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Investigating situated use of the MUST method

Keld Bødker, Finn Kensing and Jesper Simonsen

Abstract

What. MUST is a design method that is targeted early IT design where future users are actively involved in the project. The textbooks about MUST have been used as part of the curriculum in many university courses, including at Roskilde University. The method has also been commercially applied by a large number of private companies and public organizations.

Why. Nowadays IT design not only takes place as an initial part of large IT development projects. Design projects often apply generic and configurable standard systems, and design activities may continue throughout organizational implementation and beyond.

Where. The challenges for participatory design arise because 'users' are no longer only employees, but also consumers, citizens, members of voluntary organizations, or the like, who may not be co-located with designers; so how can we ensure 'users' can have a say? And how do we 'organize design' when design increasingly takes place as part of, or after, implementation – because the design product is increasingly made up of multiple generic systems, including smartphone apps, systems integrating data and/or functionality from existing systems, or systems dedicated to new ways of collaborating or coordinating across organizational or professional boundaries?

How. By investigating and reflecting on our experiences from two design projects outside its original application area we derive lessons for how we situate the concepts, the principles, the organization of the design project, and the techniques and tools provided by MUST.

1 Introduction

MUST is a design method that is targeted early IT design where future users are actively involved in the design project. The textbooks about MUST have been used as part of the curriculum in many university courses, including at Roskilde University. The method has also been commercially applied by a large number

of private companies and public organizations (Kensing, 2000; Bødker et al., 2011).

MUST is a method for participatory design firmly rooted in the Scandinavian tradition for information system development founded in the struggle for workplace democracy in Scandinavia. IT design nowadays take place not only as an initial part of large IT development projects; many design projects apply generic and highly configurable standard systems and design activities may continue throughout organizational implementation and beyond. The methodological challenges can be summarized as (Bratteteig et al., 2012, p. 135-139):

- ensuring users can have a say in design when users and designers are not co-located;
- new technologies imply that design increasingly takes place as part of, or after, implementation;
- users no longer share the commitments in relation to a shared workplace.

In this chapter we want to investigate a question often posed to us by students and colleagues: How can we apply MUST outside its original domain? We intend to do this by critically examining two design projects in which we have been deeply involved ourselves. Both projects take place in contexts outside MUST's intended domain; the first is a design project to support communication and collaboration among health professionals and patients using ICD pacemakers, and the second is a design project on energy renovation of private houses. Based on these cases we critically reflect on learning points in relation to answering the research question.

Research method-wise we hereby adhere to Yin's multiple case study approach (Yin, 2009). Both cases involve one of the authors as a central actor, and the presentations in sections 3 and 4 represent accounts of the projects based on personal reflections and already published sources. From these cases we intend to derive lessons learned regarding adapting the design method to the particular situations.

2 The MUST method

The core idea behind the MUST method is to enable a participatory design approach responding to contemporary business needs and conditions for IT projects. Information technology has moved from supporting and automating well-structured tasks, typically within organizational boundaries like accounting, inventory control, or payroll, to support and inform less clearly defined activities of knowledgeable and often also quite powerful professionals, such as caseworkers or clinicians in direct contact with customers, citizens or patients.

MUST includes a conceptual framework for the participatory design process, emphasizing the need for a thorough problem setting during the early stages of design "that reveals goals, defines problems, and indicates solutions" (Bødker et al., 2004, p. 13). MUST is conceived as a 'meta-method', i.e. in every design project the participants have to design, or situate, the project using the method as a resource for action (Suchman, 2007). MUST provides four types of resources for supporting the designers in planning and conducting the project according to the particular situation:

- well-defined concepts (17 in total) to help designers understand and frame the situation;
- a particular perspective formulated as four design principles guiding the designers throughout the design project;
- suggestions for how to organize the design project in four phases;
- a set of techniques and tools for specific activities (altogether 16 techniques and related tools), including meta-guidelines to help in selecting and tailoring techniques or tools to specific purposes.

In the following the four design principles, the project organization and some of the core techniques and tools are described briefly.

2.1 Four participatory design principles

The objective of a design project in an organizational setting is to achieve sustainable change by introducing new IT systems. Visions play a central role in envisioning, outlining and sketching future IT systems and their use. The result of a design project is one or more *coherent visions for change* in the company in question and in relation to its environment (principle 1). The claim for coherency is related to striking a balance between IT system(s), organization of work, and the qualifications users need to perform their job with the help of the envisioned IT systems in the proposed work context. The method systematically relates its overall activities and results to such coherent visions for change.

