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## **User Interfaces as Organisational Action Media**

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### **Abstract**

The issue at stake is how to conceive user interfaces of IT artefacts in an organisational and semiotic perspective. Different communicative functions of user interfaces are investigated and the sequencing of user-system interaction. Two earlier models in the information systems actability approach are investigated and integrated: The Elementary InterAction Loop (EIAL) and the communicative model of user interfaces. Three new EIAL models are created dependent on three interaction modes (reading, formulation and navigation mode). A small example from eldercare is used for illustration. The foundations of the different interaction models in socio-instrumental pragmatism are discussed.

## 1. Introduction

Human-computer interaction (HCI) is usually considered as a single individual interacting with a technical artefact [25], [30]. This way of conceiving HCI conceals its genuinely social character [23], [29]. A human sitting in solitude interacting with his computer is doing something more than managing this technical device. To use an IT-system (in an organisational setting) means usually that one is taking part in organisational communication. Messages are produced and messages are received and interpreted. Messages in organisational communication are mediated through IT-systems and specifically through the media of user interfaces. IT-systems and their user interfaces are thus considered as instruments for organisational communication [19], [35], [1].

A human reads what is on the screen (the user interface). What he reads are to a large extent messages from others. When he enters data into the computer (through the interface) he produces messages not only intended for the IT-system itself. He produces messages, which later will be presented to others, either with original content or transformed by the system into some other messages [34].

There are several earlier contributions to a communicative and semiotic understanding of user interfaces. Connolly & Phillips [10] and Baranauskas et al. [6] have, based on Stamper's semiotic ladder [36], made an analysis of user interfaces. Signs (on a computer screen) are characterized according to the different steps of the semiotic ladder (physical, empirical and syntactical, semantical, pragmatic and social). An explicit communicative interpretation of user interfaces is presented by Andersen [5] and de souza et al [13]. A differentiation into three types of communicative situations is made: (1) User-system interaction, (2) user-user interaction and (3) designer-to-user communication [13].

Founded in the information systems actability perspective, Sjöström & Goldkuhl [35] build on this differentiation of communicative situations and make a further elaboration. The communication via a user interface is elaborated into four types: (1) designer-to-user communication of action possibilities, (2) business communication from others to user, (3) business communication to others from user and (4) user navigation of system. A communicative and socio-pragmatic model of user interfaces is presented (ibid).

Information systems actability theory (ISAT) is a perspective founded in communicative action<sup>1</sup> and social action theories<sup>2</sup>. An IT-system is considered to be an organisational action artefact. The main purpose of IT-systems is to mediate communication. An IT-system is thus a mediator of organisational communicative actions. IS Actability is defined as an information system's ability to perform actions, and to permit, promote and facilitate the performance of actions by users, both through the system

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<sup>1</sup> ISAT is based on language action theories (e.g. [32]; [21]) and conversational and dialogue theories (e.g. [28], [22]).

<sup>2</sup> ISAT is also based on social action theories (e.g. [40], [7]).

and based on information from the system, in some business context [19]. According to ISAT an IT-system is considered to consist 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 workpractice language (giving frames for actions, action memory and documents)

The communicative model of user interfaces mentioned above, is one way to conceptualise human-computer interaction within the information systems actability theory [35]. There are other conceptualisations of the user-system interaction within ISAT. An Elementary InterAction Loop (EIAL) consisting of three phases of the interaction is presented by Ågerfalk et al. [3]. The phases are: user action, IS action and user interpretation. This model has later been refined and the interaction loop has been expanded to four phases; informing, execution, IS action, interpretation [12]. These two models (the EIAL model and the user interface model) have however not been related to each other. The communicative model of user interfaces describes different types of communication. The EIAL model describes subsequent phases of interaction. When looking at these models, some questions arise: Are the interaction phases (according to EIAL) not dependent on the different types of communication pursued through the interface? How are the different communication types (in user-system interaction) sequentially related to each other? One way to answer these questions is to explicitly relate, or even integrate, the two interaction models. There is a potential, not yet exploited, in relating these two models to each other.

The purpose of this paper is to make an integration of the two interaction models, the EIAL loop and the communicative model of user interfaces. This will hopefully lead us to a better understanding of user interfaces and human-computer interaction. This will also help us to deepen the understanding of the multi-functional character of user-system interaction [12], [35], [2]); i.e. to explain, within a coherent theoretical perspective, both user-artefact interaction and organisational work communication. The two research questions stated above will drive our work.

The two existing models will be presented below in section 3 (EIAL) and section 4 (the communicative model of user interfaces). First we analyse, in section 2, the foundations for these models in socio-instrumental pragmatism. In section 5 we present the integration of the two models. We use an empirical example in order to illustrate the integrated model. We end the paper with conclusions in section 6.

