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ABSTRACT

Aim: In eHealth development there is an increasing focus on user participation inspired by the information systems field of practice and research. There are, however, many other challenges in developing information systems that fit healthcare practices. One of these is the challenge of cooperation and communication in development projects that are initiated and managed by clinicians e.g. cooperating with IT professionals in 'bottom up' health informatics projects that have been initiated and are managed by healthcare professional project managers.

Method: The analysis and results are drawn from a qualitative case study on a systems development project that was managed by a local, non-technical, healthcare professional and the complex blend and interactions with the IT professionals in the phases of ideas, design, development, implementation, maintenance and distribution.

Results: We analyze the challenges of cooperation and communication using perspectives from information systems research and the concepts of 'language-games' and 'shared design spaces', and thereby exploring the boundaries between the different communication, practice and culture of the IT professionals and the healthcare professionals.

Conclusion: There is a need to (a) develop a better understanding of the development process from the point of view of the 'user' and (b) tools for making technical knowledge explicit in the development process. Cooperative and communicative methods are needed that support and develop the shared design spaces between IT professionals and the clinical context in order to strengthen small-scale health information systems projects.

1. Introduction

In recent years, the health informatics field has expanded, giving rise to new perspectives on how to develop systems within the healthcare sector. Building on the systems development tradition, the involvement of users, either healthcare professionals or patients, when developing healthcare information systems (hereafter eHealth) has been the focus of many research projects, using methods from, e.g. participatory design, HCI, CSCW and Scandinavian and agile development methods [1–5]. The focus on participation generally takes its departure from the perspective of the IT professional (system developers, designers, programmers, etc.) engaging users in the development process, but how does the challenge of engagement and cooperation look from the other side of the table? How do healthcare professionals involve IT professionals in eHealth projects initiated and managed through a

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'bottom-up' approach by a project manager with a background in healthcare and little technical knowledge?

For a project manager with a clinical background, it is a challenge to 'stay in control' of an eHealth development project where the technical terminology is not familiar or where the healthcare professionals do not have a clear view of the limits and possibilities in information system development. Cooperation and communication with the IT professionals becomes a major challenge and will influence the outcome of the eHealth projects. Therefore, to be able to design and develop eHealth projects initiated by healthcare professionals, it is important to search for ways and methods of cooperation and communication that allow the non-technical project manager to stay in charge of the systems development project.

Cooperation and communication play a key role in the process of designing and developing an information system. However, it is a skill often forgotten in the work practice of the IT professionals [6] and other stakeholders involved in eHealth projects. Healthcare professionals who manage systems development projects need to facilitate communication and cooperation with the IT professionals. Tools for cooperation and communication are important as they enable the project managers to understand and make decisions during the system development process. The different actors need to share ideas and meaning, practice and language. Communication and cooperation challenges occur on many levels in relation to eHealth development projects, both in user participation and in what we call IT professional involvement.

In this paper we describe and analyze the communication and cooperation between IT professionals and a healthcare professional project manager (co-author, Charlotte D. Bjørnes – hereafter termed 'HC project manager') in the development and implementation phases of an eHealth system (the 'Online Patient Book') from 2006–2011 and the associated challenges [7]. The study also show organizational, political and management challenges. However, it is the aspects of cooperation and communication that are the main focus of the analysis here.

The Online Patient Book is a web application for exchange of information and 'personal' communication between the healthcare professional and the patient and between patients. The objective of the information system is to bridge the communication gap between the healthcare professionals and short-stay patients. The empirical data is used to explore the challenges involved in cooperation and communication between IT professionals and the HC project manager on the systems development project.

Firstly, the challenge of cooperation and communication is presented through Pelle Ehn's interpretation of Wittgenstein's concept of language-games [8,9], and the concept of shared design space is coined. Secondly, four examples of specific communication and cooperation challenges experienced during the above-mentioned systems development process are presented. Both these challenges are related to cooperation, communication and negotiation processes. Finally, we analyze the communication and cooperation challenges in relation to 'bottom-up' system development with an emphasis on how to bridge the gap between the language,

practice and cultural differences. We conclude that a prior and specific focus both on facilitation and brokering of communication and cooperation, and on bridging the knowledge gap between the healthcare professional project managers and IT professionals in eHealth development projects is needed, and we propose a framework based on the concept of language-games and shared design spaces for understanding the challenges and pointing towards future research in the field.

Below, we introduce the analytical framework of language-games and shared design spaces. These concepts will be used both in relation to understanding the case stories and in the final analysis of the cooperation and communication challenges.

2. System development perspectives, language-games and shared design spaces

Challenges of communication and cooperation can be framed in different ways. As Michael Polanyi states in 'The Tacit Dimension', 'We can know more than we can *tell*' [10]. He gives the example of knowing a person's face, but not being able to say why we recognize it; it simply cannot be put into words. The knowledge imbedded in doing many practical things is not something known explicitly, but a kind of practice that we 'just do' because of practical, social and shared experience. Additionally, and as a consequence of this, communication and cooperation between participants from different contexts can be challenging, especially in design processes. If we cannot say what we do or what we know – how do we then cooperate in the design process?

