The thesis explores how interactive technologies and digital media can be used as transformative mediators and tools. They have the potential to strengthen and enrich the experience of different transformations that are discussed as being important for practices of creativity and learning, where the engagement and relationship to processes of change is fundamental. The flexibility of digital media and forms for tangible interaction constitutes major elements in the design experiments described in the thesis.

Material artefacts and physical space play a central role in how people make sense of the world. Looking closely at practices where creativity, learning and communication are important for collaborative work it becomes clear that this insight implies that the concepts of objects and space carry quite a portion of multiplicity. They are used differently and with different intentions, they are understood differently from different perspectives and the look and feel of them appears differently even if they can be described as “one” thing or “one” space. Dealing with these heterogeneities challenges the way we use objects and spaces. It becomes a matter of connecting the multiplicities and how we configure them in relation to each other. The research discusses how the discipline of interaction design can support dealing with multiplicity, configuring and mixing of objects and spaces. They are not only used or inhabited; they are performed and enacted.

In exploring these issues the thesis discusses the development and experiments with a couple of design prototypes that rests upon basically the same technology which is a combination of technologies for tracking and/or tagging. Studies and experiments have been performed in three different domains: design work, patient learning while undergoing lengthy rehabilitation and artistic work and performances. The diversity of studied domains provides a way of talking about design that focus on use and users’ appropriation of technology rather than reflecting the technology itself. From a methodological perspective issues of participatory design have been foundational to the research.

Some design consequences refers to how we can not only regard interactive artefacts as bundles of functionality. We must also look into issues of giving form to them as material things and the thesis especially reflect how we can override a distinction of things being either material or virtual. Another consequence is how digital technologies often does not replace “analogue” media and material things, but instead are used in parallel and must find a place in an already existing ecology of artefacts, devices and services. In the thesis there is a strong focus on how human action is co-shaped together with artefacts and technology as we perform specific tasks or simply go on about our living and making sense of the world.
Metamorphing
The transformative power of digital media and tangible interaction

Per Linde
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# CONTENTS

1 Introduction .......................... 5
   1.1 The research question ......... 8
   1.1 Metamorphing .................. 10
   1.3 The thesis – a short reader and acknowledgments .......................... 17
   1.4 The projects .................. 21
   1.4.1 Atelier ..................... 21
   1.4.2 Palcom ..................... 23
   1.4.3 Artistic installations and performances .......................... 24
   1.5 Contributions ................ 24

2. On methods and design – understanding and transforming places. 29
   2.1 Field studies - a linkage to ethnography and ethnomethodology .................. 34
   2.2 Field trials and evaluation – a linkage to action science and participatory design .......................... 40
   2.3 Methods as design – an example; the tracking game table .......................... 48

3. On objects and spaces; real, virtual or both. .......................... 53
   3.1 A new multimodality in design representations & materials .......................... 58
   3.2 The Texture Painter example .......................... 62
   3.3 Spaces, places and appropriation .......................... 67
   3.4 As I travelled to Vienna with a suitcase full of fibre glass..... .......................... 79

4. Metamorphing and the power of transformations
   - the case of design work. .......................... 89
   4.1 Inquiries and reflection .................. 90
   4.2 Atelier – Design as Metamorphing .................. 91
   4.3 Transformations in dialogue .......................... 99
   4.4 Metamorphing a saw into a design concept .......................... 103
     4.4.1 Mixed objects - the role of technology .......................... 107

5. Metamorphing as aligning actants – the case of hand surgery 111
   5.1 The enactment of “hand talk” .................. 113
   5.2 Building a discourse around digital media as boundary object .......................... 116
   5.3 Dealing with heterogeneity .......................... 121
   5.4 Explicit interaction .......................... 123

6. Metamorphing as space transforming- the case of artistic work. 129
   6.1 Diagnoses, remediation and liminality .......................... 136
   6.2 The suitcase once again - now on stage .......................... 145

