Preprint: Sustained Participatory Design: Extending the Iterative Approach
Simonsen, J. & Hertzum, M., 2012, *Design Issues*, Vol. 28, Issue 3, pp. 313-328.
DOI: 10.1162/DESI_a_00158

Sustained Participatory Design

Extending the Iterative Approach

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Abstract. With its 10th biennial anniversary conference in 2008, Participatory Design (PD) was leaving its teens and must now be considered ready to join the adult world and to *think big*: PD should engage in large-scale information-systems development and opt for a sustained PD approach applied throughout design and organizational implementation. To pursue this aim we extend the iterative PD approach by (1) emphasizing PD experiments that transcend traditional prototyping and evaluate systems during real work; (2) incorporating improvisational change management including anticipated, emergent, and opportunity-based change; and (3) extending initial design and development into a sustained, stepwise implementation that constitutes an overall technology-driven organizational change. Sustained PD is exemplified through a PD experiment in the Danish healthcare sector. We reflect on our experiences from this experiment and discuss four challenges PD must address in dealing with large-scale systems development.

Keywords: Sustained Participatory Design, Extended Iterative approach, Large-Scale Information Systems, Improvisational Change Management, Technochange, EPR.

1 Introduction

In 2005, Shapiro[1] described how many large-scale systems-development projects are highly troubled. Attempts to introduce ambitious information systems in the public sector have been especially notorious with regard to being late, over budget, or functionally inadequate and ”the situation in the private industry may be no better but commercial confidentiality and the lack of public accountability may make it less visible”[2]. In order for PD approaches to lead to the best and most effective systems, with regard to support of the work they are used for, ”Participatory Design as a community of practitioners should seriously consider claiming an engagement in the development of large scale systems”[3].

There is no doubt that PD has a lot to offer, for example with regard to the clarification of goals, formulation of needs, design of coherent visions for change, combining business-oriented and socially sensitive approaches, initiating participation and partnerships with different stakeholders, using ethnographic analyses as part of the design process, establishing mutual learning processes with users from the work domains in question, conducting iterative experiments aiming at organizational change, managing stepwise implementation based on comprehensive evaluations, and providing a large toolbox of different practical techniques.

[1] Dan Shapiro, “Participatory Design: The Will to Succeed” (Paper presented at the 4th Decennial Conference on Critical Computing, Aarhus, Denmark August 20 - 24, 2005, 2005), ACM Press.

[2] Ibid., p. 30.

[3] Ibid., p. 32.

PD is characterized by the aim of establishing mutual learning situations between users and designers[4]. There is a need for a sustained PD approach that allows the organization to experiment and learn – not only as part of the initial design but also as part of the organizational implementation and use of a technology. Such an overall design process that includes, and transcends, the technical implementation of a technology has been identified by Markus[5] as 'technochange' management and (in particular) as a technochange prototyping approach. Technochange combines large IT projects with organizational change programs to produce technology-driven organizational change: "Here what is to be prototyped is not just a technical solution *or* just an organizational change, but both together"[6]. The technochange prototyping approach may be considered as using the traditional iterative prototyping approach as an overall model for organizational change.

Iterative PD experiments using various sorts of mock-ups and prototypes have been conducted for decades[7]. But most PD experiments have been restricted to small-scale systems (often driven by researchers)[8] or to the initial parts of larger-scale information-systems development followed by a conventional contractual bid[9]. Recently, however, a growing number of PD experiments include both initial design and real-use evaluation[10].

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[4] Keld Bødker et al., *Participatory it Design. Designing for Business and Workplace Realities* (Cambridge, Massachusetts: MIT Press, 2004).

[5] Lynne Markus, "Technochange Management: Using it to Drive Organizational Change," *Journal of Information Technology* 19, no. 1 (2004): 4-20.

[6] Ibid., p. 17.

