Voices in design: The dynamics of participatory information system design

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ABSTRACT

Knowledge is missing of how participation in information system design is built in practice and, particularily, of the interaction taking place within multi-disciplinary design groups. The aim of this study is to explore the dynamics of small-group design meetings where rules for a democratic dialogue are used. Using the grounded theory method, a descriptive model is inductively composed in which actions and events during the meetings are related to frames of sociocultural reference. This model can be employed as a theoretical background in the planning, performance, and evaluation of participatory design projects.

KEYWORDS: Participatory design, information systems, small-group sessions, critical theory, qualitative methods.

INTRODUCTION

A general characteristic of most participatory design strategies in working-life is the explicit attempt to channel discussions of development and change to seminars and small-group meetings where all involved parties and levels in the organization are represented. Both structural and procedural means to achieve co-determination in decision-making along these lines have been reported (Cole 1988). In Sweden, for example, 'rules' and agendas emanating from critical theory have been used for operationalization of a 'democratic dialogue' [Gustavsen 1992]. Yet, within information system development, success of participatory design at more than a local level has been limited [Clement 1992]. A factor contributing to this may be that descriptive knowledge still is missing of how participation in design is built in practice, and of the processes taking place at development group meetings.

The available studies of small-group meetings in this field have showed contradictory results. For instance, on the one hand, from studies using quantitative methods have been reported that questions regarding requirements are the most frequently occuring [Hersleb 1993]. On the other hand, qualititative studies suggest that requirements are not ready to be 'read-off' by external observers, but instead, are negotiated products of argumentation [Bowers 1994]. Moreover, no study has approached naturalistic design meetings in working-life with consideration of the 'democracy' dimension in design participation [cf.Thoresen 1992].

Hence, to provide components of the missing knowledge, the aim of this paper is to explore the dynamics of small-group meetings where rules for a 'democratic dialogue' are used [cf.Gustavsen 1992]. Building of a grounded theory of these meetings is used as the point of departure. This method has previously been used in the social sciences to inductively construct social theories in unexplored areas from field data [Strauss 1967]. However, its tabula rasa strategy has recently been discussed within the qualitative research community [Charmaz 1990]. Grounded theory uses input from relevant literature only after the categorization and reduction of data, which means that an unique analytic frameworkt has to be developed for each application. Yet, to be able to use the method, the investigator also has to have solid training to attain theoretical sensitivity and thus has to be familiar with other methods and theories. This study will use the grounded theory approach, but with the difference that theories from several domains are introduced earlier in the research process. The choice of theories is, however, still guided by field data. To be chosen, a theory has to be both applicable and found contributing to the research agendas.

The design context for the study is the development of a hypermedia system for primary care teams [Timpka et al 1994]. The participatory phase in this long-term project, where health care practitioners co-operate with scientists and engineers, started 1987 as a project in the Swedish MDA-program [Lennerlöf 1994]. Having resulted in a preliminary design, several new projects were initiated during 1991-3. The largest of these, PRIMUS 2000, is a collaboration between the primary health-care providers in Linköping, Sweden, a software company (UI Design Medical AB), and the MDA-group at Linköping University, where the aim is

to integrate information technology and organizational learning in primary care [Timpka 1994]. The system product, MEDEA, consists today of 6000 texts pages and 600 colour images, and is also available in a commercial version.

MATERIALS AND METHODS
The PRIMUS 2000 project context
The PRIMUS 2000 project is managed by a senior general practitioner assisted by an advisory board and is operationally led by a commercial software consultant. The design period reported in this study started with introductory meetings between designers of the MEDEA hypermedia system and a new group of practitioners (Figure 1). The participants from the design team in the meetings were a systems analyst and a programmer from the research environment, and a systems consultant and a psychologist from the software company. Two General Practitioners (GPs), three nurses, a nurses aide, and a secretary represented the primary care team. The initial meetings had a character of 'future workshops', and the meeting agendas thus suggested, for example, the presentation for the group of each participant's work experience, present work tasks, and expectations from the design activity [Timpka *et al* 1992].

The four participatory design meetings
In the next four meetings, on which the analyses are based, no means to structure the meetings were initially used other than rules aiming at leveling of the group interaction [Timpka *et al* 1992]. The aim of the first design meeting was to discuss the health care practitioners' first impression of the prototype system. This meeting became turbulent, and came mainly to introduce issues which became starting points for discussions in the meetings to follow.

