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Exploring the use of design pattern maps for aligning new technical support to new clinical team meeting routines

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We propose the collaborative activity of mapping design patterns against stakeholder values as a viable method for grounding conceptual design of information and communication technology (ICT) services for heterogeneous sets of stakeholders. Preliminary experiences from designing a case book service for video-mediated gastro-medical team meetings are presented. A diverse set of stakeholders and the challenge to apply novel technologies in a demanding environment have placed more responsibility on the Human Computer Interaction (HCI) team to conceptualise new work practices and their expected effects than what traditional participatory design projects typically entail. By combining the methodologies of genre analysis and pattern languages, design pattern maps have been used to conceptualise solutions that span both work and interface aspects of the solution and that match declared values of the stakeholders concerned. A series of mapping sessions with different stakeholders helped the inter-disciplinary project team to better define, what stakeholder values called for what new work patterns and what kind of supporting interaction design patterns these new work patterns in turn called for.

Keywords: CSCW; health information technology; interaction design; user involvement; visualisation; patterns

1. Introduction

The introduction of electronic medical analysis and record systems into today's health care sector highlights the complex interplay between new technology, users' needs for timely and accurate information and the highly specialised collaborative medical work routines that shape those needs (Fussell and Benimoff 1995, Cabitza *et al*. 2009, Swedish Ministry of Health and Social Affairs 2010). To address this multilayered interplay of changing user needs, work routines and organisational patterns, we need theoretical frameworks that can help conceptualise, compare and evaluate alternative socio-technical design solutions in transparent ways. If the diverse set of stakeholders affected by this ongoing change should have a chance to participate as active co-designers of new ICT systems, they also have to be involved in the ongoing process of conceptualising professional needs against the backdrop of new ICT systems, work routines and organisational patterns (Erickson 2000, Dearden *et al*. 2002). Thus, the theoretical framework has to provide for certain pedagogical qualities such as *sufficiently clear overviews* of the processes at hand and an *open and flexible vocabulary* that helps stakeholders to model their own unique variants of known patterns and proven solutions. In this article, we report methodological findings from a study performed in a gastro-medical setting, in which we have combined the methodologies of genre analysis and pattern languages to help facilitate this kind of ICT design dialogues.

We begin by presenting the gastro-medical work and communication processes that the study is aimed at enhancing and the overall research project design in which the study is carried out. In the second section, we present the proposed theoretical framework in terms of what earlier research we build on and our arguments for combining the genre and the pattern language methodologies. In the third section, we report on how we applied the framework to one of the project's ICT enhancement activities at a gastro-medical department of a Swedish University Hospital and how the framework helped the inter-disciplinary project members to reflect on the proposed enhancement, an interactive patient case book to complement the existing electronic patient record. In the concluding sections, we discuss the conceptual design of the proposed case book, both in terms of useful results for the ongoing re-design of the department's ICT systems and in terms of lessons learned regarding applying the theoretical framework. In respect to methodological result, we conclude that the collaborative activity of mapping communicative genres, with their corresponding design patterns, against stakeholder values proved to be a promising method for

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grounding conceptual designs of ICT services for heterogeneous sets of stakeholders.

1.1. Research setting and aim of study

Beginning in 2004, the Gastro Centre at a University Hospital in Sweden has built up a video-mediated conferencing system connecting six regional hospitals to support multi-disciplinary consensus conferences, team meetings in which treatment of individual patients are discussed, decided upon and learnt from, before and after surgery. The basic video-conferencing equipment connecting the hospitals is complemented with two large screens at each hospital for presenting MR, CT, ultra sound and other imaging technologies.

The consensus conference system engages a wide range of direct and indirect stakeholders, including team members from many medical professions (about 25 surgeons work at gastro), technical personnel, department management, software and hardware providers, public agencies, patients, relatives and citizens as tax payers. The patient record system (Prof Doc, Take Care) is an important infrastructure for accessing medical data all along the clinical pathway in which the consensus conference is the main point of decision making.

The study reported here is done as a methodological development effort within the Funk-IS project (functionality enhancing technologies for built-in systems with application within advanced medical processes), a project that focus on how haptic and information management support can enhance the clinical and medical effectiveness of the decision conference. The project was initiated by the Gastro Centre in close dialogue with the Human Computer Interaction (HCI) researchers and the project team is comprised of seven physicians (two of them on management level) and nine HCI researchers (three PhD students, five PhDs and one research engineer). One of the key aims of the Funk-IS project, stipulated in the call for applications by the research sponsors, is that its results benefit commercial system providers by the year 2016. This means quite a radical challenge for a user-centric perspective on human–computer interaction which, not least influenced by the Scandinavian school of Cooperative IT design, has focused IT and work practice design on a strong participation of end-users of the new support system to be developed (Ehn 1993, Bødker *et al.* 2000). Since changes in workforce and work practices are expected to be quite substantial in the 6 years to come (staff turnover, new insights and routines for diagnosis and treatment, overall technical infrastructure), some new steps have to be taken to complement traditional here-and-now user participation with a pedagogical method for supporting a *long term stakeholder engagement in participatory design practices*. All empirical studies performed within the project build on established HCI methods, such as participatory observation, interviews and design workshops with use scenarios for testing of mock-ups and interactive prototypes. The aim of this methodological study is to explore a complementary method, design pattern mapping, as a feasible method for *building and sustaining stakeholder engagement* in participatory design of ICT support for the consensus conference.