The second principle, *genuine user participation*, calls for the active participation of organizational members ('users') in the design project. In subscribing to both political and pragmatic arguments for participation, MUST acknowledges the challenges established by current business contexts:

- in large companies, not all employees can be involved in the design project – a design project thus has to rely on representation of users;
- experienced users are hard to get involved because they are needed in daily operations.

In such circumstances, open criteria for participation are essential, as is anchoring the intermediary and end results from the design project among all interest groups. Further, mutual learning is considered essential for ensuring that all participants and their knowledge are genuinely accounted for. A framework

for mutual learning, see Figure 1, functions as a guide to support different kinds of mutual learning situations.

We recommend iterating between abstract knowledge and concrete experience in many design activities, and a general movement from focusing on understanding 'current practices' and 'technological options' early in a design project, and gradually shifting focus to deal with 'new practices.'

	Current practices	Practices with new technologies	Technological options
Abstract knowledge	Relevant descriptions	Visions and design proposals	Overview of technological options
Concrete experience	Concrete experiences with current practices	Concrete experience using new technology	Concrete experience with technological options

Figure 1. Six domains of knowledge (based on Kensing and Munk-Madsen, 1993)

Ethnographic techniques have come to play an important role in participatory design in getting access to concrete experience and other elements of tacit knowledge involved in work practices and the use of technology. Trying to overcome the classic say/do problem and its many dimensions in design projects by applying ethnographically inspired techniques is a vital part of the MUST method – manifested in principle 3, *first-hand experience with work practice*. Designers observe and participate in users' *in situ* practices to understand their current practices and their experience from using early prototypes in work-like settings. Seeing how work – or another practice – as a social activity is different from descriptions, prescriptions or visions is basically a major tenet from first-hand encounters that brings a rich body of knowledge to any design project. Such insights can be used to challenge current understandings or early design visions as well as for deriving new designs.

The final principle, *anchoring visions*, involves ensuring that stakeholders understand and support the design project's goals, visions, and plans. The idea is that when the domain of the design project is large and complex, the project needs to ground findings and proposals among the larger group, encompassing the organization's employees as well as top management (Simonsen, 2007). By openly presenting design ideas and proposals and testing critical assumptions and hypothesis the project group not only establish a sound foundation for critical decisions but also, in fact, prepare the implementation.

2.2 Project organization

MUST recommends organizing a design project in four phases. We use the term ‘phase’ to denote a group of activities taking the design project from one decision point to the next. Thus the four phases support a stepwise decision process regarding the scope of the project, understanding the situation by in-depth analysis, and outlining visions by design-oriented activities (see Figure 2).

Phase	Focus	Result	Decision
Initiation – project establishment	The scope of the design project	Project charter	Premise and scope of design project
In-line analysis – strategic alignment	Aligning the project’s goals and company strategies	Strategic alignment report	Work domains to investigate
In-depth analysis – ethnographic analysis	Work practices in selected domains	Analysis report	Prioritizing goals and ideas for change
Innovation – vision development	Visions of it and relation to work organization and qualifications	Design project report	Visions to realize, scope and order of successive implementation projects

Figure 2. The focus of the four phases and associated decisions.

We want to emphasize the successive decision process, not the phases. We recommend designers start planning each phase by mapping the current situation, hereby identifying four prototypical situations with distinct scope for each. In some rare situations we may recommend skipping a phase altogether, reducing it to an activity in the following phase.

Further guidelines for situating the project suggest the focus of the various reports in order to support the upcoming decision – focusing on the project, the usage, and/or the technical dimension.

2.3 Techniques and tools

MUST contains a toolbox of techniques and tools each supporting specific activities in a design project. To help choose among the techniques and tools designers are provided with a guide indicating appropriate techniques or tools for each knowledge domain in Figure 1 and for each principle.

We have illustrated how MUST is considered a toolbox for the designers in a specific project, not as a design recipe to be followed blindly. To a large extent we have thus designed MUST to be *situated* to the specifics of a concrete design project. However, the method was developed for IT design projects in an organizational context, which only accounts for some of the contemporary design projects. Now, let us turn towards two projects outside this domain.

3 Empowered patients and better-informed clinicians

This case is about how we situated the MUST method for use in a design project to support communication and collaboration among health professionals and patients.

