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Technology use and patient participation in audiological consultations

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RESEARCH

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Abstract

In this paper, we present a study of audiologists' use of technology in consultations with patients. We highlight the ways in which the hardware and software the audiologist uses to adjust the settings on the patient's hearing aid are not designed with their necessary use within the consultation's interaction in mind. Rather, the technology is designed for use by a single user with audiological training. Furthermore, the local interactional context (in the consultation) in which the technology is used creates difficulties for patients to follow the course of their own treatment. For example, the relevance of the audiologists' actions with the technology is often not available to the patient. Patients cannot know (due to both the arrangement of the computer and the technical sophistication of the software's interface) whether or not the audiologist is actually addressing their problem when doing something with the technology. We argue that the technology is much more than simply a professional medical tool that mediates an adequate solution to patients' difficulties. The move towards "patient-centred" design of technologies must appreciate the variety of roles of these technologies in the consultation. Such roles of the technology in a consultation include patient education, explanation, demonstration, and the medical professional's justification of treatment decisions. In making these observations, we suggest that the existing design and use of technology can marginalise patients' own participation in their treatment.

Introduction

Patient participation has recently gained prominence in health care. The last decade has seen a shift towards initiatives which encourage health care service users to view themselves as active participants in consultations, with individual rather than homogenized needs. In government policy, this move towards patient participation is strongly encouraged [1]. Concurrent with this development, the roles performed by technology in health care consultations have steadily increased. In this study, we consider the use of technology in health care consultations in order to examine the impact these technologies have on a patient's potential to take an active part in the consultation and to be involved in his/her own treatment. Focussing on a particular type of health care setting, namely the audiological consultation, we demonstrate how the use of technology (such as the computer) creates difficulties for patient participation. Patients' compliance with wearing hearing aids is one of the most significant problems in audiological treatment, and as recent studies have shown, patient participation is one of the most crucial factors towards ensuring patient satisfaction and compliance. As this applies not only to the domain of audiology [2], but also more generally to health care per se [3], gaining an understanding of how existing technology poses barriers to patient participation in one medical setting is a crucial first step towards the creation of technologies that can invite active involvement in other health care settings. We begin by framing the tradition within which this study is situated, and briefly describe the context of the hearing health care situation we study. We then turn to an analysis of particular interactional sequences from these audiological consultations, which serve as illustrations of the way in which technology (and the health care provider's interaction with it) can introduce barriers to patient participation.

Background to the approach, setting and study

Recent years have seen the application of user centred (or human centred) design practices to the development of medical technologies. The emergence of the idea of the "patient centred design" of assistive [4] and information [5] technologies for medical settings is a document of this trend. User centred design is an approach that has a considerable legacy in the design of interactive technologies in a range of different settings. While user centred design is ostensibly a term that glosses over a variety of distinct approaches to the design and development of technology, what these various approaches share is a commitment to designing *first* from an understanding of the issues and concerns of the people who encounter and use technology in their daily lives. Where this congeries of approaches differs is in their particular take on precisely how best to do

this: some are more analytic, some more participatory, some more pragmatic, some more theoretical, some more critical, some more political.

We situate this particular study within one of the more analytic traditions of user centred design, where detailed scrutiny is given to the situated use of technology in context, from which implications for the design (or re-design) of technology can be drawn. This line of work owes a great deal to Suchman [6], whose landmark analysis of photocopier use remains a touchstone for the study of technology in action. Subsequent work, adopting a similar analytic orientation to the situated character of interaction with technology, has investigated many other sites, including air traffic [7] and London Underground [8] control rooms, the print shop floor [9], the work of desk officers at the International Monetary Fund [10]. There has also been a line of such studies examining the use of medical technologies, including electronic patient records [11], software for issuing prescriptions [12], and anaesthesiological alarms used in surgery [13]. In this paper, we consider the use of technology in consultations between audiologists and their patients.

There are a range of technologies that audiologists rely on in the course of administering hearing tests, diagnosing the severity of hearing loss, prescribing hearing aids, fitting hearing aids, configuring the settings on hearing aids, keeping medical records of patients and their treatments, and testing the functionality of hearing aids. These tasks (with the exception of physically fitting the hearing aid to the anatomy of the ear) are typically performed through a personal computer. In this paper, we want to show how some interactional difficulties (interaction between the audiologist and patient) arise in the consultation, and how the design of the technology is implicated in some of these difficulties.

