Collaborative Articulation in Healthcare Settings – Towards Increased Visibility, Negotiation and Mutual Understanding

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ABSTRACT
As digital media are becoming more and more ubiquitous in our environments, it has the potential to capture and mediate situated information expressing the embedded nature of practice. Within healthcare settings, such information is often important for patients’ learning about diseases or injuries as well as their own engagement in rehabilitation and treatment. It is possible to design the necessary interaction around digital media in such a way that it becomes part of a collaborative articulation in consultations, hence increasing the degree of patient participation. This paper reports on two interrelated projects exploring how this can be achieved within the domain of hand surgery rehabilitation. Our aim is to contribute to patients’ possibilities to learn about the injury and the recovery process. Furthermore we seek to contribute to the field of human-computer interaction by showing how physical forms and explicit interaction can facilitate collaborative articulation processes.

Author Keywords
Healthcare, interaction design, patient empowerment, digital media and learning, explicit interaction.

ACM Classification Keywords
H5.1.Multimedia Information Systems,H5.2.User Interfaces

INTRODUCTION
Learning and communication evolve in a networked interplay between human actors and material artifacts. The role of artifacts in mediating knowledge and their ability to increase the range of what could be made visible has been highlighted by many practitioners and scholars (for example[32]). Related is also the issue of how we engage in interacting with artifacts and how our actions are made visible both to ourselves and to others [27]. People’s continuous interaction with material artifacts in everyday life has a counterpart in information technologies in the way digital media supports understanding and alignment of different human actors In two interaction design projects with the focus on supporting patient empowerment with information technology we have addressed these questions.

A challenge for the field of interaction design within the domain of patient empowerment is to create a set of devices, services and content that can, through appropriate interaction, support the healthcare staff, the patient and his surrounding social network to collaboratively articulate the state of the injury and the necessary steps for successful patient learning.

This aim—to increase articulation and visibility—needs to take into consideration the situated nature of human action where practitioners adopt to local circumstances to manage their objectives [31]. This is something that is highly evident in the healthcare sector where procedures are deeply embedded in diverse practices and varies depending on the patient’s situation or the local department’s available resources [21]. That procedures are situational and embedded in practice is accounted for by Bruno Latour’s writing on how we engage in talk about the body [18]. He proposes that the body becomes more and more describable as it learns to be affected by more and more entities. These entities are often artificial set-ups, such as the use of medical instruments and mediating artifacts. Learning about the body is from this perspective a progressive enterprise that cannot be described only in generalizations. The deviations in individual cases have to be accounted for and aligned to the general knowledge developed within the tradition of medicine and surgery. This learning can be expressed in articulations which are propositional rather than final or general. We explore how digital content and interaction with digital media strengthens the articulations. Digital media has the potential for easy and instantaneous...
documentation that renders a situated character to information. While resting in between the general and the particular, it can be related to the specific moment in which it was conveyed. Further, we propose models for interacting with digital media and associated devices that are understandable for all parties and controlled by the users in explicit ways: the notion of explicit interaction.

Several studies of information technologies within healthcare settings relate to issues of electronic health records [1,13], generalized information accessible online, such as NHS Direct Online, or models of remote communication that promotes caring at home or other distant sites such as described by Perednia and Allen [25]. By contrast, we explore how technology can support the making explicit and visible of vital information captured in situated interaction during consultations or other instances of on-site clinic/patient communication. Drawing on our findings, we propose an interaction model for such situations.

