Unpacking the notion of participation in Participatory Design

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Abstract. The paper explores what exactly it is that users participate in when being involved in participatory design (PD), relating this discussion to the CSCW perspective on collaborative design work. We argue that a focus on decision-making in design is necessary for understanding participation in design. Referring to Schön we see design as involving creating choices, selecting among them, concretizing choices and evaluating the choices. We discuss how these kinds of activities have played out in four PD projects that we have participated in. Furthermore, we show that the decisions are interlinked, and discuss the notion of decision linkages. We emphasize the design result as the most important part of PD. Finally, participation is discussed as the sharing of power, asking what the perspective of power and decision-making adds to the understanding of design practices.

Keywords. Collaborative design, Participatory Design, power, decision-making, choices

1 Introduction

Participatory Design (PD) is an approach to the design of IT where the designers invite future users to participate in all phases of the design process. The motivations for engaging in PD vary from the rather pragmatic view that having users participate makes it easier to implement the design result, to a political position that users have the right to influence their future use situation. The degree of participation varies accordingly. Although the literature on participation abounds (e.g. Clement and Van den Besselaar 1993; Kensing and Blomberg 1998; Kensing and Greenbaum 2012), the PD community lacks ways of talking about these differences and how they affect the PD process, as well as its outcomes. This has also to do with the fact that much of the PD literature focuses on methods and techniques, demonstrating different ways of practicing participation in design. The focus is on the process and its characteristics, not necessarily on the details of the design practice: on the technical work involved in designing an IT artifact. Hence, it often remains unclear what it is that users participate in, what and how they contribute to the design result, and how they can see that they have contributed. This is the topic of this paper. It presents a conceptual approach to discussing the practice of participation in PD projects, focusing on power and decision-making.

This interest in understanding power and decision-making in design reaches back to the early days of PD, to the *Florence* project and its experiments on users' participation in the design of IT artifacts (e.g. Bratteteig 2004). In those days (the 1980ies) politics and conflicting interests were at the core of PD, emphasizing the different worldviews of employers and employees in particular. An important point was to counteract the power/knowledge of designers and their highly specialized technical language. PD was about enabling discussions about future technical solutions between designers and users by having them communicate through mock-ups and prototypes instead of a specific formal language. Several decades later collaboration in an urban planning workshop (the *IPCity* project) stimulated us to revive our common interest in understanding issues of power and decision-making in PD. This resulted in a first joint paper (Bratteteig and Wagner 2012). The book that followed this small paper (Bratteteig and Wagner 2014) is based on an in-depth analysis of empirical material from two PD projects we had participated in. It looks at the dynamics of decision-making in these projects, asking: what does it mean to participate; what is it that you participate in in PD? The book also provides an extensive discussion of the key concepts: power, decision-making, and participation.

This paper takes a step further in that it develops a framework for systematically analyzing participation in design, based on a distinction of arenas for participation in a design project. To demonstrate the usefulness of our

approach our discussion includes a range of PD projects. Getting a grip on the details of participation in design has made us aware of the need to build on rather detailed knowledge of all the different design activities that have been carried out in a project. Hence, we also for this paper selected projects that we had participated in; four projects that represent small and large PD projects, short and long-term projects, industry and research contexts, with different types of users as participants: nurses, architects, and children.

Although the participation of users has become important in areas like health care, environmental planning, community development and urban planning, this paper focuses on the 'classic' version of PD that explicitly aims at designing IT artifacts. In this type of PD project the decision to look for a technology solution has often already been taken. The main issue is to, in a participatory way, create a design solution with a participatory result: one that increases the autonomy and space for action for its future users (Bratteteig and Wagner 2014). Key to this view of PD is the ethical stance that participating users should be involved in *all* aspects of a design process (e.g. Ehn 1988, Greenbaum 1993). In addition to the ethical and political view, the prevalence of involving users in design also stems from the more pragmatic view that 'it is not only about social democracy but also about the systems that stand more chance of a success when the users are able to have a stake in their development' (Martin et al. 2009: p.134). Engaging in the practice of participatory IT development not only results in 'new understandings about how designs could be arrived at and introduced into the workplace, but also led to a broad base of new knowledge being built upon among workers and managers' (Brereton & Buur 2008: p.103) that can be built into the design result (Bjerknes & Bratteteig 1995).

This paper seeks conceptual clarity about decision-making in design as a highly complex and often subtle process, in which 'moves' of opening and closing choices in the process of 'making' are driven or modified by decisions that users participate in as co-producers of design ideas and as 'evaluators'.

We build our understanding of design on the notion of 'design moves' (Schön 1983; Schön and Wiggins 1992). Schön understood design as processes of 'seeing-moving-seeing': seeing and evaluating a situation or a thing, making a move to change the situation, and evaluating the result. Our analysis of design decisions is also inspired by the writings of Alfred Schütz (1962, 1951) on human action, imagination, reflection, and choice. Creating choices is fundamental to PD where all participants are invited to contribute to those choices. Our emphasis on choices and design decisions suggests decision-making as a framework for analysis. Originating in the literature on management and organization, it begs a series of conceptual and methodological questions. Decision-making in design is a highly complex and often subtle process, in which the moves of opening and closing choices in the process of making are driven or modified by decisions that users participate in as co-producers of design ideas and as evaluators.

Our main aim in this paper is to explore the question of what it is that users participate in. We discuss the different types of activities involved in making design moves, making use of fieldwork material from the four PD projects. We suggest moving away from idealizing notions of participation, showing that there may be different degrees of participation in a PD project. A key question is whether better participatory processes promise better participatory results. We think that there is no straightforward answer to this question. One of the insights we seek to demonstrate is that users do not have to participate in *all* aspects of a design project for it to have a participatory result. However, a participatory design result is not possible without users having contributed to creating choices.

Analyzing how choices are opened and closed and who participates in decision-making as an element of PD practice leads to a more precise understanding of the practical limitations of participation in design, some of which point to power issues. We consider the notion of 'power to' (Pitkin 1973) a useful concept for PD. 'Power to' means agency: the capacity to shape action, which partly depends on access to organizational resources, partly on 'power/ knowledge' in the Foucault sense (e.g. Foucault 1982). Hence, the second part of our analysis looks into what shapes the possibilities for participation, looking at: the institutional framing of the projects; the sources of power and influence different project participants were able to mobilize; the linkages between the decisions that influenced the dynamics of decision-making in the projects. The decision-making framework we will introduce is intended as a tool for 'reflection-on-action' after a project has been completed; but also as a to reflect on power and decision making when taking moves as designers in the design process.

As members of both research communities, PD and CSCW, we also seek to frame the question of participation and decision-making in design in a CSCW context. PD is a special kind of cooperative design process, with a focus on enabling different stakeholders with different perspectives and competencies to cooperate. The focus of CSCW is on understanding collaborative work practices and the details of the working together more generally, including design practices. In this sense CSCW and PD are addressing the same phenomenon, assuming somewhat different perspectives.

After having introduced the 'decision-making framework', which is the conceptual core of the paper, the analysis and reflection part is carried out in a series of steps:

- Section 4 'Participation in what' introduces the four PD projects and describes the decision-making process in each of them, clarifying user participation in creating choices, selecting a choice, concretizing, and seeing/evaluating it.
- Section 5 'The sharing of power in PD' takes the analysis a step further. It examines the constellations that framed the possibilities to participate: the institutional context in which the projects were

embedded; the power and influence exercised by the different participating stakeholders; the 'decision-linkages' – how participants' choices influenced each other.

- Section 6 discusses if and how the depth of participation in design can possibly be assessed.

The paper concludes with reflections on the conceptual framework we have developed for understanding and designing the participatory part of PD, also reconsidering what the perspective of power and decision-making adds to the understanding of design practice.

2 Design and PD as collaborative work

Design deals with 'wicked problems': they are ill defined and ill structured, with the consequence that 'Problem understanding and problem resolution are concomitant to each other. … [The] process of solving the problem is identical with the process of understanding its nature' (Rittel and Webber, 1973, p. 162). A result of this 'wickedness' is that most design processes are open-ended, often exploratory, and highly complex. A big challenge in design is therefore to expand the design space, creating a multiplicity of design options, and not closing it too early by focusing on a particular solution (Tellioglu et al. 1998; Bratteteig & Stolterman 1997). As design problems are 'wicked' and 'ill-defined', an important part of the practice of design is to support the possibility to make choices that can be unmade if the trying out of a promising 'design move' did not have the wanted effect (Wagner 2004).

As the product of design work does not yet exist, creating representations of possible design results plays a major role (see e.g., Buxton 2007). Studies of design practices in an architectural office looked into the details of creating design representations (Binder et al. 2011). One of the main insights from these studies is that much of the work of designing consists of producing design representations in different modalities, scales, and materials, in a continuous transforming process of ongoing refinement and increased specificity. The more complex a design task, the more difficult it may be to represent a design idea and this often results in a plethora of sketches, scale models, material samples (to illustrate properties), or prototypes. These representational processes can be seen as processes of 'seeing-moving-seeing' where the different representations partly depend on each other.

Within CSCW design practice in areas as different as software development, product design, and architectural design has been studied. A special issue of the CSCW journal in 1996 (Schmidt and Sharrock 1996) as well as a number of edited volumes such as Dittrich et al. (2002) and Voss et al. (2008) indicate an interest in design work. Researchers have looked into the various requisite coordinative practices that design work involves. Some research projects offer detailed accounts of parts of the design process, like Bowers and Pycock (1994)

who documented some of the details in the design of a computer interface, analyzing dialogues between a programmer and a user about how to get the details right. A classic study of software developers at work was carried out by Button and Sharrock (1994), who were concerned with the organization of engineering work as project work. They showed that part of the knowledge of software engineers 'is about how to co-ordinate distributed work' (p. 385). Other research projects studied special practices, such as: the adoption of a configuration management tool by software developers (Grinter 1996); testing (Rooksby et al. 2009); coordination mechanisms (Carstensen and Sørensen 1996); or coordination of sub-teams that work on different parts of the same projects (Johannessen and Ellingsen 2009; Herbsleb et al 2000). Distributed design work would not be possible without 'coordinative artifacts' (Schmidt and Wagner 2004) that support, standardize, synchronize, and connect local practices so as to take care of logical, functional, spatial, social, and other interdependencies in complex design projects.

PD research also addresses design as collaborative work but from a different perspective. Kyng (1991) portrays PD as collaborative design while pointing out the difference to a CSCW approach: 'Cooperation is an important aspect of work that should be integrated into most computer support efforts. In order to develop successful computer support, however, other aspects such as power, conflict and control must also be considered' (1991, p. 65). Kensing and Blomberg (1998) see the difference between CSCW and PD in the fact that 'PD has made no attempt to demarcate a category of work called cooperative, but instead has focused on developing cooperative strategies for system design' (1998, p. 180). They add that for PD 'distinguishing between systems that support cooperative as opposed to other types of work holds little value' (ibid).

As PD's main interest is understanding how to practice participation or what Kensing and Blomberg (1998) call 'cooperative strategies for system design', it focuses mostly on those aspects of design work that involve collaboration with users, emphasizing how to collaborate across professions and disciplines in terms of methods and techniques. There is a strong presence of principles: to share power with users and to respect 'people's expertise and their rights to represent their own activities to others, rather than having others do this for or to them' (Robertson and Wagner 2012, p. 65). Moreover, PD looks at design practice from a normative point of view, which is based on ideas of autonomy, democratic self-realization, and empowerment. Often, the detailed technical part of the work, when design ideas are concretized in a prototype, is blended out from a closer analysis.

Given these commitments, many accounts of PD pay less attention to the details of collaboratively designing an IT artifact or system than to concerns about conflict, politics, and power. If the making of an IT artifact is addressed, the focus is on the contributions of the participating user. A classic example is the UTOPIA project, where graphical workers were involved in the design process

> through a rather concrete approach using mockups and simulations of computer based working environments (Ehn 1989). The mock-ups were more or less sophisticated, like paper boxes representing mouse and laser printers, or large paper drawings and (later on) slides showing alternative screen layouts […] one of the benefits from this approach is that the workers do not have to explicate their work processes, they can express their craft skills by demonstrating and doing their work. This approach was called 'design-by-doing'. (Bjerknes and Bratteteig 1995, p. 77)

More recent examples are 'user mock-ups' built by young people with diabetes (Glasemann and Kanstrup 2011) or by families addressing issues of electricity consumption in private households (Kanstrup et al. 2006). Participatory designers want to learn about users' problem definitions and ideas for solutions through the things they make; as part of 'mutual learning' (Bratteteig et al. 2012), which is seen as central to PD.

