Requirements Analysis of Joint Tasks in Hospitals

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Abstract

Joint tasks in complex cooperation contexts are hard to analyse and describe. They consist of a number of individual tasks and are performed by workers from different professions and in different organizational units. A good illustration can be found in the domain of hospitals.

To provide an appropriate system support a special way of proceeding is required. This has to be oriented to the characteristics of joint tasks and is usually not supported by traditional approaches.

Thus, in this article we present and evaluate new analysis techniques. They were developed and applied in the context of a cooperation project with a hospital. These techniques visualize cooperation in joint tasks by means of representations directly understandable to users. They can be applied by developers as well as users in order to gain an understanding of which and how different functional roles contribute towards the accomplishment of complex tasks. Additionally they allow capturing the meaning of individual tasks. Gathering and feeding back these pieces of information form indispensible prerequisites for system design with heterogeneous user groups.

1   Introduction

Complex cooperation contexts in organizations are characterized by joint tasks. We understand joint tasks as tasks in an organization consisting of a large number of individual tasks and responsibilities. They are performed by workers from different departments and professions in close cooperation. The necessary coordination takes place through explicit or implicit arrangement and has to provide the space for situative adaptation.

Besides the immanent complexity and situatedness of joint tasks and the heterogeneity of the workers involved, in the light of their software support yet other specifics have to be considered.

For some areas either specific systems are in use or are being offered on the market. These support the individual departments with their particular tasks. Notably, the integration of these stand-alone solutions and the explicit support of cooperation are frequently omitted. Moreover, stand-alone solutions are mostly provided by specialized vendors and are available in form of standard software which has to be adapted.

Software support for joint tasks thus implies the combination of, firstly, system development or choice of stand-alone solutions, secondly, adaptation of these subsystems and, thirdly, designing an integrated system with task oriented cooperation support based on well-defined technical interfaces.

As is demonstrated in this paper by the example of hospital information systems, in the context of joint tasks new requirements arise for software engineering. These already emerge at the stage of requirements analysis and carry on into system design for cooperation support. In addition an increased emphasis is to be placed on the methodology for developing adaptable standard software and for integrating distributed workplace solutions.

The techniques to be introduced in this paper contribute to software engineering methodology. They are grounded in the tradition of evolutionary system development, in particular STEPS (Software Technology for Evolutionary Participative Systems development) ([5] [6]) and the Tools&Materials approach ([3][10]). The emphasis and aims of these approaches lie

- in *evolutionary software development*, based on a cyclical process model,

- in the support of a *participative communication* and *learning process* for the developers and users alike,

- in the emphasis on the *use context* which means an interlacing of system design and organizational development,

- on a *task oriented* requirements analysis, oriented at the tasks of organizations instead of system functions as well as

- in the *support perspective* which is expressed in the leitmotif of software workplaces for qualified human activity and treats the user as the expert.

The techniques to be introduced have been developed and used by us in the context of a concrete project. The project is concerned with the development or choice respectively of an integrated solution in the domain of hospital information systems with an emphasis on the clinical section. We adapted the techniques from STEPS and the Tools&Materials approach but discovered the

necessity to further elaborate these in the context of complex cooperation contexts.

This is illustrated in the following sections. Section 2 describes the context of and the proceeding in the project. It shows why and to what extent existing analysis techniques had to be expanded. Section 3 elaborates on the specifics of joint tasks and gives a concrete project-specific example. Section 4 presents the analysis technique of Cooperation Pictures for a graphical presentation of joint tasks. From the background of the project it is described to what extent this technique is as useful for an increased understanding of the developers as it is for the feedback with heterogeneous user groups. Furthermore the complementing technique of Purpose Tables is introduced in section 5 capturing the semantic content of joint tasks in a detailed tabular description. Section 6 evaluates the results with regards to the underlying methodological approaches.

2 The Project Scenario

2.1 The Project's Environment

The subject of our cooperation project is to support the decision finding process of a hospital. This concerns the development and/or choice respectively of an integrated Hospital Information System in the clinical sections and planning the configuration and use of this HIS in the light of changing demands. The cooperation partner is a small acute care hospital with 230 beds and 560 employees. The assignment of the project is embedded in the organizational development in the hospital which is taking place with the participation of all groups of employees from the different departments: internal medicine, surgery, anesthesiology, nursing staff, administration, maintenance/ technical support. These will be the future users of the system. The involvement of the users in the development and/or choice of the system is presumed and supported methodically.