2. A theoretical framework for supporting sustainable user participation

What steps have to be taken in order to ensure that user engagement in analysis of new work and interaction patterns is sustained, beyond the users' occasional encounters with usability professionals during pre-studies and/or follow-ups of ICT projects? First of all, in order to transform the often ad hoc initiated user involvement measures into a habitual quality assessment practice, the usability issues addressed have to be important enough to be *recognised by management as being within their area of responsibility* (Brynjolfsson and Hitt 2000, Brödner 2005, Brynjolfsson and Saunders 2010). The usability effects of alternative design solutions have to be expressed in relation to the core values of the organisation. This means that the usability effects on quality of treatment, patient satisfaction, employee engagement and other core values have to be discernible in a way that allows for collaborative interpretation, negotiation, decision making and follow-up of usability metrics. This, in turn, means that certain pedagogical demands have to be made on the way usability and interaction design issues are communicated between designers, developers, users, management, system providers and other stakeholders.

Based on our earlier studies on video-conferencing and quality assurance practices (Lantz *et al.* 2004, Walldius *et al.* 2005, 2009) a literature review of current studies on video-conference applications within medical settings (Frykholm and Groth 2009) and a series of workshops within the interdisciplinary project team of HCI researchers, surgeons and radiologists, we identified two partly overlapping, complementary approaches that together seemed to meet our requirements on pedagogical affordances. In our earlier studies, we had built on communication genre analysis for understanding user expectations in complex communication settings. For this study, we chose to combine genre analysis with the use of pattern languages for supporting user participation in complex ICT design efforts. In the following sections, we present these two approaches and how we see that

they interlock in ways that can underpin long-term design dialogues with diverse sets of stakeholders.

2.1. Genre analysis for matching interaction design solutions against desired communication patterns

Since the early 1990s, there has been a sustained interest in applying the concept of genre for analysing organisational communication in the computer science and HCI literature. Based on analysis of genres in literature (Bakhtin 1986) and on speech act theory (Searle 1969, Austin 1975), Yates and Orlikowski (1992) began a series of empirical studies of organisational communications in which business letters, memos, face-to-face meetings and different kinds of reports were analysed in terms of communicative purpose and regularities in form and content. Building on these studies, Yoshioka and Herman (2000) analysed coordination mechanisms of a conference website from the genre perspective and, together with Yates and Orlikowski (Yoshioka *et al*. 2001), modelled a Process Handbook developed at the MIT Center for Coordination Science from the same perspective. Here they use the formula '5W1H' to summarise the six core questions posed in genre analysis of sets of typified activities: why (purpose), what (content), who (participants), when (timing), where (location) and how (form of communication). Since the notion of genre is extended to genre systems and since a repertoire of coordination mechanisms is presented along this 'genre taxonomy', we found that both these latter contributions offer particularly useful insights. Not only about how social expectation and interaction are *shaped by* communication artefacts but also about how the genre perspective can support deliberate re-design. In other words, how collaboratively analysis and design efforts can *shape* – by collaboratively enacting – new genre expectations manifested in new artefacts and activities.

The possibilities of genre analysis as a tool for design efforts is even more pronounced in Antunes and Costa (2003), a contribution that explicitly builds on the work referred to above and which reports the enhancement, through genre system analysis, of a series of meetingware applications. What specifically caught the attention of our project team in the paper of Antunes and Costa (2003) was the clear, pedagogical mapping of the full meeting genre system, a system which incidentally coincides to a large degree with the consensus conference we were studying at the university hospital. The straightforward approach for using the concept of genre as a tool for design was also inspirational for our study. As we have interpreted their overall process for genre-based design, it builds on the three main steps of:

(1) identifying the habitual activity patterns performed in the existing genre system,
(2) offering enhanced functionality by designing digital support for critical activity patterns in the genres, and
(3) providing an integrated view of the, thus, enhanced genres in order to gain acceptance, enact the new enhanced genres and build participant expectations for how things are done in the new way.

Although the literature on genre analysis often refers to regularities of content and form as 'patterns', it is striking that the connection to another strand of HCI literature, that of pattern languages, is seldom made. As the genre approach is used in this study as an overarching methodology for integrating aspects of participants, purposes and regularities of content and form, we see the pattern language approach as a design-oriented method that may inform the genre perspective with an open formalism for highlighting and matching social and technical aspects in a transparent and practical way.

