ACTABLE INFORMATION SYSTEMS
- Quality ideals put into practice

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1. INTRODUCTION

The problem we are approaching in this paper is that the actions offered by information systems (IS) often seem to disharmonise with the actions performed in the work practice. Several researchers report lacks in IS use. For example, Hägerfors (1994) claims that there is a lot of IS which is not fully usable in the context wherein they exist. Henderson & Kyng (1994) claims that there is a discrepancy between creation of IS and work situations. Bannon (1994) claims that there is need for a better understanding among researchers and system designers about users and their work settings. We need to understand people as actors with a set of skills and shared practices based on work experiences (ibid.)

There are many different philosophies, methodologies or checklists aiming at supporting the information systems development (ISD) process. One of the most popular methodologies today is the object-oriented approach Rational Unified Process (RUP), (e.g. Kruchten, 1999). Another familiar methodology is Structure Analysis and Structure Design (SASD) (Yourdon, 1989). The tradition of participatory design has paid a lot of attention to user influence in the ISD process. Followers argue for a broad and genuine participation aiming at agreement of IS and work (Hägerfors, 1994). Carlshamre (1994) claims that participatory design is more of a philosophy than a methodology. Vonk (1990) discusses a prototyping approach and claims that this approach will put more attention to the user interface then traditional ISD methodologies do. In the Human Computer Interaction (HCI) area usability and IS are focused. In this area we can find

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checklists such as Nielsen's (1994) ten usability heuristics and usability models such as Shackel (1984) and Nielsen (1993). What they all seems to miss or at least not have in focus is the action character of the IS.

The purpose of the paper is to propose actable quality ideals for ISD. Following this purpose we have formulated our research question as: How can more actable IS be achieved? In order to answer our research question we have used an action-oriented perspective as a basis (see section 3). This perspective has been operationalised into actable quality ideals that support the ISD process (see section 5). In section 6 we show some examples where the quality ideals are put into practice.

2. THEORETICAL BASE: INFORMATION SYSTEMS ACTABILITY

There are many different approaches to support ISD. Even though they all aim at building good IS, they can differ in several ways. These differences often depend on underlying values and perspectives. When designing IS there is always one (or several) perspectives applied (e.g. Nurminen, 1988; Löwgren 1995). Nurminen (1988) claims that a perspective is defined through how to look at a phenomenon and how to think of a phenomenon. Perspectives contain principles, values, ideas, experiences, categorisations and definitions. Further more, perspectives can exist on an unconscious level, not reflected, unclear and not sufficiently articulated. It is obvious that the choice of perspective has implications for how we design IS.

We adopt an action perspective on information systems in this paper. Actions are humans´ intentional way of changing the world. Humans intervene in the external world. These intervening actions are overt actions, which can be communicative or material. Actions can also be covert. In such a situation a human tries to make sense of something external. He performs an interpretative action. He is not changing something externally as in intervening actions. He is instead trying to change his inner world, his knowledge of the external world. Besides interpretative actions, there are other covert actions. When a human is intentionally trying to solve a problem mentally through reflection this can be seen as a covert action. This action view is inspired by American pragmatism (e.g. Mead, 1938), social phenomenology (e.g Schutz, 1962) and language action theories (e.g. Austin, 1962). Confer also Goldkuhl (2001) and Goldkuhl & Ågerfalk (2002).

From an action-oriented perspective, IS are viewed as communication systems, as distinct from strict representational views of information. A representational view of information means that designers try to create an 'image' of the reality in order to have the analysed piece of reality properly represented in the systems database. This strict representational view can be challenged, which an action perspective certainly does (e.g. Goldkuhl & Lyytinen, 1982; Winograd & Flores, 1986). In the action-oriented perspective, IS are not considered as "containers of facts" or "instruments for information transmission" (Goldkuhl & Ågerfalk, 2001). The action-oriented perspective emphasises what users do while communicating through an IS (*ibid.*). IS are systems for action in work practices, and such actions are the means by which work practice relations are created.

IS have an action ability. We call this IS actability. We define actability as an IS ability to perform actions and to permit, promote and facilitate users to perform their actions both through the system and based on messages from the system, in some work practice context (Ågerfalk, 1999; Goldkuhl & Ågerfalk, 2001).

