*Translated from: Wikipedia: „Information“ (German version), [Wik 07]*

**Definition 3:** Information is knowledge on certain facts and/or processes being part of the perceived or imagined reality. Information consists of communicated and received particles of knowledge. These are derived from (linguistically articulated) knowledge and communicated by means of linguistic tools. On the one hand side they represent (subjective) knowledge of the originator and on the other hand they can actualize or extend the (subjective) knowledge of the addressee.

*Translated from. Barkow et. al. in: Lexikon Informatik und Datenverarbeitung [Scn 97]*

A closer analysis of these definitions shows their different focus and scope. Further it suggests a *semiotic* approach to the concept of information as has e.g. been followed in the FRISCO report (cf. [FHL+98]). Definition 1 is limited to the pure syntactical dimension of information and thus it reflects more or less Shannon’s approach. From a nowadays point of view, we would prefer the term *data* for this explanation.

On the other end of the scale, definition 3 abstracts from any syntactic or technical detail indicating how information might be represented or communicated and focuses on its meaning for and effect on some observer (originator or addressee), i.e. on its semantic and/or pragmatic dimensions.

Definition 2 maintains some compromising position in between. It requires an *observer* to judge on the relevance of information – who is not needed in the purely syntactic definition 1. But in contrast to definition 3, where information is inseparable from the observer (originator or addressee) and emerges in his/her mind, in definition 2 it is just a “pattern” based on some matter or energy form which might be transported between some sender and receiver as in Shannon’s channel model.

## **Consequences for Information Systems (IS)**

If we want to understand, clearly define and precisely use derived constructs like *Information Systems*, *Information Technology* or *Information Society* we have to start with a clear determination of the underlying concept of *information*. For example, a pure syntactic view (corresponding to def. 1) would lead to a reduced, techno-centric view of information systems limited to technical functions such as storing, transferring, manipulating, re-arranging, searching certain amounts of pure data, i.e. to a

view sticking more or less to the functionality of a conventional database. In the FRISCO report, this kind of Information system was called *IS in the narrower sense* (cf. [FHL+98]). It is just a tool for organisations, for private persons or whoever can make use of it - nothing less but nothing more either.

On the other hand, a more encompassing concept of information – including its observers and their mental states (possibly influenced by sent and, in particular, by received messages) – implies what the FRISCO group called an *IS in the wider sense*: It does not only consist of technology and tools but includes their users, their organisation, their processes and their ways of using the tools. To conceptualise and design IS of this kind is a much larger and more challenging task than just to provide tools. It requires a deep analysis of the relations of tools and their users (both taken as part of the IS) and, in particular, of the user needs and of the effects tools may have on the work and life conditions of their users and other people concerned.

Similar arguments apply to the concept of *information technology*: If it is meant to be more than just *data processing* technology it should not be restricted to computer hard- and software but also include “*orgware*” and “*peopleware*” (cf. [D-L 87]), i.e. all the context which is necessary to understand information processes and their technical support in an organisation or any other form of human communication.

### **Consequences for the “Information Society”**

The term *information society* was coined in the second half of the last century. It has widely been propagated in the computer rainbow press but also in serious publications as well as in politics and thus it has become the new buzzword of the last decades. Again, any serious attempt to assign it a reasonable meaning has to take the main word component “*information*” into account - in other words: our understanding of *information society* has to be based on our explanation of information. If we take *information* in its everyday sense, information society degenerates to an empty formula: Every society we can think of has relied on exchanging information – thus there is no other society than information societies!

Ergo we should take *information* in a more specific sense, e.g. in its narrowest, pure *syntactical* form. However, as we have seen above this leads to a reduced, technocentric view of information systems which dominate our societal activities and thus inevitably form the shape of our society. In fact, if we read governmental “*action programs*” for the “*future development of the information society*” we find much about digital networks, broadband network access and the pavement of “information highways” but less about improving the education level or the democratic consciousness of the citizens.