7. Epilogue .......................... 149
   7.1 Reflecting some cornerstones .......................... 150
     7.1.2 Technology .......................... 151
     7.1.3 Understanding and transforming .......................... 154
     7.1.4 Reflection .......................... 157

References .......................... 163
Appendice 1 .......................... 173
Embodied Interaction – Designing Beyond the Physical-Digital Divide. 173
Appendice 2 187
Playful collaborative exploration. 187
Appendice 3 207
Exploring relationships between learning, artifacts, physical space, and computing 207
Appendice 4 225
Collaborative Articulation in Healthcare Settings –Towards Increased Visibility, Negotiation and Mutual Understanding 225
Acknowledgments

I am the main actant, but still just one of the nodes in the network that constitutes the research that have lead to this thesis. Many colleagues, near and distant, have played different but important roles in shaping the research. My supervisor Pelle Ehn has of course been an especially important, but there have been many others;

Lone Malmborg, Bo Peterson, Thomas Binder, Jonas Löwgren, Mette Agger Eriksen, Tomas Sokoler, Simon Niedenthal, Jörn Messeter, Peter Warrén, Per-Anders Hillgren, Erling Björgvinsson, Martin Johansson, Ina Wagner, Giulio Jacucci, Giorgio De Michelis, Andreas Rumpfhuber, the other researchers in Atelier, Palcom, the people at Imagination Computer Services and many others.

I am also grateful to all the students that participated in the Atelier project, the staff and patients at the Hand Surgery clinic in Malmö, especially Fredrik Järnkrantz and Marianne Neving.

Andreas Bertilsson and Conny Malmqvist for contributing to the performances.

Lena Mattsson stands in a class of her own when it comes to contributions.

The main parts of the pictures I’ve taken myself but there are contributions from above mentioned Mette, Andreas, Giulio, Lena and also from Christer Hallgren who documented the performance and exhibition at nordiska akvarellmuséet.

K3 as an environment made it possible to work.

My friends and the whole of my family, but especially; Lena, Sidney, Siri and my mother.

The work is dedicated to the memory of Lilia.
1 INTRODUCTION

This thesis explores how interactive technologies and digital media can play an active role in important parts of human activity. To be more precise, my interest is less on technologies as such or on media in itself. Rather the focus is on interaction with technologies and digital media and what kinds of situations that can be staged through this interaction. To be even more precise, interaction cannot be studied as an isolated phenomena floating around as a self contained autonomous entity. It is always performed within a specific context addressing certain kinds of objects and spaces. It is not only an issue of interfacing since interaction plays a role not only in relation to the entities humans are directly interacting with, but also in relation to other humans that they share these objects and spaces with. Having a socio-material understanding of how making sense of the world is performed, I believe in general that mundane artefacts and spaces play such a central role in this sense making that they are more like actors in a play almost on the same level as the human actors participating in that play. An important aspect of the way objects are mobilized in an environment is the way they are shared and how they align different actors in joint efforts. Creative design, an example that will be elaborated further on, for example occurs in a relationship with other designers and stakeholders in an engaged interplay with spaces and objects. The objects mobilized are boundary objects (Leigh Star, 1998); they are performed for reaching and communicating an
understanding that if not shared, still is common enough to make communication meaningful. They have the potential for crossing the boundaries between communities with different interests or belonging to different social worlds. They might be weakly structured as to achieve flexibility and allowing transference and commonality, but strong enough to be used in individual use or use in a uniform environment. Within universal interpretations more specific readings becomes possible. As the objects move between environments they are subject to translations. They are talked about and annotated upon, and they are also places for breakdowns and conflicts. Similar ideas has been developed, under the term “conscription devices”, by Henderson (Henderson, 1999) who looked specifically on design activities and how engineers are using graphics during the design process. Henderson’s observation points to not only the aspects of communication potential in visual and material things, but also how technology not replaces analogue media but makes ground for a mixed practice, where old formats are used in parallel with digital counterparts, each exhibiting different qualities. This I find being very important. In recognizing the importance of a whole ecology of artefacts as a fundamental resource within most practices, we can’t design interactive systems with the intention of replacing that ecology. Most of the time design should find a place within that ecology.