2.2. Pattern languages for collaborative assessment of design solutions

The pattern language (PL) method is a method for representing design experiences that originally emanated from the field of architecture in the 1970s and that today has been successfully applied to the fields of object-oriented programming and interaction design (Alexander *et al*. 1977, Borchers 2001, Gamma *et al*. 1995, Tidwell 2005). By emphasising the use of visual sketches and providing a formalism for accounting for context, the method helps designers and researchers describe practical solutions to recurrent design problems in its different fields of application (Guy 2005, Schümmer and Lukosch 2007).

As the PL method is a well-known approach in the computer science community with its own conference tracks for different application domains, it will not be summarised here (see e.g. Erickson (2009) for an overview of its application within HCI today). What we will do, in the following sections, is to *exemplify how design patterns can express design experiences* from our empirical work in terms of its main formalism (context – problem – counteracting forces – solution –supportive patterns). What is particularly relevant here is in what way pattern languages can inform genre analysis with a systematic way of matching relevant *interaction design solutions* against *desired work patterns*. This amounts to the challenge of finding a pedagogical way of collaboratively assessing trade-offs between the *content* (what),

form (how), *timing* (when) and *location* (where) of alternative design solutions based on how the respective solution fulfils the *purposes* (why) of the engaged *participants* (who).

One major goal of PL in all its guises, regardless of if it is applied to architecture, object-oriented programming, organisational or interaction design, is to facilitate the emergence of a common ground for the diverse set of stakeholders involved in complex design ventures (Tidwell 2005). This pedagogical aspect of the PL approach makes it ideal for our project, which aims for involving a diverse set of stakeholders in long-term collaboration. What we specifically wanted to test was the potential of pattern maps (Schümmer and Lukosch 2007) to explicate genre patterns visually in a way that would give all stakeholders concerned a sense of overview and understanding of the overall context.

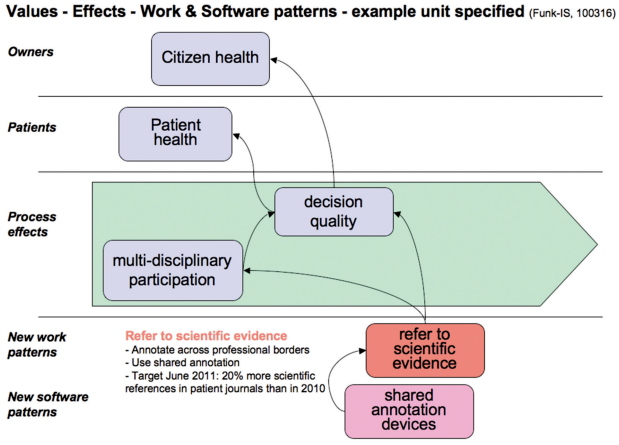

Figure 1. Example of a partial strategy map detailing links between values for owners and patients, process effects, work and interaction patterns.

2.3. *Design pattern mapping for aligning design proposals to stakeholder values*

We propose the use of *design pattern mapping as a key activity* for supporting ongoing conceptual investigations within the research team and, more importantly, between the team and the different stakeholders involved in the project. With pattern mapping we mean the activity to iteratively map out, visually, the set of design patterns selected for making the solution meet declared user needs and values. To map out *the relationships between* design pattern visually has been a common exercise in the pattern language literature. Christopher Alexander, the inventor of the method, did it in his influential doctoral thesis on architecture (Alexander 1964), the so-called 'Gang of four' did it in their application of the method to object-oriented programming (Gamma *et al.* 1995) and recently (Schümmer and Lukosch 2007) have used maps systematically in their application to computer-mediated communication. After having discussed the general relationships between patterns thoroughly in the introduction through the use of maps, Schümmer and Lukosch (2007) lay out each of the three levels of patterns (Community support, Group support, Basic technology) as well as each sub-level (e.g. on the Community level *Welcome me, Guide me, Save me*) through maps that depict the relationships between the patterns on the respective level (e.g. on the Welcome me sub-level *Quick registration, Login, Welcome area, Mentor, Virtual me, User gallery, Buddy list*). In Figure 1 we exemplify how a digitally supported work pattern in a consensus conference can be mapped out for collaborative evaluation in the strategy map format, a format that will be introduced shortly.

It is important to note that this mapping exercise of work enabling patterns, specifically in the early stages of a project, may be local in kind and deal only with minor aspects of the work and technology under consideration. They may be sketches rather than thoroughly worked out analysis of all aspects. The point is that the map allows all the team members, and then all the stakeholders, to collaboratively and iteratively see and reflect upon a set of complex relationships between new work routines (*refer to scientific evidence*) and new digital artefacts (*shared annotation device*) in order to discuss which effects (*multi-disciplinary participation, decision quality*) and values (*patient health, citizen health*) these routines and artefacts should enhance during an agreed upon test period.