[7] For a more elaborated review of related literature, see Jesper Simonsen, and Morten Hertzum, "Participatory Design and the Challenges of Large-Scale Systems: Extending the Iterative PD Approach" (Paper presented at the 10th anniversary conference on Participatory Design, September 30 – October 4, 2008, Bloomington, Indiana, USA, 2008), ACM Press.

[8] Andrew Clement, and Peter van den Besselaar, "A Retrospective Look at PD Projects," *Communications of the ACM* 36, no. 6 (1993): 29-37; Anne-Marie Oostveen, and Peter van den Besselaar, "From Small Scale to Large Scale User Participation: A Case Study of Participatory Design in E-Government Systems" (Paper presented at the eighth Participatory Design Conference 2004, Artful Integration: Interweaving Media, Materials and Practices (PDC 2004), July 27-31, 2004 Toronto, Canada, 2004), ACM Press.

[9] Keld Bødker et al., *Participatory it Design. Designing for Business and Workplace Realities*.

[10] see e.g. Monika Büscher et al., "Ways of Grounding Imagination" (Paper presented at the eighth Participatory Design Conference, July 27-31, 2004 Toronto, Canada, 2004), ACM Press; Thomas Riisgaard Hansen et al., "Moving Out of the Laboratory: Deploying Pervasive Technologies in a Hospital," *IEEE Pervasive Computing*

Active engagement in – and documentation of results with – large-scale information systems represent a major goal for PD. In this article we pursue Shapiro's call for a collective PD approach by extending the iterative prototyping approach into a sustained PD approach including large-scale PD experiments. We do this by means of an exemplary reflection: *What are the challenges that PD must face when engaging in design and implementation of large-scale information systems?* We describe and reflect on a Danish PD initiative in the healthcare sector involving a PD experiment with an Electronic Patient Record (EPR) system. The experiment was conducted by the authors in close collaboration with the vendor CSC Scandihealth ('CSC') and the customer, the region of Zealand, one of Denmark's five healthcare regions, in particular the region's EPR unit and the neurological stroke unit at Roskilde County Hospital. We describe the experiment and our experiences and present the challenges that the PD paradigm has to cope with to succeed in striving for a greater role in large-scale information-systems projects.

2 A Sustained PD Approach

Our sustained PD approach introduces iterations of design and implementation and emphasize improvisation, experimentation, and learning. This challenges conventional plan-driven approaches that maintain a clear distinction between design and organizational implementation[11]. As an alternative model for managing technological change, Orlikowski and Hofman suggest improvisational change management defined as "a way of thinking about change that reflects the unprecedented, uncertain, open-ended, complex, and flexible nature of the technologies and organizational initiatives … [where] managing change would

5, no. 3 (2006): 24-31; Volkmar Pipek, and Volker Wulf, "A Groupware's Life" (Paper presented at the Sixth European Conference on Computer Supported Cooperative Work, Copenhagen, Denmark, 12-16 September 1999, 1999), Kluwer Academic Publishers.

[11] Barry Boehm, and Richard Turner, *Balancing Agility and Discipline. A Guide for the Perplexed* (Boston: Addison-Wesley, 2004).

accommodate – indeed, encourage – ongoing and iterative experimentation, use, and learning"[12].

Orlikowski and Hofman[13] characterize improvisational change management by distinguishing between three kinds of organizational change: anticipated, emergent, and opportunity-based. *Anticipated change* is planned ahead and occurs as intended by the originators of the change. *Emergent change* is defined as local and spontaneous changes, not originally anticipated nor intended. Such change does not involve deliberate actions but grows out of practice. *Opportunity-based changes* are purposefully introduced changes resulting from unexpected opportunities, events, or breakdowns that have occurred after the introduction of a new information system.