For the following three meetings, the designers met two days ahead to discuss the agenda and write scenarios. The scenarios were based both on topics not yet concluded from the first meeting and new themes brought up in the recent meetings. The design meetings started with the election of a chairman for the meeting. When a planned topic was introduced, a corresponding scenario was handed out to the entire group. Even though additional structure was imposed on the later meetings by the designers (agendas, scenarios), lateral issues were frequently introduced. This freedom of introducing new topics in the discussion, and not strictly following the meeting agenda and scenario, was accepted and supported by both practitioners and designers.

Data collection and analysis
The second author (CS) participated in the design meetings and made field notes. The meetings were also video-taped and later transcribed, the primary data thus consisting of seven hours of video recordings and one-hundred pages of transcripts (Figure 2). To get acquainted with the data and to find overall structures, the transcripts were read in detail by both authors. This analysis resulted in each meeting being divided in themes [Repstad 1988]. If possible, the event (sequence of utterances) that resulted in a change of theme during a meeting was marked, and the themes were also connected to agendas and scenarios used during the meetings. At this stage, a need appeared to introduce a more rigorous framework for the analyses. This need came to lead back to the theoretical origin of grounded theory, which is symbolic interactionism [cf. Hall 1987]. The essential matter for this sociological theory is the ongoing social process. It is assumed that human action depends upon the meanings people ascribe to situations, and that these meanings derive from shared interactions. When analysing design meetings from the broader perspective of symbolic
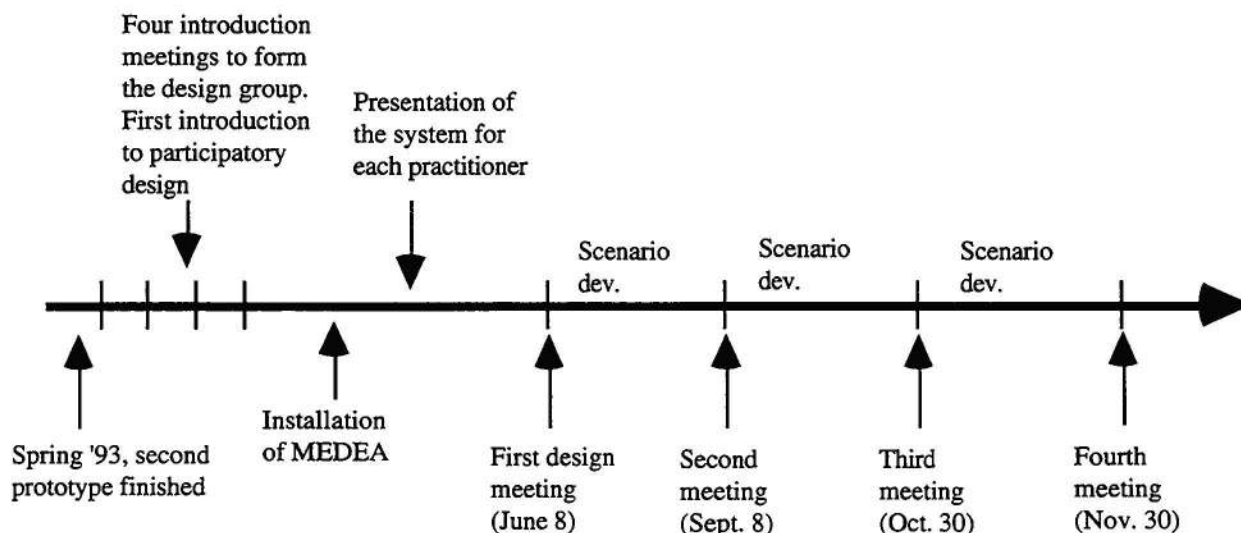

Figure 1. Time-line for the data collection.

interactionism, regard of the situated background of actions is needed for their interpretation [Bogdan 1975]. The analyses thus become characterized by a concern with 'the actors point of view'; an emphasis upon process rather than structure; and a preference for formal generalization [Cuff 1990 p.151].

