

Visualization of processes for external and internal end users: A research proposal

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Abstract. *The research idea originates from empirical findings during two different projects, project skåneportalen (ended in 2002) and the bath-booking project (ended in 2004). Early this year we (myself, Harald Kjellin and Björn Cronquist) started a research project, **Communication enabling the implementation of innovation (CEII)**. In this project, which is funded by the Knowledge Foundation (KK-Stiftelsen), the idea of the communication designer and visualization of processes should be studied more thoroughly. In mid February this year (2006) we made a road trip and visited three of our partners involved in CEII. During this visit we made a quite informal interview with the participants and all of them mentioned visualization of processes as a goal or as a problematic area.*

The proposed research is aiming at describing relevant description-techniques that should be used by a communication designer when visualizing processes in order to facilitate communication between the actors during the designing and developing of interactive services included in a Web Based Information System (WIS). The main research question is at the moment: which are the relevant description-techniques to be used (by the communication designer) when visualizing processes in order to facilitate communication between internal (employees/managers) users and external (citizens/customers) users in a Web Based Information System?

During the early stages of the research I will conduct a literature survey and a case study with an interpretative approach. The literature survey will focus on process visualization directed at end-users during the designing/development of WIS and the case study will be conducted among internal and external end users. The field of procurement/purchasing competence will also be covered during the literature survey.

1. Introduction and a short background

The research proposal will follow a structure inspired by H.C Lauer (Lauer 1975). According to Lauer the doctoral student should first of all make a statement of the problem to be addressed in the thesis and why it should be solved (Chapter 2); secondly, conduct a survey of previous and related work (Chapter 3); thirdly, present his/her own ideas, preliminary work and empirical data (Chapter 4); fourthly, make a characterization of the solution being sought (Chapter 5); fifthly, make a plan of action to bring the research to a conclusion (Chapter 6) and at last make an rough outline of the thesis. I have replaced this last point with a chapter about my proposed research method (Chapter 7) and also added a discussion (Chapter 8).

1.1 Personal experience

Last year, in the beginning of May, my son wanted to earn some money of his own during the summer. He and some friends had discussed the idea of selling baguettes at the beach during the sunny summer days (when the beach is crowded), they were also thinking of making the baguettes (pre-baked I think) in their parents kitchen. I supported the idea and said that they need to have permissions, there are a lot of laws and regulations that should be followed, this is Sweden after all. After this discussion I searched the municipality website about some guidance that could help my son, but I didn't found anything that could help us except names and telephone number to different departments. After that I contacted the different departments and asked about help/guidance about this idea and to my surprise the staff members couldn't answer my questions, instead they connected me to another department and staff members at that department connected me back or to another department. One staff member recommended me to contact the Police department before bothered them again. After two days by the phone I gave up but I will give another try this spring and see what happens. Why do I tell this story? Well I am pretty sure that I wasn't the first one to contact the municipality about selling food in public spaces and I am also pretty sure that there is some kind of standardized manner the municipality and other department's deals with problems like mine. What will it take to visualize that standardized manner, so I as a citizen, would have an idea to understand who to contact, in which order to make different steps, which forms to fill in etc? In other words, how will the visualization of work processes effects the concept of procurement/purchasing competence?

1.2 Governments and processes

Different researchers who are active in field of e-government have observed problems similar to my personal experience and they propose different solutions

to this problem that, citizens outside the government cannot cope with the logic of administrative thinking and do not comprehend the administrative jargon. One solution is to recognize all work processes and give them names (Andersen 1999), make everyone aware of these work processes, especially the work processes that involves different departments associated a service function (Traummuller and Wimmer 2004). The idea of e-government is to utilize all kinds of information and communication technologies, to facilitate the daily administration of government, and to provide better services to citizens and businesses, as well as other government agents (Siau and Long 2004).

The key phrase I think is to “make everyone aware of these work processes”. I interpret the word “everyone” as all of the employees and the users outside the organization. Is it possible to make “everyone” aware if the processes are visualized? The success of e-government is depending on the active engagement of citizens in the planning, design, implementation and evaluation of the entire process (Land, Sorrentino et al. 2005).