Emergent and opportunity-based changes are widely noted in PD projects[14], but there has been surprisingly little focus on managing and learning from such changes over longer periods of time. A sustained PD approach entails that large-scale information-systems projects have to integrate design and development with organizational implementation. This is necessary to obtain data and experiences from real use during design and development and thereby iteratively (1) evaluate progress on planned changes, (2) become aware of emergent changes, and (3) turn selected emergent changes into opportunity-based changes. While progress on planned changes is a mean to ensure that system possibilities get integrated in actual work practices, turning emergent changes into opportunity-based changes is a mean to ensure that work practices are changed in relevant ways.

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[12] Wanda Orlikowski, and Debra Hofman, "An Improvisational Model for Change Management: The Case of Groupware Technologies," *Sloan Management Review* 38, no. 2 (1997): 11-22., p. 12.

[13] Ibid.

[14] E.g., Gro Bjerknes, and Tone Bratteteig, "The Memoirs of Two Survivors: Or Evaluation of a Computer System for Cooperative Work" (Paper presented at the 1988 ACM Conference on Computer-Supported Cooperative Work, Portland, Oregon, USA, September 26-28, 1988, 1988), ACM Press; Susanne Bødker, and Jacob Buur, "The Design Collaboratorium—A Place for Usability Design," *ACM Transactions on Computer-Human Interaction* 9, no. 2 (2002): 152–69; Pelle Ehn, *Work-Oriented Design of Computer Artifacts* (Stockholm, Sweden: Arbetslivcentrum, 1988).

Our sustained PD approach – outlined in Figure 1 – is an extension of the iterative approach to PD. It emphasizes evaluation of systems through exposing them to real situated work practices[15]. The starting point of an iteration is the changes that are anticipated and aimed for. These desired changes are further specified, for example in terms of effects of using the system. The system (or a part/prototype of it) is then implemented and tried out under conditions as close as possible to real use. Actual use of the system allows for unanticipated change (emergent and opportunity-based changes) to occur. Finally, evaluation of using the system informs subsequent iterations. This includes that selected emergent changes are turned into opportunity-based and new desired changes, hereby forming the starting point for the next iteration.

In the following we describe our proposed sustained PD approach by presenting a PD experiment that exemplifies the four elements depicted in Figure 1. The experiment concerned the clinical-process module of an EPR system. This EPR module supports clinical documentation and decision making and comprises the ongoing documentation of medical patient information made by the clinical staff. Today, a majority of clinical documentation is still paper-based. To initiate the development of this EPR module a large-scale PD experiment was conducted during the fall of 2005, involving a close collaboration between CSC, the region of Zealand, the stroke unit at Roskilde County Hospital, and the authors. The stroke unit is an acute in-patient clinic with nine beds and treats approximately 850 patients a year. The experiment involved one iteration of the sustained PD approach.

First, *identify desired change*. The overall desired change that the experiment aimed for was to implement a fully IT-integrated EPR that included support for the clinical process and replaced all paper-based patient records. The clinicians at the stroke unit specifically requested improvements in obtaining patient overview and support of their mutual coordination. On a

[15] Lucy A. Suchman, *Human-Machine Reconfigurations: Plans and Situated Action, 2nd Edition* (Cambridge University Press, 2007).

national level it is also a long-term aim to increase the structuring and standardization of the content of patient records as part of the development of EPR[16]. In response to this overall political objective, the EPR unit wanted to introduce and evaluate a new structure of the nurses' narrative recordings by dividing it into 14 categories of basic nursing care[17].

Second, *specify and implement*. The desired changes were specified in the first part of the experiment (August to October) through five full-day PD workshops where clinical staff in cooperation with designers from CSC and project managers from the EPR unit designed and configured the EPR system. Main parts of the system were designed and configured in three steps as depicted in Figure 2: At one workshop, mock-ups were drawn on flip-over charts. At the following workshop, a preliminary non-interactive PowerPoint prototype was discussed. At a third workshop, a running prototype was demonstrated and discussed. In their requirements the physicians and nurses focused on two aspects central to their work, namely their continual creation and recreation of an overview of the status of the patients and the coordination among the clinicians. Overview and coordination are particularly prominent in relation to three clinical activities:

- Team conferences. Every morning on weekdays physicians, nurses, and therapists meet for about 15 minutes to go through the admitted patients.
- Ward rounds. After the team conference the chief physician starts the ward round, which consists of medically assessing each patient and adjusting the treatment and care accordingly.
- Nursing handovers. At the start of every nursing shift the nurses meet for about 45 minutes to go through the admitted patients and coordinate activities.