In Denmark, as well as internationally, there has been a trend towards involving patients more in their own treatment and care and to support professional communication across the sites where patients are treated. The national and the regional IT strategies for the Danish health-care sector, as well as the IT strategy of the University Hospital in Copenhagen, mention that an effort should be made to give patients access to their own data.

Chronic patients have been in focus as they take up a lot of time and economic resources in the health sector. Heart failure patients living with an ICD, implantable cardioverter-defibrillator, is one such group of patients. An ICD is an advanced pacemaker that can be implanted in patients at risk of sudden cardiac death due to ventricular fibrillation. It is designed to monitor the heart rhythm and to deliver electric shocks to restore the normal heart rhythm in case of arrhythmic events. The ICD also records data about detected arrhythmic events as well as selected overall conditions of the body. In this way ICD patients carry not only a monitoring device – it is also individually programmed to deliver the therapy (electric shock) when a certain level of ventricular fibrillation occurs. In the case described here, the implantation and the every three months device follow-up is taken care of by the University Hospital's Heart Center, while the patients also see a cardiologist at a local hospital every three months to have their medication checked.

For almost ten years a telemedicine set-up has been in place and patients are now routinely included. It transfers data (an ICD reading) from a patient's device to the Heart Center. Here heart specialists interpret the data and decide if any actions need to be taken. For unproblematic device follow-ups (when nothing has to be done except for sending a letter to the patients indicating that the device works as planned), the telemedicine set-up saves time for the Heart Center and also for patients, who now only have to go to the Heart Center once every other year. This set-up has worked fine in most situations, except that over the years many patients have asked for more detailed information about the interpretation of the transmitted device data.

However, experience also shows that when patients are co-present when the device data are interpreted at the Heart Center, the heart specialists could collect further information from the patients. This could, for example, be about their general well-being, the medication they take and how it works for them, and the circumstances under which events registered by the device took place. For problematic device follow-ups such information is important for the specialists' interpretation of the transmitted data and for which actions should be taken to care for the patient. One consequence of the design rationale of telemedicine in general and for this IT set-up in particular is that the patient is not available as a source of information. This means that the specialists have to use much time and effort to collect the data needed for providing the care that is necessary.

We now turn to a description of how some of the resources (key concepts, principles, phases, tools and techniques) of the MUST method were brought to bear in a design project with a group of IT designers, 50 ICD patients, and heart specialists from the Heart Center and Bispebjerg Hospital, a local hospital in Copenhagen.

Compared to earlier project in which MUST has been applied, this project was special in the sense that the prospective users were not part of the same organization. They comprised health professionals at different hospitals as well as chronic patients living at home. Further, while it could probably be required that the health professionals should use the system, this may or may not be the case when it comes to the patients. Anyway, it turned out to be helpful to use the four phases suggested by MUST to structure the project from start to finish. Some of the selected tools and techniques are mentioned below after a brief introduction to the application's main functions. Then in the subsequent sections we discuss the degree to which we managed to realize MUST's four guiding principles.

After initial ethnographic studies in patients' homes and at the two hospitals, one of the design ideas that gradually evolved was myRecord. It is a personal health record, kept and maintained by each involved patient. Some of the data are for the patient's personal use only; others are automatically made available to the heart specialists. The patient may decide to share other data with other clinicians and patients. It is a Web application that, in order to reduce integration problems, runs separately from the telemedicine system. Its overall purpose is to allow for patients to take an active part in their own care and for patients and heart specialists to be better prepared for consultations, whether these take place in the clinic or via telemedicine. Its main functions include: (1) A calendar with scheduled appointments. Before a scheduled face-to-face visit and an ICD reading through the telemedicine set-up, the patient reports about his situation in (2) checkboxes for a set of symptoms defined by the cardiologists, and in a short free text in the patient's own words. The patient may also (3) monitor a set of self-defined parameters (e.g. in relation to diet, smoking, alcohol, etc.). Further, patients have to (4) maintain a list of the medicine prescribed and taken, and keep track of any side effects. Finally, it is possible (5) to communicate with

the Heart Center about the ICD readings and (6) to keep a diary. It should be noted that the project did not include a redesign of the ICD and the associated software since the company that supply these parts was not interested in taking part in the project. That changed after the project ended though.

myRecord was iteratively designed based on observations and (*in situ*) interviews with heart specialists, focusing on which type of information they would normally ask for and use during face-to-face consultations. Further, the designers worked with patients both in workshops and during patients experimenting with prototypes of myRecord at home, when preparing for check-ups at one of the hospitals. In the latter situations the designers helped the patients use the prototype while at the same time conducting an analysis of which parts of the prototype worked and what did not work for the patient. Further, the designers introduced new features to collect initial feedback from the patients.

