

## The Design Lab

### Re-thinking what to design and how to design

by Eva Brandt, Jörn Messeter and Martin Johansson

In the field of IT design, there has been a dramatic change of the design agenda over the last few decades. With the growing importance of mobile and wireless devices and the massive expansion of Internet availability, the classical object of design, the dedicated information system targeted towards a well-defined group of users, is about to vanish. Even if we conceive of the information technology setting as a 'system', this system can hardly be seen as the outcome of a systems design process. Consequently, IT design is today guided by new design agendas. Ubiquitous computing<sup>1</sup>, and from the user side, information ecologies, seem to be more appropriate labels for the emerging design context. The object of design has correspondingly changed from systems to devices, tools or information appliances<sup>2</sup>.

This radical opening of the question of what to design has led to an apparent confusion concerning how to design. As the fields of information systems design were about to mature, with a broad and widely accepted repertoire of design approaches and methods emerging, ranging from workflow analysis to user involvement, this battery of approaches is quickly losing ground in favor of more techno-centric explorations. The confusion consists in a growing divide between mainly North American approaches emphasizing technological concepts such as ubiquitous computing, tangible interaction<sup>3</sup> and augmented reality,<sup>4</sup> and mainly European approaches emphasizing the grounding of technological applications in a potential context of use.<sup>5</sup>

Broadly speaking we find that the possible merging of top-down and bottom up approaches to IT design envisioned for example in the Computer Supported Collaborative Work (CSCW) community, tend to split up and relapse into more conventional schemes of technology-oriented concept development and context-sensitive application design. Behind this unintended divorce of previously converging approaches, we see two largely overlooked and partly related mechanisms at work. First of all we believe that both sides of the field of IT design are still held captive by the early framing of systems design as deductive problem solving. Since Simon and others formulated the broad notion of design<sup>6</sup>, it has become axiomatic for the new design professions to see the design of new artifacts as a straightforward translation and reduction of intended, specified outcomes. Secondly, and partly as a

result of the first problem, the field of IT design has by large been unable to reach out to, and integrate, other design fields, such as architecture, industrial design and engineering. The reason for this is the fact that the notion of information systems in itself is largely resistant to encompassing the particularities of a specific embedding of interaction technologies in an architectural site, a full-fledged consumer product or a production facility. We regard this as a problem, as for instance ubiquitous computing and information ecologies have obvious connections to architecture and product design.

A way out of this dilemma is, as we see it, to adhere to the upcoming notion of interaction design, and to develop approaches to this new design field transcending the mere fusion of conventional design and information systems disciplines. What is needed is on the one hand to firmly (re-)install the 'creative leap' of design in the self-image of the interaction designers, and on the other hand to develop what we, with a loan from Schön, will call "a conversational design practice"<sup>7</sup>. The medium for this new interaction designer is not information technology or digital media, but interaction technology in its full-blown combination of script, embodiment and symbolic connotations. The elementary processes of designing interaction are not a Simon-like general model of problem solving running from defining a problem, searching solutions and selecting the optimal. Rather, the micro processes of design resemble the Schönian notion of designing as a revolving cycle of seeing, moving and seeing. The crucial point in developing this new interaction design practice is not only to make room for, but also to actually install 'conversations' with the context of use and envisioned technology. To accomplish this, it is equally important to establish new formats of design representation, to explore new approximations of the design activity, and to probe for and reflect upon how the designed artifacts eventually are rendered meaningful in everyday life.

In the following, examples are given of how we, in the Space studio, have worked with the emerging notion of interaction design. Within the fields of ubiquitous computing, embodied interaction and augmentation, we have explored what to design and how to design in parallel. The design approach presented is that of the "Design Lab". Over the years, this design approach has been gradually developed in various design projects carried out in collaboration with industrial partners. The approach suggests a 'conversational' design practice, focusing first of all on what to design. Ubiquitous computing, tangible interaction and augmented reality are all notions pointing out new directions for what to design. The main issue addressed has been how to accommodate for a higher density of technology by letting devices blend in with our everyday practice, in order for the interaction with technology to become better integrated with our "being in the world".