[16] Claus Bossen, "Participation, Power, Critique: Constructing a Standard for Electronic Patient Records" (Paper presented at the 2006 Participatory Design Conference, Trento, Italy, August 1-5, 2006, 2006), ACM Press.

[17] Virginian Henderson, "Virginia Henderson International Nursing Library," www.nursinglibrary.org.

Through the PD workshops a number of desired effects were specified by the clinicians. The clinicians requested coordination support during the three activities mentioned above. The chief physician wanted, for example, to be able to complete the daily ward rounds as a "one-man show" (without an escorting nurse), where all information and coordination with other clinical staff was done through the EPR system. This effect was given high priority because the nurses are busy and have little time left for escorting the chief physician during the lengthy ward round. Improved patient overview was also defined as a desired effect, especially in relation to the team conferences and nursing handovers. In addition, the EPR unit required an increase in the structuring of the nurses' recordings and required prompt response times to evaluate the performance capabilities of CSC's new configurable development platform.

In November through December, CSC undertook the technical implementation of the EPR system, along with interfaces to various systems currently used at the hospital. Five years of patient data were migrated to the system to enable access to previous patient records even for patients that would be hospitalized during the experiment. The amount of data also provided a data load that enabled a realistic evaluation of system performance.

Third, *real use enabling unanticipated change*. The trial period, where the EPR system was in real use, took place in December and lasted five days. During this trial period all clinicians at the stroke unit used the EPR system 24 hours a day, and the system replaced all paper records for all patients. The system involved stationary and portable PCs, PDAs for bedside measurement of patient parameters, and a large shared display projected on the wall during team conferences and nursing handovers, see Figure 3. Transactions involving other wards not involved in the experiment were simulated by a back office staffed 24 hours a day. Patient-record entries that involved paper transactions with other wards were initiated in the EPR system by the clinicians. The back office continuously monitored the system, identified such entries, mailed them in the conventional fashion, waited for the results to arrive, and

immediately typed them into the EPR system. Thus, the clinicians at the stroke unit experienced the EPR system as if all transactions were fully IT supported. To safeguard against troubles and misunderstandings, which might have entailed risk to patient health, the clinicians were supported by 'shadows', having detailed knowledge of the EPR system and were present 24 hours a day.

The five-day trial period made it possible to test the EPR in real use enabling unanticipated change. Though the trial period was short we observed both emergent and opportunity-based changes. Emergent changes included that the traditional oral way of informing about patient status changed to collectively reading the information on the large shared display used for team conferences and nursing handovers. As a result of being able to collectively read the patient record on the shared display, we further observed that the clinicians initiated collective investigations of the patient record during these activities[18]. At the nursing handovers we observed before the trial period, the patient record was only seen by the nurse team leader, who held the patient record in her or his hand and conveyed the status of the patient by reading key information out loud. During the trial period the patient record was projected on the wall and repeatedly inspected by all nurses present at the handovers, and they collectively participated in interpreting the status of the patient. As an example of an opportunity-based change the nurses managed to make their observations more visible at the team conferences: Halfway through the trial period the nurses initiated a change in the team conference screen by having CSC add a panel with nursing observations relevant for the team conference. In this way, the nurses' observations became more salient to the clinicians as they were forming their overview of the status of the patients.

[18] For a detailed ethnographic study of this, see Jesper Simonsen, and Morten Hertzum, "Iterative Participatory Design," in *Design Research: Synergies From Interdisciplinary Perspectives*, ed. Jesper Simonsen et al. (Boston: Routledge, 2010).