Within the actability perspective the notion of IS can be defined in the following way (ibid): An IS consists of

- an action potential (a predefined and regulated repertoire of actions)
- actions performed interactively by the user and the system and/or automatically by the system.
- action memory (a memory of earlier actions and including other prerequisites for action)
- documents (as action conditions, action media, action results)
- a contained structured work practice language (giving frames for actions, action memory and documents)

Designing an IS means suggesting and establishing an action potential. An action potential both enables and delimits actions. It entails a repertoire of actions and a related vocabulary. The vocabulary consists of concepts related to the work practice language. An IS must also offer a record of actions performed. Information about these performed actions can normally be found in the IS database. We call it an action memory, which is part of an organisational memory.

In order to design actable IS three types of IS use situations have been identified in Ågerfalk (1999). First, there is an interactive use situation (a user interactively using an IS, for example, registering some information). Secondly, there is an automatic use situation (an IS perform an action independently by the user, but of course according to some predefined rules). Finally, there are consequential use situations (information from the IS that will be used in other situations). The generated quality ideals are of the interactive use situation type.

3. RESEARCH APPROACH

In this study we have used an action-oriented perspective (see section 2). Contemporary approaches do not seem to give the necessary support for specifying IS in a way that sufficiently emphasises the action character of information and IS needed to achieve the work practice goals (Ågerfalk, 1999). In several IS it is not clear which actions are possible to be performed in a specific use situation. One reason for applying an action-oriented perspective is that there is a lot of communication needed in the work practice studied.

IS Actability is articulated as a perspective (see Ågerfalk, 1999; Goldkuhl & Ågerfalk, 2001) and as a requirement engineering method (ibid; Ågerfalk et al. 2001). The notion of an actable information system is described in a general way. There is however not in this literature an explicit list of quality ideals for IS actability, which can govern the design of such systems. When reflecting upon this perspective and this Requirement Engineering (RE) method we obtained some preliminary ideas of how to formulate quality ideals for IS design. Having these preliminary ideas in mind we carried out an ISD-project (see section 4). The ISD-project has contributed to a refinement of these ideas. This means that quality ideals were developed continuously during the ISD-project, which was performed in an action research manner. The developed quality ideals have guided the design process and they have been implemented in a prototype and been tested on a small scale (see figure 1).

The research approach has been performed in a dialectal way where both theoretical claims and empirical findings from the ISD-project have influenced the quality ideals. In order to structure our quality ideals we have used a paradigm model suggested by Strauss & Corbin (1998). The model has acted as a means for categorising the ideals. The reason for choosing this model is that it is action oriented and the categories (ideals) identified are either considered as conditions for or as consequences of actions/interactions. This model also harmonises with our general pragmatic view on research and IS.

The quality ideals have been tested by user reviews of prototypes during the ISD process and limited user test of executable prototypes. For full empirical grounding there is a future need for studying users full utilization of implemented IS in their work.

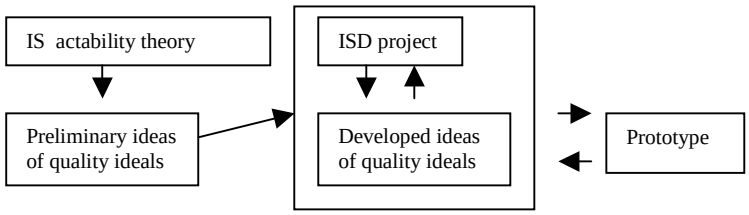

Figure 1. The overall research model

4. DESCRIPTION OF THE WORK PRACTICE AND THE ISD PROJECT

The ISD project was performed in a municipal home care unit for serving elder people. The major tasks of the home care are to help the elders with daily hygiene, simple medical tasks, cleaning, doing laundry, shopping etc. The personnel consists of two home care managers who are responsible for the home care unit and a number of home care assistants. The home care assistants are responsible for the daily work with the elders.

The home care assistants are well qualified and experienced. Their work can be characterised as flexible and responsive to the different needs of the elders. This kind of flexibility is also characterising the administrative work at the home care unit. The home care assistants are governed in their work by much tacit knowledge. Documentation routines have evolved gradually. There are many types of documents; a number of self-made as well as pre-printed forms (e.g. journals, diaries, note pads, schedules etc.). These documents are used for communication about clients, assignments, measures and work procedures. Many documents, especially the self-made forms, are unclear. There are no exact rules for what to write in different documents. The terminology is rather fluid. Many documents lack a clear rubric and after intervewing the staff it became obvious that some documents lack a common name. From an information systems perspective it is easy to be critical towards this fluid and vague communication and document treatment.