The challenge of cooperation and communication between actors with different backgrounds is therefore central within the field of system development. Here the modelling of practice is important for the IT professional, but the question is how to model something that might not be explicit or even possible to make explicit. In the development of methods for systems development, the focus has traditionally been on ways of involving the user in the system development process (e.g. the so-called 'Scandinavian system development tradition', agile methods, HCI 'participatory design' and CSCW) [1–5].

In the literature on design, the challenges of communication and cooperation between IT professionals and system users are addressed in many ways. One fruitful way of understanding the challenges in the development process described below is through Wittgenstein's concept of language-games [11], i.e. practices or forms of life as something that cannot be understood separately from a given practice, setting or 'game'. You have to know the 'game' or practice to interact in meaningful ways. Pelle Ehn describes ways of making software for and with the end-users, viewing system development through Wittgenstein's concept of language-games and family resemblance. Ehn's perspective is on '...the role of skill and *participation in design as a creative and communicative process*' [8]. The aim is to find 'creative designary [sic] ways of thinking and doing design as cooperative work, *involving the skill of both users and designers*' [8]. Through Wittgenstein's concept of language-games, emphasis is put on design as
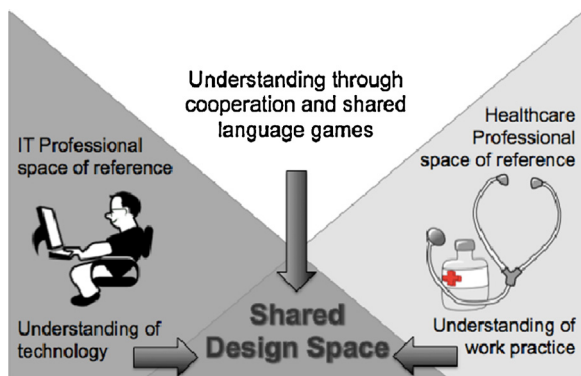
Fig. 1 – Illustrates the different professional backgrounds or spaces of reference of the IT professionals and the healthcare professionals, and is their main contribution to the shared understanding to the shared design space. The design space additionally needs to be supported through cooperative practices and work on a shared language and understanding.

a creative, cooperative and improvising activity. Language is often viewed as a way of describing and making sense of the world. But it is not just descriptive; it is also shared, social and sense-making practices [12], as illustrated in the following cases. Through the concept of language-games, we can emphasize that different practices do not necessarily share the same understanding. 'Two groups with different technological frames can appear to an observer to be working with the same technology, while at the same time understanding it in radically different and perhaps *incommensurate ways*' [11]. Practical or practiced knowledge is often tacit, but furthermore different social and cultural forms of practice or different professions like that of the healthcare professionals and the IT professionals can differ to the extent that the two do not understand each other – they do not share the same language-game about developing an IT system.

The difference in the language-game or practice is illustrated in Fig. 1. The language-game is here described as a space of reference, emphasizing the materiality as well as practices and knowledge involved in defining the framework or background of a professional group. The intersection between the two spaces of reference in relation to systems design is termed the shared design space, thereby emphasizing the need for not only verbally trying to understand each other, but also interacting and cooperating in a more substantial and physical way in the development of a shared understanding or language-game. This shared design space also has an impact on considerations on the structural aspects of design, development and implementation. The design space is only possible if all involved parties are ready to create the appropriate organizational room for communication and cooperation.

In the following, the method of the study is described and then four challenges of the small-scale systems development project are described and analyzed using the perspective of language-games and shared design spaces.

3.   Cases: the online patient book – challenges of cooperation and communication between IT professionals and healthcare professionals

3.1.   Method

The cases in this paper are based on data collected through the use of qualitative methods and a case study approach [13–15]. The data was generated during a PhD research and development project [16] and consists of documents, e-mail correspondence, minutes from a range of meetings and conversations between the HC project manager and the IT professionals. The analysis of the data has been centred on four case stories that exemplify the challenges of project management, which have been analyzed in a language and culture perspective by the first and second authors. The examples were chosen because they were the most clear and precise descriptions of the cooperation and communication challenges in the systems development process.

The IT professionals were contacted by the first author, but did not have time for an interview in relation to the exploration of the perspective of this study. Therefore, the focus is on the perspective of the HC project manager, and the practice and perspective of the IT professionals are based on a retrospective analysis of the written communication during the systems development period and a qualitative case study of the Regional IT Department in the PhD dissertation of the first author [17].

In the following, we illustrate cooperation and communication challenges within an eHealth development project and the disputes that these can lead to.

3.2.   Background

The Online Patient Book was designed, developed and implemented in clinical practice in cooperation between healthcare professionals and IT professionals. The idea of creating the system was initiated in clinical practice.

The eHealth system was developed using a bottom-up design process managed by the healthcare professionals. The HC project manager defined the stakeholders as both the patients and healthcare professionals. These groups were seen as the core users in the design of the eHealth tool. The eHealth system was well received by both the clinical department and the patients.