The situation in the hospital at the beginning of the project in September 1995 was characterized by the existence of stand-alone systems in some parts of the hospital. The administrative department has been provided with a closed software system for some years already. Some computers exist at the different functional workplaces of the internal medicine department like in the X-ray department, the ECG unit etc. They have no access to the patient data of the administrative system, though. In the surgery department it was just begun to introduce a software system which is likewise not connectable.

The project was triggered by a new health care law which was passed in 1993 and discharged the financing of the actual expenditures of the hospitals for a recompensation of the performed deeds. This brought along a strong intertwining of clinical and administrative data. In view of that, the focus of the project lies on finding an integrated solution with an open interface that allows the access and use of data in different departments. Thus, it makes possible a continuous registration of case dependent performances. This integrated solution aims at supporting the cooperative work in the clinical departments as well.

2.2 The Hospital Project

The course of the project was planned by us in four partly parallel activities, each of them concluded by a workshop:

- the task oriented analysis of work practice by means of interviews and group discussions on the basis of scenarios and glossaries;

- the requirements specification based on system visions with consideration to the required organizational development and the existing hard- and software systems;

- the market analysis of the available software systems in view of adaptability, extendibility, usability and data security. In the context of this activity pilot systems are to be used and evaluated;

- the decision process whether a cooperation with potential software producers is wanted and if so in which frame. The cooperation may either consist of the adaptation and integration of standard software or of a customized solution for the hospital.

A period of nine months was estimated for the project.

The project was planned in awareness of the fact that existing software systems in the hospital so far provide little task oriented support of activities or satisfying usability. One of many voices accounts for this insufficiency in a concise way: „Without being malicious one can say: There are only variably bad solutions"[1]. The suspected reason is: „This certainly depressing situation has its root in the fact that so far developers of information systems have only insufficiently managed to grasp and portray the existing needs and processes in an informationally correct manner, i.e. with means in their actual semantic and not formalized orientation and in their actual complexity"[1].

Since gaining an understanding of the tasks and of how they are accomplished in the users' world is of paramount importance, we will describe the implementation of the analysis of current work practice and the experiences resulting from it. We shall justify the need for additional analysis and feedback techniques.

2.3 The Course of the Work Practice Analysis

At the beginning of the project we took stock at the site of the hospital in order to get an impression of the existing situation and to hold preliminary talks. Next was the establishment of the project which defined the frame of the cooperation and the kind of feedback of results. The list of planned interviews was passed. Subsequently interview guides were developed for each planned interview which were to be held with representatives of each of the different departments. In these interview guides the topics and questions to be discussed were collected.

Altogether 20 qualitative interviews were held at the corresponding workplaces. The interview partners were chosen following the concept of the functional role [9]. A functional role is classified by a collection of tasks for which a person or a group of persons is responsible. From these interviews scenarios were extracted which describe the present way of accomplishing work tasks with means and objects of work in the professional language of the users. In addition a glossary of the technical terms was produced. Scenarios and glossary were fed back to the interview partners and revised. For the feedback of joint tasks in the course of the work practice analysis, two workshops were carried out with the participation of the interview partners as well as members of the installed project group of the hospital.

2.4 Experiences with the Work Practice Analysis

The techniques used in the course of the work practice analysis, i.e. interviewing, orientation on functional roles, production of scenarios and glossaries, and the feedbacks were helpful to gain an understanding of the tasks of the application domain. At the same time through the use of these techniques, a process of learning and communication among the people involved was furthered. Thus, the problem setting for which a software support is sought could be worked out together with all parties concerned.

In the hospital context we encountered specific problems in writing the scenarios. Frequently tasks are attended to in teams. Maybe a task is started by one person and taken over by another like setting up a new patient's record. Attention has to be paid to the fact that the workers are differently qualified and

thus not every person is allowed to execute all tasks. For instance the task order entry of an X-ray implies taking the order sheet to the X-ray department. The task can only be accomplished by a registered nurse but she can delegate the errand. This taking over of acting persons could not be described in the scenarios with the concept of the functional role. Nevertheless the future software system is required to support the special needs that arise from team work.