The application of this perspective on the data resulted in a preliminary categorisation. When models were searched for to integrate phenomena related to the categorization, sociocultural activity theory, with its notion of socially situated cognition and use of language, was found to provide suitable structures [Bakhtin 1981]. It was found in the data that the participants did not hold onto their professional roles, e.g., as health care practitioners. Instead, their "roles" changed dynamically over and within the meetings. In sociocultural theory, the concept of "voice" is used to denote a speaker's perspective, frame of social reference, and consequently, use of language [cf. Wertsch 1991]. The introduction of "voices" was also compatible to symbolic interactionism, where attention to the dynamics of each given situation is required. The analysis thus proceeded with application of the model of voices back on the data. Three instances thus emerged (the voice of participatory design, the voice of practice and the voice of engineering), which were found to adequately express the workplace context, the intentions and actions of the participants, and the influences from the involved institutions, together constituting the design process.

Following the construction of the three "voices", the analysis proceeded from within the data, and from within each voice category. This lead to further examinations of the meetings, what the voices addressed, how they intersected, and how they were employed in argumentation. This analysis can be described as identifying dimensions of the voice categories. The first dimension to be identified was the use of narratives [Fischer 1987]. Story-telling was found not only to be used by one person to inform an audience, it was also used for co-operation within a group. In the same manner, conflict and target value dimensions were identified. The concept of "dialect" is introduced to model that within a voice, types of utterances can be connected to specific contexts and the speaker's purposes (cf. heteroglossia [Bakhtin 1981]).
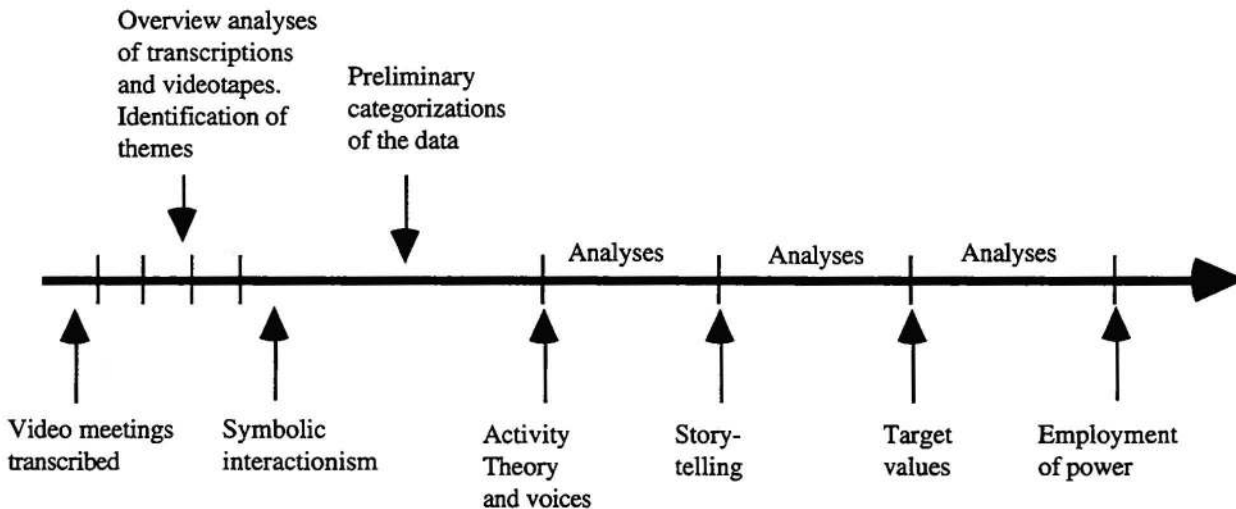

Figure 2. Time-line for data collection and analysis. Theoretical constructs are gradually introduced into the model.

Dimensions

Voices	Storytelling	Conflicts and power	Target values
Voice of participatory design	Tells short stories. The aim is to inform the design group. The stories are mostly told in an unobtrusive manner.	The voice most strongly tries to avoid conflicts (by, e.g. mediating in conflicts). Regarding power, this voice can use a "project leader" dialect to rule a meeting.	The voice uses strategic means to make the design process run smoothly. Process matters are in focus, and the product comes in second order.
Voice of practice	Tells stories about work practice. Depending on the situation, the stories can be both informative and have political motives orginating outside the group.	The voice can become involved in conflicts both with the voice of engineering and with the voice of design (when this voice uses the project leader dialect).To win an argument the voice of practice uses institutional dialects.	The voice addresses the product in the practice context, and in use. The process in the design group is of secondary interest.
Voice of engineering	Tells stories about technical possibilities and constraints. Depending on the situation, the stories can be both informative and have political motives orginating outside the group.	The voice can exhibit its power by using technical knowledge. Conflict situations can occur with the voice of practice (speaking at cross purposes) or with the voice of design, when technical detail threatens to confuse the design process.	The voice focuses on the product. The process in the design group is not of importance.