CSCW research on the other hand pays little attention to issues of power. The literature on decision-support, which was a main topic in the early days of CSCW, focuses on groups and how to best organize the process of 'proposing alternatives, evaluating alternatives, making choices (e.g., by authority, consensus or voting)' (Malone and Crowston 1990); without, however, conceptualizing power. There are some exceptions though that seem to have been of limited influence on the field as a whole; such as for example Sauvagnac and Falzon (1996) who in their study of production and maintenance workers of a dairy, have described negotiations as power games and unpredictability and uncertainty as sources of power; or Clement and Wagner (1999) who have operationalized issues of interdependence and power in organizations spatially. Some of the debate within CSCW on power has followed Suchman's paper 'Do categories have politics?' where she looks at the 'normative imposition of categories by some actors' (1995) as acts of power. Also of influence was Star and Strauss' (1999) exploration of the relations between power and invisible work. However, there are few studies that would conceptualize details of a work practice in terms of 'power'. This may be due to the legacy of ethnomethodology. Lynch 1997 addresses this question:

> The problem in a nutshell is that ethnomethodology is not clearly aligned with an 'emancipatory' politics or, for that matter, with any transparent political agenda. On the one hand, it has sometimes been argued that the approach is 'conservative' because ethnomethodologists rarely talk about power or coercion, and superficially understood, the approach seems to suggest that enterprising actors freely create the world(s) in which they act (p. 31).

What ethnomethodologists may look at, however, is the institutional context in which design work is embedded. Martin et al. (2009), for example, have provided a thorough analysis 'of the everyday practicalities of achieving participation and managing user–designer relations' (p. 133), taking the design of an electronic patient record as an example. They stress the ways contingencies are handled as affecting and in some cased limiting the possibilities for stakeholder participation. The contingencies they identified were:

> (1) differences in analysts and stakeholders and their relationships, (2) differences in complexity encountered in different areas (or modules) of development, (3) competition between participation and socio-technical concerns and other design concerns, and (4) organisational, interorganisational and regulatory (Government) pressures (p. 153).

As a consequence of multiple pressures user involvement may compete with other concerns (p. 153). Although we will look at the institutional context the four PD projects are embedded in, our focus on power and decision-making partially blends out the 'everyday practicalities' Martin et al. refer to. As we will demonstrate, such a level of analysis (and abstraction) poses some challenges. In the next section we seek to highlight what makes decision-making as a framework for studying design both problematic and attractive.

3 Power and decision-making in design

Most theorizing about power and decision-making originates in organizational theory. Hence, an important step consists in rethinking these concepts in relation to design work in general and PD in particular, asking: how can decision-making processes in design be conceptualized; and how do different types of power influence decision-making? We start with decision-making, suggesting that talking about power in PD requires a rather detailed analysis of decision-making in a project.

3.1 The dynamics of choices and design moves

The debate on decision-making was for a long time dominated by Herbert Simon's notion of bounded rationality and decision-making as a three phase 'intelligence-design-choice' sequence (Simon 1960). James March, who had collaborated with Herbert Simon, many years later co-authored a paper on 'organized anarchies' as a form of organization that does not follow the rational model. This type of organization was seen as operating on the basis of 'a variety of inconsistent and ill-defined preferences', as often using simple trial-and-error procedures, and by 'fluid participation' in the organization's choices. The so-called 'garbage can' model of choice, typical of such type of organization proposed to

> view a choice opportunity as a garbage can into which various kinds of problems and solutions are dumped by participants as they are generated. The mix of garbage in a single can depends on the mix of cans available, on the labels attached to the alternative cans, on what garbage is currently being produced, and on the speed with which garbage is collected and removed from the scene (Cohen et al. 1972, p. 2).

The 'garbage can' model seems to account for the situation in highly complex projects with lots of stakeholders with potentially diverging perspectives and a certain level of ambiguity concerning:

> The nature of the problem is itself in question; information (amount and reliability) is problematical; multiple, conflicting interpretations; different value orientations,

> political/emotional clashes; goals are unclear or multiple and conflicting; time, money or attention are lacking: contradictions and paradoxes appear; roles vague, responsibilities unclear (Weick 1985, p. 123)

The 'garbage can' also seems to capture the fact that we may in hindsight talk about a decision having been taken while finding it difficult to reconstruct how exactly it came about. Hence, before talking about how rational and orderly or anarchic decision-making proceeds, we need to have clarity about what a decision *is*: how can we possibly recognize it when observing people at work? We think this is partially a question of granularity or level of analysis.

The philosopher Alfred Schütz has written about situations that involve choices. Schütz was interested in the 'natural attitude' that he describes as typical of daily life where we are 'geared into the world', which 'is the scene and also the object of our actions and interactions' (Schütz 1954, p. 534). It is a world given to us. Hence, in daily life much of our action is habituated, characterized by a 'suspension of doubt'. However, Schütz also describes situations that involve choices between alternative 'projects' (Schütz 1962). He quotes John Dewey who, in writing about 'the nature of deliberation', saw a choice between alternative projects as being preceded by

> a dramatic rehearsal in imagination of various competing possible lines of action. It is an experiment in making various combinations of selected elements of habits and impulses to see what the resultant action would be like if it were entered upon' (Dewey 1922, p. 190).

For Schütz such moments of 'dramatic rehearsal' apply to situations in which our knowledge of possibilities becomes open, questionable, or problematic. In these moments we have to suspend our belief in what we take for granted. Such choices only happen in situations that 'give rise to a decisive new experience: the experience of doubt, of questioning, of choosing and deciding, in short, of deliberation' (Schütz 1951, p. 169):

> All projecting consists in an anticipation of future conduct by way of phantasying. […] Metaphorically speaking I have to have some idea of the structure to be erected before I can draft the blueprints. In order to project my future action as it will roll on I have to place myself in my phantasy at a future time when this action will already have been accomplished, when the resulting act will already have been materialized. Only then may I reconstruct the single steps which will have brought forth this future act (Schütz 1951, p. 16).

When Schütz couples 'phantasying' with 'projecting', he sees them as motivated by a purpose, pointing out that

> The practicability of the project is a condition of all projecting which could be translated into a purpose. Projecting of this kind is, thus, phantasying within a given or better within an imposed frame, imposed namely by the reality within which the projected action will have to be carried out. It is not, as mere phantasying is, a thinking in the optative mode but a thinking in the potential one (Schütz 1951, p. 165).

Schütz' arguments can help us understand the practice of PD. In PD 'imaginative freedom' is bound by the commitment to support better ways of performing a particular practice in the future; and not only so:

> What we are able to imagine is bound by our cultural-historically inherited collective imaginaries; by the discourses that define and produce the objects of our knowledge and influence how ideas are put into practice; and by (in)vested interests, time, already-existing conditions, and so forth, all of which are part of the 'politics' of PD (Bratteteig and Wagner 2014, p. 17).

The 'imagining' part in PD is supported by a variety of techniques. They help designers and users explore, think, tell and enact differently by emphasizing the value of sharing and understanding each other's imaginings (Bratteteig et al. 2012). Hence, PD builds on imaginative acts that are made concrete in the form of e.g. stories, visual material or playful enactments. The moving from imaginative acts to choices is crucial for design.

In his book *'The Reflective Practitioner'* (1983) Schön uses the notion of 'design move' to describe how designers work: a 'move experiment' (or 'design move') includes the designer's evaluation of a situation, a move to change it, and an evaluation of the move. 'Seeing-moving-seeing' is a process, in which problems are set and solutions are found and evaluated. Design moves involve different kinds of seeing: seeing what is there (what has been drawn, built) as well as seeing and judging (is this how it should be, does it work?), before taking the next move.

Schön stresses that design moves close some choices whilst opening others. He describes 'Quist' [one of the architects he observed] as 'spinning out a web of moves, consequences, implications, appreciations, and further moves' (Schön 1987, p. 94), concluding:

> As the designer reflects-in-action on the situation created by his earlier moves, he must consider not only the present choice but the tree of further choices to which it leads, each of which has different meanings in relation to the systems of implications set up by earlier moves. Quist's virtuosity lies in his ability to string out design webs of great complexity. But even he cannot hold in mind an indefinitely expanding web. At some point, he must move from a 'what if?' to a decision, which then becomes a design node with binding implications for further moves. Thus there is a continually evolving system of implications within which the designer reflects-in-action (p. 62).

Design is about widening the range of choices before taking a decision on which of the choices to concretize in a design move. This is a process that opens up new choices, while closing others – both the opening up and the closing of choices are essential in design (see also Bratteteig and Stolterman 1997).

Schön uses the notion of imagining: while engaging in move experiments like sketching, interacting with materials, designers make use of their imagination and it is precisely this imagining that widens their choices. With each design move some of these choices are closed, while evaluation and reflection of the move open up for new choices:

> And we also have the ability to reflect-in-action to generate new knowing, as when a jazz band improvises within a framework of meter, melody, and harmony: the pianist laying down "Sweet Sue" in a particular way, and the clarinetist listening to it and picking it up differently because of what the pianist is doing-and nobody using words (Schön 1995, p. 130).

Whilst performing, musicians pick up what the others are playing, integrating it and jointly producing new knowing. The imagination becomes a part of reflection-in-action.

When observing designers at work, Schön focused on rather short units of activity. Also Goldschmidt defines a design move as 'a step, an act, an operation, which transforms the design situation relative to the state in which it was prior to that move' (Goldschmidt and Weil 1998, p. 89): a design move results in a change of a representation, be it a sketch, a mock-up, or a prototype.

The positions of Schütz and Schön can be seen as complementary. Schütz' notion of 'projecting', emphasizes the need to envision, simulate, draft a blueprint, in order to be able to imagine the (design) idea in future action. In contrast, Schön stresses the experimental, step-by-step character of design work, the imagining and evaluating that is built into each design move.

This leaves us with a conceptual and a methodological problem, which requires clarifying the level of analysis we want to address when talking about decision-making in design. Design work involves the making of many small step-by-step choices. It proceeds through subtle shifts and turns of a kind that may only be accessible to an observer through participating in design sessions, capturing the designers' 'reflection-in-action' that Schön portrays (e.g., Newman 1998; Henderson 1999). However, some of these choices may be taken in a more explicit way, involving the kind of 'phantasying' and 'projecting' that Schütz describes.

We should not forget that PD projects are intensely collaborative, with users or stakeholders convening to discuss, propose, evaluate solutions, and so forth. These are activities where the 'seeing' of the designer that Schön observed is complemented by argumentation and reflection, and more explicit types of 'decisions' will be taken (Bratteteig et al. 2016). Evaluating an evolving prototype (in use) involves observation, the joint critical assessment of these observations and, eventually, new 'move experiments'. Finally, all design practices involve mundane activities, such as making calculations, scheduling, handing designs over to others for them to control, complete, annotate, etc. All these activities involve choices.

How do we account for these very different types of decision-making? This question is further complicated by two facts, both of which have been described by Langley et al. (1995):

> First, while the concept of 'decision' itself (which we take to mean commitment to action) may imply distinct, identifiable choice, in fact many decisions cannot easily be pinned down, in time or in place. […] Third, even when a decision can be isolated, rarely can the process leading up to it. (p. 261)

Hence, analyzing decision-making in design may require going back to the fieldwork material we have collected, in a 'reflective attitude' (Schütz, 1954) or an act of 'reflection-on action' (Schön, 1983, 1987), revisiting the arguments that have been brought forth by all involved participants. We may find out that some

of the decisions that we identify in this way are not the result of explicit deliberation. We will show that, in design work some choices are made in the process of making.

The second complication has to do with the fact that in this process of revisiting some decisions will turn out as more important than others, as they are interlinked with other choices. In the process of designing 'decisions typically become inextricably intertwined with other decisions' (Langley et al. 1995, p. 261). The fact that decisions interact with each other may make identifying a decision and those involved in taking it even more difficult. Langley et al. propose to look at decision-making as 'a complex network of issues involving a whole host of linkages, more or less tightly coupled' (p. 275). They have identified different types of decision linkages: *sequential*, that link decisions over time; *precursive*, that frame later decisions; and *lateral*, that share resources and context. The different types of decision linkages are useful for seeing how decisions are linked and intertwined and, ultimately understanding why some choices are more important than others. Our analysis shows that while some of the choices made in the four PD projects framed later decisions, some small choices 'snowballed' into a major one and that a choice prevented the designers from seeing other options.

To sum up, the decision-making framework we use in our analysis has several conceptual constituents:

- The notion of 'design-moves' captures the experimental, step-by-step character of design work, where evaluation and reflection of a move open up for new choices (while closing others);
- More explicit choices emerge through processes of deliberation – the (collaborative) imagining and 'projecting' into the future;
- The notion of decision-linkages captures how choices are interrelated.