The designers then brought the prototype to the Heart Center and asked them to first go through the ICD follow-up procedure, as they would normally do. When they had finished the procedure for each of the patients that had used the prototype, the designers asked the heart specialists to think aloud while going through what the patients had registered in the prototype. In this way the patient was virtually present and able to contribute information needed by the specialists and other types of questions and information that the patient had found relevant. In about 20 percent of the cases, the heart specialists changed their mind or wanted to do something extra based on information provided by the patient through the system. Further, in potential problematic cases the designers encouraged the specialist using a recorder to send their response to the ICD-reading to the patient. This feature was much appreciated by the patients and also, eventually, by the specialists too.

3.1 Coherent visions for change

myRecord and its use by patients and heart specialists was a coherent vision for change that guided the designers' work and their collaboration with patients and heart specialists. It was nurtured and challenged throughout the project by introducing, making more concrete, and testing new ideas grounded in the ethnographic studies or stemming from interesting concepts found in the literature. The vision comprised a technological part in terms of functions, ways of interactions, and physical form. But that would not lead to much change unless patients and heart specialists were to start acting differently by the help of the system. The designers kept refining the system until patients experienced the benefit of their own monitoring, and until heart specialists consulted the data entered by the patients in order to improve the quality and efficiency of their work. Finally, for the vision to materialize, both types of actors had to learn new skills in order to act differently.

3.2 *Genuine user participation*

Genuine user participation relies on two rationales: A democratic ideal, and the need for mutual learning. MUST was originally developed for in-house and contractual bid types of projects. In such projects it is possible to identify future users and have them participate if management and designers choose to do so. Instead, this project was rather a product design type of project (Grudin, 1991). Therefore, the participating patients and specialists were not included to represent future users in a democratic sense – they could not be hold responsible by any constituencies. Anyway, the designers saw their input as representing the knowledge and interests of ICD patients and heart specialists. Further, the designers acknowledged that it was necessary to allow for mutual learning, and they included the above-mentioned activities, tools and techniques to make that happen.

3.3 *First-hand experience with work practice*

First-hand experience was realized in two different ways. First, and in line with the recommendation of the MUST method, the designers started out by conducting ethnographic studies focusing on actors, activities, information searched for and produced, technologies and other artifacts involved in living the life of an ICD patient and working as a heart specialist. They interviewed patients, relatives, and heart specialist to get to understand better the rationales of their conducts. Second, the designers were present while patients and heart specialists were using the evolving prototypes. Also, they organized sessions in a way that allowed them to explore, experiment, and intervene in the daily practices of patients and specialists.

3.4 *Anchoring visions*

Above we described how designers brought the prototype of myRecord to the patients' home and asked them to use it, and how the designers later took the prototype to the Heart Center to have the heart specialists work with it. These examples show how the designers strove to anchor the vision with the future users as an integrated part of the design, experiment, and test activities.

The designers used the four phases to ensure an incremental decision-making process based upon the materials produced in each phase. So, in order to produce relevant groundings for the decisions, the designers iterated, within each phase, between analytic and design-oriented activities. However, the designers allowed themselves less strict decision points than recommended by the MUST method. This was because this was both a research project, aiming for generating new knowledge, and a development project, aiming for a product within time and economical constraints.

Some of the prospective users were involved in different ways and with different intensity over a period of a year and a half. They participated out of interest, willingness to contribute to research, and they hoped that some day patients

would benefit from the time they invested. This is again related to the difference in development context. There was no manager demanding the users to participate, or allowing them to use their working hours for the project. Therefore the designers had to strive for a fun and meaningful process in order to maintain a commitment to participation.

4 Energy renovation and CO₂ reduction project

This case describes a private-home renovation project completely outside the application area of MUST. The case demonstrates how the MUST method's four principles can be situated in design projects that do not focus on IT. The project was not conducted as an IT-design project and did not specifically follow the phases or use any IT-related techniques and tools from the MUST method. The MUST principles were, however, an explicit concern during the project as represented by one key designer, the owner, who is also a co-author of this chapter. Below we describe the project and reflect on how each of the MUST principles was applied.