In parallel with the increase of technology density follows an increase of mobility and continuity in IT use. In ubiquitous computing, the mobile IT user is constantly moving through different contexts of use, social as well as technological, and at any point in time and space, a new information and communication service may be provided. This increase in dynamics of use, where each artifact can take on different roles, makes it difficult for the designer to predict use situations. Instead, we suggest a more open-ended view of the functions of IT artifacts. In the traditional application perspective, the possibilities of use for an artifact are restricted to the activities designed for. From what we can see, the technical components in the ubiquitous computing era will still have a limited set of functions. However, it is crucial that these functions are regarded as possibilities that can be configured by the user depending on his or her current situation and the activity engaged in. This may be described as a deliberate 'under-designing' to provide room for the user to independently configure devices for the situation at hand. Trying to meet the challenges of a new design agenda, our goal has been to design for an open-ended use, where the role of artifacts in a particular situation is in the control of the user. An example of this approach was given in the project "Beyond the control room", where we were looking for alternative approaches to process control work in a wastewater treatment plant<sup>8</sup>. The centralized control room has for long been a guiding image for process control work, however mobile IT opens up for new ways of working. In fact, centralized control draws a sharp line between a physical world with the machine components at the process operator's hands, and a digital world with digital representations of the same components on a computer screen in the 'control room'. While addressing this duality between the material and the digital, we tried to dissolve the border between machinery and screen icons

by designing mobile devices for process control. In the study of operators' work practice, our conclusion was that the centralized system in use was far too rigid. A process control plant is characterized by never being in a normal state. There are always issues to deal with, coming from malfunctioning equipment or abnormalities in the processed material, as well as from the expanding or rebuilding of parts of the plant. Based on the framing of a perceived problem, a core need for the process operators was to be able to select a set of components related to the problem for close monitoring – or what we termed 'a temporary focus'. We developed a concept called the "Pucketizer", a handheld device that allowed operators to configure temporary foci for control "on the move". Even though the operators may be seen as users of the technology, the notions of use and users was somewhat misleading. With the concepts, we collaboratively imagined instances of use, however these 'use cases' served more as examples of an emerging new practice, where operators configured their own systems of monitoring. Or perhaps, more precisely put: The concepts pointed to a new set of system building components, which left the actual construction of usable system configurations to the future users.

Consequently, we did not design systems or applications in terms of directly matching our design to the activity system of the operators. Neither did we make tools or appliances. The notions of tools and appliances imply a fit to particular tasks or purposes, which in our view very easily direct us as designers towards what Floyd calls "over-designed artifacts"<sup>9</sup>. For example, remote controls for specific plant components, such as pumps or engines, could be seen as such tools. With the design of the Pucketizer, we rather suggested a "system builder" that enabled the operator to assemble a (potentially general) input and monitoring device, such as a wireless display, with a particular set of plant components, such as a pump and a flow meter. This assembled configuration, the Pucketizer, eventually became a tool for the operator, even if it is better described as a configuration device.

In general, the strength or quality of a concept of open-ended use depends on its ability to support use in different contexts. For instance, the Pucketizer as a general configuration device arguably can fit into a number of different environments and activities with mobile users. The critical issue is that, in every new context, the artifact evokes a significant and distinct meaning for the users in the . A functionality too general, would become superficial, or too open-ended. And accordingly, if the Pucketizer's main function were to support the exchange of information solely with objects in its vicinity – as a general probing and controlling device – it would not take on significant meaning in other contexts. Consequently, it is the creating of temporary foci in general that, to us, has been the main transcending quality of the concept.