In the development process the patients' point of view was explored through a literature study and interviews [7]. Six nurses, all experts in urology, participated in six design workshops set up and conducted by the HC project manager, from March to September 2009. The IT professionals were not invited to these workshops.

At the hospital, the HC project manager was employed as a nurse at the clinical department, and had her daily work in an office close to the clinic. She had limited knowledge of system design. The IT professionals who participated in the project had limited knowledge of clinical practice and were situated at the IT department, remote from the hospital and clinical setting. Thus, the development process had to bridge

the boundary between different locations as well as the contexts and work practices of two very different professions: the clinical practice and the practice of IT professionals.

The HC project manager contacted the IT department in November 2007 to initiate cooperation. Face-to-face meetings were proposed and preferred as a means of cooperation by the HC project manager. However, only two initial meetings were held in the preliminary phase, followed by four design meetings during the eight-month development phase from January to September 2009. The rest of the cooperation was primarily based on e-mail communication (Table 1) as favoured and proposed by the IT professionals. In other words, the user-generated design, which was reached through the involvement of healthcare professionals and interviews with the patients, had to be communicated from the HC project manager to the IT professional primarily by the use of e-mails. The output of the workshops was in this way presented to the IT professionals as puzzle pieces. In addition to the e-mails and meetings, phone calls were used sparsely and mostly on intense workdays close to deadlines.

In this paper we focus on the aspects of interaction, cooperation and communication between the HC project manager and the IT professionals.

From the initial design phase to the implementation of the system, more than 500 e-mails were sent containing various requests for changes from the HC project manager to the IT professionals. The e-mails had numerous attachments, in all 1750 text pages with colour codes, 50 pamphlets, 100 PNG pictures and 380 commented screenshots, as specified in Table 1.

Through engaging both healthcare professionals and IT professionals, the project manager acted as the communicative bridge between clinical practices and the IT professionals. In the following, the challenges of this interaction and communication are presented through four case stories.

3.3.   Difference in work practice means difference in design

The healthcare professionals at the Urology Department and the IT department were – and are – employed by the same regional health authorities. However, the working contexts of the two were different, e.g. in relation to: theoretical background, knowledge, demands and circumstances in relation to daily practice, style of cooperation, traditions, language, priorities, and so on. They basically engage in different language-games and have different spaces of reference. Even the use and role of the computer is different – as illustrated in the following case.

In the development phase, the HC project manager requested an eAlert function for showing new messages from patients in the system. The IT professionals had designed the system in such a way that it would send an eAlert to the department e-mail whenever there was new correspondence from a patient to the hospital in the dialogue part of the system. This department mailbox was, however, only accessible through the Outlook system installed on the department computers, and not when logged in to the clinicians' private Outlook web interface. The following correspondence gives an example of the different perspectives and includes excerpts from a correspondence between the HC project manager and the IT professionals.

From a clinical perspective, this functionality was problematic. In daily clinical practice the healthcare professionals did not have easy access to the Outlook inbox because of their different uses of computers based on one shared logon and shared computers. It would have been a complex task to activate the eAlert on all 15–20 computers in the ward if the healthcare professionals used their own login on the computers, not least because of the generally high level of change in staff. This would be required because of the 'mobile' work practice of the healthcare professionals. Therefore, the eAlert functionality was finally changed.

It is clear from the examples from the dialogue (Table 2) that the IT professionals and the HC project manager had different perspectives on the need for change. The IT professionals are used to working on a personal computer using a personal logon and having direct access to the Outlook mailbox. This is not the case in clinical practice, where different computers are used during a workday and logons are used in various ways. A workaround practice has developed, where everyone logs on with the same user profile to lessen the time spent logging on.

The perspective of the IT professionals was coloured by their practice. They have their own personal computers placed at their work-desks, while the healthcare professionals share all computers in open work-spaces. The HC project manager's perspective was influenced by what she saw as user-friendly practice, based on her experienced knowledge or language-game of what was possible during the busy workday of a clinician. These diverse contexts and perspectives set diverse frameworks for system functionality, when working across professional fields, e.g. what constitutes user-friendliness when using a computer.

The problem of the eAlert was finally solved after involving many different IT professionals. An eAlert function was built directly into the system. Every time a patient writes a note to the healthcare professionals, a notification is posted at a sep-

Table 1 – Interaction between the HC project manager and the IT professionals during the systems development project (e-mails from the IT professionals are not included).			
Phase	Time	Meeting activities	E-mail communication
Idea phase	2006		
Preliminary/contract	Nov. 2007–March 2009	2 initial meetings 1 design meeting	A few initial e-mails
Development and implementation	Feb. 2009–Sept. 2009	3 design meetings	0–20 e-mails pr. day Attach files: >1750 text pages, >50 pamphlets, >100 PNG, > 380 screen dumps
Operation phase	Sept. 2009–Sept. 2010	1 meeting	Ongoing