Mol and Law highlight in a text on hypoglycemia how the sickness is performed and ‘done’ rather than being described and known [22], including treating the patient as a human being far beyond the sickness or disease. They propose that healthcare take an ethnographic turn that is not accounting for general states of bodies but rather looks into pragmatic ways of dealing with the state at hand. Inspired by this, and from a point of view grounded in our work, we find that such a turn can include exploring how digital media can enrich a mutual understanding that both the hand surgery clinic and the individual patient can share as a foundational platform for successful rehabilitation. The use of the “ethnographic” label indicates that it:

- addresses how dysfunctionality of the hand is performed rather than being described as a finite or general state of the body
- tries to capture these doings of hand surgery in the instant and specific moments of rehabilitation rather than being instructional and generalized
- includes the patient’s body as a lived human body, including the life-world of the patient from healing of tendons to work ambitions and love life, rather than treating her as primarily “ill”

We have carried out two successive projects in the domain of hand surgery. In the paper they are addressed as two steps exploring different aspects of visibility. Our focus has been on the rehabilitation process, which implies that our concern is the patient’s situation after surgery. In the first project we will see how healthcare professionals and patients with the support of off-the-shelf information technology collaboratively articulate the patient’s situation, thereby making it more visible for the patient. In this project the patient is getting a better picture of his/her forthcoming recovery. This creates a more balanced/symmetrical relationship with a focus on dialogue where information is negotiated between the parties. In the second project, we pursue a different technological approach, focusing more on interaction design where the technology can be controlled by both patient and staff, making the communicative work of rehabilitation clearly visible for both parties as well as other people being present. Finally we will discuss the possible implications of our approach.

**COLLABORATIVE ARTICULATIONS**

An extended body of healthcare literature has discussed different conceptualizations and models for patient empowerment and patient learning. On a discursive level, patient empowerment requires mutual agreement in consultations. Our understanding of collaborative articulations takes these mutual agreements as foundational. However we want to stress that those articulations go beyond the situation of the consultation and include participants also outside the clinic. It is also important to stress that the clinic is not a homogenous actor. Different physicians and therapists not only have different notions of rehabilitation, but also talk and express those notions in very diverse ways. Our goal has been to explore how information technologies and design of interaction supports articulation and aligning all of the participating parties, with the patient as a focal point. We have found that various perspectives of visibility are needed for how negotiations are performed towards a mutual understanding and these will be addressed throughout the paper.

**From information towards dialogue**

Concepts such as the educated patient, patient empowerment and patient-centered approaches gain interest in the healthcare sector around the world. The educated patient seems to be in a better position to recover [24]. The basic idea to “educate” the patient is not new; within the tradition of diabetic care this has been the case for some time where patients have to take responsibility for their situation and everyday care. Often the strategy has been to provide the patients with information and to convince them to follow given prescriptions [9]. Recent initiatives within this field include both physical settings where patients can get help in searching for relevant information (e.g., Patientforum UMAS in Sweden) and web-based services such as NHS Direct online in Great Britain or “smärtverkstaden” in Sweden. Today, considerable resources are spent on producing information leaflets to support patients. "Patient education" often focuses on biomedical information and follows a typical one-way model of communication [4]. Whether leaflets, websites or physical settings are the chosen means, putting too much energy in “information” approaches where the main problem is considered to be how to formulate a message in the right way, will always risk missing critical aspects of communication. Already in 1979, Michael J. Reddy convincingly showed how the English language often is used in a way that suggests that it can be used as a “conduit” or “container” transferring meaning from the speaker to the listener [26]. Reddy instead presented an
alternative to this simplified one-way model of communication that rather emphasized dialog and hard work from both sender and receiver in a communication process. Since then, more researchers within healthcare have argued to go beyond a simplified conduit model of communication if patients are going to be able to make sense of medical information [33].

Shared responsibility
The concept of patient empowerment stresses the notions of “informed choice” and the “reflexive consumer” [15] where people get the tools and opportunities to cope with, take responsibility for and make their own choices in their situation as a patient [24]. Some researchers are quite optimistic regarding the possibilities that the Internet will be one of the tools that allow people to take these steps toward empowerment and responsibility for their own situation [8]. Others are more critical, both to the idea that internet as such will be enough to ensure empowerment and to the idea that patients should take full responsibility for their treatment [13]. In a large world-wide study [16], patients regard the physician as the most reliable source of information compared to internet, media etc. The study concludes that the roles have changed significantly in the last ten years from a more paternalistic and authoritarian model to a more mutual partnership. The majority also rank the patient–physician relationship as the second most important after their own family. Another study [15] also emphasizes the importance of the physician–patient relationship. It was found that many patients do not want to take the full responsibility, make difficult decisions on their own or search for information. They want their physician to make the important choices. Many patients also find it cumbersome to question their doctor’s opinion and report that they experienced resistance from them when doing so.