1.3 History of WIS

Organizations have built websites for the public since the first half of the 1990s. In the early years the focus was simply on presenting information via the Web. In recent years, however, the focus has shifted from presenting information to building complete Web-based information systems (WIS). A WIS encompasses the functions of informing, communicating, interacting, and completing transactions(Vidgen 2002b). This shift in focus, from merely presenting information to building complete WIS, entails a more complex development process. Even in the early stages of development the complexity is great, because of the need to handle requirements for information, communication, interaction, and transactions. Another matter that increases the complexity of the process is that these requirements need to be supported both on the inside (by employees and managers) and the outside (by citizens/customers) the involved organization (Johansson and Carlsson 2004). The development process needs to co-ordinate communication between the involved actors in order to understand individual user needs and demands(ANDERSEN, RANERUP et al. 2006). As early as 1993 Communication has been recognized as problematic task in systems development (Molin 2005) (Kautz 1993).

The manuscript must have page numbers in the bottom right corner and a running header with author and the (abbreviated) title. The manuscript should be in A4 format, with 35 mm margins on all sides.

2. The statement of the problem to be addressed in the thesis and why it should be solved

The problematic area that my licentiate thesis and doctoral thesis will investigate is visualization of processes as a tool for improving Communication between the actors involved in the design process.

2.1 Research question

Which are the relevant description-techniques to be used (by the communication designer) when visualizing processes in order to facilitate communication between internal (employees/managers) users and external (citizens/customers) users in a Web Based Information System?

The concept of the word “relevant” must be discussed during the research, but an early interpretation is that relevant connects to both understanding and usefulness.

2.2 Aim

Describing relevant description-techniques that should be used by a communication designer when visualizing processes in order to facilitate communication between the actors during the designing and developing of interactive services included in a Web Based Information System (WIS).

2.3 Why

The design and development of interactive services in a WIS is always connected to organizational activities and operational goals and crucial to the outcome is the usage of the interactive service (Markensten and Artman 2004). It is the usage that generates the business value, if no one uses an interactive service than there is no business value generated.

In order to the generate business value, communication needs to be supported between the actors during the development process. In this research proposal the focus will be on visualization of work processes as a tool supporting communication. Several researchers has recognized visualization of progress in work processes as a problematic area, one example is the placement of a document in a bookshelf sectioned in steps taken in a process (Braa and Sandahl 2000). When the document has been moved from one place in the bookshelf to another place this indicates progress in the work process.

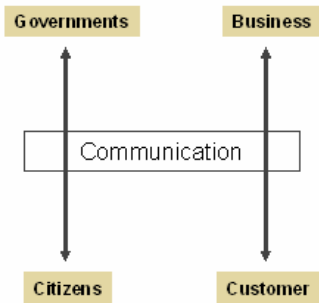


Figure 1.Overview

In order to get an understanding of the work processes, communication needs to take place between internal (employees/managers) users and external (citizens/customers) users otherwise there is a risk that (figure 1):

- the customer may choose another business partner
- the citizen will be dissatisfied (There is an election every fourth year)

3. Survey of previous and related work

This chapter will act as a seed to the more thorough literature survey that will be conducted during the research. The characteristic of this chapter will be more breadth than depth. Hopefully the reader will get an insight in, User Centered Design (UCD) in WIS, e-government and visualization/communication. In the subchapter covering visualization/communication the concept of process modelling will be mentioned but I am aware of the research discipline and will cover it more thorough in my literature survey.

3.1 User Centred Design (UCD) in WIS

In this sub-chapter the concept of UCD in WIS should be covered and we start by describing the phenomena of WIS according to Richard Vidgen (Vidgen 2002; Vidgen, Avison et al. 2002a; Vidgen 2002b) and the writers in the specials issue of Scandinavian journal of information systems (Boedker and Carstensen 2004).