## **2 Fundamentals of Socio-Instrumental Pragmatism**

Information systems actability theory is founded on socio-instrumental pragmatism (SIP). This is a general theory concerning social action and interaction by support of material and immaterial instruments in organisational settings [17], [19], [20]. We describe parts of SIP here as a basis for the models presented later in the paper.

SIP acknowledges human action as purposeful and meaningful behaviour [31]. A human acts in order to make a difference in the world [14]. Our focus is towards social action. We build upon a classical definition of social action made by Weber [40]: "That action will be called 'social' which in its meaning as intended by the actor or actors, takes account of the behaviour of others and is thereby oriented in its course". Our interpretation of this definition is that a social action (performed by an actor) has *social grounds* ("takes account of the behaviour of others") and *social purposes* ("thereby oriented in its course").

A social action may be communicative or material [17]. For communication, signs are used. Language and other semiotic tools are used to communicate to other people. Communication consists of two related reciprocal acts: One act of expressing signs (speaking, writing) and one act of interpreting signs (listening, reading); [9]. A communicative act is an act of expressing signs with a communicative intent (sense-giving). An interpretive act is an act of decoding signs in order to understand the message (sense-reading)<sup>3</sup>. Goldkuhl [17] has described these two related acts, in a general way, as an interventive action and a receptive action. Intervention means creating changes in external world, either material changes or symbolic changes. A symbolic change (i.e. a produced sign) is intended to lead to effects/changes in other humans' inner world (new understanding) and in effects/changes in the inter-subjective social world (changed interpersonal relations) [21]. An actor can receive a material thing given to her or receive something said and thus interpreting its meaning. Interpretation is an action aimed at creating changes in inner world; an understanding is created through perception and interpretation of signs.

This conceptualisation builds upon a differentiation of action performance, result and effects [38], [20]. The performance is the active part (the doing). For example the process of writing a letter. The result is the concrete product of the action; what is done (the written letter). The effects are what arise as consequences of the action and its result, for example the reading of the letter and the thoughts and actions made by the interpreter.

In order to support and in many cases enable action, instruments are used. Instruments are used as mediational means for action [15], [41]. One can distinguish between internal instruments (as language, procedural knowledge, methods etc) and external instruments. External instruments can be material or semiotic. External semiotic instruments must have a material basis, e.g. a note written on a piece of paper. Sometimes the material basis of a semiotic instrument is so advanced that we need to treat it as significant. This is the case when we talk about IT-systems (computer-based information systems). An IT-system is "the pen and the paper" together and also "the file cabinet and the files". It is also "the letters and the postal delivery system" together.

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<sup>3</sup> The concepts of sense-giving and sense-reading are described in [23].

In SIP there is a differentiation between base and instrument [17]. Base is something that is transformed in action. It is the object that is being transformed (consumed) in an interventive action; e.g. wood is transformed in chopping to firewood. The axe is the instrument that is utilized in chopping. As a material instrument, the axe may be reused in chopping. The wood, as base, is transformed and consumed in the chopping. The purpose is to change it. The purpose of the axe is that it should be (re)utilized, which includes that it should be sustained for further actions. The purpose is to preserve the instrument from changes. Exceptions from this are intentional adaptations and redesigns of instruments.

Social actions are usually parts of social interaction. As said above, a social action has social grounds and social purposes. A social ground for an action (e.g. chopping wood) may be that someone else has requested that action. This involves thus also a social purpose; i.e. in this case to fulfil the request of chopped wood. Social actions performed by different actors in a social interaction (turn-taking) can be described as adjacency pairs or larger sequences [28], [22]. An initiative is an action, which may be followed by another action, i.e. the response. The response can in turn function as an initiative for further responses/actions.

Interventive actions are embedded in interpretive actions. Before one intervenes in the external world it is necessary to observe it and to assess action possibilities: What to do and how to do it. After the intervention, the actor usually assess if the act was successful. This post-assessment can turn into a pre-assessment before next intervention. Human action can be described in such cycles of pre-assessment, interventions and post-assessments (fig 1). This follows a classical model of action phases by Mead [24]. The terminology in Mead's model is perceptual<sup>4</sup>, manipulatory and consummatory stages. Goldkuhl [18] has analysed and adapted Mead's classical model into this cyclic model; confer also [12]. With inspiration from Giddens [16] the interventive phase has been complemented with a simultaneous monitoring (fig 1).

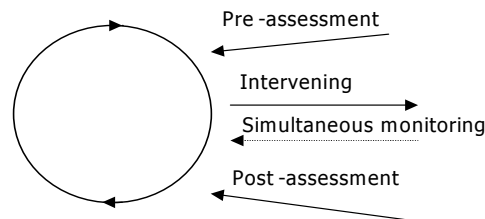


Fig. 1. A cyclic model of action (from [18]).

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<sup>4</sup> Mead [24] made actually a division into four stages where the two first were impulse stage and perceptual stage. These two introductory stages are here grouped together to one perceptual stage.