THE PROJECTS AND METHODS
The methods employed have been ethnographically inspired, participating as observers during consultations and other instances of rehabilitation, making extensive video recordings and performing interviews with patients as well as staff. We have also been inspired by ethnomethodology in the sense that the material has been interpreted and analyzed with a focus on how artifacts are used under specific circumstances [10]. Patients do not only refer to information as such but make sense of it in relation to how it is expressed, by whom it is mobilized and in which context it is used. Our work has not been descriptive, however, but rather proactive with influence from participatory design [6]. We have worked with staff members and to some extent also patients as participants in change-oriented activities and design sessions.

The aim of the first project, called Everyday learning, was to explore and develop the relation between the patient and the healthcare staff. We investigated how off-the-shelf technology could support patient empowerment and what kind of mediating format would be most appropriate to enhance a collaborative articulation of the patient’s situation. The second project, which is part of the larger EU-funded Palcom project1 has had a slightly different goal, in trying to develop a complementary perspective to ambient computing. Here, foundational issues have been how the experience of technology within a healthcare setting must be noticed and apprehended and how devices can connect to other devices in joint performances of activity-based services that support the idea of collaborative articulation.

REHABILITATION AFTER HAND SURGERY
We have undertaken studies in the Hand surgery clinic of Malmö University Hospital. The Hand surgery clinic is a specialist clinic with patients from all over southern Sweden, some even from other parts of Sweden and abroad. The hands play an essential part in people’s lives and injuries can be traumatic, life-changing events. Quite apart from the pain, patients often struggle to understand the complexity of their injuries and the healing process, and it can be extremely difficult to come to terms with the necessarily slow process of recovery, and possibly radical and lasting effects on their everyday life. The stress of the new situation means that it is difficult to take in information. Yet it is crucial for the success of rehabilitation that patients take charge of their recovery processes. The necessity of understanding the recovery process includes the patient’s surrounding social network such as family and employers. It can be quite a challenge for them to accept that after several months it is still not possible for the injured person to perform tasks that he/she usually performs. According to the staff, there is a noticeable difference in success between patients with a supportive network and those who are alone or have difficulties in accepting their functional impairments. Moreover, it is a challenge for the staff to understand the patients’ possibility to adhere to rehabilitation. For example, fine-grained movements of the hand used in work tasks can be difficult to understand by verbal reports. The foundational circumstances of how the hand is used in the patient’s everyday activities such as working, carrying out household activities, or dressing are also changed in dramatic ways in many cases. For patients with severe injuries, the hand may never be the same as before the injury, even after successful surgery and rehabilitation. This implies new ways of living and operating with the hand. Many skills taken for granted have to be re-learned. The hand must be accommodated differently by all parties in the patient’s lifeworld. To change the appropriate pace in rehabilitation might lead to incapacity, so re-aligning

1Palcom (palpable computing) is an integrated project in EU’s 6th Framework Programme under the proactive initiative The Disappearing Computer in Future and Emerging Technologies (FET), part of the Information Society Technologies.
knowledge and actions of this multitude of actors and actants is of utmost importance. This calls for collaborative articulation to a degree that is very difficult to achieve. Together with the doctors and therapists, patients learn to re-train their perception of the hand and how it is used in a situated learning process, which is distinguished by mutual and negotiated interaction.

An evolving picture of the patient’s situation
During the patient’s trajectory of his/her recovery process and different encounters with healthcare professionals and their diverse forms of artifacts such as patient records and x-ray images, a picture of the patient’s overall situation is gradually taking shape. From the healthcare professional’s point of view, the patient record works as a center of gravity for this evolving image [1]. However, in our work it became clear that the patient has no explicit tool to rely on regarding the creation of this image. Still, many sources, among them different staff members (and the patient) and their artifacts provide small pieces forming a puzzle that gradually increases the visibility of the patient’s situation. We will look closer on some of the central factors that we could see played an important role in forming this puzzle.