A further difficulty arose from the fact that in the description of a task we frequently focussed on how it is to be performed for one patient, for instance the execution of an X-ray. But since every functional role has to perform its part of the task on several patients, the workers frequently organize their work in such a way that they perform the same part of a task on all the patients at once. For instance for every execution of an X-ray the radiology technician has to write data on an X-ray card. She collects and files away these cards not for every patient but for all of them at the beginning or at the end of the day respectively. This intertwining of tasks was hard to describe in the scenarios with our orientation to the single patient.

Also in these interviews it remained unclear why something (for instance a document or a piece of information) was passed on to another person or another department or what the receiver does with it. Here we had gaps and contradictions, which were only resolved through further interviews or work-shops.

In the course of the project it became apparent that it is necessary to look at tasks that expand over more than an individual workplace or over the inter-locking of a few workplaces. From the many single interviews we gained an increasing understanding of the joint tasks in the hospital. At the same time we noticed that we were lacking techniques to feedback our understandings to the persons concerned.

Thus we will first describe the characteristics of joint tasks before we introduce the techniques Cooperation Pictures and Purpose Tables which were developed by us.

3   Characterization of Joint Tasks

In figure 1 we give an example of a joint task. It describes in a largely simplified manner a patient admission to an internal nursing unit. It requires the cooperation of the organizational units admission office, nursing unit, functional departments, laboratory, archive, kitchen, gate, secretary of chief physician, administration and of the functional roles senior physician on duty and resident physician.

The admission of a patient to the hospital is usually initiated by a call of a general practitioner or the central hospital bed registrar. The calls are received either by the admission office or the senior physician on duty. Each morning the admission office provides a list with all available beds. The senior physician makes himself knowledgeable about it. The allocation of beds is made by the senior physician and the admission office in close cooperation.

When a patient arrives at the hospital he usually brings with him an admission sheet from the general practitioner on which the diagnosis is stated. The patient signs an admission contract and is being questioned regarding his personal data. He receives his admission contract and stickers on which are printed his personal data and walks to the nursing unit. The admission of patients usually occurs in the morning.

On the unit he is questioned further by a nurse. She fills in a sheet about his physical condition and starts the patient's record. She enters his name on several tables for overviews of bed usage, telephone numbers, diagnosis and treatments. She passes on a menu card of the patient to the kitchen.

The responsible resident physician examines the patient and fills in a physician's order sheet. The nurse copies all the doctor's orders into the patient's sheet. For the (routine) examinations ordered in the course of admission she fills in the order entry forms, hands them to the physician for his signature and delivers them to the corresponding department e.g. X-ray department. She labels the blood tubes for the blood tests and also fills in order sheets. If the patient was previously admitted to the hospital she calls the archive and orders the old patient record.

When the arrangement with the functional departments have been accomplished the patient goes or is brought to the corresponding department e.g. X-ray department. The radiology technician orders the old X-ray bag from the archive if the patient was admitted before. The result of the examination is dictated on a recorder by the radiologist and typed directly on the order entry sheet by the secretary of the chief physician. Sometimes in the afternoon the nurse picks up the sheet from the X-ray department, hands it to the resident physician to read and sign, and after that files it into the patient record.

In the afternoon the admission officer assembles a physician portfolio and a patient portfolio. The physician portfolio contains the discharge form and further patient stickers and is sorted into the patient record. The a patient portfolio remains in the admission office and contains documents for billing purposes. Also data is sent to the hospital controlling department.

Figure 1: Admission of a patient to the hospital

By further characterizing the notion of joint tasks we follow the requirements identified in the area of clinical care. Nevertheless, these characterizations match situations which are found in other application domains like servicing airline passengers or hotel guests.

- Joint tasks require the cooperation of a multitude of people from different occupational groups often with highly varied fields of activity, e.g. admini-

strative employees, nursing staff, radiology technician, surgeon, internist, anesthetist, and so on.

- Joint tasks require a high degree of flexibility since their accomplishment is dependent on external factors like the patient's condition.

- Within joint tasks we perform a multitude of single activities solely for coordination purposes, e.g. passing objects, especially documents, processing knowledge for information sharing, coordinating appointments, allocating resources or signalizing urgent changes.

- Joint tasks are characterized by group workplaces, e.g. wards or functional departments. Group workplaces imply that a set of single steps belonging to a joint task and performed by a functional role are not necessarily carried out by the same person. Therefore, this emphasizes once again activities for information sharing and synchronization.

- Joint tasks need actors who have a clear understanding of the flexibly required activities to be performed ([2]). Indications for starting activities are e.g. the location and status of a document (e.g. a partly filled out X-ray form for signing in the mail-basket) or stipulated signals (e.g. a rider on the patient record which signals a change).