3.2 Power and influence

Looking at power (and influence) helps understand *why* decisions in a PD project may be taken in a more or less participatory way, as participation does not necessarily make power issues disappear. In the early days PD was about empowering workers. The power of different participating stakeholders was described in terms of an unequal distribution of organizational resources, knowledge and skills (e.g. Bjerknes and Bratteteig 1995). Articulating and challenging power relations formed an important part of the PD process. Joan Greenbaum (1996) describes this tradition of early PD that focused on political struggle and empowering workers:

> The early action-research projects in Scandinavia which were part of the Critical tradition realized that designing for workplace democracy was not something that could be done within the profession alone. Using political coalitions they fought for and won laws which gave workers the right to co-determination in decisions involving technology. They also realized

> that workers as users needed more and better training in order to participate in design. This gave rise to a second generation of Scandinavian research projects in the 1980s which took an analysis of labor-capital relations a step further, using labor process analysis to explicitly design for increasing skill […]. These projects were designed for specific groups of workers - supporting their interests and including the workers tacit skills in design principles for future systems (p. 232).

While power relations remained a recurrent theme in the PD literature, little effort has been made to more systematically examine the different aspects of a concept that, as Crozier stated in his 1973 essay 'The problem of power' sometimes borders confusion. Our interest in using power as a conceptual tool has led us to revisit the vast literature about power, carefully selecting what we think is useful for understanding power issues in design (see Bratteteig and Wagner 2014). In her book 'Wittgenstein and justice' (1973) Pitkin distinguished between 'power over' and 'power to', stressing that these two uses of the word 'power' express rather different phenomena. 'Power over' another person ('by his getting the other to do something, but also by his doing something to the other') is a relational concept. 'Power to' denotes 'capacity, potential, ability, or wherewithal' (ibid, p. 276). Pansardi (2012) also examined this distinction adding that it 'is nothing more than an analytical distinction between two aspects of a single concept of power, and, since they always occur together, an investigation of the former is always also an investigation of the latter' (p. 86). We think that both positions are valid and helpful: the analytical distinction that helps identify power as the ability to contribute; while also keeping in mind the relational aspect of any kind of power. PD is about sharing power with users; hence both aspects need to be examined.

A related concept is empowerment, which 'is frequently theorized as power to' in contrast to 'power as domination, largely characterized as power over' (Haugaard 2012, p. 33). The discourse about participation (e.g. Gaventa and Cornwall 2006) traces the notion of empowerment back to the pedagogical work of Paolo Freire, who believed that community empowerment starts when people listen to each other, engage in a dialogue, identify their commonalities, and develop solutions for their own problems:

> In truth, the opposite of manipulation is learners' critical, democratic act of participation in the act of knowing that they are also subjects. The opposite of manipulation, in brief, is people's critical and creative participation in the process of reinventing their society […] (Freire and Macedo 1987, p. 43)

'Power' is only one way of looking at decision-making in PD. Pitkin also insists on the difference between 'power' and 'influence', which are often treated as (almost) the same (notably by Robert Dahl, 1957). These concepts 'are not strictly comparable. They are of different kinds, or move in different dimensions' (Pitkin 1973, p. 279). The difference between the two concepts has been described by Zündorf (1986):

> While power represents an intervention in the action space of others, influence has to begin with one's interaction partners' own dispositions to act: how they develop opinions and take

> decisions and not—as in the case of power—with pushing through what already has been decided. (p. 38)

Other relevant concepts for understanding decision-making, such as 'trust' and 'loyalty'. Trust includes the feeling that one can somehow rely upon others: it is the 'confident expectation of the benign intention' of others (Dunn 1990, p. 74). Loyalty is 'the feeling of confidence that trust between others […] can be maintained in the long run and therefore restored in the future if absent at any given time' (Barbalet 1996, p. 80). More generally speaking, the sharing of power in PD is a complex interplay of mechanisms, in which different resources and multiple dependencies and loyalties come to work together. We have shown elsewhere how influence as a regulating mechanism is very common in decisions requiring highly specialized (mostly technical) expertise. A large number of decisions are based on trust: delegating power to people who have the expertise to solve a problem competently (Bratteteig and Wagner 2014).

In this paper we are particularly interested in the 'power to' of the different participants in a PD project: the agency and capacity to shape action, which partly depends on access to organizational resources, partly on 'power/knowledge' in the Foucauldian sense. Foucault (e.g. 1982) has argued that depersonalizing power is important if we want to understand the most effective forms of it. What makes power so effective are particular 'technologies' or regimes that construct knowledge, bodies and subjects. The term 'power/knowledge' refers to the power of defining issues, 'normalizing' them so that they can be recognized and resolved; translating them into a language that makes them amenable to particular interventions (at the expense of others).

Both, 'power over' and 'power to' come to play together in decision-making. They help explain what makes participation possible and what its limitations are. Some of the 'power to' in collaborative work is inscribed in the division of labor, as well as in other structural aspects, such as authority; control of scarce resources; use of organizational structures, rules, and regulations; or control of boundaries (Morgan 1986). Some 'power to' is ingrained in the 'logic' of a practice; some derives from expertise or power/knowledge.

4 Participation in what

Studying the dynamics of decision-making in design is important for understanding what users actually participate in. For this purpose we introduce a set of distinctions that are based on Schön's notion of 'design moves': between creating choices, selecting a choice, concretizing a choice, and 'seeing'/ evaluating the result of a choice (see also Bratteteig and Wagner 2014). While we find these distinctions useful, we need to stress that they should not be interpreted as stages in a design process, although they indicate a certain sequence. They stand for different sets of practices, depending on the kind of design work we are

looking at. For example, 'creating choices' may correspond to rather different practices in a PD project, from getting design ideas from an ethnographic study to involving participants in all kinds of creative-experimental exercises (Bratteteig et al. 2012); this also applies to the other types of activities we talk about.

How did we proceed? We chose the starting and end point of the timeline of each PD project, working our way back and forth. As it turned out, two of the projects (*Sisom* and *IPCity*) had started out with choices that proved to be 'big' decisions: decisions that strongly framed further choices. While some of these were about values and concepts: the visions (Bratteteig and Stolterman 1997), others were technological choices how to implement these visions. When reconstructing how some of these decisions had come about we had to extend the projects' timeline well before their official start, recognizing that they were based upon and inspired by previous work that in both cases dated back several years. Hence, our first round of analysis looked at the dynamics created by these 'big' decisions, trying to understand how they influenced the many other choices that came up in a project.

However, not all PD projects start out with a vision; the vision sometimes emerges slowly as part of many smaller choices. This is why we, in our second round of analysis, chose to look closer at the final design result, aiming to identify the choices that became part of it. In a PD project not all design ideas or choices that participants create will or can be pursued. Some of the ideas will never be represented and explored, for a variety of reasons: they may be discarded as too complicated to be implemented or as not fitting into the project vision, or they may not find the alliances that are necessary to 'push them through' (Bratteteig et al 2016). Here, questions of politics and power in a PD project come to the fore. Identifying choices that are visible in the design result allowed us to work our way back, looking into some of the smaller decisions that can be understood as happening in a series of design moves.

As mentioned above, we chose projects we know rather intimately, since we were involved in them, in different roles. The main reason for this is that the kind of analysis we undertook is not possible without a deep knowledge of the project and the many details of the design process – including the things that participants do not want to talk about. This is a limitation of our method, which we discuss later. The empirical material we have worked with is not ethnographic in that the projects we were involved with were not systematically recorded by any outside observer. We have performed a secondary analysis of written project accounts based on empirical material (some of it ethnographic). Our reconstruction of the decision-making processes is mainly based on documents from each of the projects: reports, memos of different kinds, and video material (in the case of the *Sisom* project). These documents were complemented by personal memories and, in the *Sisom* project, interviews with the project leader. In all four cases we have relied on an extensive project documentation.

4.1 The projects

In the *Florence* project (1983-87) designers, together with health care personnel, developed prototypes to support professional nursing practices. The prototypes were based on an extensive mutual learning period that included fieldwork enabling the designers to understand nursing practices, and training sessions enabling the nurses to understand technical possibilities. The *Nursing* system is a simple, flexible reporting system made for the presentation of patient information on screen and in print, giving overview as well as details. The prototype makes it simple to update and access patient information, and its reports are used as flexible work sheets for the nurses on duty (Bjerknes and Bratteteig 1988). The nurses continued to use the *Nursing* system and it later served as a requirement specification when the hospital invested in a new IT system for nurses.

The *Sisom* project (2005-06) aimed at developing a symptom registration system for ill children to be used before meeting with a medical doctor. The *Sisom System* was developed with health care professionals and healthy children representing the main stakeholder group: children with cancer. Two age-differentiated groups of children from a nearby school participated in a series of workshops aiming to design the interaction of the system in ways that children understand and like, following Alison Druin's method for participatory design with children (Druin, 2002). In parallel to designing the interface and interaction mechanisms the project team collected and evaluated symptoms reported in the medical literature. These evidence-based symptoms were checked with oncology experts and children. The system was first tested with the healthy children and only at a later stage with two children at the cancer ward. The *Sisom System* is still in use in the hospital (Ruland et al. 2008).

In the *Desarte* project (1999 - 2001) IT designers, together with architects and landscape architects, developed several prototypes in support of professional design practice. One of these design results, the 3D *Wunderkammer*, is based on fieldwork revealing the relevance of and need for inspirational objects throughout the design process. The 3D *Wunderkammer* is an inhabitable multi-media archive, collection support, and view generator. Users can place inspirational objects – images, sketches, 2D or 3D scans of samples and objects, sound, and video – in a metaphorical space of cities and landscapes. They can navigate in this space and explore it, search and collect material, and generate different modes of viewing it (Büscher et al. 1999). The participating architectural office used the 3D *Wunderkammer* for a little while but found it difficult to maintain due to lack of support. It inspired numerous publications but at some point became technically obsolete and too much work to revive.

The *IPCity* project (2006-10) aimed at designing a collaborative mixed reality application for supporting mixed teams of urban planners, politicians and citizens in using participatory technologies to create and manipulate design alternatives for real urban planning projects. Two groups of users were involved in this project:

urban planners, who participated in all stages of the project, and 'normal' citizens and other stakeholders, who contributed to testing the evolving prototype in the context of real urban planning projects (Wagner 2011). As using the rather complex prototype required not only technical support but came with an elaborate method of preparing both, the participants and content to work with, it was never used beyond project time.

Table 1 provides an overview of the four PD projects. As mentioned, all projects were preceded by research that had a big influence on the project vision. The *Florence* project was started as the first Norwegian PD project aimed at designing an alternative IT system together with nurses (Nygaard 1986), and was seen as the reference case in a Nordic research program on PD (Kaasbøll 1983). The history of the *Sisom* project started well before 2005, in the late 1990s, when the project leader Cornelia Ruland did her PhD. Her idea was to enable patients to give medical personnel more and better information about their symptoms, hence a more complete picture of their situation. Ruland engaged in developing a number of prototypes to concretize the idea: on a PC in 1999, on a Palm Pilot in 2000, on a tablet computer in 2001. *Desarte* was a two-stage European project. Some of the design ideas in *Desarte* had been explored as part of *Desarte* I (1996-97). Much of the understanding of architectural practice that *IPCity* is based on was shaped in an extensive period of fieldwork (1995-2005). It was also inspired by project *ATELIER*, which had ended with the notion of 'bringing mixed-reality technologies out of the studio' (Binder et al. 2011). The pre-history of these projects shows that some decisions were taken before the projects actually started. We discuss the role of project proposal writing later.

Project	Florence Project (1983-87)	Sisom Project (2005-06)	Desarte Project (1999-2001)	IPCity Project (2006-10)
Intended end-users	Nurses in hospital ward	Children with cancer Hospital staff	Architects and landscape architects	Urban planners, different stakeholders in an urban project
Project team	IT designers, anthropologists, nurses, medical doctors, nursing assistants (anthropologist and one nurse employed 100% by the project)	Project leader, child psychologist, systems developers, graphic designer, participatory designer, healthy children as substitutes for very ill children	Participatory designer, systems developers, (landscape) architects, graphic designer, 3D designer	Project leader, urban planners, designer team (IT specialists, product designer, visual artist, sound artist)
Design result	Work sheets with patient inform-	Mobile system for patient reporting of	Navigable 3D archive for	Collaborative urban mixed-

	ation overview	symptoms	inspirational material	reality application
Context	Real use in hospital; later requirements for new nursing system	Real use in hospital	Research	Research

Table 1. Overview of analyzed PD projects

4.2 Creating choices

A lot has been written about the role of fieldwork in PD as fostering the co-creation of representations of a field of practice in which practitioners can recognize themselves and their practices (e.g., Blomberg and Karasti, 2013). Some of the choices in PD emerge from these ethnographic accounts; learning about the practice is important in order to understand suggestions for choices and their rationale. Other choices open up while participants engage in imagining possible futures, deliberately changing the users' basis for needs and wishes through systematically looking for new possibilities. PD projects use techniques that help participants widen their choices rather than closing the problem/solution space too early, handling openness and multiplicity (e.g. Simonsen & Robertson 2012). In PD, as in design work in general, this enlarging of the space for design ideas and maintaining it open to the possibility of change is critical.