A network of actants
At the centre of the rehabilitation process is the hand. It is not only the object of the rehabilitation, but also the main means of formulating, aligning and anchoring knowledge, a ‘boundary object’ [29] that has potential for connecting people and perspectives of understanding of the injury across the boundaries of the clinic, the workplace, and the home. Bruno Latour uses the term actant to describe both human agents and the non-human artifacts [17]. Since these non-human actors can be said to have an almost equal impact on the patient’s understanding we will continue to use the concept of actants, including the human body as well as mediating artifacts used in talking about it. The human hand is an always available and highly visible artifact that both the professional healthcare workers and the patient use as an articulation tool to enhance their communication process.

![Image 1](Image 1.png)

Figure 1. The human hand is constantly used by doctors for referring to issues of surgery and rehabilitation.

The physician’s own hand serves as a stand-in, a replica of the patient’s hand, and without any specific preparation they have a tool that can help them to improvise a story they think is necessary to tell in the moment. We have seen examples of how physicians use their hands to visualize surgical procedures when they accidentally bump into each other in the corridors, by drawing with their fingers on their own hands where they plan to do the cutting. We have also seen examples of how they use their hands when they report to a colleague on the status of a recently arrived patient. They use their hands to mark and draw lines of how extensive the patient’s injury is, what parts are affected etc. The hand is also used in several different ways during communication with patients. The staff members use them to gesticulate and emphasize in the same way as many people normally do. They also use them in a more indexical way. As an example, during a meeting between a physiotherapist and a patient, the patient points to troublesome areas on his hand. The physiotherapist in this case uses his own hand to illustrate how to do an exercise:

Physiotherapist: “If you hold like this, and straighten your fingers as much as you can, and then you bend as much as possible with straight fingers.” (The physiotherapist watches the patient’s corresponding movements and corrects a sequence he thinks needs it by moving the patient’s finger.)

Physiotherapist: “You can move that finger a little bit more. There, so you are able to feel a stretch over here.”(The physiotherapist draws a line with his fingers over the patient’s knuckle.)

![Image 2](Image 2.png)

Figure 2. The hand is at centre of consultations.

Both the physiotherapist’s and the patient’s hands are used as visualizing tools to clarify the discussion. The physiotherapist moves smoothly between using his own hand to demonstrate the appropriate performance and using the patient’s hand to point at critical or important features and correct inappropriate movements.

Articulating with artifacts and materials
A number of tools and log sheets are used to assess and monitor the flexibility of hand and fingers, grip strength, tactile sensitivity and pain. They also serve to make progress visible, which can otherwise be almost imperceptible to the patient. They also use other artifacts to articulate the stories they want to tell. During a consultation, the physiotherapist uses a poster showing the anatomy of the hand to reveal and explain what kind of injury the patient suffers from. In conjunction with the poster, he complements the story by pointing at corresponding parts at his own hand. A patient with severe nerve injuries can suffer from strange and unpleasant tactile sensations. One patient describes a feeling of electricity in his fingers that makes it difficult for him to use some of his fingers appropriately. The physiotherapist starts rubbing the patient’s hand, something the patient initially experiences...
Physiotherapist: “The swelling is now positioned here, has it been the case since Thursday”

Patient: “There I think it has been a swelling all the time” […]

Patient: There is something hard, is it the bone?

Physiotherapist: You mean this? It’s scar tissue that has become hard… everything is in layers when you are not injured. After injury and the bones are repaired with the tendons and skin, healing doesn’t occur in these subtle layers. Instead, the scar is like a lump. Some people get harder scars than others—it depends on genetics. Your scar will soften gradually; it will take about a year.

In this case, the two parties negotiate the evolving picture. How extensive is the swelling? Is it getting better? Is that a part of the swelling? Both of them are asking questions and the physiotherapist produces explanations addressing the patient’s specific circumstances and worries.

