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Appropriations and feedback from technology in use

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Abstract. Performing iterations of information systems development (ISD) may be tricky in complex organizational contexts where development, implementation, real use and redevelopment must meet with several implicated stakeholders. Furthermore crucial technical and organizational issues might not appear until the IS is exposed in the actual use context, showing its actual usefulness and quality. Implementing so-called pilot systems into the actual use context may reveal these needs for change and enable an iterative feedback loop from using the technology.
Looking at a case study of a pilot implementation of an electronic ambulance record (EAR) system, we qualitatively investigate the role of feedback of real use that enabled iterative redesign of the technical configuration and its organizational adaptation. Through observations of three events where stakeholders and users were present, we found that the pilot implementation fueled user motivation for changing the EAR while management realized the need for redesigning the technical configuration. As a result the pilot system was temporarily terminated from further operations.
The paper adds to the scarce literature of technology in use within ISD and proposes one answer as to how feedback can be used to propulse redevelopment in a pilot implementation setting Feedback does not simply involve developers and end-users but also co-realization processes between other stakeholders and end-users. We contribute theoretically to the appropriation matrix by Davern and Wilkin (2008) and propose how it can be improved to bridge past appropriations with hypotheses of future appropriations.

Keywords: pilot implementation, feedback, appropriations, technology in use, design in use, learning, iterative development, emergence, information systems development, isd

1 Introduction

How do organizational stakeholders handle feedback that occur when experimenting iteratively with mature prototypes in information systems development (ISD)? The concepts of “iterations” and “prototyping” are two old timer concepts that have been diffused throughout the software development and information systems literature for the past 30 years. The software development spiral model by Boehm in 1988 has been well cited and other scholars at the time were quite avid in exploring the usefulness of prototyping as well (Alavi 1984; Mogensen 1992; Budde et al 1992; Beynon-Davis et al 1999).
The iterative model also gained foothold in the Information Systems Development (ISD) literature although applied in a much wider organizational context. Markus (2004) for example notes a distinct difference between handling new information system as either IT projects or as organizational change processes. She advocates equally for a ‘technochange’-

oriented approach that consists of iterative development using prototypes to tie down business gains and benefits with the acutal technical solution (Markus 2004).
However heroic these attempts are to incorporate iterations and prototyping into the ISD process, they have a tendency to view the appropriation of the technology as the final stage of the project.
In recent years only few papers have been published regarding putting an IS into use in an iterative ISD context and assess the values and benefits as the purpose for further re-developing the IS. Alter's (2001) review of ISD approaches present an overall picture of four phases consisting of: initiation, development, implementation and operations and maintenance as the last stage in the process. Although an iterative nature is acknowledged in that changes may move back and forth between the phases, the review does not include any detailed evaluation activities nor does it explain how feedback in terms of incompleteness, needs for change etc. actually move between the phases and the organizational stakeholders that are implicated in the ISD cycle. This is a crucial leftover because new ways of working with the technology as well as stakeholder change requests (both organizational and technical) emerge constantly and do not pay homage to a particular stage of the life cycle of the IS. It has been argued that "…in practice user participation can be most powerful after 'go live' when users are truly engaged" (Wagner and Piccoli, 2007, p. 51), since users become especially committed to participate when their work is apparently impacted. Such 'real use' opens for unanticipated changes to emerge spontaneously, including inappropriate, undesirable, or disastrous side effects as well as unforeseen opportunities and unintended advantageous and desirable possibilities (Orlikowski and Hofman 1996).
According to Tyre and Orlikowski (1994), when new aspects of work and technology is discovered, the organization has as little as 3 months to take advantage of this new found knowledge and redevelop the IS before work practices simply 'congeal' into a muddling through approach for completing the work. Within the IS literature, these uses have been coined 'appropriations' (Davern and Wilkin 2008). Davern and Wilkin provide a model for exploring and understanding these innovations by proposing the "innovation evolution cycle", conceptualising the type of behaviour that users perform depending on how dysfunctional the IS actually is. What can be gathered from these writings are that workarounds and emergent and opportunity-based changes that either benefit or damage the overall organizational business model are inevitable. Whenever they become apparent in the informations systems life cycle decisions need to be made to either accommodate them by taking advantage of them, ignore them or change them.
One concept for formatively assessing benefits and value through redevelopment has been coined by Hertzum et al (2012) through the term "pilot implementation". A pilot implementation is defined as performing a "field test of a properly engineered, yet unfinished system in its intended environment, using real data, and aiming – through real-use experience – to explore the value of the system, improve or assess its design, and reduce implementation risk" (Hertzum et al. 2012, p. 314). Here the sole purpose is systematically learning about the organization and the need change of the IS (as well as organization) either for further development purposes or to prime the organization for implementation ahead of time. They provide a framework consisting of five elements: planning and design, organisational adaptation, technical configuration, use and learning. The first four elements all feed back input to the 'learning' element. However, who provides this input, what this input is used for and what it consists of is, like Alter's IS phases, not emphasized and only roughly defined.