To summarize, essential features of socio-instrumental pragmatism are:

- social grounds and social purposes of actions
- reciprocal actions of intervention and receiving
- interactional character of initiatives and responses
- differentiation between performance, result and effects
- use of base and instruments in actions
- different cyclic phases of an action

These different aspects of social action can be put together in a model (fig 2).

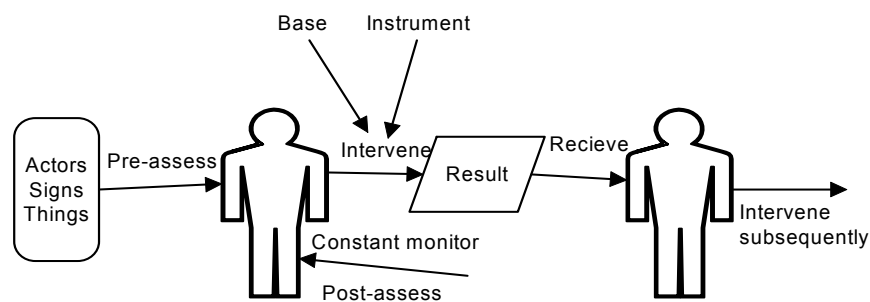


Fig. 2. A model of social action (modified and simplified from [20])

The primary interest of SIP is social actions in organisational settings although its generic character makes it possible to use outside such settings. An action performed in an organisational setting by an employee is usually a representational action. The actor performs an action on behalf of the organisation [4], [37], [20]. The employee is an agent of the organisation and acting in an organisational role.

Due to its capability of programmed behaviour an IT artefact can also be an organisational agent [19], [20]. An IT artefact has the capability to perform pre-defined informational actions. An IT-system is a complex mediator. It does not only transfer messages from one sender to one receiver. It has a programmed capability to transform several messages (from different origins) and create new messages for several different receivers [34]. This delegation of tasks from human actors to the artefact increases the complexity of the communication that is taking place – one user could, for instance, receive a report from the system that is based on a large number of input messages. This could also make it unclear for the user who is responsible for the report. One way to resolve this according to the actability perspective, is to differentiate between input message originators and output message rule definers. There are some persons responsible for what is said by (input) messages. There are some persons responsible for the existence and arrangement of rules how to derive output messages from input messages. This view makes it possible to design system where the communication is transparent, even if the business messages have been processed by the artefact. Each report from the system, no matter its complexity, is created on behalf of

someone who should be able to clarify potential misunderstandings concerning its contents.

### 3 The Elementary Interaction Loop

The elementary interaction loop (EIAL) was developed from the idea of viewing the interaction as an ongoing iteration between the user and the IT-system [3]. The model consists of three phases 1) user action, 2) IS action and 3) interpretation made by the user (see figure 3).

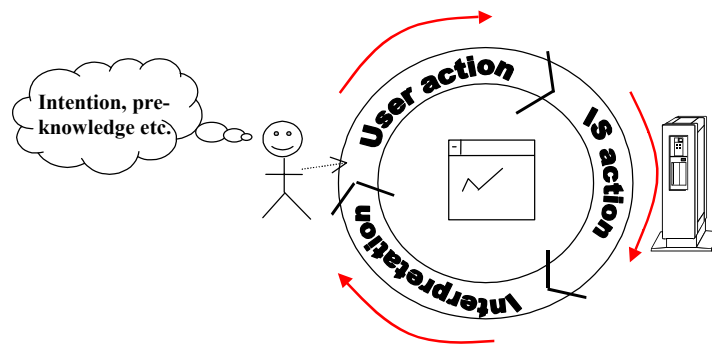


Fig. 3. The original Elementary InterAction Loop (from [3])

This first version of the EIAL was compared to the seven stage action model of Norman [26] by Goldkuhl & Ågerfalk [19]. The seven stages in Norman's model can be grouped into three main stages: Preparation, performance and evaluation (ibid). There is some resemblance with the phases of the action model by Mead described above in sec 2. The phases of the EIAL loop corresponds to the phases of Norman's model in the following way. Preparation and execution corresponds to user action and evaluation corresponds to (user) interpretation. The reaction part (= IS action) is however missing in Norman's model which is noticed (ibid). User action (in EIAL) consists not only of an interventive action (manipulation in Mead's terminology and execution in Norman's terminology). It is preceded by a preparation (pre-assessment). This preparation includes both a perception and interpretation of the actual situation and a decision what action to take. Based on this insight a second version of EIAL (figure 4) was developed [12]. This second version EIAL model describes in a clearer generic sense the interaction between a user and a computerised IS (see figure 4). The interaction between the user and the IT-system is divided into four phases within the loop. The first phase (user action) has been divided into two phases: 1) informing and 2) execution. The other two phases remains: 3) IS action and 4) interpretation.