Figure 3. A descriptive model of the dynamics in participatory design groups.

RESULTS AND COMMENTS

A matrix resulted when the induced interaction structures for participatory design were iteratively applied back on the data (Figure 3), in which the identified voices in design are characterized by dimensions relating them to the process, structure and desired outcome of design meetings.

The voice of participatory design

The voice of participatory design bridges the gap between work practice and technology. Utterances in this voice express knowledge and understanding of both technical design issues and the actual workplace. Participants in design meetings use this voice to encourage and moderate discussion, and mediate between practice and technology. The voice of participatory design could be described as passive, unobtrusive, and not claiming its rights. Yet, there are also trends in the voice that can be characterised as powerful and demanding.

Story-telling and strategies: Typical expres-sions
In the following excerpt two designers are telling similar stories about the hypermedia system. The first designer (line 255) tells a neutral story, on what she regards as possible today, while the other designer's story is more optimistic and oriented towards future possibilities.

Excerpt 1.
255   Designer: At this stage it [MEDEA] is a read-only system, the books can only be read as they are. But the idea is that in the future versions you should be able to insert your own notes and documents...hopefully...

256   Designer/practitioner: Yes, but the idea is to...

257   Designer: ...and link them [to the read-only documents], making these links personal.

258   Designer/practitioner: ...lets say you have a document in [MEDEA] about, what shall we say, sore throat or something and you have been traveling somewhere [conference, seminar]. Then you can insert a link here [shows on a paper] just like you have seen where it says "Gösta's recommendations". ... and under you can write something like this "Dr. Ericsson here at the health care centre suggests..." or "The ENT department at the University Hospital suggests..." or something else you believe is worthwhiled, and you link it to the corpus. Then you have your own document with index and all...

259   GP1: Right, precisely, you put it in the same way [as the read-only documents in the system], and then it is as easy to find...

Comments

The voice is not a primary story-teller and it tends to only tell short stories. The user of this voice also seeks to let the other participants to complete the stories. When it tells stories, it is to inform the design group and not to claim standpoints or provide experiences.

Power and conflicts: Typical expressions

The following excerpts show how the voice of participatory design can use the "project leader" dialect to express power. In the first excerpt, one of the GPs shows doubts about the real value of the hypermedia system. He expresses that it might be a threat against professional competence. The answer (line 129) is made in the voice of participatory design, but in a powerful dialect. It encourages or demands all practitioners to get more involved and participate in the development of the system.

Excerpt 2.

128   GP2: Well, regarding all these functions that don't specifically concern medical issues, there I can see obvious advantages in having this [hypermedia] system, and I can also see it being useful in the consultation situation. I hesitate about using it for the purely medical questions, so as to maintain some sort of self-confidence. The cases you go in and look up have to be the very special cases - they have to be the really tricky problems. All this ordinary you better...we have for example the Glaxo dermatology document. It is almost too common for me...to find a good reason for using that.

129   Designer/practitioner: But Peter, then I would like to answer you immediately. What you see here today - is only an example of how one can put things together. Then it should be...during this process, hopefully...possible, so to speak, to go into depth in a number of different areas on your requests. It is not like that..we can't stop with the idea that there are things too general in here so they're not useful for me.

Yet, the voice of participatory design does not start conflicts. It instead uses strategies to avoid this, as displayed in line 16 in the following excerpt.

Excerpt 3.

14   GP1: That's what I mean lies in the updating and on the owner responsibility, do you understand what I mean? I think....I might know which is the latest date, but I will never be able to set a time limit. It must be so that the person responsible [the author] makes sure that it's revised all the time, that it is changed. I don't think it is certain...even if it says that this [text] is only valid to '78, that it's not ... um... not valid any more. I don't believe in the best-before date...I don't believe in it in this context.

15   Designer/practitioner: ...yes, yes...

16   Designer/psychologist: But for some documents, couldn't you have both systems, then to...?

Comments

The voice of participatory design does usually not display power openly by using strong arguments. Yet, the voice of participatory design uses a "project leader" dialect, which does not employ "facts" to expose power, but rather refers to position or ideology. For example, excerpt 2 shows asymmetry as a way to attain dominance [cf.Linell 1990]. The question from the GP displays medical power, but the answer is asymmetrical. It does not answer the question, but instead uses managerial power to control the situation.