Our motivation for this paper is to investigate the role of feedback, otherwise known as 'learning' (for a lack of a better word, since the connotations of learning may be many and significantly differs depending on the reader) in the context of technologies in use and its impact on the design of the overall IS. Through a case study of a pilot implementation of an Electronic Ambulance Record (EAR) we investigate the research question: *"What kinds of use situations are shared between end-users and other organizational stakeholders and what is the impact on development of this feedback?"*

We start by briefly outlining the project setting and our research method. We then describe three different consecutive feedback situations and the roles and lessons learned for each of those. We then discuss the lessons we, as researchers, can learn from these situations and relate our findings to the concepts and theory provided above.

2 Case setting

The case studied was an IT project that was regionally[1] owned and a collaboration between four organizational stakeholders: a software/hardware vendor from Norway, a pre-hospital ambulance dispatch center (where healthcare-related emergency calls are directed and the level of emergency is assessed), and two ambulance contractors. The IT project was a pilot implementation designed to learn more about the consequences of transitioning from using paper-based records to an electronic ambulance record (EAR) system.

The project began with eight months of planning and design that finally culminated in implementing the EAR in 17 ambulances for six weeks until it was taken out of operations. The pre-hospital centre acted as top-management and was responsible for the planning and design phase of the pilot implementation. Many resources were spent on fixing practical issues such as configuring the EAR unit to integrate the content of the old ambulance records, setting up printers at the emergency departments (EDs) and in some of the ambulances to work as an interface between ambulance crew and ED personnel, certifying that the units could take physical punishment according to practice and finding a place for a docking station in the ambulances. The first couple of weeks of operation and maintenance of the EAR were very troublesome and feedback from the users were mostly negative. The ambulance crewmembers experienced a world of difference between testing the EAR at the ambulance station and using the EAR in real situations where patients were implicated. The ambulance crew had to make up a number of workarounds on-the-fly during the ambulance run in order to keep documentation to a satisfactory level. The first responses about time taken to document a patient after handover to the ED were at around half an hour, where the paper-based ambulance records took up to 8 minutes. Pre-hospital management and ambulance had expected that duration of filling out the records woul increase but not with such an enormous amount. Many ambulance crewmembers blamed a lack of training of using the records which hitherto had been very sporadic. Hence pre-hospital management and ambulance management arranged a training day where all end-users could participate. After the training day a workshop was arranged with selected ambulance crewmembers who were deemed super-users in order to let them redesign the graphical user interface (GUI) of the EAR for improving time

[1] Five public Regions exist in Denmark, all acting as umbrella organizations for controlling the health sector in the five geographical areas of Denmark

consumption. After this workshop had been held a second workshop was arranged with organizational stakeholders as participants in order to sign off on the changes decided by the users.

3 Method

The three events previously mentioned (the training day, workshop one and workshop two) are the primary empirical foundation for this paper, although observations of the EAR in use were also performed. As such all empirical data were gathered qualitatively by two researchers (one being the author) who participated in and observed the training day that took place two weeks from go-live, one user-driven workshop four weeks from go-live, and a workshop that included all stakeholders five weeks from go-live. All events were documented by thorough notes. The initial coding was an open coding process that was performed while notes were taken during and immediately after events and interviews were observed (Strauss and Corbin 1990). Both researchers aided in this. Afterwards the primary author of this paper used the appropriation matrix from Davern and Wilkin (2008) for deductively coding the rest of the notes in order to identify the use situations (appropriations) that were shared between end-users to other stakeholders (see Table 1).