Furthermore this sense making of the world is performed individually, I say very little about that, but what is more important; it is most of the time also a collaborative effort carried out in co-operation with others, and I try to say something about that. This co-operation is not only a strictly functional one carried out at workplaces, but the interaction with others is being performed as an essential part of human life from homes and public places to workplaces and even the hermitage, since entering the hermitage the hermit’s wish to be alone is driven by his previous interactions with others. Since spaces and objects are so important in our “living with others” they necessarily carry quite a portion of multiplicity. They are used differently and with different intentions, they are understood differently from different perspectives and the look and feel of them appears differently even if they can be described as “one” thing or “one” space. Dealing with these heterogeneities challenges the way we use objects and spaces. It becomes a matter of connecting the multiplicities and how we configure them in relation each other. In doing this we let them “borrow” aspects from each other, like comparing the pen to the sword or “writing oaths in blood”, or like eating lunch on the public square or performing a quick one-man theatre play in front of a surveillance camera. Humans are in general extremely skilled and creative in this mixing of objects and spaces without any specific technology being involved. It might also seem like a trivial notion that these kinds of mixed objects and media influenced spaces are primarily distinguished as
material or virtual. This can be one property that actually is interesting, but they are also mixed and entangled in other ways; spatial/temporal, accessed from a variety of perspectives etc. The important issue is how and what possibilities for human action that are being staged and made possible through our designs.

Nevertheless, often this mixing is performed with support of electronic devices such as computers or mobile phones. And these devices do have an impact of how life is lived, and how basic things are carried out. The short but explosive history of the mobile phone is a good example. Just consider what has happened to the “device-for-talking-over-distance”. Talking is but one of many offered modes of interaction. The design of such devices are no longer seen as only a matter of affairs for engineers, but design is becoming more and more complex including notions of aesthetics and form as well as infrastructure and a demanding imagination of use in different situations. An important design strategy for mixing objects and spaces seems to be to mobilize a great quantity of materials in order to maintain the potential resources within them. Basically any material can be used and different qualities can be supported with different combinations. Freedom in combination of materials will also affect what modalities that will be addressed in perception.

A strong visual focus has emerged both in western culture and design of digital media. Mixed objects can well benefit from multi-modal expressions other than visual such as for example sound or tactile feedback. Another design material that should be recognized is the temporal structure of digital media. To view computation as composing in time is to acknowledge that we can view time as form and it also implies that we can turn to film and music rather than traditional “design-by-drawing” for inspiration. The temporal aspect is clearly observable in the way mixed objects are used. They have no final or preferred stage of being; they evolve in different situations over time.

Here I think that the discipline of interaction design has a role to play and in this thesis I look at how it can contribute to involving our co-actors in the play of life, the objects, spaces and the mixing of them. They are not only used or inhabited; they are performed and enacted. Especially they can be interacted with in a way where digital media potentially changes the conditions of how they are performed and experienced, which is the focus of the thesis. Because I believe that the design of interaction can deal with multiplicity, configuring and mixing of objects and spaces. I have had a specific focus on different forms of tangible interaction. Being less precise, because I also believe that design knowledge should carry a portion of transferability, I apply my research to three apparently quite different domains; design work, rehabilitation after hand surgery and artistic installations and performance. Moving basically the same technology and aspects of tangibility of digital
media between these domains, trying to see how it fits with the above mentioned socio-material process of mixing and performing objects and spaces, widens the perspective but also weakens the rigidity of more thorough case studies. But these stories are not foremost sociologically motivated. For that the answers lies within other disciplines. The issue at hand here is design and however well meant my studies have been carried out, possible design interventions are what have driven them.