A WIS is described as new medium of human communication, (not a technology for information processing) that should be available at anytime and anyplace. The WIS should also be connected with an existing IS. It's possible that a service has one front end application that uses the web and a back end application which is used by the employees. This indicates that the systems boundary line is outside the organisation including customers/citizens. Of course the WIS should support the company's business strategy

The development process of WIS is a complex process which has a high rate of change, tools and techniques that are developed constantly and it also demands for different skills such as graphical design

User Centred Design (UCD) or user centred system development is sometimes defined as: “a process with a focus on the users and usability throughout the development process” (Gulliksen and Göransson 2002). UCD has a different approach than traditional IS, involvement of end-users (bottom up) not only managers (top down) from the start in the development process. UCD differs from traditional information system development, not only in the approach, but in two other key ways (Mccracken and Wolfe 2004):

- It is user centric, not data centric.
- It is highly iterative and involves considerable testing and revision (Checkland 1981; Avison and Fitzgerald 1995; Vidgen, Avison et al. 2002a).

Techniques for analysis

A user-centric approach involves needs analysis, user analysis, task analysis, goal analysis, functional analysis, requirement analysis, and usability specifications.

- Needs analysis summarizes the nature and purpose of the interactive system one plans to develop. The needs analysis should describe the type of system (website, spreadsheet, etc.), the people the system will serve, and the benefits the system will provide.
- User analysis characterizes the users, describing their age, education level, etc.
- Task analysis looks at user tasks, examining user goals and how the tasks are carried out so as to achieve the goals.
- Goal analysis analyses the goals of the users
- Functional analysis identifies functions the system needs to offer users so they can carry out their tasks.
- Requirements analysis describes the formal specifications required to implement the system.
- Usability specifications include performance measures to determine how good a system is. Developers must have usability specifications. For example, developers can include performance measures such as first impression and overall satisfaction.

Personas and Scenarios

A persona is a character representing a group of users with similar usage patterns and goals (Markensten and Artman 2004). The persona is a result of the user analysis and a way of describing/communicating their requirements. Personas have been rejected by some researchers, because it replaces actual user involvement. There are some research projects in Sweden, for instance

Procurement Competence, that is studying personas in the context of usefulness during procurement of governmental Web solutions (Markensten and Artman 2004).

A scenario is a narrative story about how the intended system is used by the character presented in the persona. The scenario is the result of the task- and functional-analysis.

Prototyping and evaluation

During prototyping, the developers use prototypes such as models, patterns, part of the final product, or the whole product. During evaluation the developers test the prototype. There are two types of evaluation, user-based and expert-based evaluation. Prototypes should be used continuously during the development process in order to keep the vision of the service intact. In our opinion, the results of user-based evaluation tests are more qualitative than expert-based evaluations are.

3.3 WIS in governments (e-Government)

The Swedish government commissioned Statskontoret (Swedish Agency for Administrative Development – SAFAD), to draw up criteria as a proposed basis for the concept of 24/7 government (Statskontoret 2000). This commission included proposals for how to use the criteria and the concept to encourage continuous quality improvement. In May 2000 SAFAD presented a criteria report containing proposals for a four-stage development process whereby a government agency can enhance its accessibility and provide service round the clock, seven days a week (Statskontoret 2000). SAFAD recommends that these criteria should primarily focus on agencies' capacities to provide interactive services to the public and the business world.

The criteria report outlines a development process which contains four stages (Statskontoret 2000), as follows:

- Stage 1, Information Stage: website containing “packaged” information about the agency and its services
- Stage 2, Interaction Stage: website containing “interactive” information about the agency and its services
- Stage 3, Transaction Stage: website and communicative functions that allow the visitor to submit and retrieve personal information
- Stage 4, Integration Stage: website and network functions for linked services involving several agencies and institutions

The four stage model that is used in Sweden is also used world wide and many countries have obtained problem during stage 3, the transaction stage. The problem observed is that the number of implemented e-services is lower than expected, a low take-up frequency (Traunmuller and Wimmer 2004). In Sweden

this problem was recognized by SAFAD in 2004 and published in a progress reports and statistics concerning the development of 24/7 government (Statskontoret 2004; Statskontoret 2004)

Different researchers propose different solutions but they all share three statements (Ebrahim, Irani et al. 2004; Tambouris and Wimmer 2004; Traunmuller and Wimmer 2004):

- Involvement of citizens (external users) in the development process
- Proposal of a holistic approach
- A focus on work-processes

As a first step in the holistic approach it is recommended that governments should group the citizens according to their life situation (Tambouris and Wimmer 2004; Traunmuller and Wimmer 2004). In Sweden – SAFAD has grouped the citizens into nine groups (Statskontoret 2004) according to their stages in the life cycle:

- Single
- Couples without children
- Couples with small children
- Couples with school children
- Single parents
- Couples with grown-up children who have moved out
- Retired people in couples (aged 65–74 years)
- Single retired people and retired people over 75 years old

This categorization could help to identify the groups that will use a particular service. Citizens are the ones who will use the services presented in the context of 24/7 government, so it is important that they be involved in the development process. To a certain degree, the service itself will identify the citizens that use it. For example, if the service is for registering children for municipal child care, then the users will be the parents of small children – no other type of citizen would be interested in the service.

This first step doesn't solve the problem with involvement of citizens and the citizen's perception of the work processes conducted in the government. To quote Traunmuller and Wimmer "users cannot cope with the logic of administrative thinking, other users do not comprehend the administrative jargon". Is it possible that visualization of work-processes can improve citizens purchasing competence in dealing with governments?

3.4 Visualization/Communication

Much of the work done by the researchers has been on visualizing data or information in an Information System. When it comes to visualizing processes the target group has often been the developer. For example the results of these analyses in the user centred approach should be visualized/sketched for the actors involved in the process, to ensure that they all understand the nature of the service

being developed (Löwgren 2004). Such visualization/sketching should be employed to fully and persuasively *communicate* the service concept to the different actors (Figure 2).

	expressive	sketchy	versatile
THINK	+	+	+
COMMUNICATE	+	+	+
PERSUADE	+	-	+

Figure 2 Löwgren's motives of sketching (Löwgren 2004)

This research proposal focuses on visualization/sketching as a communicative tool (Fig 3) used in inspecting, criticizing, and appropriating the produced WIS during the development process. Various visualisation techniques can be used to create a common, shared vision of the service as it is developed. In this sub-chapter we have separated visualization techniques in two main categories, **visualization of the produced IS** and **visualization of work-processes**.

Visualization of the produced IS

Many different visualisation techniques can be used in information systems development; this paper will examine several of them. In the system development process several different techniques can be used to visualize/sketch the services under development:

- *Storyboard* (Löwgren 2004) is one way of describing the findings of the task analysis.
- *Paper prototypes* enable developers to try out different parts of the system at a low cost and time efficiency (*Mccracken and Wolfe 2004*).
- *Flowchart/nodemaps* are also useful in visualizing the system for the various actors. A possible disadvantage is that interpreting nodemaps requires training that some end users lack (*Shneiderman 1998*).
- *Unified modelling language (UML)* has become standard when developers visualize, specify, and document the structure and behaviour of a service (*Krutchen 2000*). UML is used in communication between designers and developers.

Visualization of work-processes

Many different visualisation techniques can be used when describing work-processes. One of the most popular nowadays is event-driven process chains (EPC). One of the main reasons to the popularity is that EPC is a component in the enterprise resource planning system (ERP) An event-driven process chain consists of the following elements (Aalst 1999.):

- Functions, The basic building blocks are functions. A function corresponds to an activity (task, process step) which needs to be executed.
- Events, Events describe the situation before and/or after a function is executed. Functions are linked by events. An event may correspond to the post-condition of one function and act as a precondition of another function.
- Logical connectors, Connectors can be used to connect activities and events. This way the flow of control is specified. There are three types of connectors: \wedge (and), XOR (exclusive or) and \vee (or).



Figure 3. Elements in EPC

There is also an extended version of EPC, referred to eEPC that has more elements describing organizational units and data (Aalst 1999.). So far I haven't found any articles describing EPS or eEPC in the context of external end-users understanding and purchasing competence.

Communication of a shared vision

All the different visualisation and prototyping techniques are used with a single goal in mind: to create, communicate, and maintain a common vision of the service during the development process.

4. Candidate's own ideas, preliminary work and empirical data

This chapter will be structured in five sub-chapters. Each one of the first three sub-chapters (4.1-4.3) contains a brief summary of three different papers published in conference proceedings, the fourth sub-chapter (4.4) contains a summary of a road trip (pilot study) in the project Communication enabling the implementation of innovations and the last sub-chapter (4.5) contains a summary of the ideas that empirical findings has lead to.