Subsequently, concerning the 'how to design', we have explored the idea of a "Design Lab" involving stakeholders in a series of design events based on participatory inquiry and collaborative design<sup>10</sup>. This design approach is based upon the experience that the staging of the design process is highly decisive for the objects to be designed. The "Design Lab" represents a way to open up the design process for more people than is engaged in the traditional design team. The essence and challenges consist in the creation of a reflective and constructive dialogue between designers and stakeholders with different competences and interests in the object to be designed. All design events are oriented towards two main issues: inquiring into "what-is" and exploring "what-could-be". However, this does not imply a sequential process, where focus shifts from inquiry to design as soon as a sufficient amount of information from the design situation is collected. In fact, arguably, there is never any sharp distinction between inquiry and design. Rather, at any point in time, the design lab activities may generate input to the design process in terms of new insights from the life world of users; as well as in terms of ideas about future possibilities, identification of crucial aspects of use experience, etc. The design process is iterative and event driven, each event feeding into the next.

In general, these events share two main features: (1) a working process focused around three aspects of designing – staging, evoking and enacting; and (2) the collaborative creation of design artifacts. By staging the design, we refer to the context in which the object of design is to be used. We think that the best way to do this is to organize various activities for participatory inquiry together with potential users. Main inputs include data from field studies using e.g. video ethnography and cultural probing. By organizing collaborative activities, important elements of the design situation such as interpretations,

ideas, problems, etc., can be evoked by the stakeholders. The activities can, for instance, consist of an inquiry into video-snippets about users everyday life-worlds. It can consist of a commission to play a design game guided by a set of rules on a game board, using game pieces. It can consist of design presentations or collaborative development of design concepts, scenarios, or various design models. The activities and materials can be prepared by any of the stakeholders in the design process. Essential is that they function as props and that they open up for a reflective conversation with the design materials at hand.

The participants acting out a collaborative scenario complete the design cycle. Here, a story of use in practice is performed. This enactment is tightly grounded in the participant's dialogue and puts the design and arrangements of space, scenery and props, the staging, into play. Enacted scenarios open up for external feedback and internal reflection, which gives material for the continuous design cycle to move on. When succeeding in organizing the activities in the Design Lab as a reflective and constructive dialogue, new ideas, and rearrangements emerge, driving the design task in a spiral motion distancing and immersiveness. In the Design Lab, the continuously produced design artifacts play a central role in shaping both the process and its outcome. The production of design artifacts, seen as a reification of the design ideas produced, supports the participatory design conversation by providing material for negotiating interpretations and meaning.<sup>11</sup>

The Design Lab is about collaboration, and we will now give three short examples of how and what to design. They illustrate how we have worked and explored the Design Lab idea in collaboration with various industrial partners in the Space studio. So was the Dynabook project carried out together with a large Swedish telecommunication company in collaboration with potential users. The telecommunication company was concerned with the relation between (digital) services and (physical) terminals. They did not have the competences to pursue an investigation by themselves, yet this was not a task to simply hand over to an external design firm, but had to be pursued in close collaboration with people from their own organisation. Therefore, the Space studio was invited to organise the project as a Design Lab. The project explored designing concepts for differentiated electronic books. The potential users ranged from children over teenagers to adults.

In relation to the question of what to design, we were inspired by Norman's idea of designing appliances for specific uses. Collaboratively, we investigated on what kind of services the users wanted, how the terminals should look like, and how on the interaction could be conceived of<sup>13</sup>. By the end of the project, ten different design prototypes of electronic books was laying on the table<sup>14</sup>. The prototypes suggested various physical shapes and ways of interaction. The participants were then asked to try and use each model, to conceive of concrete use situations, to comment on the interaction, and not least, to evaluate the design. Each person wrote down their comments on post-it notes and attached them to the design models. In the end, everyone presented their views, thus evoking further views, ideas, and discussions on physical shape, design expression, and attractiveness in various use situations. Services, form and ergonomic factors were discussed from the point of view of such different situations as 'while cooking', 'while in bed', 'while sitting on a bus', 'while at school' or 'while laying on a beach'.