1.1 THE RESEARCH QUESTION

Being part of large scale projects such as Atelier and Palcom, which I’ve taken part in, means that you’re entering into a research that have already been partly defined by others and where research questioned already have been defined to some extent, unless you are part of writing the application. While contributing to the overall project’s goal it is necessary to have an agenda of your own as well. This is characteristic for all collaborative design more or less and has some implications for the role of the formulated research problem. Dialogical sequences of posing questions and providing answers is fundamental for knowledge production and can easily be traced back to the works of Plato and Socrates. For me the dialogical aspect implies that it refers to a process of an evolving nature. The initial question receives tentative answers in return, which in many cases urges re-formulation of the problem, which gives rise to new sets of sub-questions. As a design researcher you are in parallel driven by spaces of possibilities provided by the field of design. I will later elaborate my view on design-oriented research, but would like to here stress a fundamental proposition for design research; to separate your lust for producing artefacts from the process of research while still having artefacts and practice as fundamental for the research. Research requires some faithfulness to the discipline and even if to a great extent confessing to socio-material accounts of how reality is constructed, I am not a sociologist, nor an ethnographer or anthropologist. The research question must concern the creation of somewhat durable design knowledge. An overall theme of inquiry for my research can be formulated as;

What are the driving forces in inspirational creative environments which are also spaces for learning and by what means could they be enriched with computational resources?

This was relevant for the Atelier project aiming at enhancing the design studio and the practice of design taking place therein. I try to address that question in this thesis. However, in striving for transferable design knowledge the question should
be re-formulated for finding generative concepts to engage in the reflection of designing.

As our exploration of the theme continued I, and also the project as such, became aware that the way that objects and spaces are shared, negotiated, altered and re-configured are such driving forces, quested for initially. This helped to give some edge to that question, now asking; how could this “performativity” of objects and spaces be conceptualized and what kinds of design could address the notion thereof? Especially an observed theme of a divide of formats and materials arose and how to overcome that divide became part of the re-formulated question. A concretization of that theme might be;

- Material objects are used in combination with digital media. How is a meaningful movement between the two achieved from an interaction designer’s perspective?

- Spaces, even if they have an apparently fixed form, appear in a variety of different expressions when used for different activities. Why is that an issue for the designer of computer artefacts and what role might be played by the use of digital media and its related technologies? I also try to address this in the thesis.

This remains the fundamental issues and questions for me. But a small extension became possible for pragmatic reasons. In order to explore the conceptualizations and understand the possibly transferable design patterns relating to the conceptualizations, other domains of inquiry could be of interest. With patterns I refer to general issues in the design that are not only due to specific applications or use situations, but can be transferred from case to case. It then became an issue of finding specifics of related contexts where creativity, learning and communication are crucial (and in what contexts are they not?). Rehabilitation after hand surgery and artistic work with installations and performances were the practices where I found possibilities for trying out the entanglement of conceptualizations and design patterns that I find important for design knowledge. These contexts have their own emerging themes which should be addressed and they form a set of new sub questions.

In the case of hand surgery I had reached a point where an envisioning of a potential for a ubiquity of digital media formed a starting point. This was a result of the Atelier experiences combined with the results of the Everyday learning within health care project, which was a smaller but yet integrated part of the Palcom project. It now became a question of how we can access that ubiquity in meaningful
ways and what the role of interaction might be. Having the practice of the rehabilitation ward in mind, we tried in our group to address this question while at the same time having more general implications lurking in the background. This will also be addressed.

In the case of artistic work I was simply driven by a lust for including more dynamic spatial narratives within the settings for the space of exhibition. My background as a poet also had evolved a fascination for including parts of the material that never made it to the “final product”, being part of the experience of that “final product”. This is not unlike design work and design knowledge, since this material forms part of a cross referencing over time which are part of the experience of the designer or artist. They could be part of the experience of the user/visitor-spectator as well. This will also be addressed within the framing of the overall theme.