	Functional	Dysfunctional
Faithful	Conformant use	Dominant
Unfaithful	User Innovation	Circumvention

Table 1. The appropriation matrix (Davern and Wilkin 2008)

The appropriation matrix is to be understood the following way: the binary concepts of faithful/unfaithful are whether or not the end-users follow the intended design of the developers. The binary concepts of functional/dysfunctional are used to denote whether or not the usage is beneficial to the organization. In a perfect setting the users will adhere to 'conformant use' and follow the intentions of the developers (although very little innovation will occur). 'User Innovation' occurs when the users find new ways to perform with the IS that the developers did not intend. This type of use is the most fruitful and should be used in order to improve the design of the IS, while the 'circumvention' and 'dominant' use may be considered most harmful and shows signs of bad design (Davern and Wilkin 2008).
Seeing as the scope of the case only included observations of the three events and not actual ambulance work, users did not mention 'conformant' use, while 'domination' and 'circumvention' was by far emphasized the most.
In order to organize the codes they were categorised into: Stories of EAR use, contradictions between explanations of use and reactions from other participants, types of design solutions (being either organizational or technical), and consequences for design solutions (being either organizational or technical). We took these stories and related them to how they were used in the interaction between the roles of target user group (the ambulance crew) and owners/sponsors of the project (pre-hospital management and ambulance management) (taken from Pries-Heje 2003).

4 Results

The results are divided into three events where face-to-face feedback occurred between the different participants in the six weeks of operation and maintenance of the EAR. Each event is first explained and then analyzed by the appropriations described in the methods section. The most prominent examples of stories of appropriation and their consequences are presented and for each subsection we summarize the lessons that the participants learned.

4.1 The training day turns into a frustration forum

It was clear from the ambulance crewmembers' feedback that they were frustrated by using the EAR, and so prehospital management decided to arrange a training day for all ambulance crew three weeks into the pilot implementation. A representative of the EAR vendor was in charge of training the users and planned to focus on teaching the users how to use the EAR the way the software developers had intended (conformant use). The training day housed approximately 30 ambulance crewmembers, an ambulance manager from each of the two contractors, and a head nurse from the prehospital management.
The day quickly veered off course though. Based on the existing experiences with the EAR the ambulance crew explained their experienced problems with the EAR in practice, while the vendor representative would then spend the day jotting down notes about bugs and functionality suggestions rather than explain how to use the EAR. The issues ranged from domination use to circumventions expressed during the day. Examples of domination use were that the users felt forced to follow the graphical user interface but due to usability issues amd wrongly translated or inaccurate clinical terms they felt that their focus in the ambulance would move away from their primary objective: the patient. Due to these issues they had to perform circumventions so instead of using the system next to the patient and the ambulance crew would wait with filling out any information until after they had handed the patient over to the ED, drastically increasing the time spent on filling the electronic records.

What is important to note here is that these issues of dysfunctional appropriation were not only presented to the vendor representative but also to the ambulance management. As such some of the feedback of circumventions prompted instant reactions and change requests from the ambulance management. For example, the ambulance crew noted that due to the excessive time it took to fill out an electronic record they would often wait with printing the documentation until their next arrival at the ED, or make a paper-based record and manually copy this into the EAR, resulting in multiple copies of a single record. Other ambulance crewmembers explained problems handing over a patient from one ambulance to another in due time and were also resolved to continue making paper-based records and then input the electronic record manually at a much later time.
Ambulance management were appalled upon hearing this because it was against regulations to finish documentation on a separate location than the ED immediately after a patient was handed over. This would cause problems for ambulance operations and patient security because: a) multiple versions of the record would exist, clouding the legal aspect of which record was the “right” one in case of complaints; b) written documentation was required to be filled out as a supplement to verbal handover; c) if multiple records were piled up for later completion, many important details would disappear due to recall problems of the ambulance

crew. It was a matter of prioritizing the patient so he/she could be transferred to the ED as quickly as possible, or prioritizing the ambulance record to make sure it would physically follow the patient during transportation and handover. The impact of this feedback of use resulted in the ambulance management immediately forcing new work procedures. The ambulance crew simply needed to make their work fit to have the ambulance record follow the patient at all times, thus trying to force conformant use of the EAR on the crewmembers. The ambulance crew were not happy with this demand, and one of the paramedics answered with an invitation to first-hand experience how ambulance work actually worked:

> "…then all patients need to be followed [to the ED]. I'd like you [ambulance management] to come with me out into the field one day." (taken from the field notes)

The citation indicates that it was simply not possible to force conformant use simply by overruling it. The ambulance crewmember predicted that this would have consequences that would further result in circumvention (by following the patient to the ED even when it was not necessary).