Table 2 – E-mail correspondence on an eAlert function in the application.	
E-mail from the HC project manager to the IT professional, September 10th 2009	"My problem is that [the eAlert] is not user-friendly … So now I need your help!!!… The intention of this eAlert is that the nurses can see that there are new mails – and respond to them within 24 hours… The most optimal solution would be to use the Online Patient Book [web interface] – so they can log on there … is this possible in any way?… As it is now in relation to the department e-mail inbox this would require all involved nurses; each would have to add the inbox on up to 10 PCs – if they even reach that point, as they do not know how… Additionally, I have the problem that one ward don't even use Outlook, but use a shared logon for the desktop and from there use WebMail – and this does not allow for adding the department e-mail inbox. So I need help!!!"
E-mail from the IT professional to the HC project manager, September 11th 2009	"I have a couple of questions that are rather important to make clear… When they arrive at work at the Urology Department in the morning/evening etc. – then they log on at one or more PCs in the department. What USER do they log on with? That is the user name of the user/users. Is it the same user they log on with on all machines, or is it different users? The healthcare professionals that have access to the Online Patient Book – is this ONLY department 109 and 110 or are there healthcare professionals that belong to other departments? Are there other departments THAN the Urology Department 109 and 110 that use the same user to log on to PCs? That is, other Urology Departments, etc."
E-mail from the HC project manager to the IT professional, September 11th 2009	"From my perspective, I would strongly prefer if it was possible to make a reminder in the Online Patient Book. In that way the users would – as I see it – only need to log on to the Online Patient Book. And only logging on to one system is clearly preferable. I was teaching some [nurses the use of the system] the other day – and they simply did not understand the thing with the inbox."

arate webpage in the system, listing all unanswered requests from the patients within the system. In clinical practice, this webpage is checked at least once a day by the nurse in charge of the system that day. Due to the asynchronous environment within the eHealth system, the nurse in charge could also be from the night watch, where there are generally fewer interruptions and tasks and less work pressure.

3.4. Challenges and workarounds in e-mail communication between the HC project manager and the IT professionals

Using e-mail to cooperate and communicate about design and changes to the eHealth system proved challenging but was also a creative process: creative, because every change request was translated by means of visualizations and colour codes. Early in the development phase (April–May 2009) more than 150 screen dumps were sent from the HC project manager to the IT professionals. Each screen dump visually illustrated between 3–7 problems, including design errors, small adjustments, spelling errors, etc.

The project manager developed a set of standard colour codes including 14 different colours to be used in the text files. Each colour represented a task, e.g. the colour red illustrated text to be removed, and the colour dark green was for text linked to a picture (Fig. 2).

The HC project manager was not able to delete or edit the information in the eHealth system by herself, but needed to send it illustrated to the IT professionals – and finally wait for them to perform the task. Visualizations and colour codes were used to reorganize, remove, change, etc., text, headings, and pictures. The project manager used screenshots to illustrate the user interface with different symbols such as arrows, circles, numbered circles, etc., as exemplified in the screenshots in Fig. 3.

This way of cooperating and communicating in the design of the eHealth system was very time-consuming from the point of view of the HC project manager. First of all, the colour coding and visualization in itself demanded a lot of work. Secondly, the coding and visualization sometimes failed, for example, because it was overlooked, the wrong colour code was used, or the illustration misunderstood.