1.1 METAMORPHING

A short tentative answer to the posed research questions could be phrased as; “Meaningful interaction with the multiplicity of objects and spaces residing as powerful resources and “co-actors” within the context at hand”. This is of course too vague to provide satisfaction. The title of this text “The transformative power of digital media and tangible interaction” gives some further hints, but a richer answer is still expected and I will provide a candidate in the gathering of stories of design and use that constructs the main part of this thesis. Throughout the text I will use the concept of Metamorphing as an organizing concept and structure for those stories. Invented, impossible to find in dictionaries and apparently carrying quite a bit of rhetorical character I never the less find the concept useful and will here argue for the use of it.

In “What’s the sound of thunder?” by Swedish sociologist Johan Asplund (Asplund, 2004), the author attempts to widen the scope of current theory of science. The starting point is how he’d become greatly fascinated by an old theatre machine used, at the Drottningholm Theatre in Stockholm, for producing the sound of thunder. The machine consists of a wooden box with an inside of sheeted metal and a number of stones of varied size are placed inside the box. It is operated manually by lowering or heightening one end of the box, with the result of the stones rolling inside, their friction against the metal sheeted inside making a sound quite like thunder. Analyzing his fascination and the relationship between the machine-made sound and the sound of actual thunder Asplund realizes that the sound is produced in a special way. It does not play a recording of the authentic sound, which would’ve been easily done nowadays. Neither is the sound an attempt to imitate the actual
sound, like onomatopoetic sounds like “wrooar” or “boom”, something we have all tried. Instead the machine produces a miniaturized experience of the sound. The effect is a playful “performed imagination”, we can fully understand that this is not the sound of thunder but have no problem accepting it as such. It is a fascination for the unfamiliar that still can be recognized, the transformed which have kept just enough of the original. To explain his fascination he makes use of the concepts of simulation and simulacrum. Simulation would be the attempt to imitate the actual sound of thunder as realistic as possible. Simulacrum would imply that the sound produced is similar enough to recognize, but it does preserve the difference between the illusionary and the real. Simulacrum can be said to be a process of transference between different entities through their commonalities. The difference between the entities forms a creative gap and is manifested as an act of transformation and metamorphoses, in where the actor must engage his imagination to understand both the common and the unique of the associated expressions. He is building a web of “thunder”. The observed differences are actually more like variations of a common theme of thunder. Moving between the variations strengthens the perception of the theme in a playful way that resembles the idea of bricolage.

Similar processes, where we can observe different transformations, occur frequently and often we focus on the polarities of the transformations, such as the actual thunder or the representations thereof, more than the overall absorbing of the “components” which make the transformation possible. Often these transformations are thought upon as mere translations, going from the one to the other, in other cases there is a more complex relationship involved. But it seems that they play an active role in vital parts of human activity such as in processes of creativity, learning and communication. I will in the chapters four, five and six provide exemplars from different domains that articulate the meaning of Metamorphing. It can be observed in “translations” from sketch to scenario in design work, it can concern the relation between a patient record and what the doctor actually said before dictating what should be in the record. It could also be about the design and performance of an exhibition, transforming the previously empty white painted gallery by expressing a whole network of artistic work in specific exhibited pieces. All these processes are often addressed as either “the thunder” or “the recording thereof”. But substantial for the process is how we move between the polarities. I address this moving between and visits of the ephemeral interstices as an act of Metamorphing. There is a metamorphoses taking place, but the means for doing it is of a greater interest here than what was first or what it then became. The verb form suggests a focus on an ongoing and emerging activity rather than a fixed process with defined entities. Especially I find interesting how the use of digital media and tangible in-
teraction can strengthen this Metamorphing. The use of digital media is not con-
strained to output of singular files, but also concerns accessing the whole life cycle
of digital media, such as recording, editing, storing, collecting etc, and these issues
are a concern for the field of interaction design. They are part of building the webs
in where we enact aspects of Metamorphing, and one design example will address
this as well. In yet other cases Metamorphing takes place as spatial transformations
which also will be addressed in one of the cases in this thesis.