Verbal strategies promoting visibility

The physiotherapist uses different strategies to help the patient get a better grasp of his/her situation. They are well aware that it is difficult for the patient (being in a stressful situation) to comprehend all the necessary information. Because of this, they often only tell them some aspects at their first encounter and then follow up on that information on the next occasion to avoid overload. This means that the patient sometimes has to wait a while to get a more complete picture of their situation. The physiotherapist also often repeats important aspects several times during a meeting with slightly different formulations; “Try to be aware that you shouldn’t put to much burden on.” “Remember, don’t use strong force, it’s not a weight exercise”. Another important strategy is to use formulations that are beyond a technical medical language. As an example, instead of saying that the patient’s tendon is only strong enough to manage X Newton m of force, they try to formulate the information in a way that is more easily connected to the patient’s everyday situation: “Normally, after 6 weeks you’re allowed to carry a bag with one liter of milk.” “You can use the hand a little bit when you’re dressing or washing your hair, but do not use it when pulling on a pair of tight jeans.” Sometimes they also use metaphors, especially when they are trying to explain the anatomy of the hand: “The tendon works like a piston in a cylinder and if it’s still for too long, it will rust and get stuck, it will grow into the sheath.” “The muscle is here and when it contracts it’s like a jumping jack.” Many of these explanatory strategies are considered necessary to motivate the patient to do cumbersome exercises, follow troublesome prescriptions and stick to a hard recovery plan. They help the patients to align important information to their specific circumstances and their everyday life and they can build an appropriate picture of their own process of recovery.
STEP ONE TOWARDS VISIBILITY
Giving the patients tools to increase visibility

We have seen how different meetings and artifacts help the patient to form a picture of his/her recovery process. Much of the relevant information is embedded and of a situated character, revealed with the help of aligning different artifacts to the patient’s injury. The articulation is performed in collaboration between the patient and the staff. The evolving picture is negotiated between the parties forming a unique story for each patient. During the Everyday learning project we did some experiments where we tried to capture such situated occasions. In the first experiment, we used a DV camera on a tripod to film three meetings between a physiotherapist and three different patients recovering from the same injury (an incision to a tendon).

Fig.5. Video recording at rehab

These movies were about 15 minutes long and you could easily see both the patients and the physiotherapist’s hands and the poster they use as illustration. The contents were to some extent similar between the movies, but there were also important differences. One of the patients was a professional athlete and in his case they negotiated how the exercises and recovery process would affect his training. One patient was afraid of doing exercises and needed extra coaching and encouragement. The patients received the movies on regular CDs after the consultations, and they used them several times in ways that we didn’t anticipate. They all used them to show their relatives what they experienced at the hospital. The professional athlete showed the material to his regular physiotherapist. The movies were used as references, in order to compare movement capability with previous exercises. And finally, the patients used the movies during their exercises. The clinic judged the results to be very positive and decided to buy a camera with built-in DVD burner to be able to continue to produce this kind of material.

Experiments with digital X-rays and screen-capturing software

Quite often during consultation sessions, a physician and a patient collaboratively watch the patient’s X-ray pictures on a computer screen between them. In those cases, the physician uses the X-ray pictures to explain what kind of surgical procedure he is planning to perform. We did some experiments where we tried to capture those occasions with the help of screen-capturing software. The software allows the physician to draw and mark the X-ray pictures to emphasize the patient’s status and what the surgical procedure will be about. All this will be recorded as an animated movie together with their discussion. The format is playable on all Windows platforms and the patients received CD copies before they left.

Fig.6 Animated X-ray discussion – a representation of the “talked about” hand.

Similar to the previous examples at the rehabilitation unit, we found differences in the explanations and discussions among different patients also when patients suffered from similar injuries. All the patients also used the material to show their relatives. Compared with the material the patients got at the rehabilitation unit, the X-ray drawings covered only a small part of the consultation. Typically the material was about 2–3 minutes long, compared with the 15 minutes of recording that where done at the rehab unit. Many questions and issues were addressed outside the limited X-ray picture slot. On the other hand, the physician found it appropriate to have a concentrated point in the consultation where he was aware that a recording took place. He was in control of the technology and started the recording when he was prepared and ended it when he thought enough information had been provided.