4.1 Grasp all, lose all!: A case study of an e-government project(Johansson and Carlsson 2004)

This paper report about the development process of project skåneportalen and discuss the fate and shortcomings of the project in the light of the theoretical framework of information system development and requirements engineering.. Project skåneportalen is the development project of a web-based information system. Skåneportalens URL is <http://www.skane.se>.

Project Skåneportalen has been explored using a case study approach after the project was ended; most of the data are from interviews and documentation.

Our conclusion in this paper is that you need to involve both external and internal end user inthe early stages of the development process of building a WIS for a governmental agency. This conclusion is based on the fact that ISDP of WIS for a government is different from the traditional scenario of development of an IS.

Our conclusion in the paper, wouldnt come as a surprise for reseracher with knowing about the scandinavvian school of information systems and knowing about research in the field of e-Government. One of the shortcomings in that paper is that we didnt discuss, analyze or propose how to involve external end-users.

4.2 Communication Space: The meeting place when implementing government to citizen services in a Web-based Information System (Johansson and Hallborg 2005)

In this paper we propose a conceptual framework for implementing government to citizen services in a Web-based information system. The framework, presented as a series of models, should be used for identifying the different actors and gathering their requirements. The paper proposes three different user categories among the actors, the public authority (governmental department), the employees (at the public authority) and the citizens. The different user categories view on technical aspects is presented. In order to meet requirements from all actors you have to establish and work in a communication space during development of web based government to citizen services. During implementation developers need to identify users with a slightly new approach, the service descript its users rather than the users defining the service. We state that failures of web based citizen-government services are due to lack of communication between, and/or failure to meet requirements of the actors involved. We suggest that the lack of communication is due to that there is no natural meeting place/space for the actors involved. Therefore, we suggest communication space as a mindset or conceptual framework for the developers to work within. The framework has its basis in models that we find do not fully cover the more specific aspects of building web-based government to citizen services. The framework is also compared to empirical studies from two different case studies

This paper was discussed during IRIS 28 in one of the working groups and there where a lot of suggestions for improvement. This paper worked as a basis for the paper Introducing Communication Space.

4.3 Introducing Communication Space (Johansson and Hallborg 2005)

In this paper we propose a mindset for developing government-to-citizen (G2C), Web-based information system (WIS) services. The proposed mindset has its basis in empirical findings, the theoretical framework of e-government, and the development of user-centred systems. The proposed mindset referred to as “communication space”, should be applied by designers/developers in two problematic areas: user and technical aspects. During the development process designers/developers should identify users using a somewhat new approach, in that the service should describe its users rather than the users defining the service. We maintain that the shortcomings of the process of developing G2C services included in a Web-based information system arise from a lack of communication between involved actors, resulting in services that fail to meet user requirements. This lack of communication happens because there is no communication space for the involved actors (users and designers/developers). Integrated into the communication space are activities performed by the designers/developers allowing them to visualize the service in the interests of bridging the gap between designers/developers and users. The mindset is also examined in light of the empirical results of two different case studies.

One of the major differences between the last two papers is the presentation of different visualization activities in order to support communication between different actors.

4.4 Summary of the road trip

In mid February this year the researchers involved in CEII made a road trip to three of our partners in the research project CEII. During this visit we made a quite informal interview with managers and employees at the different partners and all of them mentioned processes, description and visualization.

Beld and Wend Ltd which is an engineering workshop with approximately one hundred employees, has the idea of printing all the processes conducted in the workshop on a huge poster in order to visualize the processes. It was not clear why they wanted to this or what they wanted to achieve

Flower Systems Ltd which is a software developing company of a documentation/errand tool for the social services, the tool is very complex and sometimes the users get lost in the tool. The users can't get a quick overview of what they have done and what needs to be done during an errand. The idea is to

analyze the process/errand and after that visualize the process, to test if the users gets an overview of the errand.

Signform Ltd makes signs for example signboards and posts. The company needs to describe their processes (and maybe visualize) in order to find out what has been done and what needs to be done, to get an insight in the progression of a work process. They have experienced that they have delivered signs but they haven't send any invoice.