The study presented here was conducted in the course of a multidisciplinary project at the SPIRE Centre for Participatory Innovation at the University of Southern Denmark. The project team comprised members with backgrounds in design, anthropology, linguistics, engineering and informatics, and was conducted in collaboration with a leading Danish hearing aid manufacturer. The project also involved, in smaller degrees, participation with audiologists, ear-nose-throat doctors, audio technology experts, hearing aid users, and public policy advisors. The purpose of the project was to explore the possibility of designing tools that could assist audiologists (the customers of the hearing aid company) in assuring a better, more precise fit for hearing aid users.

In the tradition of Scandinavian user centred design, we used of a number of methodological approaches to appreciate the users' perspective. Among other things, we collected video data of audiologist-patient sessions in order to investigate the practices used by audiologists and patients in the consultation and the problems they encounter therein. It is this video data, in combination with some more traditional ethnographic information gathering from both hearing aid users, audiologists and hearing aid manufacturers, which forms the basis of the current study. The audiological clinic that participated in the study is a private practice with a single audiologist, located in central Jutland. Over three working days, we collected recordings of nine consultations, and sat in on a few others.

We have selected a few examples from these recordings to illustrate how the design of the technology and the way in which the audiologist interacts with it may serve as potential barriers to the patient's understanding of what is going on. This ultimately contributes to preventing the patient from participating in his own treatment.

Analysis

Our first example illustrates the fact that the actions that audiologists take with the technology in order to treat the patient's difficulties can be opaque to the patient. The example concerns a patient who has had a hearing aid for many years and is visiting this particular audiologist for the first time in the hope of getting better treatment than he has received from other audiologists. In response to an inquiry from the audiologist about how his previous audiologist performed the hearing aid adjustments, the patient responds with the following:

"They look at their screen and then they try to turn it up and down a bit. I suspect that it's like an experiment"

Here the patient explicitly states his own inability to understand what (if anything) is going on when the audiologist makes adjustments to the hearing aid in order to treat the patient's difficulties. The patient here also raises his suspicion that the audiologists may not know exactly what they are doing; rather the adjustment is done a little haphazardly ("turn it up and down a bit") and in an experimental manner. From our fieldwork and interviews with other hearing aid users, we have heard similar observations. Naturally, the patient may have very good reasons for casting a negative light over his past experience with another audiologist, and in any case, it is a fairly common feature of health care interactions for patients to complain about their previous health care provider when seeking help somewhere else [14]. So rather than take this particular patient's report at face value, in the following two examples we want to show how this kind of phenomenon—the opaqueness of the audiologist's actions in addressing the patient's problem—actually transpires in audiological consultations.

In our next example the patient repeatedly attempts to follow and participate in the audiological activity, but once the audiologist begins interacting with the technology, this participation is prevented. The consultation from which this example is drawn concerns a patient's remote control for the hearing aid, which, after having been serviced by the manufacturer no longer seems to be connected to the hearing aid. While the patient describes the difficulty, the audiologist makes the necessary preparations required for him to investigate the problem: connecting the hearing aids (in the patient's ears) to his computer and starting the

software program. From this point on, the audiologist monitors the remote control's interaction with the hearing aid's software by continuously shifting his gaze between the remote and the computer screen, as indicated in the transcript below. Whilst the patient's problem in this case is in itself one of technology (i.e. a malfunctioning hearing aid), what we wish to explore here is the problem that arises through the audiologist's interaction with the technology (both the remote and the computer) and the possible impact this has on the patient's ability to participate. (See the appendix for an explanation of the translation and transcription conventions used in this paper).

Transcript excerpt 1 "Voila"

01	Au:	Okay.
02		((Au looks at the screen and navigates through a programme by clicking the mouse))
03		((Au puts the remote control on the desk and pushes a button))
04	Au:	Yes. And then the thing is that we have five programmes coded into our
05		computer and since it went for the repair then it's come back with
06	Pt:	three
07	Au:	three programmes

Throughout this sequence, the patient makes several overt attempts at following and participating in his "treatment", i.e. the identification and fixing of the problem with the remote control. Twice, the patient leans across the table to look at the audiologist's computer screen (see figure 1).

The patient also displays his ability to grasp the nature of the problem. For instance, in lines 04-06, the audiologist begins describing the problem with the remote control, but it is the patient who completes this description by producing the word "three" before the audiologist, which shows that he understands why the remote is not working (the hearing aid has five programs, but the remote has only three). In other ways, the patient through his behaviour clearly demonstrates both his intention and ability to participate despite the fact that his problem in this case is a problem with a piece of technology. As the continuation of this example illustrates, however, once the audiologist engages with the technology, his actions become opaque to the patient, and the patient is excluded from following the audiologist's response to this difficulty (i.e. what is being done to the remote and the hearing aid). This opacity is exacerbated by some of the verbal statements the audiologist makes.