- Joint tasks have to be performed within narrow time limits or up to a certain qualifying date, e.g. examinations which need to be performed at the admission day or before an operation.

4 Cooperation Pictures as Analysis Technique for Joint Tasks

4.1 Cooperation Pictures

For the acquisition of an understanding and for the feedback of joint tasks we developed so called Cooperation Pictures for the purpose of graphical visualization which were influenced by Rich Pictures (see [4] [8]). Because of the characteristics of joint tasks the emphasis of Cooperation Pictures is — in contrast to Rich Pictures which serve for the description of differing views of different user groups on an integrated system — on the description of kinds of cooperation. For that purpose the passing-on of information and objects of work

are to be visualized. This implies the representation of „places" between which information and objects are exchanged and the kind of exchange in the shape of annotated arrows between places which illustrate who passes on what entity or by what medium information is passed on.

A distinction of „places" is made between rooms for organizational units, distinguished functional roles that have no fixed room and places or functional roles from outside of the hospital; discernible symbols are introduced for each of them. An explanation of the symbols that are used in the Cooperation Pictures is given in Figure 2. The arrows which are annotated with icons represent different kinds of transmission: objects are being passed on by humans or by a medium. We differentiate patient and staff in combination with different objects like the patient record, the X-ray bag, lists, order entry forms, cards, lab tubes, tapes. We differentiate telephone and computer as mediums.

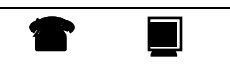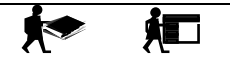|				
nursing unit	senior physician	general practitioner	→	Symbols for organizational units, functional roles, units/functional roles outside of the hospital and information transmission
🚶	🧍	👕	🖥	Icons for employee, patient, phone, computer
🚶📦	🚶📷	🚶📖	🚶🗂	Icons for employee with documents, tape, patient record, X-ray bag

Figure 2: Seclected Symbols and Icons for Cooperation Pictures

The Cooperation Pictures illustrate which errands have to be made by the hospital staff and how the patient makes his way to the different units of the hospital. Also it is being shown where data are exchanged via computer and in which areas the telephone is used for coordination. In objectifying the ways of cooperation through „places" and annotated arrows we see the largest differences to other means of representation (e.g. Petri Nets, Activity Nets [7]) in which merely abstract information passing is described. This abstract passing of information is an insufficient means to further a common understanding of the joint task at hand among all parties involved. The employment of icons as they are frequently used as signboards in public places leads to an immediate understanding of the meaning by the users and enables them to handle them promptly.

4.2 Employment in the Project Context

The utilization of the Cooperation Pictures took place in the course of the work practice analysis after the first series of interviews. The aim was the development

and feedback of our preconceived understanding of two separate joint tasks: the admission of a patient to an internal nursing unit and the planning and performance of an operation. The frame was set by a whole-day workshop with two hour sessions in small groups for each joint task where the participants were the interview partners for the corresponding task and members of the installed project group of the hospital. The Cooperation Pictures were implemented as wall paintings. We prepared labeled and unlabeled „place" symbols and a large selection of different icons. In a preliminary run we had produced the pictures for ourselves to get an overview of it beforehand.

For the development of each picture only a few start symbols were given, for instance for the task „admission-of-a-patient" the rooms „admission office" and „nursing unit". The picture evolved through the discussion of the group members. The arrows were drawn freehand directly on the paper and the corresponding icons and symbols attached. The role of the developers was reduced to moderation of the discussion and fixing the results of the discussion on the wall painting. The Cooperation Picture for the task „admission of a patient to an internal nursing unit" is shown in Figure 3.

4.3 Evaluation

With our project experience in mind we can state that Cooperation Pictures are suitable for users as well as software developers in describing the existing status of joint tasks. For *users* it means:

- With Cooperation Pictures users can actively acquire knowledge about their own work contexts. This is due to the non-formal techniques of representation which Cooperation Pictures provide in contrast to other techniques. Users were able to immediately recognize themselves and their work within the used symbols and icons. The given "exercise" - visualizing a joint task - was clear. Without much time for explanation they were able to actively participate in elaborating, discussing and introducing their activities, reasons for a particular task performance and necessary cooperation links to other departments. This was gathered and visualized on the wall painting easily and in quite a short amount of time.
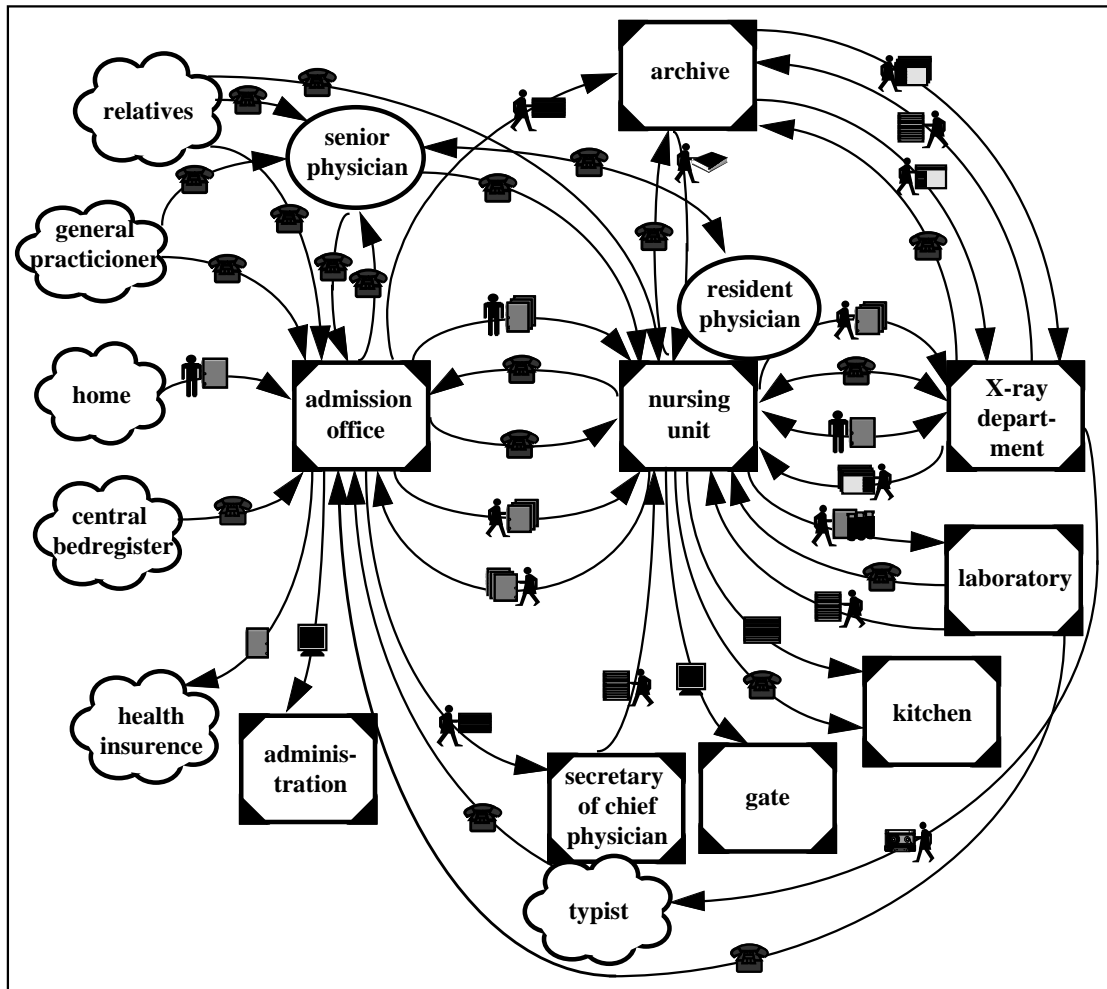
Figure 3: Cooperation Picture for the joint task „admission of a patient"

- Cooperation Pictures provide users with an illustration of the complexity of their work. They supply an appropriate subject of discussion which put users directly into the position to reflect together about their own organization. In our project context it was surprising for all workshop participants that within a regular admission of one patient in the morning up to 17 phone calls are made and a series of errands are performed. Immediately a discussion arose which of the phone calls or errands are avoidable, i.e. for what purposes they are made, and which ones will be unnecessary in case of future system support. Furthermore, for many users the wall painting manifested for the first time that their work does not consist in nursing a patient only but that a not insignificant portion includes tasks for cooperation and documentation purposes.

- Cooperation Pictures contribute to an acquisition of joint understanding. While producing the wall painting some of the participants recognized for the

first time which of the remaining activities in a joint task are performed by other departments and how and why they proceed. This supported a better mutual understanding among the group of actors in a joint task.