The feedback about the actual circumventions performed also had an impact on the technical design of the EAR. The ambulance management demanded to change the EAR so an electronic record could not be changed or edited after it had been printed: "We need concordance between the archived record and the one at the ED. [You] cannot [fill it out] the day after."

The presence of ambulance crew, ambulance management and vendor representative prompted an interesting dynamic of sharing appropriations of the EAR. Although the ambulance crewmembers had discussed these problems earlier with the researchers as well as with themselves, the presence of the sponsors of the system would mandate concrete design changes in order to hinder further circumventions, and they would emanate both from the crewmembers themselves but also from the ambulance management.

4.1.1 Lessons learned

Ambulance management learned about how ambulance crew would inappropriately work around the EAR that resulted in dysfunctionality, and in turn ambulance crew would learn about the rules and guidelines of documentation from a clinical and legal point of view. This was previously implied tacitly in the old paper-based record and only brought to life in the feedback of the circumventions of the EAR system. It is worth noting that previously forgotten regulations about clinical handling of records resurfaced due to the EAR. The ambulance crew did nothing wrong as they focused on their primary objective: the patient treatment. Documentation could and should simply not be an obstacle in this but it ultimately became important to the ambulance management because they stronglt felt the impact of the circumventions on their own work.

Furthermore ambulance management, vendor representative and, at a meeting later on, prehospital management would learn that frustrations emanated from domination and circumventions due to bugs and technical limitations and not from a lack of training of conformant use of the EAR. This new knowledge resulted in realization of a need for a redesign to solve the conflicting goal of prioritizing either patient care or the documentation guidelines due to the time it took to fill out the EAR.

4.2 Innovation emerges from the user-driven workshop

The training day showed prehospital and ambulance management that a technical redesign of the graphical user interface (GUI) of the EAR was needed in order for the EAR to be integrated better into the work practice of the ambulance crew. Hence they planned a user-driven workshop with ambulance crewmembers participating from each ambulance contractor, five in total. The participants would meet one full day and discuss changes to the GUI from a set of draft mockups that one of the ambulance crewmember had been working on in his free time. A facilitator, the head nurse of health-clinical content, would host the workshop day. The scope of the workshop was to redesign the GUI of the EAR with as little reprogramming of the software as possible. Changes to the physical setup could not be made (printer integration, hardware platform, integration with other equipment). The vendor representative were to receive the finished set of mockups over e-mail and integrate these into a new version of the software.

The head nurse's responsibility included checking that the EAR fulfilled the Danish standards. However, she would also aid the visual design of the GUI based on her own experiences. This way the head nurse and the ambulance crew would learn about each other's work practice and use this a common platform for the redesign. The feedback that occurred between the ambulance crew was based on experiences with the old GUI of the EAR that resulted in domination and circumvention. Now that the users themselves could redesign a major part of the system, they visualised new possibilities for use of the system through 'user innovation', though unfaithful to designers' intentions the redesign was borne from the original design of the EAR. However, seeing as they were unable to test and appropriate the new redesign of the system, they realized that some technical design proposals were on the verge of either being functional or dysfunctional without the proper organizational changes to accompany them as well. Examples included:

- A desire to include a Visual Analog Scale (VAS) for assessing pain of the patients resulted in the head nurse realizing that prehospital management needed to teach the ambulance crew how to use it clinically and methodically correct. Otherwise it would be useless for documentation purposes
- Documentation of oxygen administration depended on different equipment in the ambulances. One contractor could very accurately specify the dose of oxygen while the other contractor could only skip between 12 and 15 litres. This could result in circumventing the documentation of oxygen in a text field rather than in a data field where it could be extracted properly.
- The size of the oxygen masks depended on the type of dispatch vehicle used. When documenting this information it was either circumvented by typing in a text field or simply omitted from the record because the ambulance crew did not feel it was important to document.