08	Pt:	That I don't understand
09	Au:	[and that that doesn't work because it must be re-coded.
10		So that's a job- it's an audiologist who needs to look at this
11		((meanwhile Au is taking the remote apart, fiddling with something and putting it back together))
12	Pt:	Oh,
13	Au:	Yes, so...
14		(1.0)
15	Au:	It can't work. So there's a technician who needs to look at it
16		((Au looks at Pt))
17		(1.0)
18	Pt:	Is it true?
19	Au:	Yes.
20		(1.2)

Thus, having identified the problem in collaboration with the patient (lines 04-07) the audiologist in line 09 goes on to describe what needs to be done in order to fix the problem. At this point, he also begins to dismantle the remote. Though this may indicate that he intends to fix the problem, the audiologist subsequently states first that the problem needs to be fixed by an audiologist, then that it needs to be fixed by a technician. Because the audiologist uses these third person references, it may be unclear to the patient what exactly the next step will be: will the audiologist fix the problem, or does he need to take the remote somewhere else? We find evidence in this extract for the fact that the audiologist's statements in lines 10 and 15 are interpreted by the patient to mean that the audiologist is not himself in a position to fix the remote. The patient's "oh" in line 12 and his "Is it true?" in line 18 both indicate that the patient is receiving the audiologist's remarks as bad news—that someone other than *this* audiologist will have to fix the remote control.

21	Au:	It may very well work but it doesn't work if the code doesn't match
22		(1.6)
23	Au:	There ((pushes some buttons on the remote))
24		(4.7)
25	Au:	There are five programmes (1.9) separate controls (0.6) the alarm, that's
26		also on now
27		(1.4)
28		done. Now it works.
29		(0.2)
30	Au:	hopefully.
31		(0.3)
32	Au:	Okay. We'll try it again
33		(7.8) ((Au clicks the mouse, holds the remote up towards the hearing aids in the patient's ears and pushes some buttons while looking at the screen))
34	Au:	There, Now it works. ((retracts hand with remote))
35	Pt:	Okey doke
36	Au:	((Looks at the screen and clicks the mouse.)) It's because now this code
37		has been transferred to the remo- to the hearing aids again.
38	Pt:	Okay

The same misunderstanding resurfaces in this segment. Here the audiologist provides several cues suggesting the remote is now being fixed, for instance the "there" in line 23, which serves to propose that a (non) verbal activity has now been completed [15], he lists features that are now in the remote (line 25), and he explicitly states "now it works" (line 28). The audiologist's interaction with the technology (the remote control and the software) throughout this sequence has been sufficiently opaque to the patient that even these statements that the problem has been fixed are not taken as such by the patient. Rather, they are taken to be indications that the audiologist is merely investigating what the problem is, since the patient does not respond to any of the cues provided by the audiologist in lines 23-32. Thus, the audiologist provides increasingly explicit statements of having fixed the problem. Only when this is done for the second time (in line 34), does the patient respond with an "okey doke" in line 35. Though this kind of response registers the receipt of information, it does little to display whether the patient actually believes that the problem has now been fixed.

51	Pt:	Can I try?
52	Au:	Just two seconds,
53	Pt:	Okay.
54		(6.3) ((Au looks at the screen, Pt leans over to try to look at the screen))
55	Au:	That's possible now
56		(10.4)((au gets up, moves to the patient and removes the cords from the hearing aid))
57	Au:	There. You're welcome to try, ((Au grabs remote and puts it in front of Pt))
58		((Pt pushes button on remote))
59	Pt:	Voila:::, ((makes a victorious gesture with the hand holding the remote))

This emerges in the patient's subsequent request to try the remote for himself (line 51), displaying a need to experience what has been done to his hearing aid and remote by the audiologist. His reaction to his own experience of the fact that it has been fixed is in stark contrast to his earlier response to the audiologist's claim that it had been fixed: here he exclaims "Voila!", accompanied by a victorious gesture and broad grin (see figure 2).

The example above illustrates some of the ways in which the audiologist's interaction with technology presents obstacles to patients who wish to follow the course of the treatment of their problem. Because the technology is designed for unilateral use by the audiologist, his actions with the system are opaque and inaccessible to the patient. As a consequence of this, the patient requires experiential evidence to be convinced that something has actually been done to address his problem. The opaqueness of the audiologist's actions with the technology is thus problematic in terms of patients' participating in their own treatment, and indeed in the consultation as a whole. This is a recurrent problem which we have found elsewhere in our data; it has also been reported to us by patients. Furthermore, the fact that patients explicitly pursue ways in which they can participate in, and experience the results of, their own treatment (as illustrated in the example above) is another kind of evidence that this is an issue of importance to them. Our final example illustrates a related problem that the opaqueness of the audiologist's actions with the technology may cause for the patient.