What an ongoing pattern mapping activity may amount to in the month-to-month conceptual reassessment of work and interaction design aspects is *a collaborative reflection* on how the work and interaction patterns proposed afford the values of all stakeholders. In other words, design pattern maps may not only cast new light on the hands-on methods for design of new work routines and technology but also *help build a long-term involvement* of physicians, management, procurers and systems providers by offering a key activity in which they can negotiate their respective expectations. To make this integrative potential of pattern mapping more clear, we will exemplify with a brief account of how it was explored in one of the strands of work-and-technology redesign of the Funk-IS project, the introduction of a new 'clinical case book' (Frykholm and Groth 2009).

3. Mapping the case book proposal

The case book is an idea that has been developed in the early phase of the Funk-IS project to conceptualise

how the gathering, organisation and presentation of critical patient data, and relationships between patient treatments, can be recorded and accessed along the whole care chain. The case book will support the video-mediated team meetings where surgeons, radiologists, pathologists, oncologists and many other professions discuss individual patients and decide whether and how surgery should be performed. The multi-disciplinary teams have access to a patient record system but there is a wealth of information discussed during the meetings that is not saved. The case book, or the shared clinical workspace as it was initially called, is based on an overall need to record that information, to visualise available patient information in effective ways, thereby supporting efficient decision making and planning (Frykholm and Groth 2009). The patient record system, combined with dedicated systems, for example image management, is designed to cover all relevant data about the individual patient. But there is no readily accessible record system, for example linked to special purpose quality records, that covers lessons learned from treatment of different kinds of patient cases. Therefore, the video-mediated team meetings, as well as the whole care chain, would benefit substantially from a shared interactive case book that organises the hitherto quite unstructured activity of comparing outcomes of treatments *between patient cases*. In the early discussion between the research team and the medical personnel, it also became evident that such a system would enhance the information management *between the different phases* of the clinical pathway for each patient case. The comprehensiveness, relevance and accessibility of patient and clinical information could be substantially enhanced during and between the preparation, co-ordination, decision, pre-op and post-op phases of the conference through a case book that provided support for recording, analysis and access to the textual, verbal and image annotation data that got accumulated along the clinical pathway.

3.1. Initiating the conceptual exploration

How did our pattern mapping exercise help the project team develop its vision of a shared case book? The exercise was based on the Funk-IS project's extensive field work, workshops and prototyping which has been reported elsewhere (Frykholm *et al.* 2010, Olwal *et al.* 2010). To date, in year two of the three year project, the methodological effort to try to summarise and make sense of successive empirical results in pattern maps has been carried out in discussions and mapping activities during research team meetings with successive short presentations to individual surgeons, surgeons with management responsibilities within the project, with system vendors that have provided some of the technology tested in the project, and with facilitators at the university commissioned to help technical innovators reach out to existing system vendors. Since Swedish hospitals have used Balanced Score Cards (BSC) extensively to report their performance in relation to patients and personnel alongside financial data, we first introduced the idea of using design pattern maps in the format of Kaplan/Norton score card strategy maps for gaining overview of the design challenges (Kaplan and Norton 1992, Olve *et al.* 2003). This was done in an early seminar with our medical partners who were all familiar with BSC, although neither with strategy maps nor with design patterns. From our point of view, the advantage of adhering to the strategy map layout was not only that it would comply with the hospital's BSC reporting format but also that it fitted well with the case book genre perspective in which the values (why) of different stakeholders (who) are highlighted in relation to desired effects (what) of proposed design solutions (where, when, how). For investigating the prospective genre of case books, comparing it to an instance of the genre patient record systems seemed to be a good starting point. The strategy map shown to the project partners was part of the 2009 User Certified protocol of Take Care, the patient record system used at the hospital (Figure 2).

The rational for strategy maps is to map out, collaboratively, the interplay between planned *development efforts*, their *anticipated effects* in the work process and the *value fulfilment* these effects represent for different stakeholders/participants. In the case of the Take Care map, the underlying analysis was done in an investigation of user and management

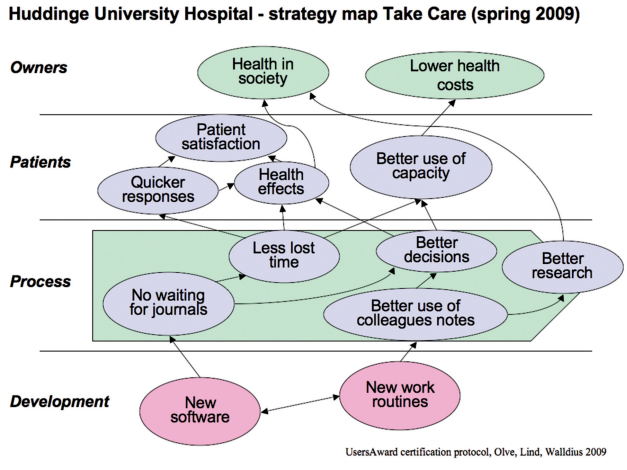

Figure 2. A summary of values for owners and patients, and process effects gained from the deployment of a patient record system, as witnessed by users and management in a software certification assessment.