In the middle of the interaction loop a screen document is placed. The screen document (as part of the user interface) plays different roles in the phases. One can say that the screen document is multifunctional. In the informing phase the screen document is used when the user is reading the screen figuring out what to do. It contains *information about the action possibilities and other action conditions*. In the next phase the

screen document is used for execution. In this sense the screen document functions as an *action media*. For example, the user enters some data in a field and clicks on a button on the screen in order to perform an action. The phase of the IS action should be understood as a response to the user execution. The IS action can result in changes of the screen document (as a feed-back to the user). In this sense the screen document consists of *action results* and functions as a basis for interpretation.

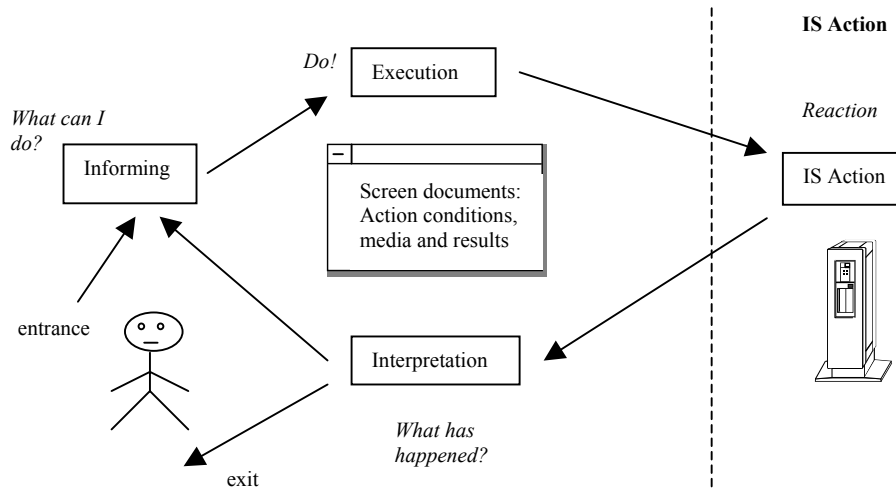


Fig. 4. A revised Elementary InterAction Loop (from [12])

The second version of the EIAL model was explicitly compared to the classical action model by Mead [12]. The first phase (informing) corresponds to Mead's first perceptual stage. Before one can act, one must perceive the action environment and become informed about action possibilities. The second phase (execution) corresponds to the manipulation stage of Mead and the last phase (interpretation) corresponds to the last stage of Mead (consummation). The terminology adopted in section 2 above was pre-assessment (which corresponds to informing), intervention (corresponding to execution) and post-assessment (corresponding to interpretation).

#### 4 User Interfaces as Action and Communication Media

Sjöström & Goldkuhl present a socio-pragmatic view on user interfaces [35]. They explicitly relate their work to the different language functions of Bühler [8]. Bühler puts forward signs in relation to its creator, its interpreter(s), and its reference to some object in the world. These three concepts as three functions of language are referred to as : 1) symptom (the expressive relation), 2) signal (the influence relation) and 3) symbol (the referential function) [8]. Figure 5 (below), *the actability view on user interfaces*, is fundamentally based on this small model of communication, which places a sign in a socio-pragmatic context. This perspective is also based on the work in semiotic engineering [13], who discuss communicative aspects of user interfaces, and especially point out that this view is useful when designing groupware applications. Sjöström & Goldkuhl argue that this communicative view is important not only



not only when we discuss groupware applications, but at all times when we wish to understand socio-pragmatic aspects of IT system use. Information systems are regarded as **systems for technology mediated business communication** [35].

A user interface is divided into four parts dependent on its communicative functions. (1) The action repertoire is considered as communication from designers to users. The user interprets different action possibilities of the IT-system. The user (as a business actor) communicates through the IT-system with other business actors based on the action repertoire. (2) The user may interpret messages from other business actors. (3) The user may also formulate messages intended for other business actors. (4) The user can also navigate in document space afforded by the IT-system. This is not seen as a communication with other actors, but is part of the user's management the system and depending on what he wants to do (next).

This view on user interfaces has proven to be a useful tool when discussing socio-pragmatic aspects of IS use. The practical usefulness of the view has been discussed in two smaller case studies [35], [33]. It has helped to emphasize two dimensions of IS use – both human-artefact interaction and the technology mediated business communication that is taking place between human actors in an organization. This is referred to as the *pragmatic duality* of information system use.