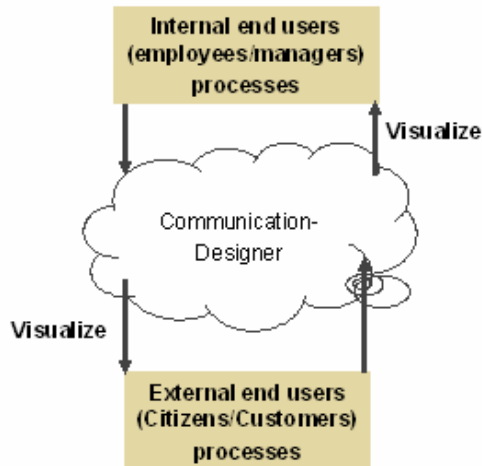


Figure 4. Communication Designer

4.5 Summary of ideas

The idea behind the visualization of the processes for end-users (Internal/external) comes from the earlier empirical findings and the preliminary study mentioned above in chapter 4.1-4.4. The visualization should be conducted by a communication designer which in some way should guarantee a better understanding among both the external end-users and internal end-users by improving the communication. The communication designer should have knowledge from many sciences, such as design science, social science and behavioural science; the communication designer should act on a multi disciplinary basis.

The idea about improving purchasing/procurement competence should also be taken into account. One of the problems that my research has to deal with is how to measure the purchasing/procurement competence and one early hypothesis is that this could be measured in time (hours spent) between the first contact and a common understanding.

5. Characterization of the solution being sought

The proposed research is aiming at describing relevant description-techniques that should be used by a communication designer when visualizing processes in order to facilitate communication between the actors during the designing and developing of interactive services included in a Web Based Information System (WIS). Hopefully this description-techniques also could improve the purchasing/procurement competence.

The main research question is: which are the relevant description-techniques to be used (by the communication designer) when visualizing processes in order to facilitate communication between internal (employees/managers) users and external (citizens/customers) users in a Web Based Information System?

6. Plan of action to bring the research to a conclusion

The planned action involves the writing of a licentiate thesis and a doctoral thesis. The period from now to the licentiate thesis consist of two parallel tracks, literature survey and case study with an interpretative approach in order to map/chart the problematic area and hopefully present at least one (or more) hypothesis that should be validated in the study which should be the basis in the doctoral thesis.

During the first period (Pre Lic), the plan is to get at least one publication each year in highly ranked information system conference and one publication on a more workshop conference. During the second period the focus on publication will be on International Journals.

7. Research Method

The research will start with an qualitative approach, which implies that the empirical data collected will be qualitative. The qualitative data will be analyzed in order give the researcher a deeper understanding of phenomena of interest. (Andersen 1998). During the pre lic period the research methods will have its basis in soft case studies (similarities with field studies and ethnographical studies) and during the pre doc the research will have similarities with action research(Braa and Vidgen 2000). A major differentiator between the two research methods is the role of intervention. *Case study* methods attempt to minimize changes caused by the research activity. In *action research*, the aim is to support desired change in an organizational setting.

The case study is commonly used in research when you are investigating an organization or other parts of the society such as a group, or an event (Patel and Davidsson 1994). Case studies are an empirical investigation of phenomena

within their environmental context and are therefore characterized by many variables and few observation units. The organization is the primary laboratory in information systems therefore the case study is frequently used (Braa and Vidgen 1997).

Action research has been described as a way of building theories and descriptions within the context of practice itself. The theories are tested through intervention in the organizational laboratory where the starting point is to learn and get knowledge about the phenomena by intervene in the phenomena to create a change (Braa and Vidgen 1997).

The intention of action research is to institute a process of change and then to draw conclusions from this process. More specifically, action research involves the collection of data about an organization in order to identify problems and their underlying causes (Checkland 1981). The researchers who investigate get knowledge and learning. The investigated organization gets a user-oriented change (Hunter 2004). After devising and implementing solutions to the problems, further data are collected to determine the appropriateness of the original action and/or to devise subsequent action.

8. Discussion

As you probably have found out during the reading of this RP, the research question and the aim of the research will be revised during the process of research. After all, the research process is an iterative process and the research question and aim will be polished until the same day as the manuscript of the phd-thesis will be delivered to the publisher.

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