Supporting collaboration between people with different backgrounds, interests and expectations by organizing an event with detailed physical design models worked very well. The models help to make the dialogue more focused, they functioned as a point of reference, and they served as 'things-to-think' with. The set-up of the event supported both critical reflections on the design aspects modeled, and thoughts about what constitutes good design in various use situations. It also evoked new ideas about functionality and use<sup>15</sup>. While looking back on the project in relation to what to design, the Dynabook project highlighted an important problem. While the aim was to produce design concepts for electronic books with limited purposes, a single-purpose device, the potential users seemed to favor designs where the artifact in use could be seen as a 'prop' in the staging of an un-prescribed enactment of purposeful action<sup>16</sup>. The designing of appliances seem to suffer from the same problems of over determination as did the designing of tools. The book metaphor in itself was evocative for the group of potential users, but when more detailed electronic book concepts were described, it became apparent that the users were reluctant to accept a connected display device, which did not allow them to set up their own connections for pursuing related purposes.

In the Experimental Office project, the Design Lab idea was tried out in a larger scale, as it involved four different industrial partners. The companies were one information technology company, one company producing office furniture, a telecommunication company, and a real estate company. The aim was to design concepts for an office, where architecture, technology and furniture were thought together to assist future project-oriented work. The project was based on a strong vision of creating a working laboratory – an experimental office in common. The partners agreed upon the premise that the object to be designed was to be a context for exploration by people actually working in the new environment. They did not want a showroom or a demo-lab for each of their latest services and products. The Space studio was involved and made responsible of organising and facilitating the design work<sup>17</sup>.

We developed a series of design games, each focusing on different aspects of the design task. It was a way of organising the design events and making room for the various competences and interests of the people involved. The first game was 'the landscape', which focused on staging the design by exploring the relations between things, people's activities and places. The goal was to build a landscape that the participants could agree upon. They had to choose between three game boards with generic shapes as a staging area. The game pieces, or to use a theatre metaphor, the 'set-pieces', for the staging, was plastic cards with images from videos<sup>18</sup>. Each player was given a number of 'set-pieces', and by taking turns they looked at the video snippets and placed the set-pieces on the game board. Soon a discussion started about what the generic shapes on the game boards should illustrate, and how the set-pieces related to one another, as well as to the game board, and to the activities taking place in the office. As time passed, the meaning of the staging developed through negotiations. The staging had social, physical and technological properties, which offered important preconditions for the work. The set-pieces were constantly moving around on the game board to make room for new things, and the moving of set-pieces evoked new discussions. The landscape game was easy to play and independent of the participants' competences and interests.

While building a landscape, the set-pieces were more than "mere" representations of the video snippets. More importantly they became placeholders of their discussions with references to their placing on the game-board. For example one group discussed a server (computer) room. One of the participants picked up a set-piece and after everyone having watched the video snippet, he suggested that a server room was not going to be necessary in the future. This suggestion started a discussion about the work environments represented by the video snippets, the participants' own experiences, and about the plans of one of the participating companies to provide this service to other companies in the future. After a while, they concluded with the opinion that the server room was not to be found in the experimental office environment and moved the set-piece away from the game board.

As a refinement a participant suggested that they should create an off-side corner on the game board for "things that do not belong here". Another person elaborated on the idea by suggesting two off-side corners; one for the set-pieces that were irrelevant for future office work and one for set-pieces that were necessary services but which the workers did not manage to have in-house themselves. Concerning what to design, the project did not fully live up to the strong visions that initiated the collaboration. While organising a design process where we worked in parallel with space, technology and furniture, the resulting experimental office concept did not fully integrate everything into a 'larger whole', which supported the work supposed to take place in the office environment. The reasons for this can be many, but we believe that an important factor was that the partners' products and services were all 'closed' in the sense that they were not subject for change. What we managed to do was to develop an interesting design concept, which made each partner's contributions work in concert. However, by not opening up for new ideas and the re-designing of products and services, the outcome was limited.