Aalborg Sygehus Nord, Reberbansgade, 9000 Aalborg – Find vej(link skal linke både jf aktuelt + teksten: find ved)
…
anden patient.
Telefonnumre. (slet punktum i overskrift – ryk ud til siden)
Urologisk Ambulatorium: tlf.: 99 32 15 02, mellem kl. 9-10 og kl.14-15.
Urologisk Ambulatorium hjemmeside
…
sygehuspræst (se pjecen på vores opslagstavle), læge med henblik på en samtale for dig og dine pårørende.
Link:Socialrådgiver
…
http://www.aalborgsygehus.rn.dk/Fakta+og+tal/Om+Sygehuset/ (skal slettes som tekst – indsættes som link jf. nedenfor
Læs mere:
Link:Aalborg Sygehus: (Link til:
http://www.aalborgsygehus.rn.dk/Fakta+og+tal/Om+Sygehuset/
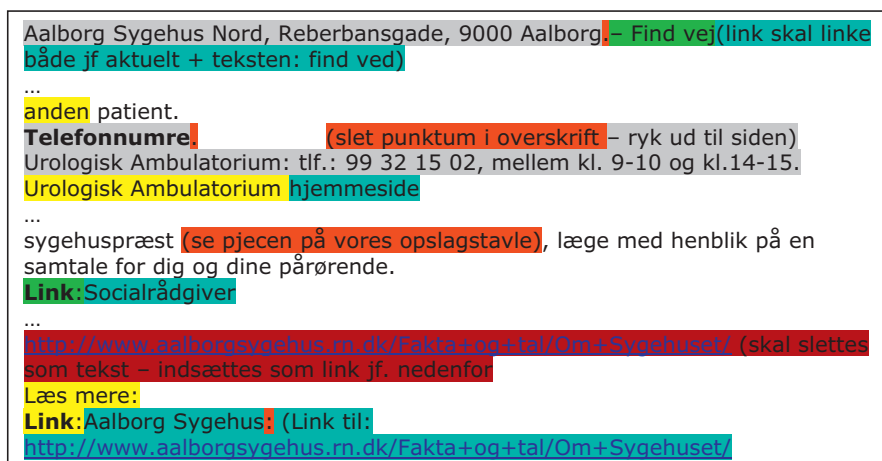
Fig. 2 – Colour codes used by the HC project manager to communicate different types of changes to the IT professionals (text in Danish – not translated).
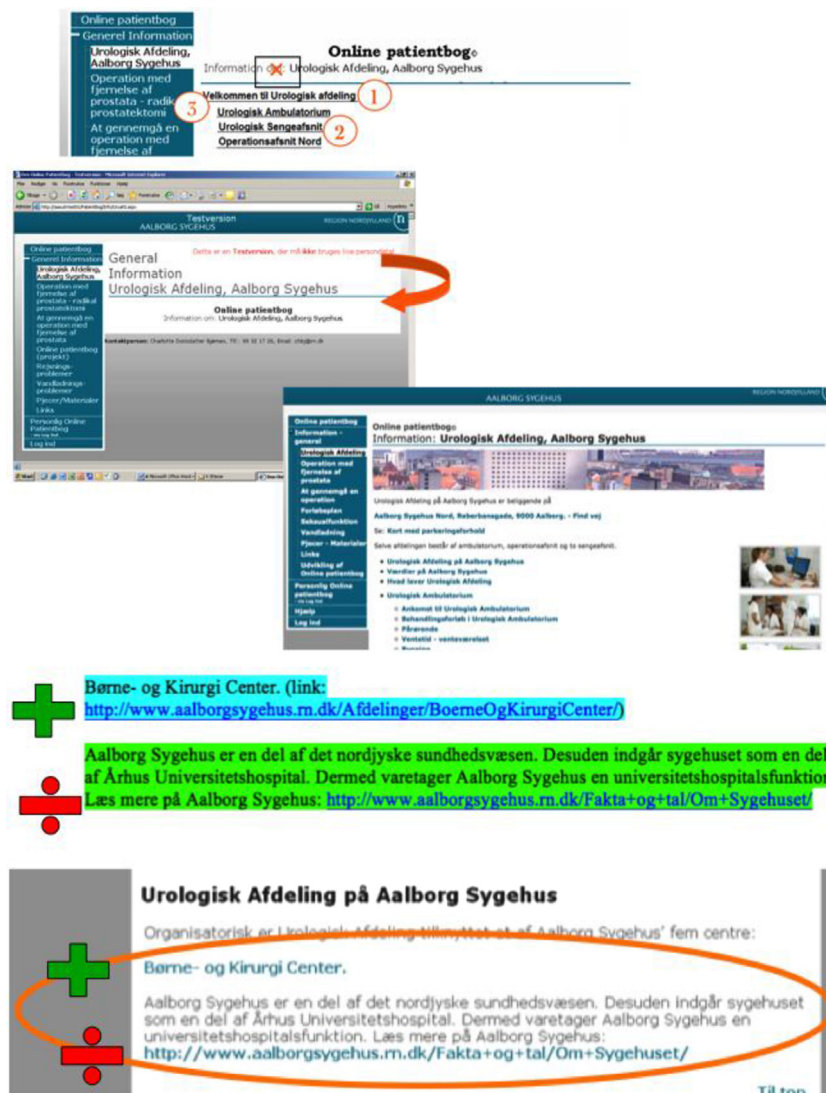
Fig. 3 – Visualization used to illustrate the requested user interface. The top screenshot illustrates the same webpage at three different stages of development; the bottom screenshot illustrates a request for a change (text in Danish – not translated).

Conversely, the IT professionals described this method as simple and easy to handle. They found it easy to understand and perform – as reflected in a comment in an e-mail: "Your colour codes are really codes (meaning good)". This comment was e-mailed from the IT professional to the HC project manager on one of the most intense work days in the development phase.

Visualization sometimes seems to be more informative than words. After pointing out the same line break text error in 4–5 e-mails, the error was illustrated by sending a print screen. That seemed to help clarify the mistake and the project manager received this message from the IT professional: "...*I did not realize what you meant by* a wrong line break until today, when I saw the picture. I found the error, and it is corrected in the *current version*".

Differences in work practice and knowledge between the two different professions, in addition to the asynchronous communication, made the cooperation challenging and time-consuming, especially seen from the perspective of the HC project manager. E-mail communication was used mostly because the IT professionals favoured this kind of communication, but also because the HC project manager and the IT professionals were situated at different locations.

The HC project manager used colour codes and visualization to communicate the changes via text files and screen dumps, trying to 'speak' the language of the IT professionals. Below are two additional examples of problems that resulted from the challenges in the cooperation and communication between the HC project manager and the IT professionals.