Thus a concept of an *information society* should be based on a wider, more *semantic* and *pragmatic* interpretation of information including its educational aspects. If we start from such an interpretation, the idea of well-informed, autonomous, creative and productive humans using computers and information systems primarily as *knowledge tools* can be established and elaborated.

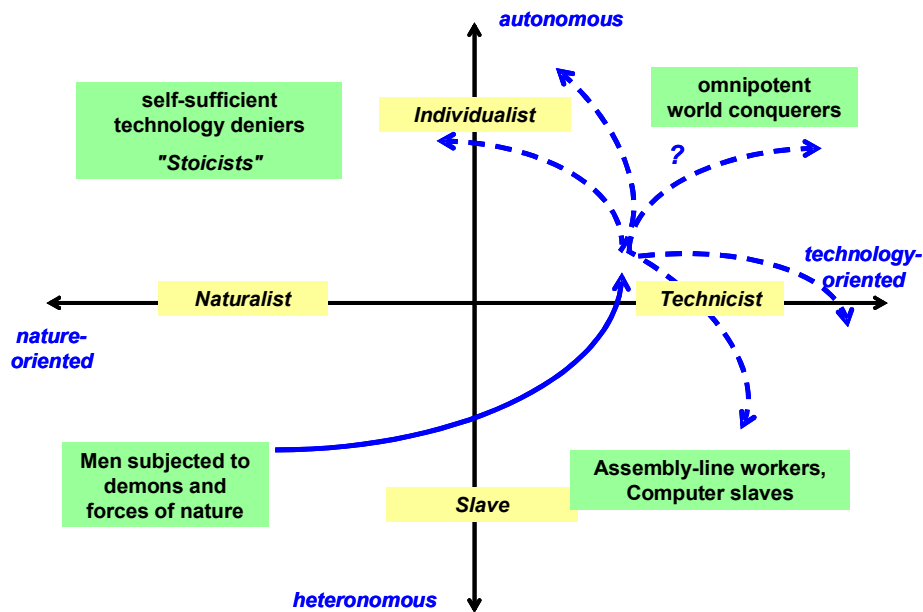


Fig. 2: Paradigmatic characters and the idea of man

### **Prospects of IT developments and their impact on the idea of man**

Now, after having passed the first wave of the Internet explosion and with new visions like Semantic Web or Ubiquitous Computing emerging we are again at the crossroads which may lead to highly diverging scenarios for the future of the *information society* and its prevailing idea of man. We try to sketch this situation in a two-dimensional diagram showing possible orientation of man in a changing world (cf. fig. 2). As spanning axes of the diagram we have chosen two dominating characteristics of human life: (1) Focus on (and dependency from) technology, tools, artefacts, technical support etc., and (2) Degree of autonomy / heteronomy.

In the long past, people had necessarily to be nature-oriented and suffered from insuperable forces of nature, demons and incalculable enemies. In the feudal and industrial ages, technology evolved rapidly – accompanied by only slight progress of human autonomy. Only the era of enlightenment, modern revolutions and growing democracies set an end to (state-sanctioned) slavery and considerably enhanced worldwide human autonomy.

At the time being, various scenarios can be anticipated (cf. the dashed lines in fig. 2). They range from well-educated, enlightened societies using computers rather for deliberate, productive, co-operative and sustainable activities through communities focusing on “smart technologies”, technical pampering, delusive security procedures, and end up with people enslaving themselves by attributing human skills and abilities to computers like *thinking, being intelligent, having emotions or taking responsibility*.