Fourth, *evaluate*. The evaluation of the anticipated desired changes included a quantitative analysis that verified a number of positive effects[19]. For example, the chief physician managed to complete his daily ward rounds without the need for nurse escort. These results were important to the clinicians. To CSC, the major result of the experiment was the implementation of a fully integrated EPR that performed well throughout the trial period. Hereby CSC got a valuable reference proving that they have a highly configurable EPR platform that can deliver satisfying response times. However, the experiment also fostered several new desired changes that were unanticipated and significant.

Using the large shared display during the team conferences and nursing handovers resulted in various unanticipated changes including (as described above): The change from oral presentation to collective reading of patient records; initiation of collective investigations of patient records; and that nurses' observations became a prominent part of the shared agenda during team conferences. As a direct consequence of the clinicians' requests for coordination support, CSC initiated the design of a completely new EPR module supporting task allocation and management. After the experiment the nurses requested the addition of more structure to the nursing record. This was a result of their experiences of how structured nursing observations became part of the agenda during team conferences. This request came as a surprise to the EPR unit who expected that the nurses would resist rather than request increased structure in their documentation.

3 Challenges for PD

We argue that the PD community should think big by applying a sustained PD approach to large information systems. Extending the iterative PD approach beyond initial design (as

[19] Morten Hertzum, and Jesper Simonsen, "Positive Effects of Electronic Patient Records on Three Clinical Activities," *International Journal of Medical Informatics* 77, no. 12 (2008): 809-17.

outlined in Figure 1) raises the overall challenge of how to manage this improvisational and relatively open-ended process. We identify at least four major challenges in managing such a sustained iterative process. These challenges are further discussed below.

3.1 Creating Appropriate Conditions for PD

Both customer and vendor need to be motivated and interested in committing to a PD approach. An *initial challenge is thus to obtain the appropriate conditions for PD*. This might presuppose earlier experiences and previous collaboration motivating PD, access to mature configurable development platforms, knowledge of other successful PD projects, etc. In our experiment the customer (the EPR unit) had become ready for a PD approach through earlier experiences with a drug administration module. The manager of the EPR unit (with a background as a physician) was further aware that the clinical process EPR could not be designed as a one-size-fits-all standard system. The vendor (CSC) on the other hand had a new and highly configurable EPR platform and an urgent need to prove its ability and obtain a good reference. Finally, the customer and the vendor knew each other from the development and deployment of the drug administration module. This mutual knowledge laid the ground for the close partnership and collaboration required by the experiment.

3.2 Managing a Multitude of Stakeholders

Large-scale information-systems projects are characterized by involving a number of different actors spanning different organizations and different organizational levels. Thus, a second major challenge is to *manage and align the motivations and interests of this multitude of stakeholders*. Traditionally, the focus of PD projects is restricted to the relation between

designer and end-users[20]. In our experiment we can identify the following, broader range of stakeholders:

- A national and political level (requesting increased structuring and standardization of the EPR content).
- The vendor (needing a reference for another contractual bid).
- The EPR unit (requesting an initial structuring of the nursing record and proof of system performance).
- The management of the stroke unit (requesting improved quality of the reporting to a national database).
- The physicians (striving to obtain a more autonomous and efficient ward round).
- The nurses (wanting improved overview and coordination during nursing handovers).

The challenge is to comply with the premises set at the national and political levels and by high-level organizational strategies, to align with the different lower levels, and to argue how PD with its direct involvement of end-users is an effective means to manage, mesh, and meet these different interests.

Navigating and managing this complex set of multiple stakeholders in a political environment is a major challenge to PD approaches as noted in other large-scale PD projects[21]. In our research we experiment with using means-end hierarchies, known from cognitive systems engineering[22] as part of a strategic analysis[23] to identify and relate different stakeholders'

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[20] Andrew Clement, and Peter van den Besselaar, "A Retrospective Look At Pd Projects."; Anne-Marie Oostveen, and Peter van den Besselaar, "From Small Scale to Large Scale User Participation: A Case Study of Participatory Design in E-Government Systems."