3.5. Disagreement in the development process

At an initial project meeting, one of the requirements raised was that the HC project manager would be the systems administrator (Table 3). In the development phase as well as the implementation phase, the administrator should be able to

Table 3 – Excerpt from a cooperation agreement and the dialogue that later followed regarding the interpretation of the agreement.	
Excerpt from a co-operating agreement (February 2009)	"*Administration function: CDB will as the project manager have the administrator function/opportunity. In the development as well as the implementation phase, the administrator will have the opportunity to generate content in the Online Patient Book – as input from study 1, cooperation with the Urology Department and literature is gathered.*"
E-mail from the HC project manager to the IT professional, May 24th 2009	"*… [At a test meeting] a design-developer attended … who was perplexed by the way we handle and implement editing and content in relation to the Online Patient Book. He found our work process very resource-intensive and considered it a given that the development of the Online Patient Book was based on a CMS system??? I had to admit that our current way of cooperation in relation to corrections and content is very resource-consuming – and has been so to date… On the other hand, I couldn't provide them with an answer on whether the Online Patient Book was based on a CMS system. I remember, though, that in our original plan for cooperation it was stated that I as administrator could generate content for the Online Patient Book.*"
E-mail from the IT professional to the HC project manager, May 25th 2009	"*… At our meeting we got the impression that the Online Patient Book was not a website where the texts would be updated constantly. As we agreed at the previous meeting, it would clearly be easiest for you to send the text to us and for us to then implement it in the Online Patient Book. The Online Patient Book is a CMS in itself. Maintenance, user account creation and the communication usability with the administration function is CMS-based. This, however, does not apply to the pages where static text has been placed. It has been our judgement that there will be too few changes in the content for it to pay off to implement CMS functionality. I also think we have spoken about how many texts/content corrections there will be in the future, and we agreed that it would be easiest if you send the corrections to [the IT professional] and then we would insert them in the Online Patient Book. We do not have the impression that this method is resource-intensive – rather the opposite. There is of course also the economic aspect in developing a CMS for content generation.*"
E-mail from the HC project manager to the IT professional, May 24th 2009	"*I do not completely agree on your experience of being in agreement that it was OK that I cannot edit. I have multiple times emphasized this – and returned to the summary of the meeting in February, where it is stated that I as project manager can edit the content… I have pointed this out multiple times as I found it undesirable and I was surprised in April when I found out that this was not the case. At the moment, I find it exceedingly undesirable in so far as we are now counting on the Online Patient Book as the primary tool [for patient communication]. I hope that we – during the first year of operation – can find a solution to the question, in so far as changes to the content will emerge.*"

generate content. The logic of this, from the HC project manager's perspective, was that she, as the administrator, should be able to edit the content during as well as after its development, because this would make the editing process more direct and, as it turned out, less complex and time-consuming. The system was, however, designed and implemented without a direct editing interface (also called CMS). As illustrated above, the HC project manager had to request all content changes by e-mail to the IT professionals, which were then made. The IT professionals, on the other hand, seemed to think that there was an agreement on this, and from their perspective, the editing process did not require any additional resources because the things that needed to be edited were clearly stated using different kinds of illustrations and colour codes. Furthermore, there were economic consequences in implementing the editing functionality, from the IT professionals' perspective. All in all, there did not seem to be a reason, from the IT professionals' perspective, to include the function or to make this an explicit topic for the HC project manager.

Table 3 illustrates the agreement between the HC project manager and the IT professionals set at the initial meeting and the e-mail correspondence between the partners later in the development phase. The e-mails illustrate the different perspectives on the agreement.

When analyzing the dialogue, it is evident that the HC project manager and the IT professionals did not agree on the system requirements. Furthermore, their views on 'additional resources' were very different. The IT professionals did not 'see' the resources involved in documenting all requests for changes via e-mail, text files and illustrations on screen dumps. The added value of implementing the editing functionality within the system might simply not be evident to the IT professionals. Also the IT professionals actually thought the choice had been made clear, though the HC project manager did not share this understanding. The shared design space was obviously lacking and in need of ways of bringing the technical decisions into the light.

3.6. Issues after implementation – scalability of the information system

Based on patients' evaluation of the eHealth system carried out after implementation, the system contributed to a feeling of security and increased their freedom in their course of treatment. The healthcare professional users supported these findings, as they experienced flexibility in their caring for the patient users, and especially in relation to accommodating the individual patients' information and communication needs [7].

The application was successfully implemented in spite of numerous challenges – but there were further issues due to the choices made during the implementation process. After the implementation, the challenge of 'scalability' of the system emerged. There were many requests concerning transferring the system to other patient groups. This, however, proved to

be difficult. One problem was that the system was not built on a CMS and therefore it would require work and repeated engagement of IT professionals in both implementation and maintenance. Furthermore, there were political challenges in the way.

The hospital department has both an interest in and sufficient economic funds to pay for the changes necessary to distribute the eHealth system. However, it turns out that they do not have the sufficient power to be able to initiate this process, as there are political discussions about having a standardized platform and further a question of integration of information between systems. The Regional IT Department does not allow the hospital department to develop further stand-alone systems. New systems need to meet the standard requirements for being part of the regional EPR system under development.

What we see here is on the one hand the healthcare professionals experiencing a need for bottom-up systems that meet the immediate needs for sharing information and communication between the healthcare professionals and patients after the latter are discharged from hospital. On the other hand, a regional IT department is trying to minimize the number of stand-alone systems that do not meet the future infrastructure standards that will in the long run allow data from the system to be integrated into the electronic health record (EHR) in the hospitals. The HC project manager was never made aware of these limitations of the system, at least not in a language that she could understand before the system was actually implemented. Put boldly, the strict requirements from the IT department have the potential of functioning as an innovation-killer within the healthcare sector.