In this example, a patient has returned to the audiologist in order to have his hearing aid reconfigured to accommodate two problems: the inability to hear in crowds and the occurrence of a grinding sound when chewing. As in our previous case the patient displays his interest in participating in his own treatment, and through the way in which he describes the problems he also displays his grasp of basic features of the hearing aid (i.e. by having identified the cause of the problem in lines 01-03).

Transcript excerpt 2 "Chewing"

01	Pt:	Where the fault is I think
02	Au:	Mm mm,
03	Pt:	Is that: .hh (0.5) eh: when you put all that noise dampening on
04	Au:	Mm hm,
05		(0.3)
06	Pt:	then I can't hear.
		15 lines of transcript omitted
21	Pt:	>.hh< And then there's been e:h >.hh<
		(0.1) some eh (.)
22		grinding >sometimes< when you *e:hh*
23		((Pt makes chewing movements with jaw))
24		(0.5)
25	Au:	E:hm. >Yes when you move your mouth<

During the description of these problems, the audiologist is setting up the hardware required to reconfigure the hearing aid: first he attaches the hearing aids to wires that are again connected to his computer, then he inserts the hearing aids into the patient's ears. Once the hardware has been set up, the audiologist returns to his chair in front of the computer and announces to the patient that he will now turn the software for the reconfiguring on. With two problems on the table and no indication from the audiologist which of the problems (and in what order) will be addressed, the patient only has the audiologist's activities with the technology to rely on. As in our first example, these activities are opaque to the patient; he can only determine that the audiologist is doing *something*, but not what that something might be. In terms of sequential relevance [16], however, the fact that the audiologist engages in an interaction with the reconfiguring activity immediately after the patient has described his second problem implies that the two are related (i.e. that the activity is concerned with addressing the second, most recent problem).

That the audiologist is aware of this opaqueness is evidenced by him, at the end of the sequence, stating overtly how he has reconfigured the different programs of the hearing aid. His description of the reconfiguration suggests that he has addressed the first of the patient's problems, but not the second. But it is only when the

audiologist moves to remove the hearing aids from the patient's ear, disconnects the aids from the computer and announces his intention for the patient to try out the new configuration and come back in two weeks, that the patient realizes that his second problem has not and will not be addressed in this particular consultation, as illustrated below:

321 Pt: But what then, (0.3) that thing with:eh with those sounds like
((Patient moves his hand back and forth next to his left ear))

In this third case, we again see how the opaqueness of the audiologist's actions with and through the technology requires both patient and audiologist to use other means to ensure the patient is aware of the process that has been going on, a process which involves an extension of his own body, i.e. the hearing aid. The crucial words here are "has been going on", in that it is only after the reconfiguring treatment has taken place and is in essence completed, that the audiologist can explain what he has done and that the patient is able to assess whether what has been done is sufficient to address his problems. Technology and the audiologist's use of it can, in effect, prevent the patient from "on-line" participation in his own treatment.

Summary and conclusion

Although the object of our analysis has been technologies that are used within audiological consultations, these issues are of general relevance to medical practices where personal computers and other diagnostic technologies similarly feature in the work of the medical consultation. The possibility of patient participation in all manner of treatments is an issue inseparable from the intelligibility of medical actions and possibilities. In this paper we have scrutinised some of the roles of technology within the audiological consultation in order to critically examine their effects on the interaction between audiologist and patient, with particular attention to difficulties encountered with respect to the intelligibility to the patient of the audiologist's actions. Our analysis has found some obstacles to patient participation that are exacerbated by the design of technology. We have noted that many of the audiologist's actions with the computer within the consultation are opaque to the patient. This is partly due to the fact that the technology has been designed for a single user in mind, and one with audiological expertise—the background knowledge required to make sense of an action with the system may far exceed what the patient can be expected to exhibit. It may also be that an appreciation of the role of the use of the technology within the consultation has not played an important enough aspect in its design. For instance, technology is not just used as a tool for audiologists to solve patients' complaints (although it is definitely that), but as we have shown it also needs to serve other functions within the consultation; e.g. as an explanatory aid. Furthermore, as we have seen, the sequential order of interaction with technology in the consultation can also render the relevance of the audiologist's current action ambiguous, since when something happens (i.e. what happened before) is a resource for participants to make sense of what is happening now. Without any other sense-making resources to rely on, the patient is frequently in a position to misinterpret the relevance of the audiologist's current action with the technology, assuming for instance that it is a response to the most recent topic of conversation. Each of these issues is heightened by the fact that audiologists, of necessity, perform these essential tasks through a personal computer that has a single user interface (i.e. a keyboard and mouse); in effect casting patients as spectators in their own treatment. In contrast, medical technologies need to be designed *also* to support such 'auxiliary' uses as patient education, explanation, demonstration, transparency to the lay person, and multiple or co-operative use if they are to create possibilities for, rather than obstacles to, patient participation. The consideration of the degree to which patients are currently able (and unable) to participate in their own treatment is an essential starting point for the design of technologies that might facilitate patient participation.