[21] Keld Bødker et al., *Participatory it Design. Designing for Business and Workplace Realities*; Anne-Marie Oostveen, and Peter van den Besselaar, "From Small Scale to Large Scale User Participation: A Case Study of Participatory Design in E-Government Systems."

[22] Jens Rasmussen et al., *Cognitive Systems Engineering* (John Wiley and Sons, Inc, 1994); K. J. Vicente, *Cognitive Work Analysis: Towards Safe, Productive, and Healthy Computer-Based Work* (London: Lawrence Erlbaum Associates, 1999).

[23] Keld Bødker et al., *Participatory it Design. Designing for Business and Workplace Realities*., pp. 117-137.

interests. Using such means-end hierarchies we might, for example, argue that: (1) a national and political demand for increased structure in the EPR can (2) be met by a stepwise change and incremental increase of the EPR structure, which again (3) can be initiated by introducing structure to the narrative part of nursing records, which (4) will only succeed if the categories fit the nurses' documentation practice; all of which ultimately (5) calling for a PD approach focusing on the nurses' work practices.

3.3 Managing a Stepwise Implementation Process

A third major challenge is to effectively *manage sustained large-scale iterative PD experiments forming an overall stepwise implementation process*. This includes managing individual PD experiments as well as an overall stepwise implementation process that involves a series of PD experiments. The latter introduces an important problem of representation: Our experiment was, for example, carried out in close collaboration with one clinical specialty. It remains an open question how well the results are transferable to similar specialties at other hospitals.

Our PD approach entails conducting a series of experiments where functional prototypes are evaluated during real use, resulting in a stepwise implementation process similar to the technochange prototyping suggested by Markus[24]. A stepwise implementation process stands in contrast to the traditional way of managing large IT projects as a "design first then implement"[25] process with no iterations or improvisation in the prevailing way of conducting competitive bids and formulating IT contracts. The argument for a stepwise process includes the problems related to the traditional process and the less risky process of phased implementation. This introduces, however, the challenge of managing an implementation

[24] Lynne Markus, "Technochange Management: Using it to Drive Organizational Change."
[25] Ibid., p. 17.

process that acknowledges the need for improvisation – the very complexity to which the traditional approach is blind[26].

PD needs a strategy for how to manage this challenge. In our research we investigate how to manage a stepwise design and implementation process on the basis of identifying and measuring the effects of using a system[27]. The sustained PD approach facilitates an iterative process managed by means of the effects of using a system: The desired changes can be specified in terms of usage effects focusing on the work domain in question (e.g., to be able to complete the ward round alone). We have been successful in convincing managers from both the customer and the vendor that such a sustained focus on effects is a promising idea, which might potentially lead to an effects-based commercial contract model where the customer's payments are dependent on effects arising from using the vendor's system[28]. This is, however, research in progress and many questions are still unresolved.

3.4 Conducting Realistic Large-Scale PD Experiments

A fourth major challenge concerns the *methodological question of how to conduct realistic large-scale PD experiments* to evaluate prototype systems during real work. Our experiment raises two issues in respect to this challenge: the restricted timeframe for evaluations and the need to safeguard against errors.

The timing of real-life experiments is a trade-off between:

[26] Ibid., p. 18.

[27] Morten Hertzum, and Jesper Simonsen, "Effects-Driven it Development Specifying, Realizing, and Assessing Usage Effects," *Scandinavian Journal of Information Systems* 23, no. 1 (2011). Hertzum, M., and J. Simonsen, "Effects-Driven IT Development: A Strategy for Sustained Participatory Design and Implementation," (Paper presented at the 11th Biennial Participatory Design Conference (PDC 2010), ACM Press.