The *Florence* project aimed at help establishing the practice of PD. It was firmly rooted in the evolving Scandinavian tradition of PD. The original project vision that an IT system should strengthen nurses' position in conflict with other professional groups (e.g., medical doctors) was rejected by the nurses. They instead emphasized the need to collaborate with medical doctors. The *Nursing* system was grounded in an understanding of nursing practices developed through months of fieldwork in two different wards. The focus of the fieldwork was on understanding the logic of the nursing practices in the two wards, treating children with allergies and adults with heart problems, respectively. A special problem in the cardiology ward resulted from the fact that the patients were moved from 24/7 monitoring central where they stayed in the acute phase to a different part of the ward when it was time to learn to live with their illness (cf. the map in Fig. 1 right). Several problems were identified during the fieldwork, and were seen as possible problems to solve with the help of IT.

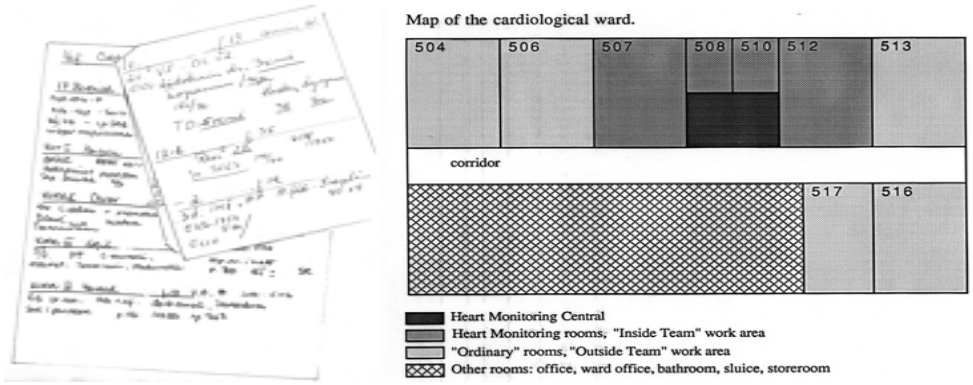

Figure 1. The nurses' notes about patients, and a map of the monitoring part of the ward

The nurses that participated in the project took part in a series of training sessions aimed at providing them with a basis for imagining and exploring how IT could support nursing. They got some hands-on experiences with new interfaces of that time through trying out a Macintosh that was left in the ward as an example of modern IT. Hence, both the nurses and the designers had opinions about what IT could be used for in the ward. The nurses identified the communication about patients between nurses in a shift and between shifts as the main bottleneck in the ward. They hoped for an easy updating and sharing of patient information while maintaining the flexibility of their existing paper-based practices (Figure 1 left). The training sessions, together with their professional knowledge, enabled the nurses to create numerous other choices, including inventory lists, procedure overviews, lab communication, etc.

The *Sisom* project proceeded very differently. The starting point was the existing *Choice* system; a mobile systems where adult patients could register their symptoms before seeing a doctor, and the idea was to make a 'children's Choice system'. A group of school children representing ill children actively contributed to the design of the user interface and interaction mechanisms, creating choices with their drawings. For example, in the very first workshop the children were asked to try out some games. After playing the games, they were told a story about a child who had stomach flu and had to stay in bed. The children were asked to design a tablet PC that could be used by this child to express symptoms and problems. The second session started with a new story about a child with an injury. The children continued to work on the drawings they had produced in the previous session, with the adults showing them interface and navigation examples. In this way the children became more aware of what was possible and wanted (Figure 2).

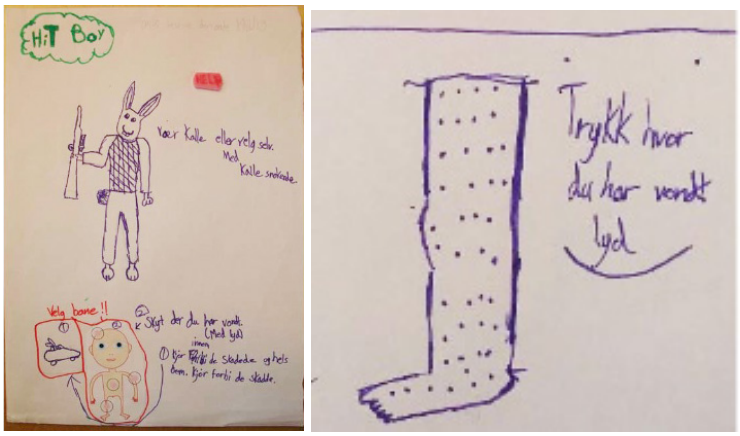

Figure 2. Game metaphors: 'shoot where it hurts' and non-game metaphors: 'click where it hurts'

The terminology for talking about symptoms was developed top-down from the medical literature about children with cancer rather than from listening to how the ill children themselves talk about their symptoms. It was a choice made by the project leader in compliance with the notion of evidence-based medicine. Arriving at a list of symptoms that reflects children's ways of talking was defined as a 'translation problem'. Hence, the children's choices were treated in accordance with predefined symptoms to consider. As concerns the use of the *Sisom* system, the project leader had decided in advance that it should be restricted to the hospital ward for children to prepare for a consultation with a doctor. Some emerging choices were not considered, e.g., aiming for a *Sisom* system that the children could take home for more continuous, long-term reporting of symptoms.

The initial idea for the 3D *Wunderkammer* grew out of many years of ethnographic fieldwork in the participating architectural office, which had, amongst other things, pointed at the importance of inspirational objects in design. The architects' stories about inspiration had shaped the notion of 'association objects' that assist the (landscape) architects in their effort to form, develop, and communicate design concepts (e.g. Wagner 2000). One of the participating architect-users took a leading role in creating choices, with a 'wish list' at the top of which was the idea of *Wunderkammer*. This notion was developed through several design sessions, with designers and users creating a vision of how this *Wunderkammer* might be filled with inspirational material, travelled, and explored with some of the material being selected and used in visualizing design ideas for an architectural project. These choices were also stimulated by extensive reading on historical forms of archiving and memory, on colonial traveling (e.g. Said 1985), as well as by looking through collections of inspirational objects that famous architects had published.

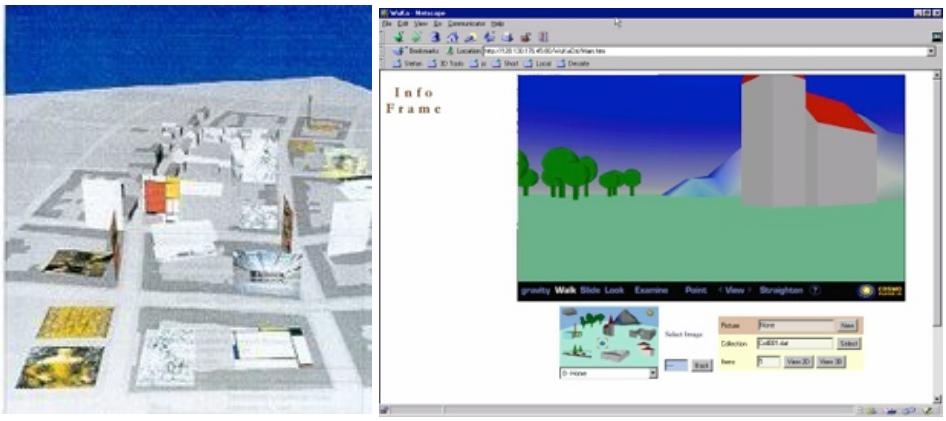

Figure 3. CAD drawing of the prototype as assembly of places on a grid; the first prototype

The architect-users than provided a first sketch, which inspired the interface of the very first prototype (Figure 3). The following design sessions furnished ideas of what kind of places the 3D *Wunderkammer* might contain and what modes of traveling through the places filled with inspirational material it should support. The architects also provided the notion of 'urban grid' (a technique used in urban planning) as the basis for a modular system. Hence creating choices in *Desarte* was a joint process of 'phantasying and projecting' much in the way Schütz has described, with design ideas being visualized to be further explored.

Also *IPCity* had architects as full partners. Unlike *Desarte* it started with a strong vision. The key commitment was to design participatory technologies for urban planning that could invite real stakeholders to the design table. Connected with this was the notion of 'openness', which in the context of an urban project has to do with giving space to the multiplicity of perspectives. Also the key technical choices had been taken before the project started: to build a tangible user interface that supports the ad-hoc, 'easy to handle' creation of urban mixed reality scenes. The urban planning team that participated in *IPCity* brought their knowledge of urban issues and how to represent these into the project. Through defining and visualizing these issues they opened up numerous choices that were materialized in successive versions of the *ColorTable*. Many of its features are directly inspired by what these expert-users thought important to address in an urban project: how to represent activities in an urban space, the ambience of a place, connections with other places, mobility, and building types (Figure 4). They also provided access to urban projects that were willing to offer a site for participatory workshops, in which the *ColorTable* was probed and tested. Their negotiations with the 'owners' of these projects – urban planners and local authorities – opened up further choices for the *ColorTable* by defining the range of possibilities, both in terms of participants and issues to be worked on.

Figure 4. Example of a choice turned functionality: visualizing flows of people in a) mixed-reality scene, b) on physical map

Users can have a rather different role in the process of creating choices: from defining the problems the choices are an answer to (*Florence, Desarte*, *IPCity*), to merely delivering ideas (*Sisom*). In the case of the *Sisom* project, the children's ideas were taken seriously but the context in which they were invited to create ideas was carefully designed and restricted. In some of the projects (*Florence*, *IPCity*) ethnographic work played a large role in generating choices. In all four projects choices also came from users' professional experiences and visions. In two of the projects (*Sisom, IPCity*) the process of creating choices was driven and partly also constrained by a strong vision that had been formulated before the actual project started.

4.3 Selecting among choices

While widening the design space and not closing it too early is crucial to creative design, some choices have to be selected and concretized in a design artifact, such as a mock-up or prototype.

In the *Florence* project, the selection of choices on which to build the *Nursing* system was arranged as a negotiation meeting between the designers and the nurses. In the early days of PD negotiation was considered an important aspect of democracy. As Björgvinsson et al. (2012) remind us:

> Hegemony within companies was at stake and constitutions or negotiation models to transform antagonistic struggles within the companies into passionate agonistic design and innovation strategies were tried out, with special focus on workers and their local trade unions, and on their empowerment and skills' (p.129).

Each of the two groups; the IT designers and the nurses, had met separately before the negotiation meeting making a prioritized list of choices. During the mutual learning period, several problems and some possible solutions had been discussed, but the choice was deliberately kept open for negotiation. The negotiation started by a presentation of the two lists of problems/solutions to address, and although the nurses' first priority (providing support for the shift report meeting) seemed technically unchallenging, the designers understood enough of the nursing practices to acknowledge the nurses' arguments (Bjerknes and Bratteteig 1988b). As the designers also had this suggestion on their own list,

agreeing on a common problem area was not difficult. The reason for this easy negotiation was the bad experiences from the first design cycle in the project, where the designers did not listen to the nurses' arguments: they decided to go for their own first priority, which was technically interesting and challenging, ignoring the nurses' arguments and warnings – actually not understanding their arguments until they were demonstrated in a faulty, hence rejected, prototype (Bjerknes and Bratteteig 1987). In the second round designers and nurses jointly arrived at the key design decision.

In the *Sisom* project all decisions were subordinated to the project vision, which the project leader had defined. Within this frame, two selection processes took place: the first selection included choices of what the children liked and thought were good design elements; the core team then decided which of the children's ideas were to be part of the final system. A graphical designer was hired to lend those ideas that the core project team thought interesting a professional touch; these visualizations were returned – beautiful and finished – to the children in the next workshop (Figure 5). In one way the children were 'seduced' into confirming certain choices by being presented professionally made design elements. While in the first session they had drawn the figures themselves, all the children used some of these graphically designed elements in their later design suggestions: they made the design suggestions look more professional. This was the case with the major navigation mechanism: the image of travelling to different islands where different kinds of symptoms are dealt with, which was originally suggested by one of the participating informatics students and then introduced to the children as one of the inspirational materials made by the artist. All the project members liked the idea of 'islands', because it would motivate children to behave like explorers, hopping from island to island, thereby covering the full range of possible symptoms. When everyone could see how the children picked up the idea, also the project leader accepted it. In fact, the adults in the project listened carefully to the children's way of talking about symptoms and considered all their visual ideas. However, the children were not included in the decision-making itself, which took place when the core team watched and discussed the video recordings of the workshops with the children.

Figure 5. Integration of professional-looking elements in children's drawings and prototyping

Much of the decision-making in the *Desarte* project happened in the numerous collaborative design sessions of the architect-users with the designer team. The first part of these design sessions served to elaborate the design concept. The functionalities that were decided on were quite literal translations of the architects' stories about how they would like to use the 3D *Wunderkammer*. In the design sessions that followed, the user interface that had been visualized in a set of first sketches was further developed. Hence, selecting among choices happened as part of what Schön describes as 'design moves'. The IT specialists in the project worked partially in parallel, exploring different technical options and taking decisions on the technical paths to follow. They brought these decisions back into the team of architect-users, project leader, graphic designer, and 3D design specialist to inform the design choices these fleshed out together.