There are programs for improved quality assurance in the home care service. There are initiatives made to have a more ensured home care service. The home care routines should be designed in ways making it possible even for inexperienced substitutes to perform work in a proper way. This necessitated a redesign of several work documents and the introduction of prescriptive routine descriptions. It necessitated the development of IT-based information systems. In the ISD project four researchers and two home care assistants and two home care managers participated.

One main objective for the home care service is the individualisation of the home care. To perform home care is not a standardised service. The home care unit strives for maximum individualisation. The elder clients should live their lives in their own desired ways. The home care assistants should support the clients to live in their own ways. In order to do this there is great need for knowledge. The home care assistants must have a good understanding of every person, about their personal life history, their current social and medical situation and their habits and needs. This partially changing knowledge must be transferable to all members of the home care team since there is not one single assistant who takes care of a particular elder. One objective of the IS to be developed was to contribute to this knowledge sharing (Goldkuhl & Braf, 2001).

5. ARTICULATION OF QUALITY IDEALS

Earlier literature on IS actability (e.g. Goldkuhl & Ågerfalk, 2001; Ågerfalk, 1999; Ågerfalk et al, 2001 is not, as said above in sec 3, explicit concerning quality ideals. In order to develop and refine quality ideals we have based our work on an elementary interaction loop (EIAL) model (Ågerfalk, 1999). The EIAL model describes in a generic sense the interaction between a user and a computerised IS. The interaction is divided into three phases within the loop: 1) user action, 2) IS action and 3) interpretation (by the user). When working with the quality ideals we have refined this model.

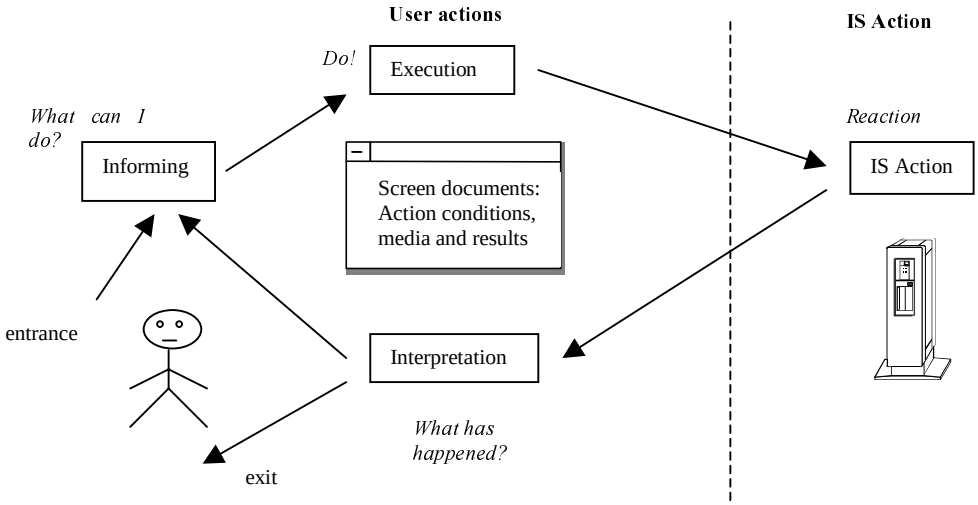

Figure 2. The elementary interaction loop (EIAL) – refined model

The first phase (user action) has been divided into two phases: Informing and execution. This means that our refined model consists of four phases: Informing, execution, IS action and interpretation (see figure 2). It describes in a generic sense the interaction between a user and a computer-based IS. In the informing phase the user has to be informed from the screen document about what can be done. He/she must have knowledge about which possible actions can be carried out. After being informed, the

user executes an action (for example by clicking on a button on the screen document). The IS reacts by performing its corresponding IS action. When the IS action is performed the user interprets what the IS has done.

The screen document plays important roles in the interaction. One can say that the screen document is multifunctional. It contains *information about the action possibilities and other action conditions*. In this sense it used in the informing phase by the user when he is reading the screen figuring out what to do. The screen document functions as an *action media* in the execution phase when the user for example clicks on some button when performing his action. The user can also (in the execution phase) type some information in a field and the screen document consists in this sense of *action results* of the user execution action. The IS action can result in changes of the screen document (as a feed-back to the user). This means that it contains of *results of the IS action*.