Considering the whole of the network which is put into play when for example
a designer works with mobilizing early understandings of a context for design in
sketches of the design, it becomes clear that this is just not an act of translation
or transformation, as we spontaneously understand those words. Russian philoso-
pher and literary critic Michail Bachtin wrote about dialogical imagination and
 contrasted dialogic and monologic work in literature. With the concept he tried
to stress how dialogical works are in constant communication with a multiplicity
of other works and authors and how they affect each other. The concept was ap-
plicable to language in itself, with quite a resemblance to Wittgenstein’s theory of
language games, in as much as it is not spoken from a nowhere but communicated
relationally, responding to what’s said before and anticipating an effect on what
will be said. Having a foundational interest in multiplicity and literature he also
wrote on the development of metamorphoses as a theme in literature. Commenting
just briefly on it I think it gives some motivation to use the concept Metamorphing.
He wrote on how the metamorphoses theme in literature developed in quite com-
plex ways and how a common notion of metamorphoses were born first with the
famous work of Ovid where it stands for a more specific form of singular, almost
magical, transformation from one phenomena into another. Previously, for example
visible in works of Hesiod, the theme also included ideas of cyclical temporal spans
and how images of different eras or generations substitute each other. The images,
or forms, were essentially “differences of the same thing”. Metamorphoses here
included time; a time not linear, but one holding an idea of development as being
taken in leaps and with “knots” (Bachtin, 1981, pp36-40). Stressing this non-singu-
larit y and including another form for time is something different than “transformation-as-translation”.

A fruitful and interesting attempt to look closer at the unfolding of these “com-
ponents” that makes possible the “building of a web”, in this case related to sci-
cientific work and knowledge production, can be found in the writings of French
philosopher of science Bruno Latour. These arguments have been inspiring for me
and they are close to my use of Metamorphing. Therefore I would like to refer them
shortly here as to somewhat differentiate them from the concept. Latour uses the
term circulating references to describe how matter gradually moves along a chain before eventually ending up as knowledge (Latour, 1999, pp.24-79). The concept is an attempt to re-structure the representational dilemma inherent in the relationship between words and things; what is really happening when moving from referent to sign?

“Space becomes a table chart, the table chart becomes a cabinet, the cabinet becomes a concept, and the concept becomes an institution.” (Latour, 1999, p.36)

The way of working is through a close and detailed analysis of his participation in the intriguing example of a group of soil scientists on a field trip to Amazonas in an exploration of whether the rain forest is advancing on behalf of the savannah, or if it is the other way around. Sampling and classifying vast collections of soil and plants, making rigid notes on locations and circumstantial facts on the sampling, moving between sites, carrying equipment and samples from field sites or to hotels the scientists uses an array of scientific methods and instruments to transform pieces of the world to shareable data. One example is the use of the pedocomparator, a box with rows of smaller boxes where clods of earth can be placed, classified and transported. The instrument is a hybrid, through which the world of things becomes a sign, eventually articulated as facts in a written article. The world is sampled in pieces and separated before it’s re-assembled by the scientists into more mobile entities that are more suited for transportation and presentation. Mobile rather than abstract, because the scientific graph for example, is perhaps not necessarily more abstract than the piece of soil. Within the scientific discourse it is just as concrete as any material artefact or entity of matter. It works in another context.