In both experiments, the patient was provided with a more visible and collaboratively articulated picture of his/her situation. Compared to many initiatives within the tradition of patient empowerment, the focus of our experiments was on dialogue rather than simply providing information. As Henwood et al have argued, the issue of responsibility within patient empowerment is not without its problems where some patients do not want to take full responsibility for their situation [15]. In our experiments, the responsibility could be seen as shared between the healthcare staff and the patient where they collaboratively negotiate the most appropriate path to follow. It takes as its starting point the relationship and source of information that the patient regards as the most important and trustworthy, namely the physician and healthcare professional [20]. The experiments also take in consideration the unavoidable diversity in medicine [21] and situated character of procedures [31], where the meetings between different healthcare workers, different patients and different local circumstances form unique constellations for every single case.
New possible alignments
During the sessions in the experiments the physiotherapist and physician made alignments between different artifacts, diverse situations and the patient’s specific condition. Latour has suggested that these kinds of alignments between different artifacts can in some instances make it easier to compare and support the evolving chain of actants [17]. The digital material and recordings made it possible for the patient to continue these alignments, now aligning the material to their relatives and friends. It also made it possible to align the story told during stressful conditions to a more comfortable relaxed situation in their home where they could grasp the content more easily. The video recordings had some advantages compared to the X-ray animations, in that it easily captured all the important artifacts that could help increase the visibility of the situation, including both the patient’s and the therapist’s hands with their diverse communicative potentials. In the video experiment, therefore, the patient could also make alignments in time where they could compare their progress of using the hand with their status at the moment of the video recording.

STEP TWO TOWARDS VISIBILITY
We have addressed how collaborative articulation can strengthen the emerging aim of patient empowerment. We have argued that increased visibility in the rehabilitation process supports a notion of mutual understanding that we find crucial for collaborative articulation. So far, the visibility aspect has been concerned with visibility of perspectives, how the patients’ voices are part of expressing the current state of rehabilitation and deciding on the next steps to take. This is already inherent in today’s practice, but our observations of these more or less tacit negotiations inspired an approach to how visibility of situated information, that is mobilized in the consultation, can align to more abstract medical information that is needed for patients’ understanding of the injury and learning to cope with it. The situated information such as video recordings of “hand injury talk”, training exercises and screen recordings of how X-rays are used in discussion with the doctor, were also used by patients as boundary objects when discussing the injury with family and friends. Thus it was used for re-aligning the overall network of actants, humans and non-humans that ideally are engaged in successful rehabilitation. The experiments from step one showed promising results and the use of off-the-shelf technologies showed that the ideas could be put into play immediately. However the CD and DVD disk formats do not fulfill the potential of networked digital media and the interaction still relies on the therapist or physician unilaterally determining the recording. In the following section we will address another level of visibility that we find important for collaborative articulation, namely that of visibility of actions and intentions through use of technology. This is an issue we address through the concept of explicit interaction.