Global climate changes caused by burning fossil fuels have led to a general concern towards our society's energy consumption. A large part of the energy consumption is due to heating and cooling the buildings we live and work in. The Nordic Council of Ministers established, as part of a joint Nordic vision to prepare for future independence from fossil fuels, the 'Nordic Energy Municipality' initiative. This initiative is focused on sustainable energy, green growth and energy-related climate work in the Nordic countries. The aim of this initiative was to recognize, in particular, those municipalities that make an extraordinary effort to implement innovative energy and CO₂ reducing projects. The Danish municipality of Albertslund was, in 2011, named the Nordic Energy Municipality, based on the 'Albertslund-concept of energy-effective renovation of houses' (Nordic Energy Municipality, 2012).

The majority of the housing stock in Albertslund was built between 1968 and 1972 before the energy crises in the seventies. The municipality aims for an overall 25% reduction in CO₂ emission by energy renovation of the housing stock. Nine demonstration projects were completed to develop new standardized energy solutions in 2011–12. These projects renovated energy-consuming houses build in the sixties and seventies into CO₂ friendly houses, meeting the new standards for low-energy houses (the so-called Building Regulation BR2015 standard).

One of the demonstration projects was a privately owned town house built in 1971. The project (see Figure 3) comprised

- exterior insulation of roof and walls mounted as a new shell on existing facades,
- solar panels ensuring self-sufficiency in electricity,
- electrical grid-powered roof windows with rain sensors,

- electricity-powered exterior awning blinds providing more daylight and fresh air while also preventing overheating during summer time,
- air ventilation with heat recovery to maximize indoor climate as the renovation made the house completely airtight,
- wireless centrally controlled heating thermostats allowing daytime and night-time temperature drop when the occupants are away or asleep,
- Rainwater fascine, draining rainwater from the roof back to the ground instead of to the sewer system to accommodate the increased flooding risks resulting from climate change.

4.1 Coherent vision

The MUST principle of coherent visions for change includes a metaphor of sustainability that in the project became a key success factor regarding the economy.

At the many public meetings, where the architects presented their ideas, the residents recurrently mentioned their concerns regarding the economy of the project. All houses in Albertslund are heated by a large district heating plant providing some of the cheapest heating costs in Denmark. Even though the houses are poorly insulated and draughty they are, therefore, relatively cheap to warm up. The architects and energy consultant were very enthusiastic about the project and aimed for an ambitious energy renovation. This challenged a reasonable cost-benefit result that is sensible for a privately owned house. The resulting prototype house was to be designed as a standard solution inspiring future renovations throughout the neighborhood. However, no one could be forced to renovate their house – the owner of a private property solely decides on this investment. Hence, a sustainable solution was contingent on being economically viable.

The contractors' bid on the first detailed design proposal turned out to be too expensive and would result in a considerable mortgage increase even when taking the lower heating costs into account. The project was then profoundly redesigned cutting all high-expense and low-energy-saving ideas, including dropping insulating the footing below ground level, aligning windows and doors with the new shell, etc. And during the actual project many new ideas were developed regarding how to further minimize costs, including blowing insulation granulate into prefabricated shells rather than attaching insulation bats and plastering a shell onto these afterwards. The result is a renovation where the energy cost savings almost balance the investment. And, taking the additional improved environmental, comfort-related and aesthetic elements of the project into account, the investment is broadly assessed as both beneficial and attractive.

The balance between technology, organization, and qualifications, which is also included in the principle of coherent visions, was not explicitly addressed in the

project. This might have been relevant as the involved technologies do have consequences regarding organization and qualifications:

- Organizational consequences include, for example, behavioral change to airing, heat adjustment and aligning electricity use with solar panels production,
- New qualifications are required to configure and use the advanced systems controlling ventilation, heating, and electrical windows and blinds. The user manual for the windows and blinds is, for example, 98 pages long and written in a highly technical language.

4.2 Genuine user participation

The MUST principle of genuine user participation, its political argument regarding the user's right to influence a design, and its related theory of mutual learning processes was realized during the renovation project in relation to the design of the roof construction of the house.