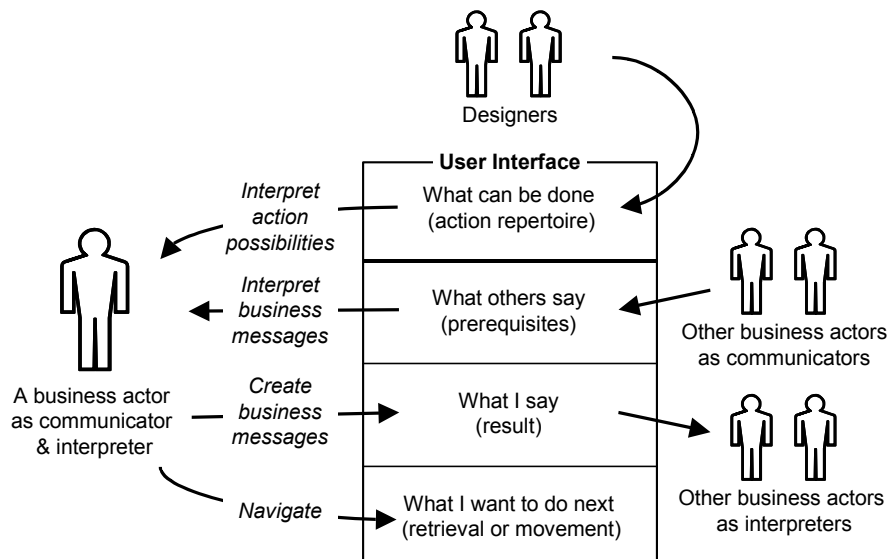


Fig. 5. An actability perspective on user interfaces (based on [35])

This view is, as described, primarily based on social action theories and semiotic theories, however there are other theoretical justifications for this perspective. One example is the work by Walsham [39], who builds a model of basic communication based on Polanyi's concepts [27] concerning knowledge and re-presentations of

knowledge. Walsham's model consists of four steps: 1) An actor acts in the world and reflects upon his action, 2) based on these reflections he/she creates a re-presentation of some kind (e.g. using an IT system) with the intent to communicate something to some other actor. Both during reflection and the creation of the re-presentation the actor's *tacit power* is a vital. It is an act of sense-giving, as presented by Polanyi. 3) Another actor 'reads' this re-presentation and tries to make sense of it – once again, the concept of tacit power is important, since it is related to the sense-reading. 4) The actor performs some action(s) based on the interpreted meaning of the re-presentation. This model seems to be similar to our view on user interfaces, even though it is based on another theoretical foundation. Polanyi's view on sense-making may very well be conceived as a semiotic theory, since it discusses the creation and interpretation of signs. Walsham (ibid) further argues that in order to explain phenomena related to these re-presentations, there is a need to involved sociological theory. Walsham applies some concepts from Giddens [16] to illustrate this need, which puts the focus on the norms related to re-presentations, and the power and politics behind these norms (e.g. who demands representations, what are the incitements to make re-presentations etc). We believe that the actability view on user interfaces allows for this type of sociological complements, which makes it possible to use this view as a foundation to study the communicative and social aspects of the use of IT systems.

### **5 Three Types of Elementary Interaction Loops**

The user interface model presented above divides the user interface into four parts dependent on its semiotic function (interpretation of action repertoire, formulation of business messages, interpretation of business messages, navigation). The interpretation of the action repertoire is however to be seen as a necessary preparatory part of every interaction loop. Due to this, the interpretation of the action repertoire does not give rise to any particular type of interaction. The other three communication modes give rise to interaction loops of different characters. Formulation mode, reading mode and navigation mode will be performed rather differently. We will in this section describe three different Elementary InterAction Loops dependent on these three communicative modes derived from the user interface model:

- Reading mode
- Formulation mode
- Navigation mode

An example to illustrate the different interaction loops is given at the end of the section (5.5).

#### **5.1 Reading Mode**

The reading mode means the interpretation of business messages emanating from other business actors. As said above an IT-system may have a programmed capability to derive new messages from other provided messages. This means that the focused user may not read messages directly produced by other business actors. The IT-system may have transformed other actors' messages, and it is these new messages

that are exposed to the user. Nevertheless, the origins of the exposed messages come from other business actors.

We follow the four phases of the EIAL loop (sec 3 above): Informing, execution, (IS) reaction and interpretation. The Elementary InterAction Loop model for reading is presented in figure 6 below. In the first phase of informing, the user finds out what to read. The user's interest is towards the reading repertoire of the IT-system's action repertoire. What reading possibilities does the IT-system afford to its users? The informing phase (pre-assessment) is ended by a decision by the user what (type of) messages to select for reading. In order to do this he needs to manipulate the system in some way, for example input some parameters in order to get what he wants. This is done in the second phase (execution).

In the third phase the system reacts. It exposes the requested messages. The IS action may involve different types of actions. It consists of retrieval of messages from the system's action memory [19]. It may consist of derivation of new messages in accordance with the retrieval parameters of the user (from phase 2). The third phase is ended by the exposure of retrieved messages on the screen. In the fourth phase (interpretation) the user reads the displayed messages. After this is done he may proceed with another Elementary InterAction Loop of reading or some other interaction type or he may end his system interaction session. Between interpretation and informing we have a general entrance/exit point.