Cooperation Pictures also provide software *developers* with a useful means for gaining understanding of complex and highly cooperative application domains.

- Cooperatively produced Cooperation Pictures equip developers with a feedback technique for users. They support clarifying whether the understanding of a joint task elaborated by the developers from of a bunch of scenarios align with the user's point of view. Lack of clarity can quickly be eliminated.

- In the discussion developers are able to recognize unknown interrelations. Developers find „blind spots" in their analysis and they receive indications about further involved functional roles needing to be interviewed. E.g. in producing the Cooperation Picture for the joint task „performance of an operation" we recognized that we had to interview the nurse in the ambulance to reach a comprehensive understanding of the task.

- Indications towards a future system support can be derived from the weak point discussion on the basis of and following the construction of the wall painting.

- By visualizing cooperative interrelations for joint tasks we can recognize the density of the information flow. This supports and triggers a weighting which type of the cooperative activities could be supported by a future system.

5 Purpose Tables for a Detailed Analysis of Joint Tasks

The overall description of joint tasks as provided by the Cooperation Pictures needs to be supplemented by further more detailed information for the discussion about the existing and aspired future organization as well as for the system design. Obviously it is necessary to name the objects that are shown on the icons.

With regard to the objects of the application area the Cooperation Pictures show that the objects are characterized by the cooperative context in which they are being used. Alas, Cooperation Pictures merely show that something is being done with the objects or that they are passed on but not for what purpose this happens. To be able to understand the manifold implications and purposes of individual tasks and objects in their cooperative context they have to be looked

upon at a much more detailed level. Thus the need arises for a different description technique.

5.1 Purpose Tables

Starting point of our means of description of Purpose Tables is the technique of Object Behavior Analysis [11] in which tasks are described in the pattern „who - does what - with what - which service does the object have to provide?". On the basis of the objects employed and entered in the table the entities and the affiliated operations of the future software system are being extracted.

We also use a table for representation, but in the first column we describe the task split in its smallest divisions (who - does what - with whom). As a supplement to the Object Behavior Analysis and other analysis methods, in the second column of our table we record the purpose or the implications of the individual task.

We want to demonstrate this by an example which is the registration of a patient for an X-ray examination in the course of his admission to the hospital which is shown in Figure 4. At first glance the only purpose is to get the patient registered for an X-ray. Only through the use of the second column it becomes clear that there is much more happening. For instance the time and responsible person of the ordering and registering of the X-ray is documented. Moreover, the nurse is informed about the examination and thus the treatment of „her" patient. Finally, through the entry in the patient's flow sheet the registration is visible to other physicians and nurses. This way the flow sheet contains an overview of all the examinations the patient is registered for and those which were performed already.

5.2 Employment in the Project Context and Evaluation

Capturing the purposes and implications of joint tasks is of paramount importance because it provides a foundation for a fruitful communication with the users about the existing organization and the desired or necessary future development of a software system. Also existing software systems can be evaluated with regard to the implications for the organization. Alternatively a basis is provided for decision making regarding the system design.

Single Activities of an Order Entry	Purpose/Implications
Physician writes the order on the physicians order form.	It is documented who ordered the test at what (forensic, quality assurance). To kick on the implementation of the test.
Physician puts the order entry sheet in the nurse's mail basket.	Nurse is alerted that she has to act. She knows what is planned with her patient.
Nurse enters patient's name, other relevant data and the type of test on the order entry sheet.	Nurse prepares the order entry sheet in order to relieve the physician of such burdens.
Nurse enters the test with pencil on the patient's flowsheet.	It is documented for every member of the care team and physicians when the examination was ordered and to which further examinations he is scheduled.
Nurse puts the order entry sheet in the physician's mail basket.	Physician knows that he has to validate the order.
Physician sees the order entry sheet in his basket, enters the relevant clinical information, signs it and puts it in the nurse's mail basket.	The physician that carries out the test knows what to do and that the ordering physician is responsible for the test.
Nurse carries the order entry sheet to the X-ray department.	The X-ray departement can schedule the test and the performing physician can check the order.
Radiology technician chooses a date for the test and conveys it by phone to the unit.	The tests are coordinated within the X-ray department. The nurses know when to take the patient to the X-ray Department.
Nurse enters the date of the test in the units calendar.	Whole nursing stuff knows about the date.