One specific design change incited wide debate regarding the contractual relationship between prehospital management and ambulance management. The ambulance crew wanted to document the difference between arriving at the provided address and at the patient's side (by included a 'patient contact' button) due to difficult terrain or apartment blocks where the stretcher could not be taken. This could explain why one contractor had better overall ambulance run times. However, the participants as well as the head nurse recognized that this

could instigate political desires to renegotiate the contracts between the two ambulance contractors, based on who was the quickest to arrive at the patient. Due to this risk they decided that prehospital management and ambulance management should decide the fate of this functionality at a later stage.

4.2.1 Lessons learned

The participants would learn about each others work practices and clinical backgrounds. They realized that no one really knew from whom (vendor or prehospital management) the design and content of the EAR originated from, and it was decided that this was to be looked into.
It further became clear that the different appropriations of the EAR came from two different cultures and tools between the two ambulance contractors, which made it difficult to standardize into one single GUI redesign, and this would require top management intervention to solve. As a result some design changes that could be innovative and provide value for the organizations were halted because it could have consequences for the contractual relationship between prehospital management and ambulance management.

4.3 The quest for faithful use – a second workshop to sign off on changes

A second full day workshop was arranged where the ambulance crew, ambulance management, and prehospital management could meet with the vendor representative to discuss the final design changes and see how far the integration of the mockups had come. Participants at this workshop included two ambulance crewmembers from the first workshop, an ambulance manager from each of the two ambulance contractors, two nurses from top management with each their competence areas (one of them from the previous workshop), the prehospital medical director, and the vendor representative. The vendor would walk through each new page of the redesigned GUI of the EAR via a projector.

The workshop was an opportunity for the ambulance crew to discuss the limitations of design that they had realized at the first workshop. Thus some of the user innovation that had been incorporated could be discussed by the implicated stakeholders to assess the functionality for whether or not the design would have functional or dysfunctional consequences for their organizations. This opportunity struck when the ambulance managers showed surprise at the "optimization" of the EAR pages. The ambulance crew had chosen to have two subpages and merged the full range of input fields and buttons within these subpages, effectively creating 64 buttons and input fields on one page.
This prompted a design discussion of how to reduce the number of buttons on the page. When an ambulance manager asked an ambulance crewmember why they had chosen to include external resources such as police, first-aiders, physicians, nurses etc., the ambulance crewmember explained that they had actually left this design decision to the ambulance management, because they did not know the legal requirements for documenting external resources. In other words whether or not the use of this new design would end up in dominant, conformant or as a circumvention was undecided. However, the ambulance managers wanted to change it so overviewing the page did not take so much time. The proposed solution discussed by ambulance management and head nurses was to hide infrequent resources in a popup window called "advanced".

Another major design obstacle that the ambulance crew had left to solve for ambulance management, prehospital management, and the medical director was the medicine module. After having used the EAR for several weeks the ambulance crew simply did not know how to use it faithfully because faithful use would go against their own guidelines. Mostly it was solved by writing the medicine administered in free text other places in the EAR but ultimately it was left up to the social practice at each station. The circumventions of this module became apparent when all of the participants (ambulance crew, ambulance management and nurses) walked through vairous usage scenarios, some experienced, some fictional. They experienced difficulties with certain medicines that needed to be mixed or calculated depending on the weight, medical history and symptoms of the patient. The participants simply had different interpretations of how to understand the flow and the labels provided, such as "Number of doses", "Dose given", and "Administration way". They inquired the vendor representative about this and she also realized the problem. It incited a design discussion and realization that the appropriation of this module would result in circumventions that could be highly problematic for the whole project organization:

> Medical director: "…the problem we are discussing [I] also recognize from OPUS [a hospital medicine administration system], it's highly relevant. What you are looking for is the method of dispensing."
>
> Ambulance crewmember: "…and many [ambulance crewmembers] will be puzzled by this."
>
> Ambulance manager: "… and that is a possible documentation error." (taken from field notes)

Based on prior experiences of medicine module designs the medical director underlined a strong need for redesigning the flow of the input fields. The vendor representative noted that the design solution required a complicated redesign since each type of medicine differed in substance, form and administration way that was way beyond the scope of 'minimal reprogramming' as originally predicted.