A consequence of this continuous collaboration was that those designers that worked with the landscape architects decided to develop 'their own' 2D *Wunderkammer*, a 'visual and textual indexing landscape' (Büscher et al. 2000). This conflict in and split of the project team illustrates the problems geographical distance may pose in a design project, in which some of the decisive design moves are made without all participants having the possibility to be present.

IPCity was driven by a strong vision, which shaped the selection of choices. The team had lots of space in how to implement the vision, making it concrete. However, the cornerstone of the vision – to provide 'normal' citizens with a tool and language for participating in urban projects - was not open to negotiation. Several key decisions in this project were taken as a result of the first participatory workshop with a rather simple first prototype:

> to work with multiple representations of the site, including photographic panoramas for being projected on the wall; to allow for rotating and zooming the table as well as the wall panorama; to include dynamic, changeable content; and to dedicate effort on how to design the 'tangibles'. In retrospect we can say that the following eight participatory workshops mainly served to implement these decisions and to improve the design (but new functionalities were conceived, evaluated and redesigned). But the overall concept of the *MR-Tent* was maintained throughout the project. (Bratteteig and Wagner 2012, p. 43)

Within this framework, many design choices were largely uncontroversial, like those proposed by the urban specialist-users: they made choices how to represent an urban site and through this defined most of the functionalities of the

ColorTable. Other choices required negotiating and convincing: for example, the decision not only to include 'normal' citizens in debating and visualizing the future of an urban site (which met some skepticism at the beginning) but also to dedicate time to preparing user-participants in the urban workshop for their task. Hence, this decision, which was imposed at the beginning, created conflict in the project. Also highly controversial were the choices of visual content for these urban workshops, with different visual cultures clashing. The technical decisions of how to implement the vision were taken by the designer team and the possibilities for non-engineers to participate in these decisions were rather limited. Some of these decisions, such as using color tracking, were much debated and put into question time and again, when it became clear that the sensitivity to changing light conditions turned out to be a problem that was difficult to master.

The four projects highlight quite different ways of taking decisions about which path to follow in a PD project: from classical negotiation between equal partners, to 'coaxing' participants into particular choices, to more implicit forms of decision-making as part of ongoing design moves. We also see that diverging perspectives between participants were handled in different and not necessarily inclusive ways.

4.4 Concretizing choices

A particularity of designing IT artifacts is that design moves materialize choices in an evolving set of prototypical realizations of a design concept or idea that can be demonstrated – or even tested – in more or less real situations of use. While users may contribute substantially to opening up choices for design through various techniques of collaboratively imagining potential futures, the (technical) implementation of design ideas may be much more difficult for users to contribute to. While users may not be able to engage in the technical development itself, PD encourages forms of expression and concretization that are easier to master, such as building mock-ups and enacting scenarios of use. The projects illustrate different levels of participation in this process.

After the *Nursing* prototype had been discussed in the negotiation meeting, the nurses came up with a sketch of how they imagined the screen. This sketch served as a specification of the prototype, and the designer team quickly made a text-based prototype to check with the nurses (Figure 6). Then they went on to program the prototype to make it possible to use with real patient data. The programming turned out to be very difficult. The nurses had based their specification on the Macintosh computers that they had worked with during the mutual learning period. However, the computer available to the project did not have an object-oriented interface (this was in the 1980s): it did not support graphical representation or drag-and-drop interaction. The programming therefore took longer than expected, but turned out successful in the end.

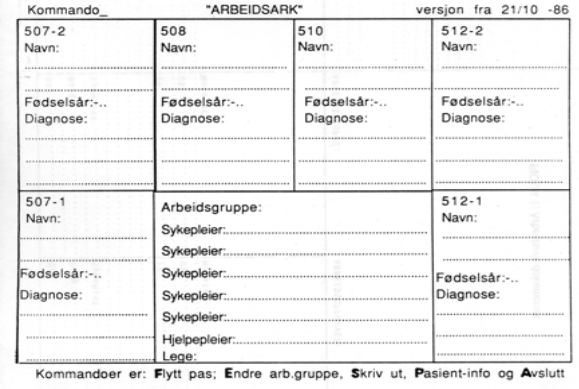

Figure 6. The text-based prototype

The children in the *Sisom* project engaged in concretizing the design choices that had been taken by the core project team in various ways. One of the workshops was a card sorting session aimed at finding out how the children categorized the symptoms to be used in the system. The cards contained words that had been checked with doctors and parents, assuring that symptoms were expressed in a simple, understandable, non-medical lay language that children could understand. A second round focused on matching symptoms to problems and explaining why for example a hurting stomach can be a symptom connected to rather different situations (e.g., nausea, disgusting medicine, being afraid, problems at school).

Physical problem	Cry a lot (own suggestion)	Tired	Sleep during the day
	Bleed nose-blood		Easily tired
	Broken leg		Don't manage anything
	Wounds on the skin		Cannot read
Head pain	Head ache	Emotions	Afraid
	Dizzy		Nightmares
Vomiting	Pain in the belly		Embarrassed
	Vomit		Angry
	Nausea		Miss family and friends
	Phlegm in my mouth		Feel sorry
	Things smell bad/ unpleasant		Cry a lot
	Nose feels tight		Irritated
	Cough	Medication problems	Can't take my medicine
	Warm or sweat		Don't want to play with others
Mouth problems	Dry in the mouth		Shivering hands
	Pain in the mouth		Difficult to walk
	Don't manage to eat	Medication problems	Can't take my medicine
			Disgusting to take medicine

Figure 7. Making a list of symptoms and categories for navigation in the system

The children's 'translation' of medical terms into a list of symptoms, which mixed physical and emotional symptoms in ways common to children, was used as a basis for designing the main navigation structure (Figure 7). Hence, the children's ways of talking about symptoms was directly translated into elements of the prototype. Their drawings were used as inspirational material, with the graphic artist and a flash designer developing them into a professional looking interface. The logic of the users was crucial for successful use of the design result in both the *Florence* and the *Sisom* projects, hence making this the basis for the interface design was considered important.

Desarte had architects as user-partners, whose professional background enabled them to contribute directly to the design of the visual interface of the prototype:

> In a series of joint design sessions with the architect, graphic designer, 3-D designer, and computer graphics specialist, we talked through the design of these worlds, developing ideas about their content, describing atmosphere and details. The architect produced sketches of each world. The 3-D designer took the documentation of this unfolding conversation, together with the associated visual materials, as a script for his design work (Wagner and Lainer 2003, p. 15).

At the core of these design sessions was the joint analysis of a large variety of examples of artwork, with the architect-users and the graphic designer bringing beautiful visualizations and the programmers asking them to simplify and omit detail (most of the designs were too complex to be technically implemented or would have slowed down the performance of the prototype) (Figure 8).

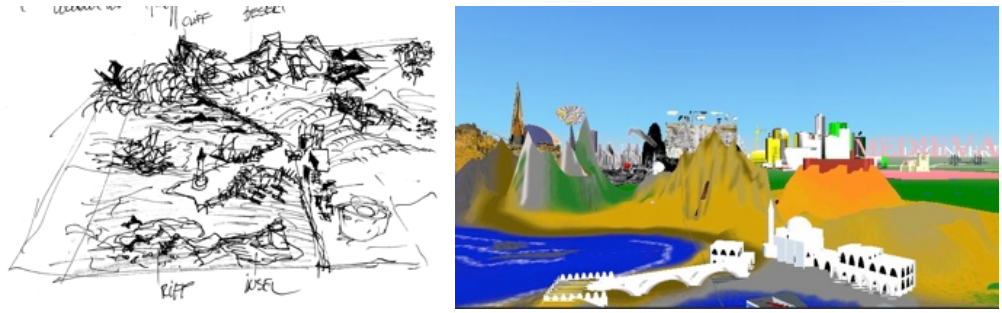

Figure 8. Designing 'ocean/desert': the architect's sketch; the 3D version using selected visual material

In *IPCity* most of the concretizing was in the hands of the designer team: they developed the tangible user interface and tracking mechanism. A core observation is that when the urban planners made suggestions they addressed problems on the 'right' level for the IT experts to respond to. They expressed their expertise verbally but also visually, e.g., producing visual examples of 'urban concepts', arguing with the help of maps and other representations of a site. This facilitated integration of their knowledge into the evolving prototype. For example, the photographic panoramas against which the visual scenes could be viewed were developed collaboratively, with the architects providing depth-maps and co-editing the panoramas together with the visual artist. *Desarte* and *IPCity* both were projects that depended on and made space for the highly specialized visual skills of their users and their deep conceptual understanding of the issues at stake.

Figure 9. Architect-user integrating his mobile phone as a possible design move; the mixed-reality

Observations made at the urban workshop that was carried out in Oslo point at additional possibilities of users to contribute. One of the participants, an architect himself, carried out a design move, suggesting a choice and concretizing it spontaneously. The participants had worked on a mixed reality scenario with the aim to making a metro station more hospitable for people waiting for the next train. They placed a small stage with musicians close to the station and the architect-user started looking for a sound in the available library, not finding any he liked. He immediately searched for sound on his mobile phone and placed it on the table associating it with the scene – a feature that was easy to implement (Figure 9).

Involving users in how choices are technically implemented seems to be the most difficult part in a PD project. We have seen that users can contribute in their own language of sketches and drawings, as well as with their own experience with computational artifacts. But participation can also be limited to having users select surface features in an already decided-on design.

4.5 Seeing/evaluating the results of a choice

Typical of the practice of PD is the involvement of users in the 'seeing part' of design moves, when choices are tested 'in use' and eventually questioned. This 'seeing' part may be organized in rather different ways: from brief episodes in a rather tight collaboration to more formal and carefully prepared evaluation workshops or field trials. Some types of 'seeing' involve mostly the designers themselves, when they are testing a technical solution or come to understand why the users proposed a particular choice.

The *Nursing* system that was developed as part of the *Florence* project was a suggestion made by the nurses. The designers aimed at realizing the nurses' sketch even though the technical conditions made this difficult. It is hence the designers' 'seeing', which makes this case unique: while the computer vendor's technical staff suggested to tell the users that 'this is not technically feasible'. However, the designers, recognizing the nurses' logic in the sketch, found it technically challenging and gave it a try.

The *Sisom* system was not really evaluated by its target group: children with cancer, until it was almost finished. However, some of the prototypes were tested

by the school children placed in a bed, resulting in a more realistic evaluation of the prototype, e.g., how heavy, big, or 'serious' it appeared.

Due to the intense involvement of the architect-users, evaluation of the 3D *Wunderkammer* was an iterative process, in which the designers and the users collaboratively probed the different versions, discussing what they were 'seeing', bringing in choices for redesign. Here the 'seeing' part was integrated with the development. Metaphorically speaking, the 'lab' in which the prototype was developed was not far from the context of use.

'Seeing'/evaluating was a major endeavor in *IPCity*. The evolving prototype was tested in eight participatory workshops, each of which required extensive preparation, with numerous decisions to take: which site to select; which issues to prepare for discussion; how to organize the transport of the prototype (not only the *ColorTable* but the *Mixed-Reality Tent* housing it); which workshop participants to select. Urban specialists, representatives of different interest groups (the local administration, business people, etc.) but also 'normal' citizens that would be stakeholders in the particular project, tested the prototype in the context of real urban projects – and by doing so actively participated in the 'seeing' part after a series of design moves: they tried hard to perform well allowing designers to learn how to improve the interaction design; they selected (and ignored) content to work with; they were active in the handling of some of the shortcomings of the representations of the site; they met the instability of the prototype, in particular the tracking mechanism. Not only this: they also challenged a premise that was close to the heart of the urban specialists: the need for precision in representing objects in an urban environment at the right scale. Most of the workshop participants, in particular the 'normal' citizens, did not see the need for precision at the stage of vision building. Their 'seeing' clashed with the 'seeing' of professional architects. The choice of the non-expert users strengthened the designers' decision not to prioritize 'precision'.

Other aspects of 'seeing' in IPCity happened before each participatory workshop. An example is the tracking mechanism whose algorithm was improved in each cycle of design-evaluation-redesign. Testing the new algorithm involved three steps: first, the engineers tested the 'machinery', probing if its execution had the desired results. They then tested the tracking in the lab space. This required controlling for the lighting conditions, which should be as close as possible to those in the upcoming workshop, and calibrating the colors of the tokens. Finally, tracking was tested in use with workshop participants moving the tokens on the *ColorTable* when building urban scenes.

A developer from another university, who was responsible for programming the tracking mechanism, was present in all urban workshops, taking notes and assessing the problematic situations together with the designer team. In the end she found out that she only fully understood the requirements when she finally used the tool herself, which was in one of the last workshops. No one had been

aware of the fact that she simply had been too shy to ask. 'Seeing' may have to involve 'doing' in order to be effective.