The COMIT project<sup>19</sup> showed many similarities with the Experimental Office in the sense that we collaborated with several industrial partners. One partner worked with mobile services and terminals, one was a telecommunication company, the third company developed digital pen technology, and the last developed handwriting recognition software. An important difference was that none of the products and services in COMIT was fixed. The partners were keen on taking their present technologies apart and use the generic functions as resources and guidelines when exploring possible futures. It was

unclear exactly where we were heading, but we wanted the project to concern mobility and situated use of multiple devices. We investigated how to design for accommodation and coordination of several devices and services across different social spaces, both work and leisure worlds. The main objective was to develop future use scenarios and associated IT concepts using the Design Lab approach. By the end of the project, potential users created enacted video-scenarios in their own environment. In preparing the scenario, they produced prototypical forms of various devices, used as props while enacting the scenario. One of the potential IT-users was a fashion designer with her own shop. In one of the scenarios she shows her new garments to a customer company representative, who takes on the role as customer. Together they browse through the collection while the shop owner comments on the different garments and answers questions. After a while, when some of the garments have been chosen, the customer wants some corrections to be made. Pictures are taken of the clothes using the 'image device' prop. Then the pictures are annotated with comments on requested changes, prices, colours, etc. using the 'imaging editing tablet' prop. The annotated pictures are then sent from the 'image editing tablet' to a portable printer. The scenario ends when the pages are printed and the personalized catalogue is handed over to the customer.

In this case, the enacted video scenarios created the basis of participatory inquiry in a later design event. In this respect, they were concrete design proposals, created in an earlier design event, but now elaborated upon by the users. While enacting the scenario, the users were immersed in the situation and used the foam props as if they were actually functioning. At the following design event, the scenarios were looked upon more from a distance. For instance, reflections were made about functionalities and use qualities, but the dialogue simultaneously evoked new design ideas. In terms of what to design, the shop owner demanded a set of multiple devices acting in concert to unobtrusively deliver relevant functionality with a minimum of hassle, where robustness is one of the key words.

The COMIT project in general pinpointed that, while mobile devices have opened new possibilities of IT use in space and time, the important design challenges are to support the user in handling multiple roles and social spaces, given the contextual factors of the situation. The partners agreed upon the fact that the scenarios and ideas developed using the Design Lab approach, provided fruitful examples of how these challenges can be met. In general, our experience is that it is better to deliberately under-design artifacts, thereby hand over the potentials of further configuration to the users themselves.

On a practical level, organizing collaborative design is not commonplace. The main activities in the Design Lab have consisted of design events based on participatory inquiry and collaborative design, where important features have been the staging, evoking and enacting as ways of taking the participants' life-worlds into consideration. All participants in the Design Lab had something they wanted to achieve, and finding ways to involve people with open agendas and a willingness to put their stakes at risk, has been of the greatest importance. It has been necessary to find ways of both bridging the gap between various language-games<sup>20</sup>, expertise and interests, as well as finding out what to explore and how to create possible futures in common. A precondition for a successful collaborative design event has been an open atmosphere, in which the participants have been able to communicate with each other. As a rule, this has been easier when the participants have shared the same work practice, competences and interests. However, this was not always the case. Therefore, the role of the design artifact has been even more important, as a way to integrate various experiences through the providing of the 'richness' of what Star calls "boundary objects"<sup>21</sup>, objects to which the participants have been able to relate both on a personal and on a general level.

Summing up, the design agenda within the field of IT design in the middle of a transition. There is great confusion as to both what to design and how to design, the emerging field of interaction design searching for solutions. We suggest the use of the Design Lab design approach, as it involves the simultaneous designing of the process and the object, abandoning the framing of IT design as deductive problem solving. Instead, we have developed collaborative design events based upon a reflective and constructive dialogue between people with various competences and interests in the how and what of design.

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