Target values: Typical expressions

In the following excerpt, a GP provides a proposal of how to rearrange the hypermedia corpus, so he can see which documents are used most frequently. A designer using the voice of participatory design (line 308) goes in to clarify and support the design question and alternative. The idea is further encouraged by making the proposal legitimate in the project leader dialect (line 310). The GP is thus supported to in developing his narrative further.

Excerpt 4.

303   GP1: I'm sitting here and thinking if you could do that, then I would quickly see the frequency of document use. That's a way of sorting this out yourself.

304   Designer/practitioner: yes...

305   GP1: ...I believe that if I, myself, if I had that [available] then it would be....if [I find a document] to be out of interest and out of date...do you see what I mean...

306   Designer/practitioner: ..."that's nothing I have a need for"...

307   GP1: ...that's something I can "copy by hand" on my own.

308   Designer: One could say that you have the control of...if there are certain documents that appear to be used very often, then they [should be] located close, so you can get to them ...very fast. Access to those documents should be rapid, and be available quickly, if you understand what I mean....They [the documents] should be placed high up in the system [hierarchy] and perhaps be the first thing you see when you open MEDEA, or something like that...

309   GP1: /mumbles/... I believe...

310   Designer/practitioner: These are the sort of viewpoints, that when you have got warmed up, then...that's what this [project] time is for. It is for us to do the small changes, so to speak, and get a clear picture of how to compose these different documents, what should be added and things that should be withdrawn.

Comments

The voice of participatory design mainly addresses process matters. It takes on the responsibility to make the design process work smoothly and be constructive, and it also is the provider of tools to be used in the process. The excerpt shows how the voice of participatory design targets on the

process by encouragement, and pointing to possible design alternatives, thus only indirectly on the product.

The voice of practice
The voice of practice is complex in that different dialects in the voice can express alternative views from a workplace. On one hand, it speaks from the individual practitioner's point of view and expresses experiences from work practice and use of technology in a situated context. Yet, in arguments it can also turn to stronger institutional dialects such as those of health care administration and the medical profession.

Story-telling : Typical expressions
In the following excerpt several practitioners co-operate in telling a story, and they encourage each other to contribute design alternatives. The practitioners do not compete in the forming of the narrative, they instead appear as "co-authors" of the same story. It seems to be important that they all agree on what is needed in their work, and they use "we" when speaking from everyone's interest. The discussion concludes in the GP giving the narrative final legitimacy, as he, too, is ultimately responsible for the health care the group provides.

Excerpt 5.
313   District nurse2: /interrupts/ This whooping-cough project we are starting this fall...that's the sort of thing you might like to look into and see "How is the status [in the area] now?" Could you add that?

314   Designer/practitioner: Well, yes...

315   District nurse2: It could be both for the doctors and us [district nurses] to look at.

316   GP1: That is in other words a time-limited document.

317   District nurse2: Yes...

318   GP1: I agree with you, just to...

319   Designer/practitioner: That would be a good thing, I think.

320   GP1: It could very well be added, and also the naevi-project

321   District nurse2: You could find many other things to /mumbles/ as we have done with otitis for example.

322   GP1: Otitis is [also] a typical thing that should be added

......

328   GP1: ...one can easily see that it's not so important. But I think your idea /turns to the district nurse/ is very good, our co-operation would become almost perfect... each of us has one [copy of the document in the system]...

Another example of story-telling comes from a discussion of how to use the systems during consultations. A GP first describes in a critical tone a type of colleague who might get "addicted" to a decision support system, since they want a second-opinion on every decision they make. A designer intervenes in the voice of engineering to explain that a hypermedia system can never get to "answer" as an expert system. The GP then turns to the dialect of the medical profession, and makes a joke about physicians who have to seek advice during consultations, too (which does not comply with dignity in medicine). This critical story is taken on, emphasised, and completed by his colleague.

Excerpt 6.
145   GP1: No, there are always some GPs I could think of, who might...go like "tonsillitis...umm, oh yes...penicillin".

146   Designer/practitioner: /Laughter/ Well, but they are maybe already today "different" [without a computer].

147   GP2: I believe that if after ten years you still need to consult a book...the younger doctors may have to look...but the older one gets, the more experience you get...

Comments
Story-telling is common in the voice of practice and it tends to tell stories in a co-operative way. The practitioner dialect seldom threatens any other standpoint. It is most often used to share experiences with the other participants or to ask questions. Both excerpts show joint production [Bergmann 1990], where several speakers add their side of the story and from their point of view, without changing the topic.