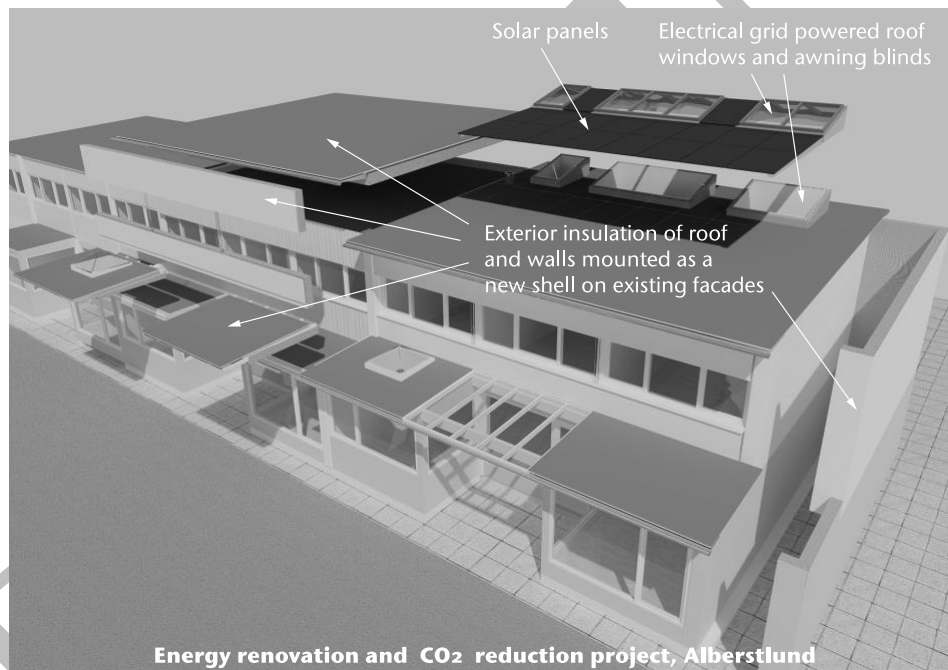


Figure 3. Model of the demonstration project made by Martin Rubow, Architect MAA, and Carl Galster, Architect MAA.

The architects' design ideas, drawings, and more and more detailed plans of the project had been presented and discussed at several meetings with local authorities and at town hall meetings where the neighborhood residents were invited. The town houses are regulated by a restrictive district plan to maintain a uniform appearance, including detailed list of the colors to be used for the buildings, style and size of windows, fences, extensions etc. The renovation had

to be balanced in a way where one renovated house among the others in a row did not look too different from the existing houses.

Any design that would differ too much from the existing regulations would require an alteration of the district plan and this involves a complicated and time-consuming procedure, hearings among the local residents and, ultimately, a new bill to be passed by the city council. Discussions involving the district plan usually spur great public interest: This plan imposes many constraints that the residents need to be aware of when they maintain and change their houses.

Perhaps the most distinct feature of the architects' design ideas was to construct the new insulated roof with quite a large roof overhang (see Figure 4). This overhang was intended to protect the facade and windows section and minimize solar radiation that during summertime caused the houses to overheat.

As a final step before the renovation could be initiated the design had to be approved by the municipality's agency for construction work. They judged that all design ideas could pass through an exemption except the roof overhang, which would require an alteration of the district plan that they would not recommend to the city council. Therefore they asked the architects to redesign the project without a roof overhang (see Figure 4).

The new design (roof without overhang) was discussed by the executive committee of the homeowners' association. The committee was very disappointed that the municipality had declined the former design. They objected to the decision but this protest was dismissed by the agency for construction work. Then the committee brought the new design proposal to the neighborhood's annual general meeting. At this meeting, a motion was carried out unanimously requiring the committee to insist on the original design solution. This public pressure at the municipality's agency forced them to acknowledge and initiate a change to the district plan to allow for an approval of the original design including the large roof overhang.



Figure 4. Design with roof overhang (left) and without (right). Model made by Martin Rubow, Architect MAA, and Carl Galster, Architect MAA.

The local democratic process and mutual learning involved in the participation of residents (users) and professionals (architects and local-authority experts) required that the residents learned about the design options of the project and that the professionals learned about a core interest of the residents. This interest

was not driven by the designers' functional arguments for the roof overhang. Rather, it was the residents' interest in the aesthetic change – that the roof overhang actually represented a major change of the district plan: If a homeowner is to invest a considerable sum of money in renovating his house he wants it to be very visible that he has actually done so. And the roof overhang was one of the most distinct changes indicating a modern and newly renovated house.