The discussion emerged due to a realization that legally and clinically, prehospital management (more specifically the medical director) would be responsible if errors in the medicine administration documentation occurred. Due to the experienced feedback of how the participants would themselves circumvent the design of the medicine module, prehospital management realized that they were themselves a very important stakeholder in the clinical content of the documentation. This also resembled the reaction of the ambulance management during the training day.

4.3.1 Lessons learned

Ambulance management and head nurses learned that they also needed to participate in design solutions where the users either lacked knowledge or competences because the design of the EAR would have implicaitons for future appropriations and as such span several layers of management rather than simply on the user level.

Prehospital management learned that they had to interfere in the GUI design (although from the beginning unwilling to) because they were owners of the EAR system and had responsibility for the quality and consistency of the documentation.

The medical director gained a glimpse of the consequences an inadequate medicine module would have on work practice and in turn on the responsibility of prehospital management.

This ultimately led to halting the EAR from operations until a better solution to the medicine module was found.

5 Discussion

In the previous section we have shown how feedback of different appropriations have both created user innovation as well as enabled the ISD case to move forward while improving the design of the IS. In the following we will discuss the lessons, advantages and disadvantages that we as researchers have gained from applying the appropriation matrix to different types of use of the IS in the case study.

5.1 Broadening the scope of stakeholder gaps

One of the single most important findings from the case was that through sharing stories of circumventions of the EAR between target user group and sponsors resulted in creating a much needed propulsion of the project, rather than simply denoting it as another failed IS implementation. Rather, the IS was revised and turned from an implementation to viewed as pilot implementation with development aspects instead.
As such the gap between developers and users as presented by Markus (2004) and Davern and Wilkin (2008) was hardly narrowed. However, the gap between many of the implicated stakeholders, especially the end-users, middle managers and top management was greatly narrowed as all seemed to gained insight into the design issues regarding practical, organizational and technical context. By sharing knowledge about actual use of the EAR redesign and redevelopment were both propulsed forward by the central decision makers of the project in a process very much akin to a "co-realisation" process of development and redesign (Hartswood et al. 2002) and also the notion of taking advantage of "mutual learning" processes through design in use that Béguin (2003) proposes.
We see a possibility for broadening the scope of the definition of 'developers' since the actual user innovation occurred both between users (who at the first workshop acted as developers as well) but also the managerial stakeholders. In this case the managerial actors of the ISD process were the gatekeepers of future changes and by showing how the appropriations had an impact on their own level of responsibility it created incentives for changing both organization and technology.

5.2 Limitations of the matrix

However, the case also showed limitations in how much the matrix could explain. The matrix has been founded from a managerial perspective. Depending on the complexity of the IS, the point of view of the organizational stakeholder and the scope of a "use situation" one could end up with ambibuous results. First of all the binary concepts of dysfunctional vs. functional design that relate to the overall organizational context and goals do not take into account that the way the users appropriate the design may be contingent on a specific contextual condition. Is the "use situation" then scoped from the start of when the users use the IS till they finish or does it only consist of taking advantage of certain functionality within the IS? The appropriations in the case clearly belonged to the dysfunctional column but whether or not it was domination or circumvention depends on the perspective taken. From the user perspective

they felt that they were forced to push the documentation effort until after hand over and then rigorously follow the flow. From their point of view this was 'domination'. However, from the perspective of the ambulance management the ambulance crew also happened to still use their paper-based records while treating the patient which resulted in double-documentation and also increased the time consumption, which would be located into the 'circumvention' row in the matrix. From the perspective of the prehospital management the circumvention consisted of the ambulance crew using the free text possibilities more than the strict data fields, and this resulted in challenges with extracting quantiative data from the system.
The goals of the organization in this sense were much deeper layered than the model can explain and this should be taken into account as part of analysing the appropriations. Some of the questions that should be answered before hand could for example be: "How broadly do we determine the use of the IS?" and "From whose perspective do we view the appropriations?" The first question begs for a definition of what an IS really is (of which scholars like Alter (2008) have a very interesting suggestion) while the second question requires the evaluator to choose "sides" from the beginning of the project. It also begs the question of pre-defining certain effects that the client organization want following up on before the IS is taken into use (Hertzum and Simonsen 2011).