satisfaction with the software at three hospitals, an inquiry carried out according to the Users Certified 2006 certification programme (Walldius *et al*. 2007). As the medical partners were familiar with both the underlying BSC method and the Take Care system depicted in the map they found this format useful as a way to gain an overview to strategic concepts and their interplay. What was particularly interesting was that, although BSC had been used for some years at the hospital, the relationships between development efforts, desired effects and stakeholder values – that is the logic behind yearly development commitments – had never been displayed in a strategy map and, possibly related to this, the engagement by different stakeholders had been rather limited. Since BSC routines were already in place at the hospital for financial, social and process related follow-ups, they deemed that the strategy map format might well be a good way to get an overview of the development of the new case book for consensus conferences.

In genre terms, the *Who* of a communication genre can be displayed as 'Owners' (of different kinds) on the topmost layer of the strategy map and, as in the health care domain, 'Patients' on the level below that. The *Why* of a genre is displayed as expressions for core values of the identified stakeholders. We started by identifying the values of the two main stakeholder of the case book genre, which in our case coincided with the values identified in the Take Care map – *Citizen health* on the 'Owner' level, and *Patient health* on the 'Patient' level.

When the *Who* and the *Why* in the prospective genre were agreed upon, the next step was to reach an agreement within the project on what detailed effects on the work process we deemed the case book should ideally have effects that would be in line with the identified stakeholder values. In genre terminology this amounted to identifying *What* the case book would afford. Based on four key themes that had been repeatedly referred to by the physicians and in the research team we identified the following effects on the 'Process' level of the map: *decision quality, accessibility of relevant info, information expressiveness and multi-disciplinary participation* (we chose lower case letters for effect and pattern identifiers to indicate their preliminary status). The next step was to identify the *When, Where* and *How* aspects of the case book's affordances on the 'Development' level of the map. In the Take Care map, as in many other applications of the format, these technical aspects are summarised in the very wide concepts of *New software* and *New work routines*. In line with our genre pattern perspective, we decided to identify, first a set of work patterns that would provide the case book's desired effects, then a set of interaction design patterns that in turn would enable those new work patterns. As displayed in Figure 3, the candidate work patterns identified from our participatory observation, interviews and discussions with the physicians were *condense relevant information* (e.g. from patient records, verbal comments of imagery analysed), *annotate imagery* (displayed at the conference meetings), *refer to scientific evidence* (quoted by participants in conference meetings) and *refer to personal experience* (as communicated during the conference meetings).

We were still in too early a situation to speculate about strengths of the relationships between tentatively identified work patterns and their effects to find it meaningful to draw distinct cause and effect lines between them. The extension of the 'Development' layer of the map into a 'Work pattern' and an 'Interaction pattern' layer was a novel trait of the strategy map format. Therefore, we decided that we needed a sufficiently rich exemplification of possible patterns for our medical partners to recognise, choose between and evaluate – if these were indeed the new work patterns they had talked about, or if still other ways of working could be more rewarding. In our own inter-disciplinary research team, we articulated a small set of candidate interaction patterns that would sensitise the physicians to what kind of technological enablers that could support the new work patterns. The tentative names we gave those candidate patterns were: a *shared work surface* (to present and visualise case data), a set of *shared selection techniques* (for all participants to select and highlight items, areas, objects etc.), a set of *shared annotation techniques* (to mark items and add data and comments to the selected items) and a set of *expressive document formats* (for representing a wide range of multimodal data types, see Figure 3).

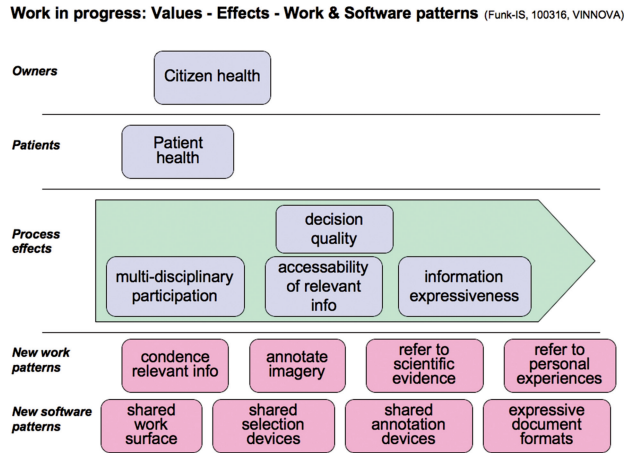

Figure 3. Work in progress – a preliminary strategy map outline for the proposed case book.