The written text in its turn, mobilizes its own internal references like charts, diagrams and tables. All the references put into play is a way of keeping something constant through the series of transformations it is undergoing. The different stages are not copied from the preceding to the next, but are rather aligned to each other so at the final stage it is possible to return to the first. It is a constructionist perspective on knowledge production where knowledge doesn’t reflect external states or things by resemblance in a depicting way, but the correspondence of words and things is described as a focus only on the outer extremes (language/nature) of a chain with many links. The term reference is what he uses to coin matter (nature), which gradually moves along the chain to form (knowledge representation). The different transformations bear little resemblance to each other and the coherency of the different stages, of what we call things, depends on how well the steps are articulated.
This is well thought and well written. The arguments dissolves a representation-al dilemma residing between words and things. But Latour also confronts another classical dichotomy, that between subject and object, with his definitions of translations. He describes our use of technology and artefacts as a collective of humans and non-humans instead of the traditional subject/object ontology (Latour 1999, pp. 174-235). He gives a multi-facetted concept of technical mediation in where the term society is substituted by the collective, an exchange of human (“user”) and non-human (“object”) properties inside a corporate body. One meaning is a kind of translation in goals and intentions. Rather than continuing distinguishing between human actors and objects, he terms them both as actants. As a human actant is allied with a piece of technology when striving for fulfilling an intention, the goal gets slightly displaced since the actor’s possibilities and ways of performing them is different when he teams up with the technology at hand. Other dimensions of technical mediation includes composition of several goals or sub-programs, reversed black-boxing as in de-composing an assembly of components (for example examining the different components of an overhead projector to find an error) or delegation, such as speed bumps being stand in for someone controlling and correcting the speed of cars.

It can be argued that the production of scientific facts and the design of technological objects follow the same patterns from Latour’s point of view. Especially if we understand this pattern, as one of unifying diverse components into a meaningful whole (artefact or fact), that could be the case. While I think that constitutes a useful analogy, I still find differences of focus, which can motivate the use of a concept such as Metamorphing. What is emerging in the arguments of Latour is a problem of control. How can we validate the chain of circulating references as truth, how well are the links in the chain connected? For him institutions can be characterized by this ordering of things, and it is a process of ordering most of the time. For me as an interaction designer using theories and concepts is a matter of directing them towards design itself (or at times the other way around). That’s what I aim at with Metamorphing. In articulating the concept what emerges is a problem of design and form giving. Consider the pedocomparator, the instrument used for indexing, storing, overviewing and transporting samples of soil, compared to the suitcase used for the performance that will be described in the chapter on artistic work. The pedocomparator is clearly a hybrid instrument for control, ensuring rigidity in the process. The suitcase in its turn is used for playing media. The focus is not primarily how to control the files or the playing of them, but how to stage and give form to an aesthetic experience. That is also the case with several other design exemplars that I will describe further on and they also use the same technology.
Certainly elements of control are present in many cases and that then becomes one of the parameters in design. But as a major design challenge, from my point of view, emerges how we give meaningful form to them as material artefacts and how interaction with them can support meaningful human action. It goes without saying that designing computational artefacts also includes an immaterial dimension in the form of executable code that provides an infrastructure platform for the artefacts. As the technology moves between different domains the problems of design as form giving arises anew for each occasion. This is a Metamorphing that I conceive as different from Latours circulating references and the concept of mediations. The pictures below, which will be elaborated later on, use the same underlying technology while they carry out different tasks and have quite a differentiated flavor as material artefacts. This implies that I move, not only the concepts, from domain to domain, but also the objects as such, but they have to gain a specific form with a suitable frame of interaction for each new setting.

In general I find that people when performing a practice do Metamorphing in a Latourian sense. They use artefacts and technology to build a web of meaning, collaboratively carrying out tasks or simply to find joy and engagement in everyday life. They do so by “following the circulations” and are constantly “mediated” as they form alliances with other actants. But in the studies I have carried out I have
also found deviances from Latours arguments or at least in the way I have been able to apply them. The difference in focus of control or form giving is one. Another is the aspect of ordering and intentional acts. There is a dimension of rational convergence in many of Latours exemplars and he characterizes the doings of institutions as an ordering of things. In several instances of my findings I have observed a reversed process of “disordering”. Metamorphing is often outside of intentional acts. The interstice as such is the event, there is no goal or the goal is of a second order to the experience of the in-between. This is for example illustrated in the case of artistic work, where the experience of the transformations is equally important as the experience of the objects. It is rather how De Certeau describes the example of the pedestrian appropriating a city by walking (De Certeau, 1984, pp.97). More than a shift of intentionality this concerns a joy of being “translated”, because reaching a goal is less important to the drifter than the experience of subverting the city plan by the act of walking.