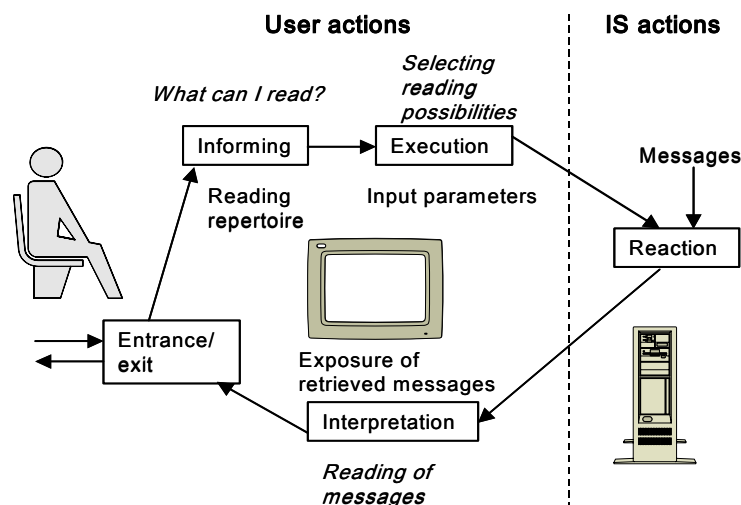


Fig. 6. The Elementary InterAction Loop – reading mode

### 5.2 Formulation Mode

A formulation interaction loop is depicted in figure 7. In this situation, the user communicates some messages to other business actors through the interface and the system. These messages can be transferred as they are to other actors or they can be put

in the action memory for derivation of other messages or some later message transfer [19]. In the first phase (informing), the user finds out what formulation possibilities are afforded by the system. “What can I say through the system?” The formulation repertoire of the system’s action repertoire is investigated (a pre-assessment). In the second phase (execution), the user inputs the message. He enters the data and he may also select some data on the screen. His formulation action is ended by a mouse click on a screen button or pressing the enter key (or some other requested operation). This is the performance of a communicative action (an intervention).

The third phase is the IS (re)action. The captured data is taken care of in accordance with the programmed action repertoire. These actions may involve storage, calculation and transfer of messages. The action memory of the system may be affected (ibid). A feedback to the user may be delivered, i.e. some message on the screen about the success of the performed action. In the fourth phase (interpretation) the user reads the feedback message in order to find out if the input data (from the second phase) were successfully handled by the system (a post-assessment). After the fourth phase the user can move on to another interaction loop or he may end his system session (exit).

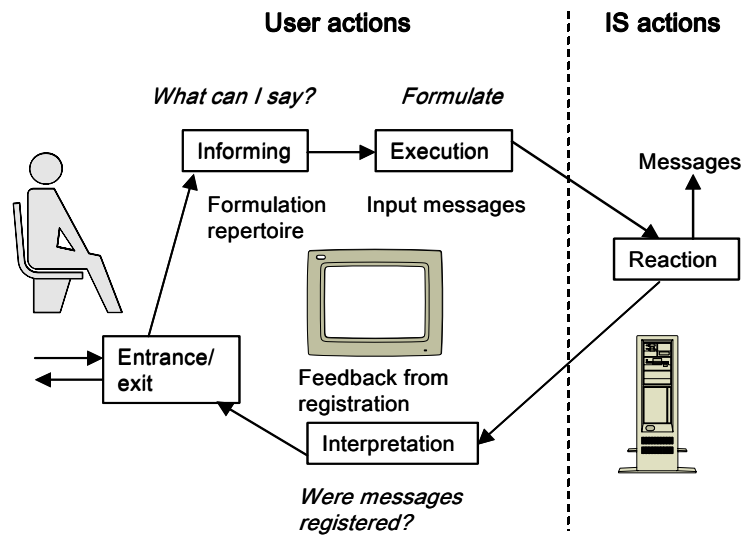


Fig. 7. The Elementary InterAction Loop – formulation mode

### 5.3 Navigation Mode

An IT-system consists usually of several screen documents. There is not room for everything that can be done with the system on one screen document. The system is a

space of several documents that can be called by the user dependent on what tasks to perform. A screen document represents different action possibilities. To move between different documents is called to navigate in the system. A navigation interaction loop is depicted in figure 8.

In the first phase (informing) the user tries to find out what navigation possibilities are there in the system. “What screen documents are there to visit?” Where can I move next?” After deciding where to move, the user (in the execution phase) makes the desired move in the system. This is probably done by clicking on some item (an intervention). Another screen document is requested. The IS (re)action is to perform the requested navigation action. Another screen document is displayed. In the interpretation phase, the user investigates if the exposed document corresponds to his action needs. “Have I come to the right place? Can I perform the desired tasks by support of this document?” If he is content in this post-assessment, the navigation loop is followed by a formulation or a reading loop dependent on purpose. If he was not content with the action repertoire of the screen document, another navigation loop may be performed in order to find the appropriate place. If no such place (i.e. a document with a requested action repertoire) is found, the user may end his system interaction session (exit).