In the following, we analyze the communication challenges of the case study through the concept of language-games, shared design space and considerations on power.

4. Results and discussion: building a shared design space

Pelle Ehn considers the challenge of communicating and agreeing across professional boundaries as a matter of not having a shared background or life-world and thereby not sharing an understanding of practice: "[...]inter-subjective consensus is more a question of shared background and language than of stated opinions. Language as a means of communication requires agreement not only in definitions, but also in *judgments*" [8]. The healthcare professionals and the IT professionals do not only need to speak the same language or use the same terminology, but they also need to share a common background that allows them to attach the same meaning to words and decisions – they need to engage in the same language-game and engage in the same shared design space. They need to share a common background in order to be able to make the same judgments. That is to use words in a way that is understandable within a shared practice: "To be able to participate in the practice of a specific language-game one has to share the form of life within which that practice is *possible*" [8].

The demand of sharing a form of life and judgments can seem excessive, but as exemplified in the cases above, the difference in practice and judgments between the HC project manager and the IT professionals did indeed lead to problems and misunderstandings regarding the systems design. The IT professionals and the HC project manager need to share 'a form of life' in order to understand the shared practice of designing an eHealth system for clinical practice – a shared design space. But can we build a foundation on which we can communicate and share judgments across the boundaries of profession languages? Ehn again refers to Wittgenstein and the concept of family resemblance: "*There* is a kind of family resemblance between games. They are possible to learn and understand because of their family resemblance with other language-*games which we know how to play*" [8]. He suggests that we can make a shared language-game of design-in-use, using experimental methods within system development that can support the construction of a shared understanding: "*Integrated* with scenarios of future use, the experimental use of prototypes in design may be an improvement technique in playing the language-game of design, games of involvement and doing that defeats some of the limits of *formalization*" [8].

In Ehn's approach, the IT professionals and the users (the healthcare professionals and the patients) need to create a shared language-game in order to create shared understanding, a language-game of design. This approach, like most traditional systems development research, focus on user involvement. But is this the same focus or language-game we need in order to communicate about system development between an HC project manager and IT professionals? How do we develop methods of engagement of IT professionals that secure that all relevant understanding of the technical limits and possibilities related to the eHealth project are clear. This challenge demands new methods and tools for asking the right questions at the right time.

In the communication between the HC project manager and the IT professionals there is evidently an ongoing negotiation of meaning and understanding about the technical limits and possibilities, but there is also the additional element and question of power. The project manager needs to control the development process, but the IT professional is the one most familiar with the language-game of system design – the language-game they need to play.

This perspective brings out the challenge described in numerous studies of the subtle yet important impact of information systems on hospital work practice [18–20]. Information technology and systems are changing work practices through changes in; structures, scripts, categorization and standardization [21]. The IT department and IT professionals who manage these infrastructures are becoming increasingly important actors in relation to the development, implementation and the on-going redesign of these information-system infrastructures. Research on the divide between IT professionals and the rest of the (hospital) organization shows how the IT professionals are not always in line with the rest of the organization [22–28]. The IT professionals can be identified as a fourth dominant culture in the hospitals along side nurses, physicians and administration [28]. The challenge in the case stories is exemplified in the clash of interests and the difference in work practices and perspectives between the IT professionals and the healthcare professionals.
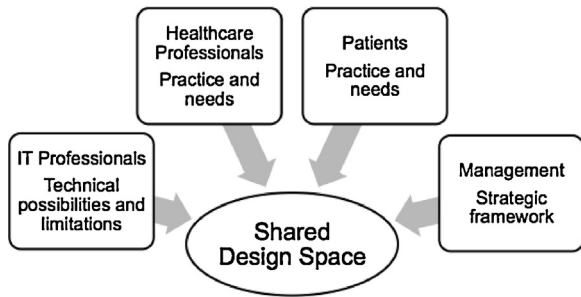
Fig. 4 – Multiple spaces or language-games are in play in the design process. Managing these requires process and practical tools that are easily accessible for the healthcare professional project manager in the planning and execution of the health informatics development project.

In the development of the eHealth system, there were different examples of 'breakdown' in communication caused by the lack of engagement in a shared language-game or shared design space. The challenges can be related to the clash between different kinds of languages, knowledge, practice or culture. A way to overcome this could be by perceiving the communication about system design between the project manager and the IT professionals as an attempt to create a new, shared language-game or design space. A game not only focused on user participation, but on managing a project and building a shared understanding of what this project is, including a clinical perspective in interplay with the terminology of the IT professionals; a game that requires engagement and willingness to bridge the gap of understanding on both sides – a game for developer cooperation.

Moving this reflection to a more situated space, we need to engage in shared practices in order to really understand each other. Understanding across professional boundaries takes an effort and interest on both sides. The IT professionals need to understand clinical practice to develop systems that support said practice and the HC project manager and users needs to understand the possibilities and limitations of systems development. In the case stories there were examples of lack of engagement on both sides. The IT professionals were not invited to the design workshops, and the IT professionals did not take the time and effort to make sure that the HC project manager had a sound understanding of the technical decisions made in the project.

