A FEMALE VIEW ON THE DESIGN OF INFORMATION SYSTEMS

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Abstract

The first step in the process of designing and implementing an information system (IS), is making models of (a part) the real world. Modelling means abstraction of phenomena in the real world. A system analyst and designer will use filters for looking at the world. Her/his view will extremely influence the initial and fundamental steps implementing an IS. With its realization the IS will become a part of the real world, too, but this part will be invisible. Moreover the IS will hide and replace a part of the original world. So, any modelling for the purpose of realization an IS will change the real world.The cycle of design, implementation and usage of IS's happens mostly again and again in increasingly shorter periods. IS's are invisible. Their number and influence are growing fast. So more and more parts of the real world or the various perceptions of the real world will become invisible. More and more views on the world will vanish. Because computer science is still male dominated, it could happen that the female view in the real world is diminished. Modelling is a mental task, is an activity having gender dependent aspects. In the paper it will be discussed how it may be possible to develop and use methods for modelling and implementing IS's to provide that female views will not get lost. "As feminists we are led to battle with the abstractions in several ways: noting that they are historically specific, not timeless; grounded in male experience, not universal; biased, not neutral. We want to make what the abstraction has hidden, visible." (Leigh Star, 1991)

1. Introduction, views on information systems, invisibility

The purpose of this paper is not to expatiate on the discussions to give a final answer to the questions: 'What is information?' or 'What is an IS?'. In the literature the given definitions of information and IS's depends on what aspects of IS will be discussed. A minimal interpretation of the concept 'information system' is that of a system for data storage, where you can 'write in' data and from which you can 'read out' data. Mostly nowadays IS's have the capability to manipulate the data which were put into the system. So, an IS can be described as a concrete system composed of physical phenomena such as people, hardware, software, sets of data and procedures for the collection, the processing, and the distribution of data. We can also look on the concept of IS by looking at the function of the IS. Throughout all ages people have expressed their feelings, experiences, wishes, and purposes by transferring them to other people. The exchange of information, the communication, they did in a verbal and non-verbal way. IS's have the purpose of supporting or replacing the spoken or written human communication. Therefore a second view on IS's can be given by conceiving an IS as an abstract system, a reflection of the real

system or organization where the IS is a part of. This second view will be used throughout this paper.

Phenomena in our real world become invisible for persons, when it is impossible to get knowledge about these phenomena by their behavior and with the support of technical resources. With behavior not only "observation" is meant but also "experience (perception, acting, feeling, smelling), thinking (reflection, deduction, questioning, imagination, (day) dreaming), and transfer from other people (co-behavior, ostentation, communication)." (Lindgren,1990) The knowledge transfer from other people about phenomena is not always a guaranty that phenomena do not become invisible. For instance in the history of women there are many examples of invisibility. Knowledge transfer by other people about a phenomenon can give you a very specific view on that phenomenon, which could be very different from your own view. Other people could be 'blind' for specific aspects of it in the real world.

Phenomena or some aspects of them become invisible when they are hidden or when they are not perceptible. That does not always mean that the phenomena do not exist anymore. Invisibility is one of the causes that a phenomenon, its behavior, or the perception of it changes to make it visible again. But the changes can be so radical that it becomes very difficult to make the original nature of the phenomenon or the various perceptions of it visible again. Advertising, for instance with tv-commercials, is an example which causes effects of invisibility; despite the fact that the view on the real world represented in the product of advertising, the advertisement, is visible. IS's, too, cause effects of invisibility by transferring information about the real world. But in contrary to advertisements their inner world, especially the representation of the contained view, is invisible.

2. The modelling process

2.1 The link between modelling process and the resulting model

IS's do not appear out of nothing. They have to be designed, to be built and to be implemented. The first step in the design process is making models of the real world. Especially to make a model of those parts, where the IS should communicate on, and where the IS is a part of: the organization. Because the IS itself is a part of the real world, it is obvious that its model of the real world should contain a model of the IS itself (self-model).