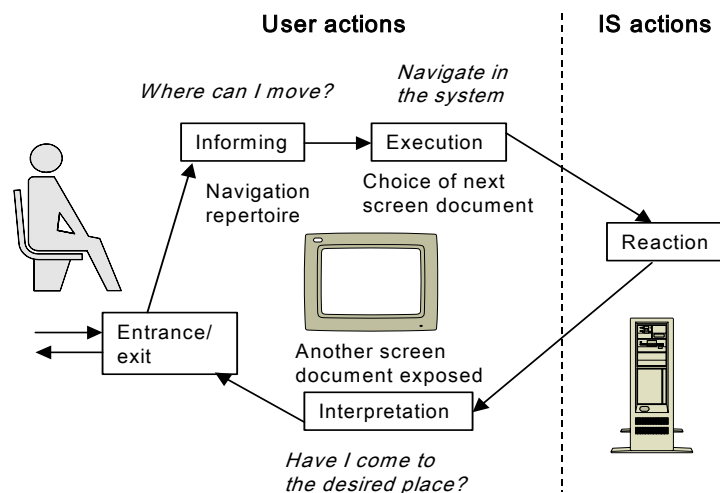


Fig. 8. The Elementary InterAction Loop – navigation mode

#### 5.4 Relations Between the Different Interaction Modes

The three elementary interaction loops have been described as pure types (ideal types). We have not mixed elements from the different interaction modes. In real interactions there will probably be some mixture of these types. A navigation interac-

tion can include some display of messages, i.e. it involves reading possibilities. These two interaction types can be integrated in other ways. A reading interaction (a request for messages) can involve an exposure of a new screen document with the displayed messages. A formulation interaction may involve some reading. In the informing phase, the user may not only investigate formulation possibilities. He can as a basis for his formulation read some business messages as a basis for his formulation of new messages. This is a way to make his communicative action an informed action! In Sjöström & Goldkuhl [35] an example of this is discussed. To make a formulation interaction more effective, it should include display of relevant business messages.

### ***5.5 An Example***

As an illustration of the three types of interaction we have used an example from a home-care unit for elderly people. This is based upon a longitudinal action research project. The authors Goldkuhl and Cronholm participated in this research project for several years. The research has earlier been reported in several publications for e.g. [12] and [18].

The action research project consisted of an integrated workpractice and information systems development. A new IS was developed in a participatory design project, where researchers and eldercare personnel participated in a co-design endeavour. One explicit research goal in this project was to utilise and test the IS actability principles [12].

Data generation in the research project has been pursued with different qualitative research methods: Interviewing directors and nursing assistants, observation of their work, collection and analysis of several documents, participation in development seminars.

The home-care service consists of different kinds of support for the elders in their homes. The nursing assistants help the elders with dressing, daily hygiene, food, minor medical tasks, cleaning, laundry, shopping etc. Normally, an elder is visited by a nursing assistant several times each day. One main objective for the home-care service is the individualisation of the home care. To perform home-care is not a standardised service. Each client has individual needs and therefore the tasks that will be performed for the different clients vary. The needs for each client will also vary over time. The home-care unit strives for maximum individualisation. The elders should be able to live their lives in their own desired ways. The nursing assistants should support the clients in their living. In order to do this there is a great need for knowledge. The nursing 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. We use an example from the developed IT system; one part which is concerned with choosing tasks to be performed for the elderly and reporting tasks that had been performed (see figure 9).