[28] Jesper Simonsen, and Morten Hertzum, "Evidence-Based it Development: Toward a New Contract Model for EPR Projects" (Paper presented at the 3rd Scandinavian conference on Health Informatics, Aalborg University, August 25-26, Aalborg, Denmark, 2005), Virtual Centre for Health Informatics, Aalborg University.

- Evaluating early and quickly to acknowledge project deadlines, save resources, and curtail diffusion of ineffective systems.
- Evaluating after a longer period of time to allow system errors to be corrected, users to gain proficiency, work practices to stabilize, use situations to reach their true level of heterogeneity, emergent and opportunity-based changes to develop, and long-term outcomes to emerge.

If a PD experiment is biased toward early and brief evaluation to honour the realities of IT projects, the consequences of various learning effects become critical to the interpretation of the experiment.

In our experiment the trial period was five days. In this short period of time none of the clinicians gained proficiency in using the EPR system and their ways of working were thus in flux, whereas their prior use of paper records was facilitated by long-standing work practices. It is encouraging that some improvements could be identified after using the EPR system for only five days. However, longer trial periods are highly desirable, also as a means of getting beyond the goodwill that can be invested in trying something new for a restricted period of time.

Special precautions against errors may be necessary to evaluate systems during real use. PD experiments involve a balancing of the benefits of evaluating prototype systems during real use against the confounds introduced by the necessity of special precautions to safeguard against unacceptable errors. While experiments with real use increases validity and the possibility of unanticipated discoveries, special precautions may reduce validity. For safety-critical systems it may not be acceptable to leave users to trial and error when they encounter situations not covered by training. Thus, users must have immediate access to appropriate support during the entire real use experiment.

In our experiment the clinicians were supported by shadows and certain parts of the EPR system were simulated by the back office using Wizard of Oz techniques[29] where designers from the vendor played the "Wizard" simulating the system's transactions involving other wards. These precautions were necessary as troubles and misunderstandings in using the system might entail risk to patient health. But with these precautions in place the EPR system could replace paper records for the duration of the trial period.

4 Conclusion

PD has obtained international reputation and widespread application. Yet, PD still seems reluctant to become engaged in the development of large-scale information systems. There is no doubt that PD has a lot to offer but also that PD approaches will face considerable challenges in claiming a serious influence on the design and implementation of large-scale information systems.

We have suggested an ambitious and sustained PD approach, emphasizing that mutual learning situations should be provided also during the organizational implementation of large-scale systems. This acknowledges the uncertainties of technology-driven organizational change and at the same time poses the challenge of treating the entire design and implementation process as a process of genuine development. Our sustained PD approach incorporates anticipated as well as emergent and opportunity-based change, as identified by Orlikowski and Hofman[30]. We argue for large-scale PD experiments that transcend traditional prototyping tests in order to evaluate systems exposed to real work situations.

[29] David Maulsby et al., "Prototyping an Intelligent Agent Through Wizard of Oz" (Paper presented at the INTERCHI'93 Conference, Amsterdam, The Netherlands, 24-29 April 1993, 1993), ACM Press.

[30] Wanda Orlikowski, and Debra Hofman, "An Improvisational Model for Change Management: The Case of Groupware Technologies."

We have reflected on our experiences leveraging PD in the Danish healthcare sector and reviewed the important lessons we can identify. Four major challenges have been discussed: The establishment of appropriate conditions for PD, the handling of the different interests of a multitude of stakeholders, the management of an ongoing and stepwise implementation process guided by a series of large-scale PD experiments, and the conduct of experiments during which the system is in real use, though it is still being designed as opposed to deployed.

So far, this PD approach has yielded promising results in the Danish healthcare sector. Applying it, however, forces us to face the challenges described. It hereby raises a number of how-to questions that cannot be satisfactorily answered with general methodological guidelines. What we need is research, preferably action research, that refines this PD approach by applying it in a number of cases and thereby stimulates the mutual creation and sharing of knowledge and experiences.