Power and conflicts; Typical expressions
A GP describes from his experience what he sees being a limitation of the system. This standpoint is, however, argued against by one of the designers, who joins into the voice of practice to defend the core document (Gösta's book). The argument is answered by the GP in the dialect of the medical profession (line 263, " I once was member of the editorial committee..."). He claims to belong to the medical peer community and thus to have the authority to decide the way a textbook should be created. The designer/practitioner has to agree and admits in the voice of participatory design the GP's knowledge in this area.

Excerpt 7.
261   GP1: but with Gösta's book, it can become out of date faster than you believe. This is as I see it a problem.

262   Designer/practitioner: Well...now, if you look at Göstas book, it is, so to speak, "thin". It's very thin medically, and it has never been the intention to provide a complete medical textbook either. But on the other hand...it is like a spider's web, so to speak. It is very broad in its approach to....

263   GP1: well, I know what you mean. I was once a member of some sort of editorial committee, so I know...

264   Designer/practitioner: yes, yes, it [Göstas book] is [only] suitable to use this way ["spider's web"], and you can add those [complementary documents]...

The voice of practice can use institutional dialects to exhibit and claim power [Cedersund 1992], for instance, in the dialects of the medical profession or the health care administration. Conflicts are mainly handled by turning to a "stronger" dialect in the voice.

Target values : Typical expressions
The management of personal documents attached to the MEDEA system was discussed by the designers and the practitioners during one of the early meetings. On the surface, it is an unproblematic discussion, where the practitioners and the designers co-operate. The practitioners provide possible design alternatives for the product, which are evaluated by the designers in the voice of participatory design.

Excerpt 8.
282   But then you put the rest in the next "box" where you want everybody in your care team to have a look at.

283   GP1:Exactly...

284   Designer/practitioner: But it's you who is responsible for updates...

285   GP1: I'm responsible for updates and so I can go in and remove parts...

286   Designer/practitioner: ...and then you get a little reminder on your computer some time when this...so that...what we called the "best before" date, "what's the story...still applies?". So that you as author know it's OK!.

Comments
The voice of practice does not primarily work on process matters. It act as a provider of "facts" in discussions. If the discussion includes practice routines at the workplace, however, this voice comes to address process matters since the hierarchy at the workplace comes to matter (see also excerpt 4). Thus, the voice adds comments, proposals and thoughts about the product. It is directed towards both the product design and the use of the product in a practice setting.

The voice of engineering
The voice expresses knowledge of technology, technical possibilities, and technical constraints. Statements in other voices of design alternatives or arguments are evaluated as "good" or "bad" and "possible" or "impossible". The voice is powerful, in the sense that it holds knowledge in a domain unknown for the other voices, but in which it is necessary to take joint decisions. Yet, holding of technical knowledge also requires holding responsibility. The voice of practice (and sometimes the voice of participatory design) can challenge the voice of engineering, either by switching to this voice and asking naive questions or by using institutional dialects. The voice of engineering then has to clarify what has been said, what is meant and what the consequences are of various technical potentials, including the risks and hazards [Ferguson 1992].

Story-telling and strategies: Typical expressions
During a discussion of the present memory capacity of the computer system, one of the designers enters the discussion in the voice of engineering to outline feasabilities and constraints. This utterance is made after some jokes about "buying memory", and therefore uses a serious tone in the explanation of the limitations of computer hardware.

Excerpt 9.
426   Designer: Text doesn't require that much space [in the computer]. It is colour images that require space - they can occupy an enormous amount of memory. So, at times, when it takes a long time for you to get up the colour images it is because they are large. There is so much information in a colour image...for the computer to handle.

The discussion continues with a question from a GP in the voice of practice (line 427), who adds that it is most important to get the colour right in the images. The designer uses the voice of participatory design to supports this view. Later (line 430), the designer returns to the voice of engineering to explain issues that might be technically problematic.

427   GP1: Can I ask a question? ...it is about these colour images. When the journalists were here and took photos I suddenly felt - when looking at the images - that the [reading light] really is an ergonomic question. You say...I mean that these images are useless if you don't get the colours right. That's what I felt. How many nice colour images haven't you seen in dermatology, for instance...where all hues are wrong.

428   Designer/practitioner: Not under any circumstances...

429   GP1: We have to, otherwise it's doomed, to have it...umm...where it [the computer] is placed in the room has to be dependent on the [type and source of] light...