The earlier (three steps) EIAL model has been compared to the action model of Norman (1988) in Goldkuhl & Ågerfalk (2001). Performance (= user action) and assessment (= interpretation) are explicit steps in Norman´s model. The reaction part (= IS action) is however missing which is noticed (ibid). The refined EIAL model can be compared to the classical action model developed by Mead (1938). Mead's model consists of four stages of an act: 1) impulse, 2) perception, 3) manipulation, 4) consummation. Our first phase (informing) corresponds to Mead´s two first perceptual stages. Before one can act, one must perceive the action environment and become informed about action possibilities. The actor assigns meaning to the situation in accordance to his pre-understanding. This pre-understanding is "action-penetrated", i.e. the world is understood as a world to act in. Our second phase (execution) corresponds to the manipulation stage of Mead, and our last phase (interpretation) corresponds the last stage of Mead (consummation). Mead defines an action consisting of all these four stages. We define each of the four phases in our interaction loop as separate actions. This follows the principal division of intervening and receiving actions made by Goldkuhl (2001).

Our analysis has resulted in two modes of interaction: navigation and performance. We distinguish between navigation and performance. In order to navigate, the user must first inform him-/herself about: Where am I? and in what direction am I heading? We call this part of navigation for orientation. The answer to these questions makes it possible to make a move in the IS. Navigation consists of both orientation and movement. From the navigation mode the user can reach a performance mode. In the performance mode the user perform work practice actions. We have used the model in figure 2 for descriptions of quality ideals both for the navigation mode and the performance mode.

5.1. Navigation mode

5.1.1. Informing

5.1.1a. Orientation. Orientation should not be confused with navigation. Need for orientation arises when a use situation is approached. The users need to locate the current use situation in relation to other use situations the IS (Nygren, 1996). Orientation is to understand where I am and to decide where I want to move.

5.1.1b. Focusing in contexts. As mentioned above, the studied work practice can be characterised as complex with a high degree of communication needed. This implies that

there is a need for understanding a specific task in a context. In order to fulfil or solve a specific task you need information from the IS (the context). The context acts like a background and the specific task as the foreground (se figure 3). This means that the context work as conditions for action. This is in line with hermeneutic theory of interpretation (e.g. Bleicher, 1980).

5.1.1c. Supporting understanding of navigation principles. There are several types of navigation. First, there is hierarchical navigation which for example take place when you access the next higher or a lower level in an IS. Second, there is sequential navigation. Sequential navigation means that you access an adjacent use situation within the same level. Finally, there is direct navigation. Direct navigation means that it is possible to access a use situation anywhere in the IS. We claim that the type of navigation offered by the IS must be clear in order to support the users mental model of the IS.

5.1.1d. Informing about action mode possibilities. The action mode of the use situation should be explicit. Is it a read, an update or a write situation? Confusion about what mode of action offered should be eliminated. We claim that text, in for example buttons or other screen elements used for navigating, should be built up with the name of the action combined with the name of the actual object (i.e. planning tasks, register information about clients).

5.1.2. Execution

Actions should be easy to execute. This means that the way of how the execution is performed should be easily managed. The selection of the desired destination must be done easily and without hesitation. The IS should support execution alternatives for both novices and experts (e.g. Nielsen, 1993).

5.1.3. IS-action

The IS should be able to execute what is asked for; i.e. perform the correct movement in the document space.

5.1.4. Interpretation

A feedback should be given to report whether that the intended navigation has succeeded. A way to do this is to clearly label each use situation. The user needs to interpret what the IS has done (see figure 2). He/she must recognise that the action has succeeded.

5.2 Performance mode

5.2.1. Informing

5.2.1a. Understanding of the screen document. The contents of the screen document should offer good conditions for performing actions both within the IS and outside the IS. This means that information presented must be easily interpreted, actions must be easily

accessible and understandable. The user shall understand the consequences of offered actions. Relations between actions performed within the IS must be visualised in a way that the users easily understand if there is a specific order among the offered actions.

5.2.1b. Action memory – easily accessible. Earlier stored information should be easy to access. This means that information about previous actions should be easily accessible. The action memory can consist of both historical information (actions that have been performed and other action conditions) and expected actions (actions that should be performed).

5.2.1c. Action memory – personalised. In our case study there was a lot of communication between home care assistants. The home care assistants communicated through messages, both spoken and written. Often when written messages were used the receiver of the message felt that there was a need to know more than that actually has been written. There was a need for contacting the sender of the message. We claim that it should be clear who is responsible for the content of the message. Information about "who has said what" should be stored in the IS as part of the action memory. This quality ideal can be seen as an exhortation to avoid anonymity in information systems.

5.2.2. Execution

Actions should be easy to execute. This means that the way the execution is performed should be easily managed. The IS should support execution alternatives for both novices and experts (e.g. Nielsen, 1993).