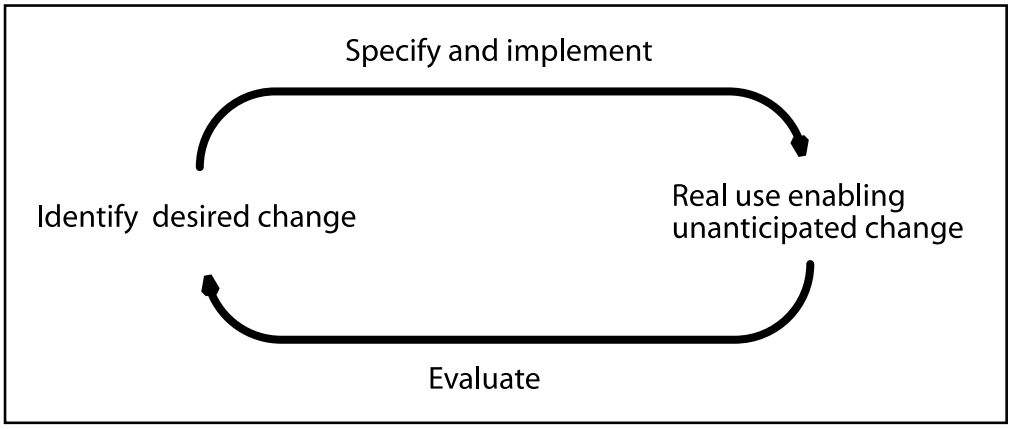

Figure 1: Outline of our sustained PD approach.

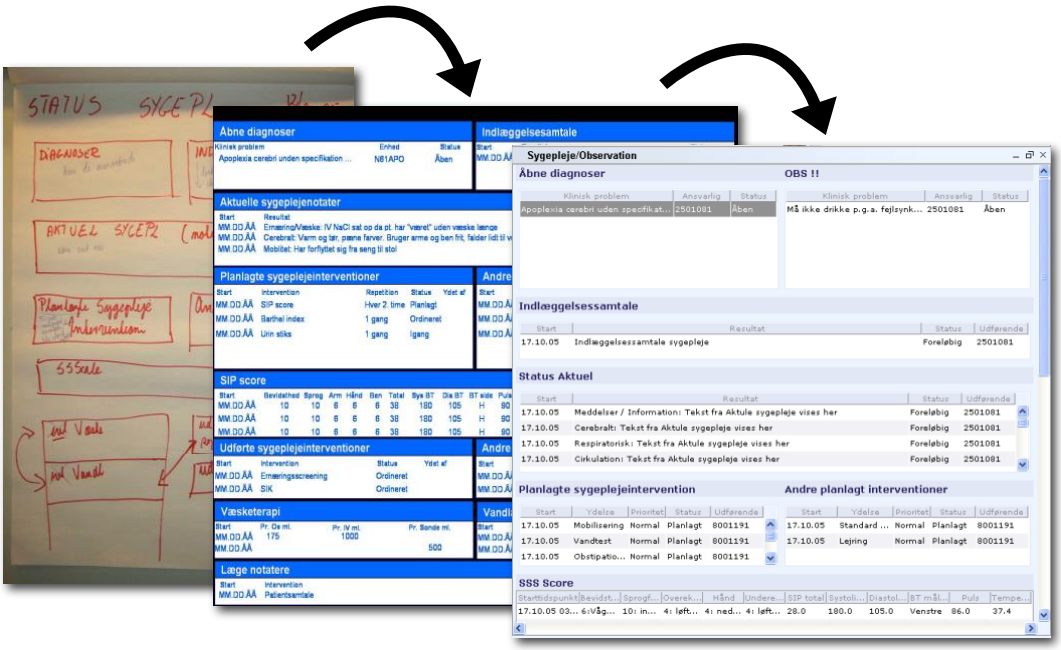

Figure 2: Results from three iterative PD workshops: Mock-up, non-interactive PowerPoint prototype, and running prototype of screen to be used during nursing handover.

Figure 3: Photos from the five-day period of real use.