The important components in the process of modelling are the real objects in the problem domain, the phenomena in the universe of discourse, the environment of that universe of discourse, the analyzers and the users of the IS, and the most important part: the relations

between these components. The modelling process is a phenomenon that takes place in that part of the real world which is the universe of discourse. Implementing the design process gives the IS a higher potential of visibility. So, if the content of the IS should be complete then it should have a representation of that design process. The consequence is that during the process of analyzing, modelling, design, and implementation of an IS; the process itself should be modelled, too. Modelling is a working process. "Work is the link between the visible and the invisible. Visibles are not automatically organized in pregiven abstractions. Someone does the ordering, someone living in a visible world." (Leigh Star,1991) In the opinion of Susan Leigh Star it is not always necessary to "restore the visible". By not forgetting the 'work' you can always make the invisibles visible again. Remembering the working process is in my opinion only a necessary condition. Not every working process or the representation or conception of it has the property of reversibility. A way of remembering is to recognize the design process as a part of the world, to model the design process, and in the last phase to implement in the designed IS the relations between the definitive design and the design process. Trying that is making the content of the IS more objective; objective in the sense of dynamic objectivity and not in the sense of static objectivity. Dynamic objectivity is "the pursuit of a maximally authentic, and hence maximally reliable, understanding of the world around oneself. Such a pursuit is dynamic to the extent that it is actively draws on the commonality between mind and nature as a resource for understanding. Dynamic objectivity aims at a form of knowledge that grants to the world around us its independent integrity but does so in a way that remains cognizant of, indeed relies, on our connectivity with the world." (Fox-Keller,1985)

Implementing the relation between the design process and the design means that a single IS could contain various representations of one universe of discourse. Then it will be the decision of the users, which representation or combination of representations is the most effective in their current situation. Designing the usage of an IS as a decision process forces the users to look at the world and make invisible phenomena visible again. They need "to listen to the material" itself. (Fox-Keller,1985) If the intention is to implement the link between the invisible and the visible in the IS - the working process of the design - we need to have a closer look at the process of modelling and the methods, which are used in that modelling process. If the modelling process gives no guaranty for a dynamicobjective view on the world, the implementation of the design will be based on a static world view. But then it will not contribute to a more effective objectivity of IS's.

2.2 The components of observation

Modelling means doing observations, making experiences, and making representations of

both. First at all you have to realize which components of the real world you will observe or experiment with. The important components of that observation should be: the phenomena, their state, their behavior (including their communication), their identity, their relations to other phenomena, the organization where the IS will be part of, the environment of that organization, the cause (mostly a problem) of starting the design process, the analyzer and designer of the model, and last but not least the users of the IS. Moreover not only the modelling process itself but also the motivations, reasons and purposes for the component's representations must be made explicit in the real world model.

Most modelling methods make only models of the phenomena in the problem domain. With some methods for analyzing, it is possible to model users, but usually only for the purpose to implement a good interface between IS and user. There are no modelling methods which models in a holistic sense all of the above mentioned components together. For instance not modelling the analyst and not implementing her/his view means that the process of modelling - the work of the analyst - will get invisible.

2.3 The position of the analyst

The position of the analyst towards the world she/he observes is in (computer) science often the position of a "knower" towards the "knowable". "The relation specified between knower and known is one of distance and separation." (Fox-Keller, 1985)

Making this relation in the modelling process an object of study in the sense that this process is a part of the problem domain will shorten the distance and will break off the separation. User and analyst then have an equal position in the design process. Both are knowers and knowables. Participatory design is a concept for a design process that has some of the necessary conditions for that balance. Participatory design "asks systems developers to put three issues in the forefront of their efforts: focusing on the whole workplace and the actual practices of the people doing the work; involving office workers at all levels in articulating their needs and expressing their concerns for what computer support they may need; and

focusing on the whole workplace and the actual practices of the people doing the work; developing new methods that help developers and office workers actively support ongoing social processes." (Greenbaum,1991) The issues mentioned by Greenbaum are necessary conditions in the process of modelling. But that is not sufficient. An analyst will in that design process still use filters for her/his observation. Filters which are not objective but mostly subjective and determined by the experiences of the observer. It is an illusion to think that analysts are objective observers (in the static and dynamic sense). Therefore an