4.3 First-hand experience

In the MUST method the principle of first-hand experience is originally intended for using ethnographically inspired techniques to access concrete experiences of work practices prior to the introduction of new technologies, as well as experiences of using early prototypes prior to full-scale implementation. In this project the principle was applied with the latter intention in mind only.

Experiencing the newly renovated house proved to have a vital impact regarding the assessment of the different solutions and the dissemination of the renovation to other households (see also the section below on the anchoring principle). There is a qualitative difference between looking at different models of the house (such as, for example, Figure 4) and considering calculations on energy savings, as compared to entering and experiencing a full-size prototype house.

Hundreds of neighbors and other interested parties have visited the house at open-house arrangements. An immediate impression was meeting a house that looked like a newly built house (due to the new roof and new facades) and experiencing a highly perceptible change of the inflow of light inside the house (due to the new large roof windows sections). This considerable aesthetic improvement had no 'voice' in the many discussions at public meetings held during the years prior to the project. Along with the owners' communicated experiences of an improved indoor climate without cold walls, draft, and overheating on sunny days, and with constant fresh air and less dust without airing several times a day, this will most likely provide many neighbors with the decisive motivating factor for making the investment.

4.4 Anchoring visions

The MUST principle of anchoring visions includes attempting to gain wider support by openly presenting design ideas and proposals and testing critical assumptions and hypotheses. In the renovation project the anchoring principle was specifically concerned towards achieving a sustainable solution that would be both attractive and economically viable to households in the neighborhood, motivating them to invest in ambitious energy renovation.

The design strategy included the completion of the renovation while the occupants of the house continued to live in the house. The insulation was done from outside the house, encasing the existing walls and roof with a new shell including 200–300 mm insulation. The project was designed in modules (each

with a separate energy savings calculation) to be completed in separate phases and at levels of ambition concurrent to the owner's desires and economic capability: A household could, for example, start with a new insulated roof (when the roof needed maintenance anyway), and then later insulate the walls.

One major design approach to minimize costs was to attach the new insulated roof on top of the existing roof, thereby also closing the ventilation of the existing roof. This caused many technical considerations to make sure that the new vapor barrier would not later cause moisture and mold. The history of Albertslund is widely known from a major construction scandal in the seventies when many of the prefabricated constructions with flat roofs (which was a new construction approach at that time) resulted in severe and costly moisture and mold damage. Construction experts approved the final solution but many residents were concerned as to whether this actually would work out. To test the hypotheses underlying the roof solution, wireless readable humidity sensors were placed in the roof construction. This way the validity of the roof construction solution and possible risks of moisture damage could be monitored.

After the renovation was completed a number of logging devices (measuring district heating consumption, room temperatures, electricity consumption and production, ventilation volume, etc.) were installed in order to test the assumed energy reduction and cost savings related to different technologies implemented in the project: The data from these loggings aim at measuring the solar panel electricity production compared to the concurrent electricity consumption, efficiency of the ventilation with heat recovery vs. traditional ventilation, savings resulting from daytime and night-time temperature drop regulation etc. Consequently the calculated (assumed) savings can be supplemented by actual values measured from each different energy solution.

The principle of anchoring visions was of great relevance in the renovation project in order to establish support and motivation for the residents to invest in energy and CO₂ reduction in their private households. This was approached by taking the residents' economic concerns seriously, by testing and documenting economic and technical assumptions and hypotheses, and – finally – by implementing a full-size demonstration project where aesthetic, economic, technical, and indoor climate aspects could be experienced and evaluated.

5 Lessons learned

In sections 3 and 4 we have described how the MUST method has been applied in two projects outside its original use domain. This is an important message in its own right: It has been possible to situate the method by using the method's guidelines to tailor, or design, the project to the specifics of each situation.

Based on the experience from the two projects we propose a model of the MUST method to be used in design projects, as depicted in Figure 5.