The cooperation and communication between the HC project manager and the IT professionals were, however, not the only spaces of reference that were relevant in the shared design space. The patients as well as IT and hospital management were important stakeholders in the project, with varying influence on the project, as illustrated in Fig. 4. These additional spaces of reference were not fully seen as participants in the design space. They were only on the periphery of the design space and a range of challenges could have been avoided if they had played a more central role in the eHealth development project.

A range of challenges that might have been avoided is related to participation and ownership. Participation means involvement, although there are various levels of involvement, for example: to take part in, have interest in, or be concerned with the thing possessed [29]. Kushniruk and Turner [30] describe a change of behaviour that goes from participation and into engagement. Fundamentally, participation often generates relationship or ownership.

In the development process of the eHealth system described in the case stories, the patients were engaged through interviews and the healthcare professionals through workshops, and finally their use of the system. The different levels of involvement have an impact on the systems design.

The engagement of healthcare professionals and patients may be classified as a user-ship, however not an owner-ship. Therefore, a relevant question is: Who owns the Online Patient Book? Even though the administrators within the hospital department in which the system was developed and implemented agreed on being owners, there was a need to further support this ownership. According to the characteristics of the new technology, as an eHealth system, it was relevant to have co-owners from the Regional IT Department as well as on the level of top management within the hospital setting. Not securing this ownership resulted in a range of challenges for the HC project manager.

A socio-technical analysis at the beginning of the current research project could have stressed the importance of thinking the bottom-up design 'to the top'. Stakeholders within the hospital's top management groups should also have been seen as project participants, as their participation is needed especially in the strategic and economic environment. If these important actors do not see themselves as project stakeholders they cannot support the project adequately. The hospital management stakeholders' involvement is almost as important as the involvement of patients, healthcare professionals and IT professionals.

In the development of the eHealth system, some attention was given to stakeholders in the IT Department as well as on the level of head administrators within the hospital settings. Both had accepted and contributed with financial support from the beginning of the process. Though the stakeholders were initially identified and engaged, there seems to be a need to know more about them during the process, to continually sustain their engagement, and to ensure that the bottom-up innovations are not stopped by structural or standardization restrictions after development.

eHealth development managed by project managers without technical knowledge is challenging, however, this bottom-up approach also leads to systems that are used and appreciated in clinical practice and that address emergent needs. Agreeing on and sharing terminology, and being aware of enabling the project manager in the system-related decision-making from the beginning till the end of the project, could have helped bridge the communication gap between the different stakeholders. The challenge of who has the power over the ICT infrastructure and thereby also the distribution of ICT innovations in the hospital also needs to be considered in relation to these challenges.

5.   Conclusion: developer-involvement in small-scale eHealth projects

In the system development literature and within health informatics, the focus is largely on the involvement and participation of users. The challenge presented here is system developer participation and the need to bridge the communication gap between 'cultures' or professions in relation to eHealth development projects. We see a potential and a need for developing a framework and methods for empowering project managers/healthcare professionals in the system development process – methods specialized to enable the shared language-games and design space and thereby also empower the HC project managers in the system development process. Here both considerations on stewarding information systems, developing brokers with better understanding of the local practices, and practices for also considering the long-term challenges and possibilities of the eHealth systems are relevant for future research.

This article has pointed out an important challenge in system development and health informatics traditions that needs more attention by putting the focus on the project manager without an IT background cooperating with IT professionals. Cooperation between different professions can be difficult, but if handled correctly it is also creative and inspiring – a game. To support this design game, there is a need to explore new ways of doing system development that enables the clinical practice and the system development practice to meet in a shared language-game and design space – a game that also enables the project manager to handle the project. The shared design space can, however, not stand alone. Structural and organizational issues are central in facilitating small-scale eHealth development projects. There is a need to develop methods that can overcome the communication challenges, support the understanding of the technical terminology of the IT professionals, empower decision-making. The concept of a shared design space gives a framework for future exploration of how to support bottom-up eHealth development projects and HC project managers.

Authors' contributions

Lone Stub PETERSEN, – Analysis and theory on language-games, shared design spaces and culture

Pernille BERTELSEN – Analysis and theory on participation and culture

Charlotte D. BJOERNES – Empirical data collection

Conflict of interest

No conflict of interest.

Summary points

What was already known on the topic:

- User participation is important in the development of information systems
- The culture of IT professionals and healthcare professionals differ and can pose a challenge in system development.
- The culture and practice of IT professionals and healthcare professionals have an impact on the structure of information system projects.

What this study added to our knowledge:

- Involving IT professionals in clinically initiated eHealth projects demands awareness and engagement on both sides.
- Healthcare project managers need to be aware of the structural limitations of information systems' infrastructures and the 'power' of the IT department in relation to the post implementation issues of the health IT system.
- The concept of shared design space can provide a framework for future models on what is needed in eHealth development projects managed by clinicians.

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