### **Concluding theses**

Finally, we would like to discuss six theses summarising and extending our ideas on the topics debated above:

**Thesis 1:** *Information is neither a material nor a “natural” thing but a “cultural” one, it emerges in the brain of an observer through interpretation of patterns, data, messages etc..*

**Thesis 2:** *State-of-the-art information technology can be located somewhere in between definition 1 and 2. However, extended use of metaphors and anthropomorphic attributes (e.g. talking about machines like on humans) make the uninitiated user believe that there is already information processing locatable between definitions 2 and 3.*

**Thesis 3:** *More information technology does neither guarantee more nor better information, more data does not necessarily produce more knowledge – in other words: quantity does not necessarily cause quality. On the other hand, a commonly agreed quality criterion for information is its usefulness – which can only be judged by human observers – as presupposed by definitions 2-3.*

**Thesis 4:** *The interpretation of the term “information society” does substantially depend on that of “information”. With a reduced, pure materialistic concept of information we run the risk of building a techno-centric society addicting itself to excessive computer and media use. On the other hand, taking “information” in its original, educational sense opens the chance to build an “informed society” – consisting of autonomous, well-educated, critically appraising citizens.*

**Thesis 5:** *The unreflecting and propagandistic use of the term “information society” causes misunderstandings and the danger of societal disruption: While politicians and advertisers suggest a “heaven of information” conforming to definition 3 they might try to sell their products which often are just capable of satisfying needs on the level of definition 1.*

**Thesis 6:** *In the age of computer technology the Kantian “enlightened human” is more demanded than any time before. However, this would require a long-term educational program including profound technology application skills as well as competences for a critical examination of technological, scientific and societal progress.*

## References:

- [CMH 94] *Conceptual Metaphor Home Page*: Cognitive Sciences, Univ. of Berkeley.  
[http://cogsci.berkeley.edu/lakoff/metaphors/The\\_Conduit\\_Metaphor.html](http://cogsci.berkeley.edu/lakoff/metaphors/The_Conduit_Metaphor.html)
- [D-L 87] T. DeMarco, T. Lister: *Peopleware - Productive projects and teams*; Dorset House Publ. Co. 1987
- [FHL+ 98] E. Falkenberg, W. Hesse, P. Lindgreen, B.E. Nilsson, J.L.H. Oei, C. Rolland, R.K. Stamper, F.J.M. Van Assche, A.A. Verrijn-Stuart, K. Voss: *FRISCO - A Framework of Information System Concepts - The FRISCO Report*. IFIP WG 8.1 Task Group FRISCO. Web version: <http://www.mathematik.uni-marburg.de/~hesse/papers/fri-full.pdf> (1998)
- [Jan 06] P. Janich: *Was ist Information? Kritik einer Legende*. Suhrkamp, Frankfurt/M. 2006
- [SCN 97] H.J. Schneider (Hrsg.): *Lexikon Informatik und Datenverarbeitung, Version 4.0*, Oldenbourg 1997
- [S-W 76] C. E. Shannon, W. Weaver: „*Mathematische Grundlagen der Informationstheorie*“, Oldenbourg, 1976
- [Sto 03] H. Stoyan: *Information in der Informatik*. In: R.Kuhlen, T.Seeger: *Grundlagen der praktischen Information und Dokumentation*. Saur Verlag, 2004 (2003)
- [S-W 63] W. Weaver, C. E. Shannon, *The Mathematical Theory of Communication*, [University of Illinois Press](http://www.press.uillinois.edu/), 1949, republished in paperback 1963. and: <http://cm.bell-labs.com/cm/ms/what/shannonday/paper.html>
- [WIE 48] N. WIENER: „*Cybernetics or Control and Communication in the Animal and the Machine*“, Cambridge: MIT-Press, 1948
- [WIK 07] *Wikipedia*: „*Information*“, <http://de.wikipedia.org/wiki/Information>, 2007, as of May 3<sup>rd</sup>, 2007

## **Outline of the session:**

Introduction: The Marburg *MeBIT* project and its goals

- I The concept of information and its different interpretations
  - Etymology and philosophical background
  - The role of information in Shannon's theory of communication
  - Semiotic approach: The "sign character" of information
  - Semantic and pragmatic aspects: Data, information and knowledge
  
- II Information Systems (IS) and their foundation
  - Definition and typology of IS
  - FRISCO: A framework of IS concepts
  - IS in the narrower and wider sense
  
- III Information society
  - Historical background, previous "xxx societies"
  - Dimensions of societal characterisation
  - What an "information society" could be depends on our understanding of "information"!
  - Scenarios of future information societies