analysis of the used filters is necessary. Analyzing the used filters is a working answer to the questions of Susan Leigh Star: "Do we want inclusion, revolution or new global order?".(Leigh Star,1991) Looking at the used methods in computer science perhaps we could find the direction of the domain in which we have to start a revolution. At this moment it is wise to follow the advice of Harding and Fox-Keller: "To locate the possible directions within which a feminist science could emerge, we should look instead to the distinctive theories of knowledge already being developed." (Harding,1986) "To the extent that science is defined by its past and present practitioners, anyone who aspires to membership in that community must confirm to its existing code. As a consequence, the inclusion of new members, even from a radically different culture, cannot induce immediate or direct change. To be a successful scientist one must first be adequately socialized." (Fox-Keller, 1985) Socializing may not mean forgetting or neglecting your own (female) view on the practice of computer science. Socializing means learning to speak and to understand the language of the present practitioners, thus making it possible that there could be communication on the practitioner's views. Communication is the most important condition to change computer science. Communication is a bridge between the inner world and outer world. On that bridge different views on the real world and on computer science can be discussed and eventually changed. Socializing is a working process, too. Therefore it is necessary to analyze and to remember this process, especially that of women, to make it possible to restore the original view of persons, who have become insiders in the computer science.

2.4 The methods of the analyst: filters in the modelling process

The analyst uses filters for selection and abstraction. These filters are representations of the view of the analyst. In computer science "we are constantly wrestling with the properties of visible things: they are many, they are resistant to our attempts to change them, they clutter our landscape everywhere. In facing the tyranny of blind empiricism, however, we temper the clutter of the visible by creating invisibles: abstractions that will stand quietly, cleanly and docilely for the noisome, messy actions and materials" (Leigh Star,1991).

The selection filters

1. The selection of the problems or the kind of problems which can be solved.
2. The selection of the domain which will be observed and modelled. This selection depends on the analyst's perception of the problem(s).
3. The selection of the border of the problem domain. Choosing the border of the domain means choosing what part of the world will be represented in the IS and what remains

as the problem domain's environment.

4. Choosing the kind of problems that the IS has to solve.
5. Choosing the model of the solution out of many possibilities.

Each representation of an analyst's view has to contain a representation of such a filter set. Implementing more than one of these filter-sets inside an IS could make the system more objective. The border of domain and environment is not a static border because it does not depend any more on the view of one specific analyst. The users are enabled to choose between various views. Even the various views on the real world of the users could be implemented. This concept of a user-view is broader than it is defined usually in the literature. There the user-view of an IS is derived just from the implemented model (which contains only one analyst view).

On the one hand the reliability of an IS could be enlarged by implementing various views and using them comparatively. On the other hand the consistency of an IS might be diminished by giving cooperating users the opportunity to choose between differentviews. Therefore it is necessary to develop interfaces between the various views.

The abstraction filters

Modelling the real world or a part of the real world means to make abstractions of the objects, situations, processes, events, in a word the phenomena of the real world. Abstraction in science and in computer science is a fundamental way of coping with complexity (Booch,1991). Abstraction is also a process of suppression, as Shaw defines abstraction as "a simplified description, or specification, of a system that emphasizes some of the system's details or properties while suppressing others" (Shaw,1984).

Abstraction filters can be described as classification, generalization, and aggregation. By classification the phenomena of the real world are reduced to object types with a limited amount of properties, and these properties have a limited amount of values. Hoare suggests that "abstraction arises from recognition of similarities between certain objects, situations or processes in the real world and the decision to concentrate upon these similarities and to ignore for the time being the differences." (Dahl, 1972). It follows that abstraction leads to ignoring and suppressing the differences between phenomena which are not relevant in the view of the analyst. Object types are made by the search of similarities. Differences are mostly neglected because they are not easy to handle. Giving more appreciation to the differences of phenomena in methods for design and modelling could be a source for finding balanced methods. As Suchman said: "the appreciation of difference itself can become a source of solidarity and agenda for social change" (Suchman,1991). The representation of phenomena in the IS should not only be based on

the decision to put some phenomena into one class because of similarity but also on the decision to put some phenomena in different classes in spite of similarity. The methods of abstraction and especially classification should maximize reciprocity and appreciate difference. Not only the analysis methods should have these characteristics. But the persons involved in the modelling process must have "the other incorporated into the self rather than dominated and/or repressed." (Harding, 1986)

The process of modelling can only be objective and has the potential of visibility, when the analyst is incorporated in the problem domain and she/he has incorporated the problem domain in oneself. Especially this means that the analyst has to incorporate the user and the user has to incorporate the analyst.