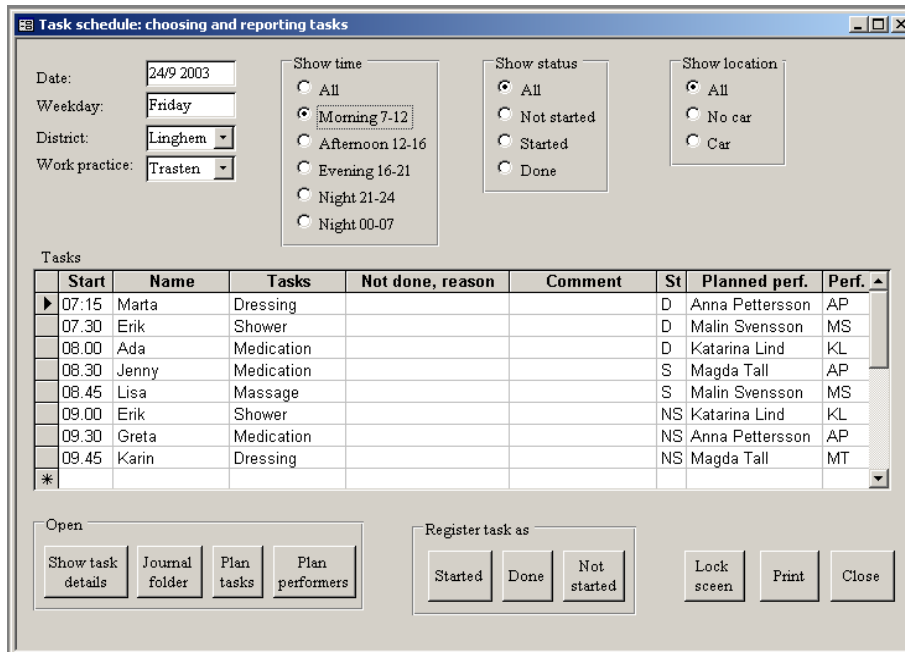


Fig. 9. Example of a screen document in eldercare setting

An example of a read-situation exists when the nursing assistant selects a view from the action memory. First the assistant has to *inform* herself about the actual view (what information is represented on the screen). The actual view is representing all tasks for the morning 09/24 2003. If the assistant wants to see all tasks for the afternoon she has to perform an *execution* (a click on the radio button “afternoon 12-16”). The *IS action* is a change of the view of the action memory that corresponds to the user execution. Messages about the afternoon tasks are displayed. The user *interprets* the IS action through confirming that the desired view is exposed. She reads the content of the newly displayed messages as an interpretation of business messages.

An example of a write-situation (formulation mode) exists when the nursing assistant chooses a task to perform for an elder client. First the assistant has to *inform* herself about which tasks that have been carried out and hence are not possible to choose. Carried out tasks is marked with the letter “D” (short for done) in the “St” (short for status) column. Choosing a task means an *execution*. The execution is done by selecting a task and registering it as started. The *IS-action* includes a response that is visualised by a change of the value for the selected task to the value “S” (short for started). Finally, the user *interprets* the IS-action by checking that the status has changed. The formulation of messages (what chosen tasks) has of course a communicative purpose. It communicates to other nursing assistants that a task for particular elder has been chosen and cannot be chosen again. This message is used in the same type of read and write situations as just described, but in another instance of it (performed by another nursing assistant).

An example of a navigation-situation exists when a nursing assistant wants to move to another screen document. First she has to *inform* herself about which screen document are possible to access. In the actual document there are explicit options to open four other documents. There is frame at the lower left corner with the text “open” together with four buttons (show task details, journal folder, plan tasks, plan performer). To *execute* the navigation, the assistants click on one of the “open-buttons”. The *IS action* consists of an opening of the desired screen document. The users *interprets* the IS action by perceiving that the desired document has been opened.

## 6 Conclusions

The main idea of this paper was to integrate two models in the IS actability approach: The elementary interaction loop and the communicative model of user interfaces. This has been done and presented in sec 5 above. Three interaction loops were described following three interaction modes (reading, formulation and navigation mode). Two research questions (from sec 1) have guided our work. We give summarizing answers to these questions here; more detailed answers can be found earlier in the paper. The question “Are the interaction phases (according to EIAL) not dependent on the different types of communication pursued through the interface?” can be answered: The four generic interaction phases (of EIAL) will have different meanings and functions dependent on the kind of interaction mode. Therefore three EIAL models have been presented following the three interaction modes. The question “How are the different communication types (in user-system interaction) sequentially related to each other?” can be answered: The interpretation of action repertoire is a necessary pre-requisite for the other three types of communication. The sequence of the three types of communication/interaction (reading, formulation and navigation) is dynamically managed through the accomplishment of the three elementary interaction loops. Sequencing is dependent on purposes of the interaction session and on the situational effects obtained.

We claim that the presentation of these three interaction models enhances our understanding of human-computer interaction and specifically of user interfaces. In the creation of these three interaction models we have built upon the principle of pragmatic duality [35]. In an interactive IT usage situation, the user is at the same time interacting with the IT artefact and with other business actors. The user is communicating (through interpretation and formulation of business messages) with other business actors. The user interface functions as an organisational action media. Through the action repertoire (visualised in the user interface) the user is guided and constrained in his organisational communication endeavours.

Communication is essential in organisational work [37], [36], [20]. Through the communication repertoire afforded by the user interface; IT artefacts play a decisive role for organisation communication and hence for what may be performed in the organisation. The design of user interfaces is not only a question of comfort for single users. It is an issue for how to support organisational actions and make them a coherent whole.



The interaction models presented here are contributions to information systems actability theory and socio-instrumental pragmatism. They are however not to be seen as contributions restricted to these theories. They represent enhanced knowledge of human-computer interaction to be integrated and used in other conceptual frameworks as well. The three models may contribute to the understanding of user interfaces as organisational semiotics devices.

What are the benefits of these presented interaction models? We conceive them as both *design and evaluation instruments* and as such they are parts of *practical theories* [11]. They can be used as generic templates when designing user interfaces and also in evaluation of IT usage. The three generic interaction models can guide the designers to a clear separation of different interaction situations. Depending on whether it is a reading, formulation or navigation situation, it should be designed accordingly. Future research will focus on the use of these models in design and evaluation situations.

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