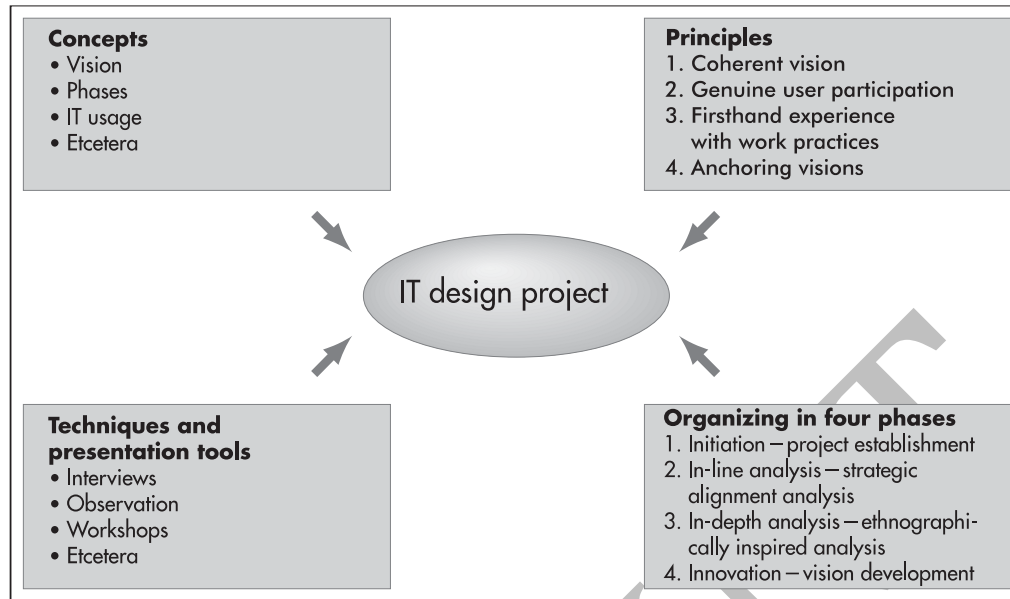


Figure 5. For types of resources for design when using the MUST method

More specifically, we derive the following lessons with regard to the method's resources:

- **Concepts:** Designers using MUST outside the original application domain will have to add concepts and definitions from that domain. For example in the energy renovation project concepts on energy consumption in housing, political initiatives to minimize CO₂ reduction and the administrative procedures for approval of construction projects were central.
- **Principles:** The two cases have demonstrated that the principles can be situated while maintaining their validity as shown, for example, by the description on anchoring visions in the energy renovation project.
- **Project organization:** There are already some guidelines in the MUST textbooks for adjustments to the recommend phases. The two cases have demonstrated further options: To start early with ethnographic studies and to combine ethnographic field visits with design experiments (visions, mock-ups, and prototypes),
- **Techniques and tools:** There is already room in the MUST textbooks for including other suitable technique tools which designers have experience with. As indicated by Simonsen and Friberg (Chapter 12) techniques from MUST have also been demonstrated to be applicable in other contexts.

The basic finding that MUST could be applied to design projects outside its intended use domain is – in our reading – due to the general understanding of a textbook method as a resource for action by an informed project group, not as a cookbook with finished recipes. This is basically supported by how the method is presented as consisting of four basic types of resources, as depicted in Figure 5.

From the health-care case we more specifically learned that it was possible to use the MUST method in a combined research and product development project, with users participating on behalf of themselves only – and not as representing a larger group. From the CO₂ reduction project we learned that the core principles were relevant to a high degree and could be supported by a pool of techniques.

Finally, we also learned that risk management is ‘embedded’ in the method. In the project management literature, risk management is traditionally a project manager task; the approach in MUST is to make it a design project issue, like in Boehm’s spiral model (Boehm, 1986). Positioning the design project in relation to (company) strategies and other ongoing projects (in the initiation and in-line analysis phases) contributes to managing the relations across design projects and with established strategies. And setting the scope and the extent of activities in each phase, by positioning the current project in one of four prototypical situations within the project group by two-by-two matrices, incorporates an evaluation of the risks when deciding on the scope of the activities.

6 Conclusion

Participatory design has moved into many different areas, as witnessed, for example, by recent accounts from Trigg and Ishimaru (2013), Braa and Sahay (2013), and Balka (2013).

Based on the cases and experience presented in this chapter we see MUST as a suitable support for projects across the traditional terrain. We see the four guiding principles as the most stable elements of the method across different contexts of use. This conclusion is based not only on the two cases presented here, but also from other projects we have been involved in (Bødker et al., 2011). Further, we know from colleagues who use the textbooks in their teaching, that students have used the four resources in a great variety of contexts.

Combining the lessons learned in this chapter and our experience from teaching (Bødker et al, 2011), we can offer a general advice: If you are about to start on your first participatory design project using MUST

- situate the four principles to the situation at hand,
- use the four phases as a way to structure the process,
- select a few of the techniques that allow for that degree of participation that, from a pragmatic standpoint, is possible to bring to bear.

Enjoy.

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