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests

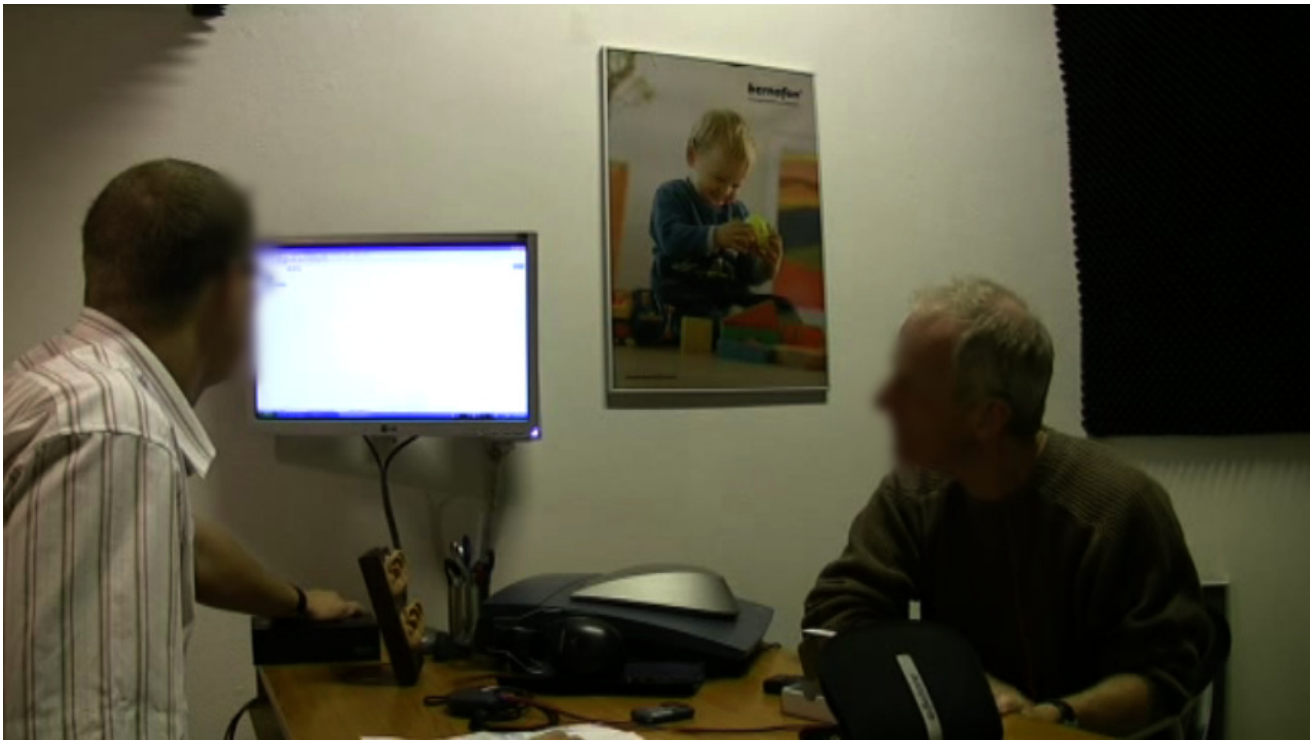

Figure 1. The patient trying to follow the audiologist's actions with the computer

Figure 2. The patient's gesture as he experiences that the problem has been solved.

Appendix

All transcripts are simplified and translated versions of original Danish transcripts, which can be made available by the authors upon request. The original transcripts follow Jefferson's [17] conventions, but in the examples we provide here, only the following conventions are used:

(( ))	is used to describe relevant non-verbal actions
-	indicates that a word or an utterance is cut-off
[	indicates the onset of overlapping talk
(0.3)	indicates silence measured in tenths of seconds
>…<	indicates that a word or utterance is produced quickly
.hh	indicates an audible inbreath
:	indicates that a word is stretched or drawn out in its production.