The complementary activity to classification is instantiation. Instantiation means to give a description of class elements. By instantiation every object in the IS gets a state, exhibits some well-defined behavior and has an unique identity. An instance is the representation of an individual phenomenon out of the real world in the IS. So real, individual objects correspond to instances of object types in the model. Real objects are made partly invisible, because only the elements of relevance to the analyst will be represented. A real phenomenon can only have a representation in the IS when it fits into a class. This sequence in the modelling process - first classification and then instantiation - makes it happen that some phenomena are incompletely or not at all represented. Incompleteness means invisibility for the users of the IS. The more as classification is based upon similarities and not upon differences. The concept of classes has the same effect as the concept of laws of which Fox-Keller noted "Such laws imply an a priory hierarchy between structuring principle and structured matter that suggests a striking resemblance to laws of authoritarian states." The class structure will suppress "listening to the material itself". (Fox-keller, 1985)

The hierarchical patron of this analyzing process is reinforced by the concept of inheritance. Inheritance defines a relationship among classes where one class shares the structure or behavior defined in one or more other classes (single and multiple inheritance). Inheritance is the concept for `the kind-of hierarchy` (generalization/specialization) or for `the part-of hierarchy` (aggregation). "To have no inheritance in your design every class would be a free-standing unit, each developed from the ground up. Different classes would bear no relationship with one another, since the developer of each provides methods in whatever manner he chooses." (Cox,1986). Models with no inheritance are models with a lack of economy and therefore are considered as inelegant. But the appreciation of inheritance reinforces the hierarchical patron of the

model. It makes it possible to define virtual classes. Classes which are no representation of real phenomena in the real world. So, inheritance will also enforce the invisibility. The appreciation of inheritance will provide neglecting non-hierarchical relations between phenomena in the real world. We have to find modelling methods where there is a balance between hierarchical and non-hierarchical relations.

Dealing with complexity means in computer science finding a hierarchic structure in a real world system. Complexity is defined by hierarchy; "the fact that many complex systems have a nearly decomposable, hierarchic structure is the major facilitating factor enabling us to understand, describe and even 'see' such systems and their parts" (Simon, 1982)

By recognizing that the modelling process as it is practiced at the moment is strongly hierarchic, hierarchic in the position of the analyst towards the world of observation, hierarchic in the steps in the design process; classification and then instantiation, and hierarchic in the product (the appreciation of inheritance) we did the first step in finding the directions of changes. We have to learn to 'see' and to 'represent' the various non-hierarchic structures; "indeed it is likely that we can understand only those systems that have a hierarchic structure" (Booch, 1991)

3. Conclusions

As the IS should be a complete representation of the whole organization, then we have to find methods to model and to implement not only the public and rational, but also the private, emotional aspects of the phenomena in our world. "Skills such as reasoning and objectivity became associated with public life, and feeling and subjectivity with private life. These dichotomies have become historically associated with the development of distinctive feminine and masculine world views." (Wajcman, 1991). As a computer scientist and as a woman I have incorporated these dichotomies in myself. In this paper I have tried to make this visible by making my view on the current design strategies explicit. By making my view visible for myself, I could think about directions in which computer science could (should) change. Perhaps then it may be possible that the content of an IS is a representation of a real world, where hand, brain and heart are united. As female computer scientists we are obliged to do so because: "The feminist theory of knowledge differs from the perspective of man's distinctive activity and experience.... Its distinctiveness is to be found in the way its concepts of the knower, the world to be known and processes of coming to know reflect the unification of manual, mental and emotional ("hand, brain, and heart") activity characteristic of women's work more generally." (Harding, 1986)

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