Explicit interaction
Paul Dourish has coined the term “embodied interaction” when addressing how computers are becoming both more tangible and more social [5]. They are becoming more tangible in the sense that the design is more and more integrating the interactive qualities of material objects in interaction between users and computers. New kinds of interfaces and artifacts are populating both work places and public spaces. They are also becoming more social in the sense that they are becoming embodied as embedded aspects in our experience of these everyday environments [7]. From this perspective, technologies are less acting as independent agents but are rather augmentations of activities taking place and are understood as parts of a shared experience evolving over time and in specific places. This implies a need for some degree of user control which we try to address with models of explicit interaction. As these activities are evolving and carried out in situated action by users, in ways that are often unanticipated by designers, it is a challenge for tangible and ubiquitous computing to integrate computational resources in the physical landscape of material artifacts and space, which have been highlighted in much research [fx 16, 19, 34]. Dourish has also been credited for introducing the distinction between space and place to computer supported collaborative work [5]. Place reflects the emergence of practice as shared experience of people in space and over time. As people inhabit shared spaces, they elaborate their means for talking about it and interacting with each other as well as the artifacts populating it, in a process that transforms space to place. In consequence, an emerging design principle is not to design dedicated spaces but to design for the appropriation of space. This calls for reflecting the physical spatial conditions for interaction and for possibilities to configure objects and actions within the space. These aspects have been addressed in much HCI research concerning end-user composition. A promising area for these configurations is the possibility to work with assemblies of devices and services. This can be dealt with either by de-construction (not to be confused with the post-modernistic use of the term) of existing devices/services or through construction of new open-ended assemblies either via parts of existing assemblies or via components exhibiting new functionalities.

Figure. 7 In an assembly the interface components might be distributed such as record/pause buttons on the camera/remote control being transformed to soft buttons residing on the display of another device.
An example in our work is how handheld devices can access the functionality of a high resolution video camera through an interaction that makes sense in relation to the concept of collaborative articulation and shared understanding within an environment. (We return to this example shortly.)

The term ambient is often used for describing systems that are pervasive and integrated in an environment. Quite often, it is hard to perceive interaction with them due to their immaterial nature. How do you for example account for the experience of a wireless connection? Is it there and if it’s working we have no problem in not being able to relate to it in other ways than text messages appearing on the screen telling about its current state. But in an open environment where several actors access and possibly compete for shared resources, the visibility of actions and services becomes an issue.

Problems of Demassification and invisibility

John S. Brown and Paul Duguid have written about the problem of demassification [3], discussing how digital technologies and new media introduce not only new materials but also fundamentally new social conditions. Demassification denotes how digital media, unlike, e.g., a book, have no physical body that can be directly accessed. But there is also a social demassification emerging in the sense that the conditions for collaboratively experiencing artifacts have changed radically. Most often artifacts have an intended functionality, but as they are appropriated through use, border resources are emerging. An example of a border resource in a common artifact, the door, is given by Andreas Lund [14] in a discussion of a movie by Jaques Tati. In the movie, which is a silent movie, the lead character, frustrated over some disagreement, wants to express his anger when leaving the room by slamming the door, a sound which we all can refer to as embodying the dissatisfaction felt by the person shutting it. It is not a property inherent in the design of doors to express emotions, but nonetheless it has evolved into a border resource comprehensible for most people. In the movie the character bangs the door again and again, but since it is a silent movie nothing is heard—the border resources cannot be evoked. And the materiality of artifacts does play a crucial role in our everyday sense making. Albert Borgman [2] uses the term commodity to illustrate how just one of several aspects are maintained when an artifact is replaced by technology. One of his examples is how central-heating well provides opportunities for securing warmth, but how wood-burning fireplaces also related to the amount of wood needed, the work of chopping and drying wood and the need for keeping the fire burning. Those might be border resources in relation to temperature, but important ones as they also provided a rhythm of everyday life. To summarize, we think important objectives for collaborative systems include supporting shared understanding and informed participation.

In our scenarios, a shared understanding is an act of knowing who will use the information and for what purpose. Our case rests on envisioning a ubiquity of digital media, where situations are potentially subject to recording and mediation. Personally owned handheld devices such as smart phones or PDAs become potential proxies for the individual, since the phone is most often carried on or near the individual. The personal device can ensure identification of the owner. It can also serve as an actor in a staging which aligns the participants in a way that can be perceived by others in the periphery. This is the case for the rehabilitation ward which has a spatial layout similar to an open office, where rooms are used by several therapists. Another object we introduce in our scenarios is the metaphor of a docking station—a physical object that in combination with a phone or PDA provides a framing for fulfilling some specific intention such as recording, viewing or sharing digital media. It is motivated by desirable use qualities such as augmenting the generic device with activity-specific functionality when needed, and supporting visibility of activity and intentions in order to exploit social skills from existing rehabilitation practices.