3.2. Involving the users in the conceptual design

The exercise to map the socio-technical patterns of our prospective case book genre in the slightly revised strategy map format was our main methodological exploration for making our development work more transparent and accessible for a wide range of stakeholders. In parallel, an empirical study was carried out on how conference participants engaged in discussions during the conference, what kind of experiences and scientific references their comments drew upon and with what kind of technical support for pointing (e.g. laser pointers) the comments were made (Moll and Sallnäs 2009). It was observed that, while participants collaboratively analysed patient data, the meetings were affected by the introduction of the laser pointers in respect to deictical references and referring to different places in an image. This was observed to facilitate the discussion since complex explanations of where the current focus was could be avoided.

To transform the finding from this and upcoming studies into empirically validated interaction patterns, a list of possible user stories was set up following the user story formalism of the Scrum development method: As *<kind of profession>* I want, during *<phase of clinical pathway>* to be able to *<desired interaction>* with *<desired interaction support>* in order to *<direct process effect>* so that *<indirect process effect>*. The list displayed a wide spectrum of alternatives for the different professions to choose between, and to add to themselves. Figure 4 shows (a translated version of) this list. One of the most experienced surgeons was then asked to mark what he deemed to be the most useful alternatives. In Figure 5, the surgeon's preferences for one of the conference phases are displayed. At the end of the same session, the surgeon was asked to comment on the strategy map agreed upon in the research team. As most of the work patterns and process effects in the map resonated with the patterns and effects he had just marked as desired in the user story list, his comments were overall confirmative. However, he was neither inclined to prioritise among patterns and resulting effects, nor comment on whether the four interaction patterns were the most fitting ones to support the new way of working.

A technical design session was conducted 3 weeks after the user story session with the surgeon, where the same surgeon provided qualitative feedback on a set of prototypes that were implemented to provide new

As

surgeon / pathologist / radiologist / oncologist / ...

I want, during the

assessment of new cases (as coordinator) / coordinator conference / preparation for decision conference / decision conference / dictation after the decision conference / SPIMO / pre-op / reading before surgery / surgery / dictation after surgery / post-op

be able to

navigate / indicate / mark temporary / mark permanently / erase / ...

with pen / finger / mouse / ...

on a mobile device / graphics tablet / ...

without having to wait for others to navigate / indicate or mark simultaneously/ with just short waiting for the actions of others / ...

in multiple layers / ...

with the same precision as the radiologist / with at least half the precision / ...

in order to

get better decision support for particularly difficult cases / for difficult cases / for all cases / ...

in regards to points / borders / interstices / paths of intervention / ...

so that

colleagues can see my annotations / I can go back and see my own and my colleagues annotations / ...

Figure 4. List of user stories about how to navigate, indicate and mark on screens.

As
surgeon
I want, during the
pre-op
be able to
indicate, mark temporary, mark permanently, and erase
with the finger
on a graphics tablet
without having to wait for others
with the same precision as the radiologist
in order to
get better decision support for particularly difficult cases
in regards to borders, interstices and paths of intervention
so that
I can go back and see my own and my colleagues annotations

Figure 5. Surgeon's marked user stories for the pre-op phase.

means for navigating the medical imagery, indicating regions of interest and supporting annotations. The prototypes were based on combinations of interaction techniques and hardware to allow manipulation with pen and finger on displays and surfaces of various sizes. A set of different interaction techniques were implemented for a Tablet PC that provided a pen and a multi-touch input, a pen-sensing Wacom tablet, and a mobile phone with a pressure-sensitive touch-screen. The interaction on the devices was wirelessly synchronised with a large display (Olwal *et al*. 2010) with the same medical imagery, to simulate the setup used during the medical team meetings. The results were compared with the surgeon's hypothesised preferences expressed previously as user stories. It showed that the feedback from the prototyping session supported several statements in the user stories, which indicates the complementary nature of these two independent methods.

The results from the initial prototyping session were then used, together with the user story list as a check-list for comprehensiveness, to prepare a user study of the shared interaction devices. Twelve surgeons tested three kinds of devices (Wacom tablet, iPod and iPad touch screen interaction) in individual sessions of a simulated team meeting in which the shared devices were synchronised with a large display. Pre- and post-session questionnaires were used as well as think-aloud combined with interview questions during the test. This study is reported in Frykholm *et al*. (2010) and Olwal *et al*. (2010). What is relevant for our conceptual design exercise is the following observations which will help us elaborate our work and interaction patterns' problem-forces-solution definitions. (1) When all team members, even remote participants, have access to image interaction devices, the work pattern *annotate imagery* (which denotes the full spectrum of pointing selecting and annotating activities) will have to address the need for a social protocol that enhances, or replaces, the (also technology based) control of image management that today resides with the radiologists. (2) The user study showed that the surgeons were more excited by the possibility of pointing than doing actual annotations, thus, the interaction pattern *shared selection device* was in this study found to be more enabling than *shared annotation device*. Among the affordances quoted in regards to pointing/selecting were the ability to 'resolve ambiguous references', 'avoid misunderstanding' and 'improve communication for local and remote users', forces that in turn all promote the desired effects *multidisciplinary participation* and *information expressiveness*. (3) Although pointing received stronger interest than the actual annotation possibilities (at this stage only simple symbols like arrows, labels and numbers) some important enabling forces of annotation were also observed: 'clearer referencing for younger surgeons', 'stored annotations would help surgeons understand patient cases faster if they could not attend the team meeting', 'annotations would be useful for lectures and educational material'.