430   Designer: ...but also on how the [original] print is - in the book- and then how we scan the image. We scan the images so that they - the quality depends also on how you scan the images...

Comments
The voice of engineering is also one of the story-tellers. This voice, however, is not the primarily initiator of a story. The voice of engineering can instead come in to a discussion and alter it by pointing at technical constraints to be considered in the on-going story. It tells short narratives about the technology, its possibilities and its limitations.

Power and conflicts: Typical expressions
The voice of engineering can be used to construct powerful arguments which are difficult for the other voices to meet. A designer turns to the voice of engineering, emphasised by use of technical terms such as "expert systems", to end a discussion of whether the system could "take over" the control of patient management.

Excerpt 11.

144   Designer/practitioner: It's this that from the beginning provided the basis for the [development effort], that is...what we have - it is not an expert system - it is not intended for "making decisions". The point of departure from the beginning has been that the decisions are [made] by the person treating [the patient] and holding the responsibility - that's the way it is. You can't take x multiplied by y, or something, and receive a result - you can't get that anywhere here [in MEDEA].

The following excerpt begins with one designer disagreeing with the others on how far the research and development of a specific technology has come. Here the voice of practice is used to bring up one of the major problems (line 224). The voice of engineering uses different strategies to "win" the argument. The designer (line 226) refers to what other technicians (known to have been working at the University) have said, thus also referring to an institutional authority.

Excerpt 12.

222   Designer: But to have the computer directly interpret the GP's spoken dictate, and have it printed....

223   Designer/practitioner: It will not be possible during the project time...

224   Secretary: I believe considering all the different nationalities we have in this building, it has be to pretty tough.

225   Designer: Yes, right. There are thousands of difficulties. Yes, precisely...that's one of the major difficulties to interpret speech, natural language. I don't think it will be available for 10 years yet...

226   Designer/practitioner: Umm...well, according to our guys it will soon...be here.

Comments
The voice can be effectively used to show power, i.e. "I know the technology, it is my area of knowledge". This gives, especially the voice of practice, little to argue against. Yet, the voice of practice may interfere in technical discussions, to test the voice of engineering and its reliability. If the voice of engineering here has difficulties to handle the situation, it acts with straightforward power and manipulative strategies are seldom used.

Target values: Typical expressions
During the first meeting, a designer uses the voice of engineering to introduce the hypermedia technique used in the computer system. It is a general description of the technology as something "that is there", and to this description the basic ideas of its use are connected.

Excerpt 13.

107   Designer: Well, the technology that is... the hypermedia technique. You can move between documents by following links, this is something that [only recently]

has been developed. It is very direct, I mean, [it should follow] how you work normally, too...

The voice is not always used by engineers or designers. During a later meeting a designer describes in the voice of engineering the interface model used in the prototype and the rationale behind the model. This is used by a nurse, who catches on in the voice of practice (line 440). However, another nurse breaks into the discussion in the voice of engineering (line 443), to provide suggestions for the configuration of the system hardware.

Excerpt 14.

439   Designer/programmer: I believe that this problem can be avoided by displaying the entire page on the screen. What you see in MEDEA is the book, chapters, sections. It is like a "road-map" you can follow at each page....in the future when you will be able to use the system in your daily routines,. You will be able to read clinical information, and simultaneously find that you have received an email. You can then check the message and return to the place in the clinical information where you left off.

440   Nurse1: "One wants to have it just as in real life"...you work with several things at the same time, simultaneous capacity, that is what you mean?

441   Designer/programmer: Yeah...and if you have a large screen, you can do these several things at the same time. [Such a screen] is not expensive, and it's not difficult to work with. The alternative is to have different screens, one for the clinical [medical record] information, and that is much more awkard.

442   Nurse1: Its not the screen that is the big [problem]...I don't think...it is those gadgets in front of it. They are what's difficult. The screen is good, it looks like a desk, and there is a lot of space there...and I [agree] it would be possible to work with several things at the same time, just as I do now. ....yet, the computer [hardware] is so large and heavy that it gets in my way when I want to move around. It should be as small as possible...just as pen and paper.

443   Nurse2: It's the tube that is so large...

444   Nurse1: Yes, the monitor...just as a TV set.

445   Nurse2: Yeah...but there are TVs which are not so large, and also thin...the latest stuff.

446   Nurse1: ...maybe there are.

447   Nurse2: One should have the thin model, not wider than this /shows with her hands/..then it would be possible to put it close to the wall.