What we designed is a PDA augmented with RFID tags, a docking station with an integrated RFID reader, physical slots for holding two PDAs, and software for handling the video stream and processing information about identity of the user, capabilities of the PDA, etc. Instead of using the remote control for initiating and stopping the recording, the act of placing the PDA in the docking station connects it to the camera. The video feed is displayed in a low-resolution version on the PDA (which eventually will store the media. This is not yet implemented). The screen of the touch-sensitive display replaces the record and stop buttons and tapping on the display thus controls the recording. When the PDAs are taken out of the docking station, the connection with the video camera is ended.

Figure 8. To the left a therapist and a researcher are making a video recording during an “envisioned” consultation. To the right a close up of the docking station on the table, with two PDAs in place.

Though not yet evaluated in actual use at the clinic we think the design responds to the notion of explicit interaction in several aspects, which have been assessed in sessions with the staff;

- **Tangibility** renders the situation as clearly perceivable for both patient and therapist/doctor in the consultation but
also peripherally from other people present in the shared space

- **Placing** is not a physically demanding interaction, which is an issue for people with hand disabilities. Neither is it a cognitive demanding task, compared with browsing for the right application and navigating in a typical PDA interface with many choices.
- **It is performative** in the sense that both partners can relate to a ritualistic series of actions that reflects a change of rhythm in the consultation. It is agreed that they now are about to start a recording. It also supports other people present in the room in adjusting how they perform, for example deciding not to disturb or make loud noises.
- **It is personal** in as much as viewing the recording on the personally owned display gives a feeling of ownership and access to the digital media.

This is the first design in an exploration of how handheld devices can construct short-lived assemblies with resources that exist at the clinic. In the network of actants they can, when combined with a material form such as the docking station, serve as physical nodes to activity-based services that relate to the life cycle of digital media in different ways (capturing, displaying, sharing, editing etc.). Apart from evaluating the first prototype in actual use, future work includes reversing the media stream to study how collaborative articulation can be supported by patients producing media and bringing to the clinic.

**CONCLUSION**

Most of the staff’s strategies to articulate and make the case more visible are embedded in practice and cannot be revealed only by verbal explanations. During consultations the dialogue unfolds differently depending on the specific patient and specific healthcare worker in a language more suitable for a medical layperson than, for instance, in the patient record. The first series of experiments helped articulating a deeply embedded practice towards something more palpable using strategies such as recording parts of consultations on video and annotated X-ray pictures. Together with other artifacts such as anatomical posters, rehabilitation instruments, and the hand itself, they have helped patients to better comprehend foundational issues in rehabilitation. Patients also brought the material to their relatives and other physiotherapists to share their experiences. In a continuation of the experiments we have suggested the model of explicit interaction that introduces physical form for mediating connections between handheld devices and central resources. Moreover, explicit-interaction devices promote visibility of action not only for patient and staff but also for other people being present. The collaborative nature of interactions enforces the shared and negotiated nature of the decision on when to record and what to record.

Several issues in our discussion that suggest a rather strong intervention into current practice have implications that must be explored further. Considering the situated character of consultations, the general impression of the clinic is that recordings have positive effects. However, there may be implications for the staff’s behavior towards the patient as they are possible subjects for being captured on a video that are carried around by the patient. While longer videos have potential for capturing important information, they might constrain what is actually being said and enforce a “correct” professional behavior among staff members. This is undesirable since it seems important to maintain a “free” channel in communication that can act as the place for casual, informal talk, maybe expressing hope and sympathy that cannot be supported from a strictly clinical point of view. More focused and concentrated recordings, collecting the most relevant takeaways, can ensure visibility of information that otherwise remains tacit in communication. What is chosen to be recorded is considered as the result of a negotiation between patient and doctor/therapist. The explicit interaction techniques illustrated by the docking station has been considered so far in discussion with the clinic as one means of emphasizing the act of mutual agreement, and we will explore this further in our research.

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