The results of this and upcoming user studies with surgeons and radiologists will provide further insights into how the problem-forces-solution sections of our preliminary work and interaction pattern should be detailed, revised and/or replaced by more fitting pattern definitions. However, our most recent feedback on the case book pattern map does not come from

direct users, but from an interview with one of the surgeons with management experience and from a workshop arranged by the institution awarding the Funk-IS research grant. There is only space here for short summaries of four more relevant points from these two encounters, points that, in our judgement, indicate the overall usefulness of pattern maps as a vehicle for collaborative reflection.

First, the interview with the surgeon started with a screening of the strategy map summarising essential values, effects and development efforts with the Take Care system, the existing patient record system at the hospital (Figure 2). The surgeon could confirm that all but one of the entities were still valid as directives for current development. *Better research* was the effect that he was not willing to validate. As the system had grown, *Less lost time* and *Better use of colleagues notes* had been sustained, but the database design had not been able to meet the needs of comparisons between patient cases or fast and flexible statistical inferences. To us, this showed that strategy maps, even used as straightforward overviews (without specification of quantitative target measures or problem-forces-solution argument for each entity as exemplified in Figure 1), could be used to articulate well-specified critique of a system in use. Second, while inspecting our proposed conceptual design of the clinical case book, the surgeon validated the urgent need for all displayed effects, while he argued that *information expressiveness* probably had the highest potential value for long-term patient and citizen health, exactly through a more systematic use of visualisation – enabled by visual interfaces and visual interaction techniques. Third, remarking on the two work patterns *condense relevant information* and *refer to personal experience*, the surgeon emphasised that patient participation also had an interesting potential. To engage patients in tighter loops via the internet could, if done with care at critical points of the clinical pathway, provide for better *access to relevant information* and, in turn, higher *decision quality*. Finally, the workshop, geared at helping to facilitate the commercialisation of the Funk-IS project results, was the first chance to test the pattern map with a system provider (Sense Graphics, a provider of equipment and software for haptic feedback used in the project) and a group of commercialisation facilitators of the university and the grant awarding institution found that the conceptual design of the case book genre in the form of a pattern map seemed to be a useful complement to other instruments for dialogues with vendors (e.g. risk analysis tools and roadmaps for market introduction).

While surgeons-as-users had given feedback on the potential usefulness of case books in their daily work, this was an example of using the map with stakeholders in the other end of the spectrum – system vendors and market facilitators. Again, we want to point out that the pattern map is still more of a conceptual outline than a fully featured map. What remains now is to negotiate indicators and quantitative goals (for effects) as well as problem-forces-solution triplets (for work and interaction patterns) with stakeholders, designers and technologists (of the Funk-IS projects as well as of future system providers engaging in development and deployment). Here, we follow the advice of 'gradual stiffening' given by Christopher Alexander and his colleagues in their original definition of pattern languages, to get the greater pattern interplay right before fine-tuning relations between subsets of patterns and the definitions of individual design pattern (Alexander *et al.* 1977).

4. Conclusion

On the whole, the spontaneous comments given by the involved medical team members in design workshops and user studies indicate that they have found the project's design methods inspiring and that the methods have given them new insights on how they work today and on weaknesses that call for new work patterns (Frykholm *et al.* 2010). In regards to the pattern map as a method to involve a broad set of stakeholders in conceptual design of new work routines and enabling technology, we have concluded that the feedback we have received is promising enough to continue the mapping exercise and to go on to define effects and individual design patterns in sufficient detail by involving a broader group of managers, physicians and technologists in the mapping process. We base this on the way our preliminary map was validated by the lead surgeon's user story preferences and by the user study results, the latter providing us with four important qualifications of map relationships and definitions. Also, the interview with the management representative and the discussions in the commercialisation workshop brought forth four additional pointers to how the maps could be used – to identify weaknesses in systems use (the effect *better research* was negated in the Take Care map), to rank importance of system effects (*information expressiveness* deemed most important in case book map), to elicit new needs and opportunities (patient participation), to complement existing methods for collaborative reflection on system design (e.g. marketing roadmaps).

Since there is a growing interest in the HCI field for both genre analysis and design patterns, we believe that the combination of the methods can be

beneficial for users of both approaches – genre analysis giving a wider and more systematic account of *why, who* demands *what* effects and design patterns giving more detailed definitions of *how, when* and *where* new routines and digital services can enable those effects.