Comments
The voice of engineering tells stories about a technical product or technology in general. It provides possibilities and constraints of technology and its primary focus is on the product and not on the design process.

DISCUSSION

The point of departure for this study was the channelling of participatory design of information systems to meetings and small-group discussions where rules for a 'democratic dialogue' are used. If given time for consolidation, experiences from the Swedish LOM-program have shown that introduction of dialogue critera in organizations results in both quantitative effects on communication processes and qualitative change in the general communication regime [Naschold 1993]. However, in the program, the design outcome of this restructured communication has mainly been limited to work organization and only to a lesser degree affected technical innovation. The present study has explored the interaction in participatory design groups having adopted corresponding dialogue criteria. The resulting descriptive model shows, first, that the traditional 'roles' in design, in a Meadian meaning, have been distributed both over persons and time. Second, the *design* activity appears to have moved its foundation to communication and mediation, rather than construction and modularization. Third, the power of the institutions and organizations surrounding the design group is utilized through explicit references in argumentation and conflict resolution. Hence, when relating the descriptive model to the intentions and the linguistic-pragmatic nature of the dialogue criteria [Engelstad 1993], it can be said that the nature of the small-group interaction corresponds to the democratic objectives. However, this study has not investigated the outcome of the design meetings. A separate investigation of the development of the MEDEA system [Timpka *et al* 1994] showed that the design differed significantly from comparable hypermedia applications in health care. For instance, emphasis is put on the information content instead of software detail.

The use of sociocultural activity theory in this study has both similarities and differences with previous applications in the information systems field [cf.Kuuti 1991]. Here, the theory is applied on design processes rather than system designs and linguistic parts of the theory are used rather than its psychological framework. In the theory, there are several theoretical preliminaries to the concept of voice [Wertsch 1991], some of which are particularily important for the model developed in this study, e.g. the notion of utterance, its connection to person and time, and its dialogicality. Voices are used to deduce and organize utterances in a dialogue according to their social and cultural origin. It is exactly this predominance of sociocultural structure over person-bound role that makes the theory powerful for organization of the data from participatory design meetings. In information system design grops, institutions, economy and tradition can show in different persons in their exercise of power and influence. For instance, in design groups, tradition and resource are important components in the 'gradient of resistance' obstructing change of existing systems or prototypes [Bowers 1994] and these conservative forces are seldom represented only by specific persons in the group.

Besides its theoretical yield, the sociocultural model could also come to a pragmatic use. In revised form, it could be employed, for instance, for reflection in the closing "round-ups" of design meetings, in that the participants could apply the model to explain their own participation in the meeting and how they interpreted other's behavior. This way actions and events can come to be related to the factual contributions of individuals to the resolution of conflicts, the telling of the 'design story' and to the attainment of project goals. However, the model is a result of an empirical study and is not necessary what all parties involved in information systems design would want or need from such a model. Hence, for these reasons, and following the lead from critical theory [Habermas 1984], it is important to consider also normative models for use in situations like 'round-ups'. Simultaneously, caution is needed when such models are suggested unilateraly by interest groups.

This paper has introduced an inductive method for study of participation in design where analytic constructs are progressively brought into the analyses. The framework is based on the fact that a "total", definite or even "true" description of the processes and practices that constitute participatory design is impossible. Instead, in the building of micro/macro links, the analyses have departed from field data and use explicit intermediate level theories and categorizations, to end in the formation of meaning and discourse structures (cf. "Social Semiotics" [Thibault 1991]).The intermediate results can thus be used as platforms for bringing in complementing theoretical perspectives for the analyses, making linkage between dialogue detail and societal structure possible. In other words, participatory design is seen as socially complex enough to require a unique sequence of analyses to be composed for each study of its processes. To ensure rigor in the analyses, arguments are built and external theories are explained step-wise towards more general theoretical representations of structure, process and outcome.

In conclusion, financial restraints, attitudes of middle management and deficient communication between departments are today recognized as problems frequently reported from participatory design projects in commercial organizations [Friis 1991]. Yet, even though these macro-level problems are known and discussed, participatory design projects in the information systems development field continue to fail. There is thus an urgent need to study the links between organizational strategy and small-group activities. Also, to be able to identify such links and use these in guidelines for action, a framework for analysis is necessary which makes it possible, without losing rigor, to follow macro-level social structures from the micro-level interaction in design groups. This study has provided the preliminaries for such an effort.

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