'Seeing'/evaluating in a PD project is a rather complex process that involves and eventually aligns different types of 'seeing': the designers who arrive at a better understanding of use, hence also the qualities of the technical solution; the users who through 'doing' (and eventually commenting) give rise to new design moves. These types of 'seeing' may be tightly integrated into the design moves in a project or they may require long and careful preparation.

4.6 Importance of the participatory result

Evaluating how participatory a design project is also requires looking at the design result, a point that has been made by several researchers. Balka points to the importance of increasing the focus on the outcomes of PD projects, asking 'can we have good participatory processes that do not show evidence of more democratic ideals in the resulting artefacts?' (Balka 2010, p. 79). We think of a participatory design result as one that increases the 'power to' of users. When assessing how successful a PD project was the quality of the end result stands out as of particular importance. In PD it is assumed that there is a relationship between the depth of participation and how many of the users' contributions are visible in the design result: 'The success of the outcome is fundamentally linked to the different voices who have been able to contribute to its design' (Robertson and Wagner 2012, p. 65). We will come back to this question later (see section 6). First, we have a look at what kinds of participatory results the four projects produced and how users contributed to them.

The *Nursing* system was implemented and used by the nurses and other health care groups in the ward for almost a year after the project ended (until the machine broke down). The designers were happy about being able to implement a robust system that behaved like an object-oriented system, while the nurses were happy for the support that the system and its reports gave them. Moreover, the nurses were able to 'see' their voice in the prototype as an implementation of their sketch. The few nursing assistants that refused to use the system, made drawings of the printed reports by hand, hence used the system's logic in their work. Also the medical doctors appreciated the overview given by the system, acknowledging the nurses' logic and structuring of the work in the ward, which possibly increased the nurses' influence in the ward. The *Nursing* system was later used as a requirement specification when the hospital invested in a new IT system for nurses.

The design result of the *Sisom* project was (and continues to be) participatory in a variety of ways. It presents a child's logic of talking about experienced symptoms. It gives children a voice they would not have without the tool in consultations with a doctor, using a language that is close to their own. This increases their influence on what is taken into consideration when the doctor

makes choices about further treatment while supporting the doctor's need for evidence-based medicine. Moreover, the children have their opinion recorded and documented in the hospital system along with other documents. A child could not have imagined a tool such as the *Sisom* system. Adults were needed to conceptualize the tool and take care of all its features. Still, its participatory features would not have been possible without the children's participation: it was their vocabulary that was used for navigation and symptom registration, and it was their suggestions for metaphors and images for symptoms and categories. The game-like design included many different elements that first appeared in the children's drawings.

The 3D *Wunderkammer* is a mirror of the architects' choices and ways of working. They can 'see' their voice in all of its features and in the user interface to the design of which they have directly contributed. As a collaboratively used visual archive the 3D *Wunderkammer* supports the architects' practices of collecting, archiving and searching for inspirational material and using it for communicating the design concept. However, requiring a lot of maintenance work, it remained marginal to their work, its value being mainly aesthetic: a 3D space with beautifully designed 'worlds' to explore.

IPCity had two user groups: the urban planners in the design team and the participants in the different workshops that were organized in the context of real urban projects. The urban planners' voice was crucial for the design result, as they taught the designer team how to represent an urban site and how to define the key urban issues at stake, translating them into features of the prototype. They also were to some extent open to breaking with the representational tradition of architecture. The final prototype clearly reflects the urban planners' perspective on how to represent an urban project. They recognized it as a tool that they would like to use in the future. From the perspective of the workshop participants the main design result was the experience of being able to contribute to an urban project on equal footing with the experts, with arguments and choices that changed the view of the participating urban planners (Wagner et al. 2009). A key participatory feature was 'immediacy' – the possibility of doing and seeing the results of your actions. Participants did not have to wait for an expert to provide a drawing and an interpretation. The tool supported an inclusive mode of debating and co-constructing, which does not favor the expert. It left space for everybody.

Our analysis of decision-making in the four PD projects illustrates different ways of organizing participation. Table 2 provides an overview, summarizing the most important observations. We will refer back to this overview when discussing how to possibly assess the depth of participation in a project.

Project	*Florence*	*Sisom*	*Desarte*	*IPCity*
Create choices	Nurses contributed	Children created main ideas for	Architects co-created design	Urban planners defined how to

	numerous choices; learned about technical choices	user interface and navigation; informatics student contributed idea of 'islands'; project team contributed list of symptoms to be 'translated'	concept, metaphors, ideas for places, modes of exploration; designer team created technical platform	represent an urban space/issues to be translated into functionalities; designer team created technical choices; project leader defined vision
Select among choices	Organized in a participatory way as a negotiation meeting	Project team took all decisions selecting choices in the absence of the children	Architects participated in most decisions as part of joint design moves	Vision framed decision-making; urban planners were included in all key decisions except the technical ones
Concretize choices	Nurses' sketches were directly translated into user interface	Navigation mechanism was based on the children's translation of the list of symptoms; their drawings were used as source of inspiration	The architects' sketches and visual material directly influenced the design of the user interface	The urban planners defined functionalities and gave input to some technical features; a workshop participant contributed a design move
'Seeing'/ evaluating choices	Important was the designers' 'seeing' the relevance of the nurses' choice	The children's 'seeing' confirmed the game metaphor (and island idea)	The architects' 'seeing' was tightly integrated with the technical development	The workshop participants' 'seeing' contributed to the decision, which choices to develop further

Table 2. Participation in what?

5 The Sharing of power in PD

While the first part of our analysis has been largely descriptive, the second step aims to be more explanatory asking: what shapes the possibilities for participation in a PD project? Our interest in understanding power issues in design has led us beyond questions of the institutional context in which the four projects were embedded to ways of talking about the power and influence exercised by different stakeholders. Here we also look more closely into the 'decision linkages' in the projects, which influence the dynamics of decision-making, with some choices having more weight than others.

5.1 The influence of context

'Each power relationship is shaped by a whole series of "structural" constraints that condition the rules of the game, and it therefore expresses, at a secondary

level, the logic of the institutions or structures' (Crozier 1973, p. 214). Also the participatory context of a project may be bounded by structural elements that limit the possibilities for joint decision-making by, for example, restricting access to resources or commending particular ways of working.

A PD project is embedded in a context that offers both, constraints and opportunities for what and how to design. It may have to operate in a highly structured environment that imposes particular 'rules' and surely it has to define its own ways of operating. A project usually starts with a project proposal. Vines et al. (2013) observe: 'Those who write research proposals (such as faculty members) or stakeholders and funding organizations that write the call for proposals and policy documents to which they respond heavily influence this process' (p. 433). Project deadlines, budget restrictions but also the need to develop a product that fits an existing IT infrastructure may limit the possibilities to widen the design space and maintain it open. Established power relations may make it difficult to design for change, as Bødker and Zander (2015) argue reflecting on a project to support stronger citizen involvement in the design and provision of municipal services. PD projects may be confronted with larger political and organizational issues that are difficult to influence, such as for example in health care where the drive towards 'new public management', often requiring a strong focus on standardization and cost containment, may have a profound impact on the design space (see e.g. Reidl et al. 2004). On the other hand, researchers may have a variety of possibilities to increase the design space even in environments that are not open to participation and change (Dittrich et al. 2014).

Let us look into the context, in which the four projects were embedded. All four projects started out as 'technology projects'. The decision that computers are part of the solution had already been taken when writing the proposal; it was never open to debate. The *Sisom* project aimed at developing a system to be used in a hospital: it had to prove its value not only to its immediate users, nurses and children, but to medical staff and the hospital administration. The choice of an evidence-based approach to categorizing symptoms ensured the support of medical staff. Moreover, the *Sisom* system built on a successful previous system for adults, with the aim of making it attractive and easy to use for ill children. This strongly framed the possible contributions by the participating children. Features of the design that could not be incorporated in the product idea were not considered useful, hence discarded. Although the *Florence* project's ambition was to support nurses in their everyday work, it was also a research project. Bjerknes and Bratteteig (1988a) describe how the expectations concerning the computer system to be developed were higher in the research community than in the hospital:

> Our experience is that, in the scientific community, technical challenges mean making computer systems that may be characterised as 'epaulets': they have technical, fancy features, but are not particularly useful. Making small, simple, but useful computer systems, more like

'utensils', does not give as much credit even if the development process may be just as challenging' (p. 258).

We can see here how the fact that participatory designers are evaluated by their own research communities may influence how a project is set up (see also Pedersen 2007). *Desarte* and *IPCity* were defined as creative-explorative research projects; hence the designers and the participating users had much more freedom in creating and selecting choices. However, there were other kinds of dependencies to take into consideration: the work of several geographically distributed partners had to be coordinated and their different research interests accounted for; the allocation of resources to particular design tasks had to be negotiated within the project consortium and defended in negotiations with the funding agency. For example, in *Desarte* conflicting perspectives on what to develop resulted in a split of the project team along geographical lines that may have been avoided if the project partners had had the possibility for more continuous collaboration. Both projects had to justify their design moves to external reviewers. *IPCity* not only started with a strong vision but with a conceptual framework that had been imposed by the call for proposals. Moreover, the vision to develop a participatory tool for urban planning included some ideas about which technological paths to take. That means that the highly specialized research interests of the participating computer scientists framed parts of the context.

The skill composition of the designer team, which had been in the power of the project leader to determine, had a large influence on how the design space was framed. For example in *IPCity*, hiring a product designer, a visual artist and a musician in addition to two computer scientists meant that their skills and visions were valued and this strengthened the artistic and the design aspects of the project. The project leader of the *Sisom* project looked for designer skills that were not present in her organization's IT group, among them a flash developer and a graphic designer. The psychologist she selected corresponded with what she thought the project was about: understanding children's vocabulary. The full time anthropologist in the *Florence* project strengthened the focus on nursing practices as a basis for design.

'Power as practice' is shaped and constrained by institutionalized aspects of power, some of which are not so easily amenable to negotiation. They reflect the world of funding agencies and hosting organizations (see also Martin et al. 2009). In previous work we have distinguished between different arenas of participation not all of which are open to negotiation and change (Gärtner and Wagner 1996; Bjerknes and Bratteteig 1995; Balka et al. 2008). Other aspects of the context in which a PD project is embedded are under the control of powerful actors, such as a project leader. Choice of funding scheme, use context, project partners, the knowledge composition of the design team, and the stakeholders to be included are part of a setting up a PD project, in which the project leader often has a large say.

5.2 How much sharing of power?

Dealing with conflict was on the agenda of PD since the early days. Björgvinsson et al. (2012) argue that today, with PD moving from the workplace to the public sphere controversial matters are endemic to any participatory project. They refer to forms of debate and confrontation between stakeholders that allow for 'constructive controversies between 'adversaries' […] These activities are full of passion, imagination and engagement' (p. 109). When controversy is supposed to result in a common design result, there is the need to share power in PD. Hannah Arendt (1970) has expressed this in the notion of 'power with', which she 'defined to mean only the power of the people united, moving to achieve common ends' (Mansbridge 1994, p. 57). How much was power shared in the four PD projects? Whose power?

User-designer relations are key to PD. In complex settings, such as for example an urban project or a health care organization, stakeholders with different interests and professional backgrounds will have to align their perspectives. Martin et al. (2009) describe user-designer relations as involving 'a more complex criss-crossing of relationships where tensions flare within and across groups' (p. 146). They provide several examples of how project participants needed to engage in '"emotional labour", while minimising the risk of disputes and ensuring that problems get dealt with according to the correct procedure' (ibid).

The sharing of power between different stakeholders was not a particular issue in the four projects we discuss in this paper. *Florence* and *Desarte* collaborated with a rather homogeneous group of users – nurses resp. architects. In *Sisom* the project vision included the medical perspective and cultivated the interest of physicians and nurses to have the children's' voice heard. Only in *IPCity* conflicts came to the fore, in particular when the prototype travelled to real urban projects. In several cases the local authorities insisted on controlling the selection of participants in a workshop, trying to exclude potentially critical voices.

A PD project needs designers that are respectful of the knowledge of users. This was the case in the *Florence* project were the designers agreed to develop what nurses thought to be most useful for their daily work, implementing their sketch of a user interface. The architects' and urban experts' power/knowledge dominated in the design result of *Desarte* and *IPCity*. Both prototypes built on their ideas. Their 'power to' was strengthened by their ability to 'speak' in different languages: in stories, in visual material, in technical terms, in contributing to the making of a prototype.

In *IPCity*, some of the choices that were part of the vision created conflict. While the urban team had on principle subscribed to the idea of participatory urban planning, their interpretation of the scope and depth of such participation was in conflict with the project vision, until the value of citizen participation was successfully demonstrated. Another example of a conflict between the perspectives of the design team and the urban team is the choice of tangible user

interface and color tracking. Although allowing for new forms of citizen participation, this solution did not meet the user-experts' need for precision. In this case the intended end-users, represented by a mix of stakeholders in an urban project, backed up this key design decision.