5. Discussion

In the theoretical section we argued that, for user participation in ICT review and design efforts to become a regular follow-up activity, there is a need for individual businesses and public services to institutionalise effective user involvement in which users, management, service procurers and providers can monitor and review quality issues with the help of pedagogical overviews of the logic and outcome of ICT development efforts. In our view, the main advantage of using design pattern maps for facilitating such involvement may be that the maps clarify that powerful ICT services is not a goal unto itself, but a means for enhancing the values of the organisation and the processes that support them. As we have seen in the comments from the physicians during our workshops and seminars, they are eager to learn from each other and to share opinions on how to increase the quality of their clinical and medical work practices. The idea to use strategy maps as a vehicle for stakeholder dialogues on ICT development projects is originally proposed by Falk and Olve (1996) and has been further developed within the UsersAward project (Walldius *et al*. 2010). The strategy map prompts us, in a very practical way, to articulate the new work routines which would provide the desired effects in the overall work process and which, in their turn, would have to be enabled by the new technical support listed as interaction patterns in the presentation of the case book (see e.g. Eppler and Platts (2009) for application of strategy maps in collaborative strategic activities).

It is important to note that our exercise to date has concentrated on the challenge to create a sensible overview of the interrelation between values, desired effects, and the new work and software interaction patterns that may support them. As our scope is a prospective case book genre, the patterns should detail the 'what' of the case book (in terms of effects on information content and function) while the interaction patterns should detail the 'how', 'when' and 'where'. The original strategy map practice developed by Kaplan and Norton requires that each effect be detailed in terms of, for example, focus area, key performance indicators, targets and initiatives. Similarly, what is outlined here as tentative work and interaction pattern names have to be detailed in terms of problem, forces and solution (note that the two other main definition subsections, context and supportive patterns, are given by the respective pattern's position and links in the map). This detailing of effects and patterns would then provide the basis for drawing connecting lines between entities, as in the Take Care map (Figure 2).

The Scrum user story format proved itself adaptable to the generic questions of: '*who, when* (and *where*)' *wants to be able to* '*what, how* and *why'*. In our conceptual investigation, geared to inform, and be informed by, the parallel empirical and technical investigations, the user stories have pointed out a set of gaps in our current strategy map, gaps that prompt new conceptual questions. In workshops and seminars, the physicians have emphasised the need for secure feedback loops that guarantee the integrity of the information in two respects: (1) that no important data gets lost or misinterpreted along the clinical pathway and (2) that important findings from all patients and investigation get learnt from and applied to all future patients with the same kind of diagnosis. How should this concept of 'Secure feedback loops' become visible in the pattern map? Should it be defined as an aspect of the process effect *decision quality*? If so, should it be explicated under the heading of focus area, and perhaps quantified in some way as a key performance indicator for *decision quality*?

Another example of 'missing links' in the emerging pattern map regards the patient in her role as an active member in the health care team. Field observations, interviews and workshops revealed that that there were possibilities for an enhanced information exchange with patients on several points along the clinical pathway. Not only in respect to patient input of timely and relevant data but also possibilities of providing patients and relatives with updates on where she was in the pathway and, if applicable, on results from investigations and treatments. So, should 'Patient information exchange' also be understood as an element in the focus area of *decision quality*? Which prompts a further question – should the case book have two-way communication links to the patient record system (which has regulated communication channels to patients and relatives) to such an extent that, for example the value *patient involvement* should be declared as a strategic value on the Patient level of the map? In which case, lines from the two desired effects *accessibility of relevant data* and *information expressiveness* (in turn prompting suitable patient versioning) would go to this new declared value. As the value-effect-pattern linkages become collaboratively reflected upon, such questions will be discussed and negotiated among the medical expert and the

management of the clinic. In parallel prototyping sessions, the supportive, underlying interaction patterns can be iteratively implemented, tested and, in turn, feed the ongoing conceptual investigation.

As of this writing, the pattern mapping exercise has involved single representatives of most stakeholders (technology and design colleagues in the research team, surgeons, surgeons with management experience and system vendors and commercialisation facilitators). Surgeons have participated directly, through validating user stories and strategic patterns during workshops, and indirectly, through their use of new or revised concepts in workshops and interviews. In view of the growing popularity of the Scrum development method, we can summarise our ambition for the third year of the project in terms of how design pattern maps may help bridge some of the all too common language gaps between systems procurers and Scrum developer teams. While interactive strategy maps may emerge as a channel for dialogue between procurers and Scrum masters responsible for interpreting the procurers' intentions (Eppler and Platts 2009), interactive design pattern maps, derived from and even drawn as extensions of strategy maps, may emerge as a similar dialogue channel for Scrum masters as usability experts and the programmers that implement the interaction design solutions in successively new versions of quality software.

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