5.2.3. IS-action

The IS should be able to execute what is asked for. IS execution can consist of changing the action memory (data base) and/or sending some message outside the system (Ågerfalk, 1999). The IS can also change the contents of the currently used screen document as a feed-back to the user (see below).

5.2.4. Interpretation

The IS should always give an understandable response to a performed action (see figure 2). The response should consist of a description of the IS action performed (and eventually the actions that will be performed). The user should understand the consequences of chosen interactive actions.

5.2.5. General quality ideal

5.2.5a. Work practice language. The IS language should harmonise with the work practice and the users' language. There should be no confusion of the meaning of the concepts used. The IS should offer explanations of all concepts and a description of the actions that could be performed through the IS.

6. THE QUALITY IDEALS PUT INTO PRACTICE

Below, there are two screen documents presented (see figure 4 and 5). The purpose of showing the screen documents is to illustrate how some of the quality ideals discussed above can be put into practice. As you see in figure 4, we have labelled the buttons with name of the action combined with the name of the actual object. In figure 5, the title of the screen document is clearly labelled with “Perform tasks”. This is the same name as appears in the menu (see figure 4). This is an easy way to support navigation and feedback.

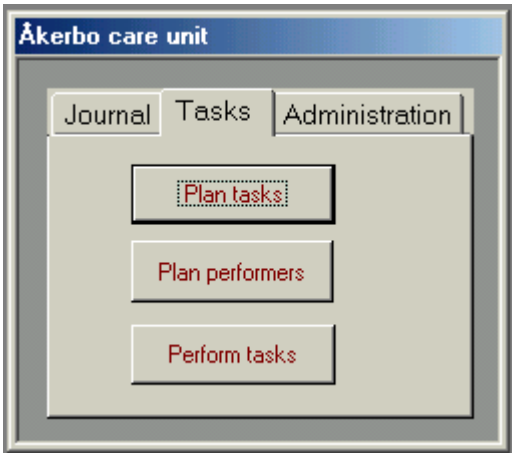

Figure 4. Screen document: Main menu

In the upper part of the screen document “Perform tasks” (figure 5) there are several parameters that can be adjusted according to what should be shown in the grid below. All the parameters help the user to make a selection of the tasks he/she wants to look at. Together with the buttons below they form the action repertoire. The language and concepts that appear are the same as are used in the work practice. Using a familiar language and clear labels helps the user to more easily understand the content of the screen document and which actions that can be performed.

It is also easy to access earlier stored information. If the user wants to check if all the tasks for yesterday were performed he/she simply changes the date and the grid will show the status for yesterday tasks.