The situation in *Sisom* was particularly complicated, as the intended users were children. The project leader had decided to protect the most vulnerable stakeholders: the severely ill children. This also excluded their views and experiences from the design solution. She had based her approach on the work of Alison Druin (2002) with children as informants and also partners in the design. However, she limited the children's influence by assuming that children cannot possibly have sufficient insight and may focus on aspects that are fun but peripheral from a professional perspective. Hence, their design moves were carefully constrained by a set of predefined criteria that were to ensure the goals of the project, and this was made explicit:

> Good design for ill children requires knowledge, and pedagogical, psychological and clinical insights children don't have. In our work we had to make sure to meet the goals of SISOM and a set of pre-defined criteria. Especially, we had to ensure to design software that could help children to report their symptoms and problem experiences, without being too time-consuming and challenging. Not all of the children's ideas were therefore, feasible'. (Ruland et al. 2008, p. 634)

The adults' monitoring of the design workshops and the ways the children's design moves were evaluated created a school-like situation, with the corresponding roles and power distribution. The adults had the role of 'actors who know best', acting in the interest of the children. Morrow and Richards contend that 'the biggest ethical challenge for researchers working with children is the disparities in power and status between adults and children' (1996, p. 98). Thomas and O'Kane (1998) demonstrate how it is possible to be open to children's agenda, have them voice their own concerns or questions, use participatory research techniques to give them control over the process, and also have them participate in the interpretation and analysis of research data. *Sisom* did not exploit all of these possibilities of sharing power with the participating children.

The *Sisom* project is also an example of power in the Foucault sense of 'normalizing' practices. Doing things in the right way was defined from the beginning as complying with medical evidence, as in the list of symptoms that the children were invited to translate. *Sisom* involved listening to how children talk about how they feel but with a standardized catalogue of symptoms in the background. In *IPCity* the possibility of 'manipulating' participants' perception of a site, which can be powerful, is another example of Foucault's 'normalizing'. Both, the designer and the urban team had the 'power to' select the representations of an urban site the workshop participants worked with, choosing and editing panoramic views of the site, and providing content.

‘Locking’ choices in an artifact, by making them in some sense material can be considered an act of power. Analysis of decision-making in *IPCity* revealed several instances illustrating that

> after a choice has been made, power comes to reside in the person who implements a decision, making it material. By being ‘chosen’ the artifact constrains in the sense of ruling out some previous alternative choices. An example is the power of editing the visual content that was shared by the visual artist and the urban planners but in the end the artist, as the person who performed the editing, took the decisions on what would become visible and how. In a similar way her editing of the panoramas that she produced according to the architects’ instructions became ‘critical’ as it shaped how participants would actually see the site. (Bratteteig and Wagner 2014, p. 83).

The four projects also give some additional insight into the ‘power of making’, which rests on ‘designerly skills’: the ability to develop a prototypal realization of some choices that has technical ‘functionalities’ to work with. In his studies of engineering work Bucciarelli has coined the term ‘object worlds’, which are ‘worlds of technical specializations, with their own dialects, systems of symbols, metaphors and models, instruments and craft sensitivities’ (1988, p. 162). Technical expertise is a particularly strong form of power/knowledge as it is difficult to share with non-technical users. However, looking at decision-making in the four projects allows for a more nuanced analysis of the ‘power of making’. We have identified several factors that may strengthen (but also constrain) it: the irreversibility of some choices when they have been made material; complexity resulting from the interdependencies of decisions (a point we will examine in 5.3); the vulnerability of some technical choices; the multidisciplinarity of a project team and the designer’s dependence on users’ ‘seeing’.

Some design moves cannot be reversed or only at a great cost, once they have been concretized in a prototype. In *IPCity* the choice of color tracking offered the possibility to freely position tokens on a map of an urban site, which the project team thought essential. The project’s strong focus on materials and haptic engagement had blurred the visibility of other solutions, such as moving from a constellation of physical table and color tracking to a multi-touch version of the prototype. Once these choices had been made, too many steps would have been required to ‘undo’ them, starting from scratch with another solution.

The ‘power of making’ can also be enormously vulnerable: things may not work and a solution may not be ready at hand. In *IPCity* the incompleteness of the early prototypes and the vulnerability of some technical solutions (e.g. the tracking mechanism, the difficulties of placing objects in a photographic panorama) created conflicts with the urban team, and also tested the patience of the participants in the early workshops (Maquil 2010). The *Florence* project can be seen as almost a counter-example of the power of designers, with the nurses’ solution challenging the limits of the machinery not suited for implementing this particular solution creating a hard technical programming challenge to realize the solution anyway.

Considering real use, preparing for it and observing may be indispensable for design work to proceed. *IPCity* would never have reached the participatory results it aimed at without these experiences. The designer team needed the support of additional 'observers': ethnographers, architects, for interpreting the observations and coming to the 'right decisions' for redesign. Finken (2005) argues that it is in the power of designers to interpret what users voice as their needs and preferences and translate these into a design result, using their power/knowledge. This is true to some extent: the technical choices that are based on 'seeing' a prototype in use are taken by the designers who evaluate their options. However, also users enact their 'power to', not necessarily through their opinionating and arguing, but through material ways of using a design or refusing to use it in the way that had been envisioned. Resisting or complying in use may carry more weight than words, as the examples of *Florence* and *IPCity* demonstrate (see e.g., Bjerknes and Bratteteig 1987). Even in *Sisom* the testing, although carried out in a simulated setting with healthy children, settled some important choices.

The sharing of power in a PD project is a highly complex, multi-facetted issue. There are numerous 'forces' at work: the expert knowledge of some participants, which may not be easy to share, but also the potential vulnerability of this knowledge in case it does not result in a successful design or is not acknowledged by the users. Still, the ability to materialize choices, 'locking' them in an IT artifact, is a strong act of power. Users' main 'power to' in a PD project is in their creating choices that would not have been possible without their contribution; and in their 'seeing' and evaluating, using or refusing to use a design in a particular way. We can also see that 'power to' and 'power over' may be interrelated, as most evidently in the *Sisom* project where all decisions were taken without the children's participation. Going back to the distinction between power and influence made by Zündorf (1996) may be helpful here. While 'power represents an intervention in the action space of others' (p. 38), influence requires listening to the voices of the other participants so as to be able to convince them and to get them on board. In some of the situations we described power as well as influence were involved.

5.3 Choices influence each other

In design (as in other types of work) many of the choices that are created and selected to take a step further, concretizing them, are inextricably intertwined with other choices. CSCW research is based on a conception of cooperative work as 'observable relations of interdependence that are formed in response to practical exigencies but which then in turn require the development of a family of equally observable coordinative practices' (Schmidt 2011, p. viii). When looking at decision-making in design it is also important to account for interdependencies that result from the fact that decisions are intertwined and affect each other, and how some decisions spur others. Interdependencies between decisions can reveal

how some decisions frame the whole design process – and other decisions – and therefore have much larger effects than what may be visible at first sight.

We go back to the proposition to look at decision-making as 'a complex network of issues involving a whole host of linkages, more or less tightly coupled' (Langley 1995, p. 275). Identifying these linkages in a design project is not only interesting, as it helps understand how the web of interdependencies evolves. In the context of an analysis of power relations it foregrounds a 'logic' that mediates these relationships. So we move from who has had a say in the design decisions we described to the interdependencies their choices created; and we come to the conclusion that participation in some design decisions is more important than in others.

Langley et al. (1995) provide a language for talking about how decisions (or issues as they prefer to say) are linked, having developed a typology of linkages. All the four projects illustrate linkages that are *sequential* (linked over time) or *precursive* (framing later decisions). For the sake of our argument in this paper we just give a few examples that illustrate our point.

Sequential linkages characterize decisions where one decision leads to a series of others, either smaller ones ('nesting') or larger ones ('snowballing') or simply the same decision recurring, when a problem is difficult to resolve. These types of linkages are characteristic of the sequences of 'moves' that are directed towards a design result. Sequential linkages are the most frequent ones in a design project. For example, in *IPCity* the original decision to build a haptic interface was followed by numerous smaller decisions concerning the design of the tokens and the interaction mechanism. Many of these sequential linkages are not strong in the sense that they do not necessarily narrow the design space: the decisions that 'follow' create their own dynamic, opening up new choices and interdependencies, such as (in the case of *IPCity*) deciding the size and material of tokens or the kind of visual feedback (as part of the interaction design). Langley et al. call this type of linkage 'nesting': big decisions generate a nested series of smaller ones. Also the choice of photographic panoramas as representations of an urban site illustrates how some technical choices may have unforeseen implications that enforce a series of additional steps. It turned out necessary to model the panoramas so as to support placing objects correctly with attention to height and volume and to handle occlusion properly: decisions that created an enormous amount of unanticipated work when preparing the *ColorTable* for testing in the context of a real urban project (Maquil 2010).

'Snowballing' captures the fact that a couple of smaller decisions 'snowball' into a major one. An example from the *Sisom* project is when the children tried out the prototypes while in bed, saying that the game prototype did not look 'serious enough'. Nonetheless the decision was to keep the game-like presentation, while a 'dinosaur' version of the system, which was also tested by the children was dismissed. This was a major design decision that built on a series

of small decisions about which kinds of game-like features to keep in the design: while the possibility to create your own figure (avatar) to explore the islands was included, the children's racing and shooting suggestions were excluded.

A decision on one issue can critically affect the premises for subsequent decisions on a variety of other issues, and in different ways: linkages may be enabling, evoking, preempting, cascading, merging, or due to learning (*precursive* linkages). The decision in the *Sisom* project to have islands as the main navigation mechanism turned out to be 'enabling'. It made it possible to include different navigation mechanisms, one for each island. This opened up for different ways of reporting symptoms, hence more choices. In *Desarte*, the modular organization of 'worlds' on an urban grid was also 'enabling', opening up for numerous design possibilities and, ultimately, for users to design their own worlds.

In the *Florence* project the participatory designers' decision to build the system suggested by the nurses 'evoked' new problems that required a number of difficult decisions. It almost destroyed the nurses' trust in the system. The decision was interpreted very differently by the nurses and the designers: the nurses had already seen a prototype and could not understand why the system was not ready, while the designers struggled with technical design decisions in order to make the available software tools enable the project to achieve its goal.

In a similar manner, *IPCity* included several design decisions, each of which influenced other technical as well as non-technical decisions. For example, moving mixed-reality technologies outdoors made it necessary to have a tent, which had to be transportable to different urban sites and easy to set up; it also added to the instability of color tracking.

Precursive linkages can also be seen as the effect of learning. 'Mutual learning' is a key concept in PD (Bratteteig et al. 2012), hence we would expect many such linkages. Numerous decisions concerning the tracking algorithm and interaction design in *IPCity* were due to a learning effect through iterations of 'see-move-see'.

The notion of decision linkages points to the fact that decisions can affect future decisions on other related issues: new problems may be evoked, alternative solutions precluded or a promising new choice enabled. Considering and eventually anticipating such interdependencies, is a major challenge for designers. The concept of 'design moves' captures this explorative way of thinking and working; as does the concept of 'placeholder' (Wagner 2004), which refers to the need to keep open the possibility to 'undo' decisions if further moves indicate that they have unwanted effects. Decision linkages may be difficult to see while being involved in a project, as a particular choice may have unforeseen consequences. This has to do with the 'wicked' nature of design problems. It is even more complicated: some decisions are more important than others since they enable many other choices or constrain the design space rather early. When looking at the most important decisions in the four projects, we see that users did not participate

in all of them. Often these are decisions that frame the whole project, such as the strong vision that guided *Sisom* and *IPCity*. 'Big' decisions in a design project may also concern the choice of a technical framework, as was the case in *Florence* and *IPCity*. Also the setting up of the context of a project is a 'big' decision that delimits the design space in many ways.

Power issues in a PD project interact with a web of dependencies: some of these have to do with the institutional context of a project, while others emerge from the choices that are made.

6 Assessing the depth of participation?

We find that the concepts outlined in this paper help becoming aware of the different ways participation in design can happen and also how these pave the way for design results that are participatory. The concepts can be used for planning for more or better participation, and for a more thorough evaluation of the degree of participation. This can be achieved by articulating in more explicit ways how the different design moves are accomplished, addressing questions such as: how can the space of possible choices be widened; which of these choices are selected, which are not – and why; were the choices participants created respected as valid choices in the decision-making? Figure 10 provides an overview of the questions we have explored in this paper.