Figure 4: Purpose Table of the registration for an X-Ray examination

Existing and future organization.

In the scope of our project it was discussed whether the present way of cooperation is sensible or whether it should be changed. In this case it was decided to - deviating from other hospitals - continue to require a signature from the physician for every X-ray registration. This was deemed necessary for reasons of quality assurance by the radiologists.

Evaluation of systems.

If we take a close look at existing systems for the hospital it is noted that some of them neglect the cooperative parts of the task and only model the requirement „registration of an X-ray examination". It is presumed in those systems that the physician performs the registration by himself. Thus he writes a note which

patients he has to register for an X-ray for himself. With this note he goes to the computer and makes the required entries. Because he is now the only one responsible for registration he won't enter the examination on the physician's order sheet. Thus any documentation of the ordering is omitted. Also the information for the nurse is lacking and thus the entry in the patient's flow sheet. Here it became evident to the users that systems cannot solely be chosen by their system functions. Rather, they were able to estimate the implications of the systems for their specific work organization.

Object oriented development of systems.
Even when developing a system, capturing the purposes of a task and the implications that are tied to it is of utmost importance in view of design decisions. In object oriented approaches the glossary provides the foundation for the establishment of the class hierarchy. The technical design is made in close approximation. To extract the application objects that are to be realized in the system, in connection with joint tasks we see the danger of overlooking the purposes and implications and therefore ignoring the significance of objects in cooperation contexts. If a decision is made not to implement a certain entity in the system using Purpose Tables it is possible to forecast and discuss the implications for the process of the cooperative execution of the task. For instance when registering a patient for an X-ray it would be necessary to examine the consequences of not modeling the physician's order sheet in the system or how the documentation can be ascertained respectively.

6   Evaluation and Summary

From our experiences within the project it is to be noted that the techniques which were developed by us benefit a participative and task oriented approach to the requirements analysis and thus helped us to clarify the interplay of organizational development and system design. They extend existing approaches (STEPS and Tools&Materials approach) according to the necessities which arise in user contexts with joint tasks. Point by point this means:

Participation. The developed techniques proved to be helpful for the feedback with heterogeneous user groups as is necessary for joint tasks. The immediate understandibility of the means of representation, its proximity to the actual work situation and the clarity of the setting of the task allowed immediate active handling of the techniques by users. The varying ability to communicate

and power of assertion were leveled out because like a matter of course in the joint work-out of a joint task each participant was the expert for his part of the accomplishment of the task. Moreover, room was given to voice the different perspectives and expectations of the participants towards other cooperation partners in accomplishment of the joint task.

Cyclical approach. It is to be pointed out that joint tasks set limits to a cyclical approach. For the developer an understanding of the joint task arises only through the identification of the affiliated parts of the task. Feedbacks with the individual departments can be performed without delay. The description and feedback of a joint task can only be accomplished *after* identification of most of the corresponding units and their requirements analysis. As a result difficulties that come along with a phase oriented approach are predetermined, for instance a long period of analysis before they can be shown system visions or prototypes for integrated solutions which seems unproductive to the users. Thus projects involving joint tasks require an extensive and clearly timed work practice analysis even more than other projects, for instance because of feedback workshops to be planned a long time in advance.

System design and organizational development. Through the use of Cooperation Pictures and Purpose Tables the complexity of joint tasks in the current work practice becomes evident to developers and users. Especially in areas like hospitals in which the tasks of organizing and documenting are not viewed as genuine work this has the effect for the users to make transparent their organization and their own position in it maybe for the first time. The extreme intertwining of individual activities within joint tasks effects a high sensibility for organizational changes. Changes in one unit or in the cooperation between units often cannot remain limited to those units but affect activities in yet other units of the organization which may again be interconnected with other activities of that unit. By means of descriptions of the interconnections in overview (Cooperation Pictures) and in fine granularity (Purpose Tables) not only the actual state but the implications and consequences of system design for the work processes become discussible. In our project this was of some importance because the users expected the solution to their organizational problems as an automatic side effect from the introduction of a software system. With the help of our techniques we could point out that decisions which have to be made in the course of system design could not be taken by the developers: their implications regarding cooperation of group workplaces, worker's protection laws and quality assurance cannot be judged and thus exceed the knowledge and competence of developers. By our techniques we laid the foundation for the necessary

communication between users and developers, continuously accompanying the system design.

Acknowledgement

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