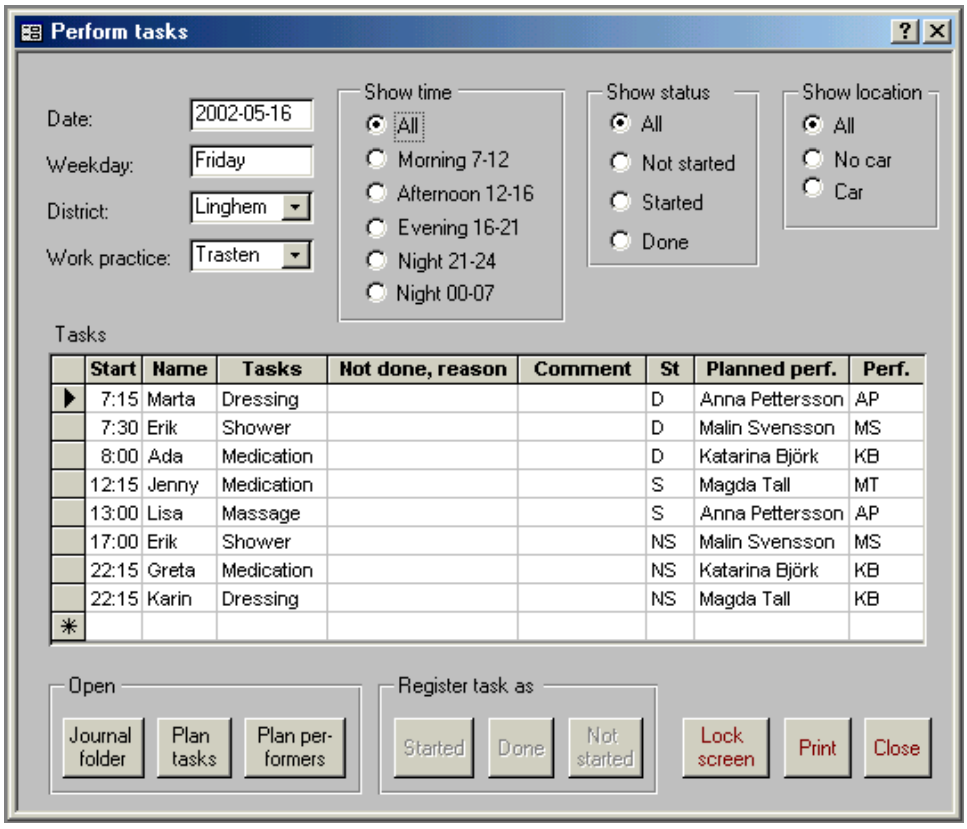

Figure 5. Screen document: Perform tasks

7. SUMMARY AND DISCUSSION

In this paper we have argued for the importance of viewing IS as an action system. This study can be criticised for using a perspective that is too limited. Of course, when designing IS you need to take care of different aspects such as organisational, cognitive, economical etc. All perspectives have their limitations and opportunities. Perspectives tell us what to view, they are not telling us what we are missing to view. We claim that the action-oriented perspective has brought forward several important quality ideals for designing IS.

When we make a brief comparison between the action perspective quality ideals to other perspectives mentioned in section 1 we can see that there are both differences and similarities. The object-oriented approaches have an obvious focus on objects and relations. However, they are not neglecting the action part (see i.e. Behaviour Diagrams in Unified Modelling Language (Object Management Group, 2002)) but it is not as well articulated as in the actability approach. SASD is a traditional ISD method that focuses on data. Well-known diagrams in this method are Dataflow Diagrams, Entity-Relationship Diagrams and State-Transition Diagrams. In this diagrams there is no way

to describe user actions. The perspective in SASD method is data oriented. We have not compared the quality ideals with participative design since this perspective is more of a philosophy than a methodology.

In the HCI area we can find Nielsen's 10 heuristics (1994). Some of these heuristics are similar to quality ideals. For example Nielsen (ibid.) claims that "The system should speak the users' language" and "The system should always keep users informed about what is going on, through appropriate feedback within reasonable time". The first quote has relations to what we have formulated as "The IS language should harmonise with the work practice" (see section 5 "Work practice language"). The second quote are related to what we are calling "feedback". There are also differences. It is clear that Nielsen's 10 heuristics are more oriented towards the user-tool relation in Shackel's model (see figure 6). The heuristic that is closest to the task component is "match between system and the real world". This heuristic discusses the importance of that the system should use business concepts that are familiar to the user. The heuristics can be classified as a checklist for user interface design. The heuristics are not confronting the task component to the same extension as the user and tool. Another difference is that the heuristics are more oriented towards cognitive aspects of the user than the quality ideals.

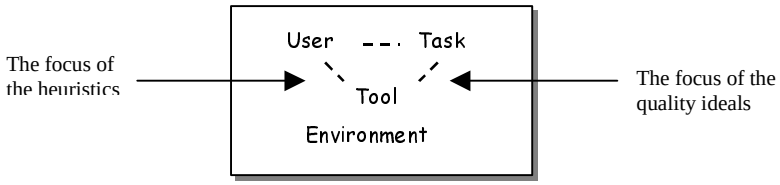

Figure 6. Overview of focus (utilising the usability model from Shackel, 1984, as a base)

A lack in Nielsen (1994) is that he presents the heuristics in a sequential list without any order. We have categorised our quality ideals according to two use situations and into conditions for and consequences of action.

We claim that if one follows the quality ideals described in this paper, one will have a high degree of probability to reach an actable information system. Of course there are other ways to arrive at actable systems. Following other approaches does not exclude the possibility to create an actable system. For example following object-oriented approaches or Nielsen´s usability heuristics might well lead to actable systems although those approaches do not contain explicit criteria for actability design. In such cases actable systems are created *by chance*. In the case of using the actability quality ideals, actable information systems are created by *intentional and conscious design.*

Our results are based on one case study. Despite this, we think that it is possible to make some generalisations. We think that our approach should be considerate in every context where a high degree of communication exists. We also think that several of the quality ideals have more of a general character that they should be valid for the most IS.

We can see two interesting future research directions. One direction is to study the effects in the work practice from using the prototype. Will the actions offered by the prototype harmonize with the actions performed in the work practice? The other direction

is to more thoroughly compare our quality ideals with the usability heuristics in Nielsen (1994) and to other ISD approaches.

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