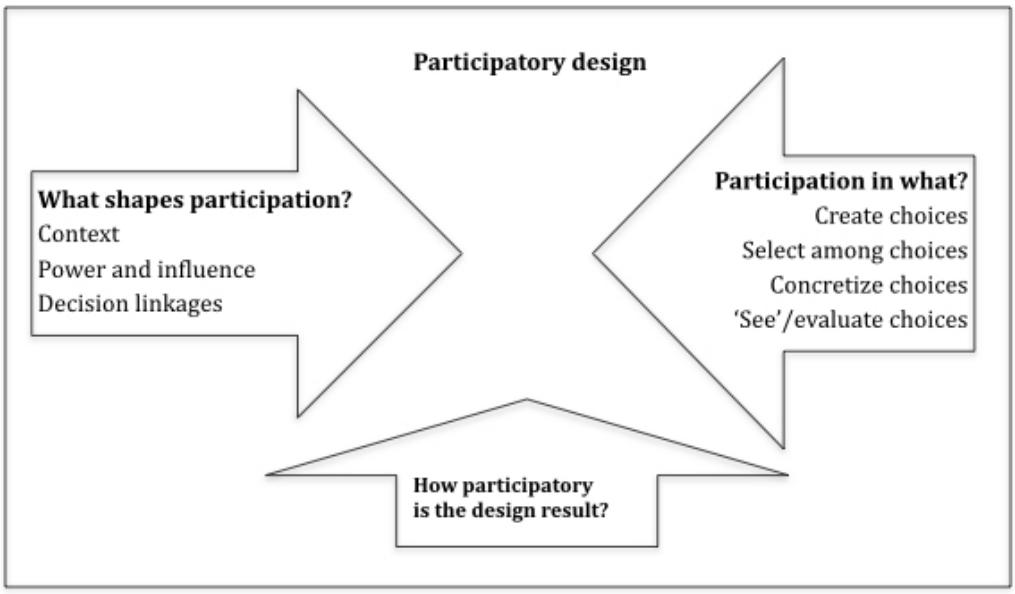

Figure 10. Dimensions of participation

In Bratteteig and Wagner (2014) we concluded:

> We have shown that not all decisions in a PD project have to be made in a participatory way. Even when choices are open to participation and all voices are heard, not all positions can be equally reflected in the design. […] within one and the same project there may be different depths of participation, depending on the role and particular expertise of participants but also on the types of issues. […] (p. 106f).

Our analysis suggests thinking about how to assess the depth of participation. This is not a new idea. Probably best known is Arnstein's (1969) 'ladder of participation', which is based on a distinction between empowering forms of participation, 'tokenism' (in which she includes consultation, informing and placation) and nonparticipation. Pretty's (1995) typology reaches from 'manipulative participation', where 'participation is simply a pretense', to self-mobilization. He also introduces a distinction between participation as a means (functional participation) and participation as a right (interactive participation), where the process is a joint effort. Other examples are Rocha's (1967) 'ladder of empowerment' or Cornwall's (2008) 'typology of interests', which focuses on who participates and where their agency and their interests take them. Hyysalo (2015) maps various use-oriented approaches according to the 'agency given to designers and users', including recent developments where users drive the design process.

Our analysis of decision-making in PD projects allows us to be much more specific. We specify a set of criteria for assessing how participatory a PD project is and even suggest a hierarchy of these criteria.

At the top of our list of criteria is *the participatory design result*, which we have defined as increasing users' 'power to', since this is what PD is all about. The IT artifacts that came out of the four projects empowered their intended users in many different ways: supporting their ways of working or giving them a voice in and influence on processes they would otherwise find inaccessible. The *Florence* project's particular achievement was an IT artifact that followed the nurses' 'logic' of working; *Sisom* implemented a system that reflected a child's 'logic' of talking about symptoms as well as a playful and stimulating way of recording them; *IPCity* created a 'new language' for building urban scenes that enabled citizens to express and develop their ideas. Although the design result of *Desarte* was not as useful as envisioned, it enriched architects' thinking about inspirational material. Not one of these outcomes would have been possible without the contributions of users.

But how do we come to know that a project has achieved a participatory design result? And how much does it depend on the participatory process? PD researchers would argue that the quality of a design result has to be assessed in 'real use' after design. This was clearly the case in *Florence* and *Sisom* where the design became embedded in the routines of hospital work. A question that is more difficult to answer is how users could see their contributions in the design result. Our analysis of the projects came to the conclusion that this was the case, without explicitly having asked the users. We think that an explicit focus on how users

may recognize their contributions to the design result may help make these more visible; or even assist in documenting the important design moves in ways that makes them open to scrutiny. The third open question concerns the quality of the process: do users have to participate in all stages of a design?

Our answer is more nuanced here, leading to the next step of assessing the depth of participation: *user participation in creating choices*. This is one of the strengths of PD. Many of its techniques support users in contributing to defining the problems that a design project should address and also indicate possible solutions. There is a difference between setting the stage for design and merely deliver ideas. Hence, apart from seeking to systematically widen the space of possible choices, participatory designers also need to consider the type of choices they invite users to contribute to. Are these just about the design of the user interface (as *Sisom* seems to be) or do they concern the problems to be considered, as in the wish list the nurses in *Florence* had prepared?

Next in importance is the *'see'/evaluate* part of designing, which is an essential part of making design moves. Probing an emerging design in use or in a situation that comes as close as possible to real use gives the participating users some real influence. It offers the designers the possibility to see and experience if what they have built meets the defined aims; and eventually correct, modify, and add to the design. We suggest that more systematically planning the 'seeing' part of a project may contribute to increasing users' influence on the design result. The evaluation method should allow the users to probe their own design moves. This requires a certain level of openness of the artifact they are supposed to test. The design result of *IPCity*, for example, was relatively open: 'We did not implement any 'rules' or 'constraints' beyond the technical limitations of the tools, and with this made an explicit step away from simulation tools. This moved decisions away from the technology into the responsibility of the participants' (Wagner et al. 2009, p. 193).

We have seen that user participation in *selecting among choices* is not always possible (or even desired). In the *Florence* project selecting among choices was organized in a participatory way. The designers carefully listened to the nurses' voice and translated the nurses' sketches into a system. *Desarte* was small and everybody involved was a 'maker'. Much of the decision-making was embedded in the joint design moves, many of which included the architect-users. *Sisom* and *IPCity* were different in this respect, with power issues playing a much more significant role. Decision-making in both projects was framed from the start: by a strong vision, by institutional constraints, the composition of the project team, which from the beginning emphasized certain properties of the design solution. The children in *Sisom* were simply not held capable of deciding by the adults 'who knew best'; in *IPCity* some of the selecting was imposed and much persuasion was needed for the urban architect team to consent.

In the context of an IT project *concretizing the choices* is mainly in the hands of the designers. The possibilities for users to participate in this process depend on the technical ambition and complexity of the project. The PD literature mostly describes users as contributing in the form of mock-ups and scenarios of use, which help the designers learn about users and future use, serve as sources of inspiration or are eventually also 'translated' into a working prototype. It seems important to emphasize and facilitate non-technical ways of 'making' in order to strengthen users' influence on the technical implementation. We have given several examples of users concretizing design choices in the form of sketches.

We contend that carefully examining the different facets of participation in a PD project may help more consciously balance the tension between an ideal of participation and the different 'constraining' forces. The hierarchy of criteria we introduced mirrors the 'reflection-on-action' we undertook when analyzing the four PD projects. It is a ranking of opportunities and not intended to be prescriptive in any way.

7 Revisiting the decision-making framework

Our main aim in this paper has been to explore the question what it is that users participate in. We have proposed a method for studying the dynamics of a PD project that, ideally, leads to a participatory result. We have argued that we can observe different types of decision-making: phases in which the design proceeds through a series of 'design moves' (Schön), alternate with or are complemented by phases of 'phantasizing and projecting' (Schütz). We have also looked into issues of power – the 'power to' of the different stakeholders in a project (in some cases only analytically separable from 'power over'), as well as structural aspects of power that are to do with the context, in which a PD project is embedded. We propose this 'decision-making framework' as a tool for 'reflection-on-action' in the sense Schön (1987) described:

> We may reflect on action, thinking back on what we have done in order to discover how our knowing-in-action may have contributed to an unexpected outcome. We may do so after the fact, in tranquility, or we may pause in the midst of action to make what Hannah Arendt (1971) calls a "stop-and-think" (p. 26).

It is a conceptual tool to apply during a design project but also when looking back. It can also be appropriated by a researcher engaged in an observational study of design practice. We do not, however, propose to do observational studies of decision-making 'as such' (or argue in favor of the development of tools in support of the decision-making process). The notion of 'design moves' indicates that coming up with choices, reflecting and pursuing some of them is inherent in the work of designing and, in many cases the act of decision-making is not directly observable. This is why we stress the importance of identifying choices as

they evolve: are there alternative paths of action and what are these; do they get taken up or dropped; in acts of deliberation or as part of ongoing design moves?

In practical terms we also suggest to document decision-making in a PD project or other types of design project we are engaged in. In the *Desarte* project this was done in the form of a diary that told the story of the *3D Wunderkammer* with all its twists and turns. In *IPCity* the designer team very early on decided to document all the decisions concerning token and interaction design that resulted in different versions of the *ColorTable* (Maquil et al. 2008). The *Florence* project produced a number of status reports documenting the progress of the project, including the slow progress in the project before the designers identified a hardware bug in the system that made the programs fail. In the *Sisom* project large parts of the design process were videotaped.

Our second aim was to frame the question of participation and decision-making in a CSCW context. We think that the decision-making framework we suggest applies to design work in general and may help better understand the particular design results that are achieved in a project. It would be an interesting example to revisit, for example, the electronic patient record project Martin et al. (2007) describe, applying the lens of decision-making. This may be difficult without an intimate knowledge of the different design moves and deliberate choices, in particular in a large-scale project that involves multiple stakeholders in different places (see e.g. Grisot and Vassilakopoulou 2015). In architectural planning, another example of design work, we can see how design decisions may 'travel' through the whole building, affecting many interlinked parameters.

An intriguing part of this kind of analysis is the notion of decision linkages. In studying design practice several authors have forwarded the notion of linkages (e.g. Cross 1979). Wang and Habraken (1982) examined designers' decision-making process, identifying a 'critical path' that led to the design result. Goldschmidt and Tatsa take up of the notion of 'linkography', with the intent to evaluate how good design ideas are:

> The first kind are those moves (or ideas) designated because of their backlinks, i.e. links to previous moves/ideas. The second kind of critical moves earn their designation due to their forelinks, that is, links that posterior moves 'make' to them (these links cannot be determined by judgment; they are derived only once the analysis is complete). (p. 595).

These authors are ultimately interested in modeling the design process or in making judgments about creativity, which we are not. However, we think that analyzing the interdependencies that are created by particular choices is crucial to understanding how a not yet circumscribed design space is narrowed down. We have given examples of how design decisions influence each other: evoking new problems that need to be resolved due to unforeseen consequences; opening up alternative choices or preempting them; several small ideas snowballing into a large one, and so forth. Some CSCW research focuses on interdependencies at work and how practitioners deal with them. While some of these interdependencies result from the complexity of the object of work, others have to

do with the fact that collaborative work involves multiple actors that bring different perspectives and types of expertise with them, with the result that 'control' is distributed (Schmidt 2002). The vocabulary offered by Langley et al. (1995) helps us talk about some of these interdependencies, focusing on the implications of choices in a dynamic way.

However, we do not think that a decision-making perspective makes sense in all work domains. It captures a significant aspect of collaborative work in areas, where space for and competence in generating and further developing choices is critical to the work. These are domains of work where the design space is rather large and the process of arriving at a solution necessarily open (Wagner 2004). In these domains, understanding where the (alternative) choices come from, how and by whom they are selected, and evaluated, is important. In a health care setting, for example, decision-making is crucial, given the complexities and uncertainties of diagnostics, the nature of patients' illness, which may involve dramatic changes requiring urgent interventions. Advocates of participatory medicine may face similar kinds of challenges as the ones we have described, having to ask: participation in what? The idea is that patients, their families or friends should assume an important role in diagnostic and therapeutic processes and that a 'participatory result', involving patients' active participation, may in many cases be a better one.

PD is characterized by a particular organization of the design in that users are seen as co-designers in many – if not all – design activities (Bratteteig et al 2012). The particular organization of design is supported by methods and techniques that enable users to take that role. The way of practicing participation, inviting users and designers to collaborate, also has to do with the actual people involved and the collaborative spirit they create together (see e.g. Light and Akama 2012). Controversies and conflicts – if they exist – must be dealt with as the final design result often implements one perspective. A participatory design result is also the result of a social work process where the participants managed to share (some) power between them.

Our last point concerns the concept of power. Our analysis has focused on the 'power to' of the different participants in a project, which is based on skills, experience but also authority and position. We have examined (institutional) givens that frame the design space: from commitments frozen in contracts, budgets and temporal constraints to rules and expectations of the outside world of funding agencies, project partners or participating organizations. Power is an explanatory concept: it helps see *why* some things are done in a certain way and not otherwise. In parts this 'why' points at particular people, their skills (which we may think of in terms of power/knowledge), or their authority; in parts at structural constraints and opportunities; in parts at the 'logics' of a practice. The notion of power suggests that the design result inter alias depends on a specific constellation of actors and resources.

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