5.3 How do we use intended use?

Faithful vs. unfaithful use also warrants some discussion. In the case it was very difficult for either organizational stakeholder to determine what was the "intended use" of the EAR and this could only properly be determined by putting the EAR into use with various results. The determining factor for this was most likely that the the IS "went live" before the users had the chance to follow any kind of conformant or dominant use and the only other choice they had was to muddle through and use the EAR in similar ways as using their paper-based records. In the case the only actor who got close to voicing the intended use was the software vendor. However, along the sudden implementation of the EAR the window of opportunity to actually teach the users the basics was shut long before the training day took place. Rather it created the frustration and motivation for changing the IS by feeding back appropriations of use that also Wagner and Piccoli (2007) were proponents of.

5.4 From analysing to predicting appropriations

Furthermore the appropriation matrix is clearly designed to analyse post hoc appropriations but through the design workshops we found a way to use it as a tool for determining how well a design decision could fare in a future scenarios. We saw this in the results section where the users proposed that they as well as their respective ambulance contractor would gain some value from the 'patient contact' button. Though this required that the users actually remembered to use the new function and that it did not result in any contractucal disputes between prehospital management and the ambulance contractors. In this sense the appropriation of such a patient contact button could have indirect effects on the organizational level without actually being able to locate the issuse within the appropriation matrix. Likewise from the example of the problematization of the medicine module it was easy for the sponsors to spot how this would affect themselves but difficult to find a concrete design change that could move the appropriation from circumvention to conformant use of user innovation. They

knew the medicine module could have been designed with only free text fields and in this case the appropriation could very well have been conformant (for example that the users would only use this free text field to input medicine). However, the actual appropriations of the text fields could have shown that the users would document medicine differently, thus showing that the problem was actually rooted organizationally and not in the design of the system. In this regard we propose that the matrix be altered so that the binary concepts of faithful vs. unfaithful are changed to also accommodate future predictions of the managerial actors in the ISD process, especially those champions who see to it that the actual appropriations of the IS are taking place.

The goal of the pilot implementation was hazy in the beginning but through realizing the shortcomings of the IS in use the goal was quickly transformed into using the pilot implementation in an ISD context rather than in a pure organizational implementation context. In this sense we see examples of how the different appropriations must be adressed to the correct types of sponsors in the project setting in order to gain attention to pending organizational effects. From the case studied we see that the 'learning' element that Hertzum et al (2012) proposes consists of new realizations about the impact of work practice, something that was unimaginable with the old paper-based records. The specifics are that whenever a stakeholder layer is threatened by an experienced appropriation, things will be provoked and start moving!

6 Conclusion

In this paper we have studied how appropriations of technologies in use in an ISD context can feed back knowledge to the element of 'learning' between organizational stakeholders and the impact this feedback has on the IS. Through qualitative observations of three face-to-face events where the participants of the target user group and sponsors met, we uncovered that the appropriations defined as 'circumventions' had an important impact on the propulsion of the organizational context, effectively changing the context from an implementation effort to a development project. The circumventions all had in common that they resulted in proposals of new design changes of the IS in question and this proposed the idea of how future appropriations would be performed, though still left untested.
We contribute to the scarce literature of how to use feedback from technologies in use in ISD contexts to propulse the project. We succesfully used the concepts from the appropriation matrix but also found room for further improvement. First of all we argue that the gap between knowledge of use situations are not only between users and developers. In order to create new innovation based on the appropriation of the IS the scope should be expanded from developers to other organizational stakeholders, eg. sponsors of the IS since these are crucial gatekeepers for change in both setup and technical configuration. Second we argue that the scope of the IS should also be defined or at least reflected on before the IS is implemented, since the appropriations discovered may vary depending on the point of view that is taken as well as how the IS supports the work and the organizations as a whole. Third we find that the appropriation matrix could and should be used as an evaluation tool in order to test the changes that result from the feedback interactions between stakeholders during the ISD process.

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[Authors' notes – left out from official paper]

[The paper is a work in progress and it would be helpful if the IRIS reviewers would consider the following reflections on further work and changes to the paper:

- how to tighten the focus in the introduction to focus on appropriations, technology in use and pilot implementations without having to move to organisational implementation literature, evalutation literature etc.
- how to tighten up the results section. One example could be to restructure the sections into concepts taken from the appropriation matrix. This could further address some of the issues and shortcomings discussed in the discussion section much earlier.
- how to further define a theoretical contribution to the two areas of appropriations and innovations of IS in use and pilot implementations.]

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