Another similar articulation of Metamorphing is how this disordering is a reversed mediation. With that I mean the resolving of an achieved structure, a liberating process of disordering such as re-programming. Re-programming refers to the ability to see something being quite different than it is. This is illustrated in several instances of design work and the process requires divergence rather than convergence in the interaction with artefacts. These aspects are at the core of Asplund’s story of the sound of thunder. The differences observed are common enough for coherence, but uncommon enough to mobilize an imagination that leads to unexpected experiences. This implies that Metamorphing can include quite marginal nodes in the building of a web that are carried out by designers, artists or patients undergoing rehabilitation.

These are my main motives for not using mediations or translations instead of Metamorphing. But finally the concept also serves as a kind of program for the thesis itself. The thesis can be seen as a web of circulating references with some easily identifiable parts. The parts are like actants and Metamorphing is my means for a meaningful arrangement of them. There is the major text, the appended papers and the DVD documentation of a couple of performances and installations. My original intention was to write a much shorter text that communicated more strongly with the appended papers. As it turned out the text grew longer than intended and does not rely so much on the papers anymore. Still some interaction remains between them and despite quite a bit of overlapping I have kept the papers as appendices. Some of the arguments in the chapters are more fully elaborated in the papers and that is referred to at the proper place in the chapters. Yet another argument for
keeping them is that they are peer reviewed and they are written in another, more traditional academical, style of writing. I want to show that I can be part of that “linguaging” too and for the main text I choose a more personal style of writing that can talk about design in another way. Concerning the DVD I simply find that it is a better way of re-mobilizing the performances than just writing about them.

The concept of Metamorphing is a narrative umbrella for the different stories that makes out the major part of the thesis. It is not abstracted from the stories as to find a general theme through analysis of the stories. Rather Metamorphing is articulated in and through the stories. The stories are themselves a kind of demonstrators circulating around the theme of the design exemplars, which include reflections on development and use as well as reflections on practices; what they are and how they might be transformed. The concept has not been a starting point for me and it is not mentioned in any of the appended papers, which all are written before the main chapters. Rather it has been a growing “thing” with shifting boundaries. As my understanding and use of it have grown during writing, it has also been negotiated with others and as such it has also been a boundary object. The birth of the concept resonates well with my understanding of things and objects; how they override precursors while being used and how they include the voices of others. The chapter four, Metamorphing and the power of transformations – the case of design work, is originally intended my contribution to a hopefully forthcoming book. The book is a collaborative effort by a group from the Atelier reflecting the project experiences and the chapter I’ve written originally was titled “Design work as transforming representations”. As discussion and reflection increased we agreed on that neither transformations nor representations are unproblematic concepts. During a coffee break Metamorphing came up. I took it up from there, or rather allied myself with it as an artefact and actant. In my research and in the thesis I perform my own Metamorphing and the concept is what orders the stories, and ties together the rather large variety of references from quite different disciplines. They are nodes in my web building. My intention is not to perform theoretical analysis and contribute to such a discourse. The theoretical nodes are vehicles and temporary alliances in directing the narratives towards a design discourse, in where the designed artefacts are the actual focal points.

1.3 THE THESIS – A SHORT READER AND ACKNOWLEDGMENTS

There is a partial overlapping of how creativity, learning and/or communication are supported by interactive technologies. This is, because as an interaction designer, I
find it hard to distinguish them from each other. In all the cases; the design practice, patient learning and empowerment and artistic performance, they are intrinsically intertwined and Metamorphing becomes a creative act which include both learning and communication. Rather than elaborating theoretical definitions of these concepts I will try to show how they are performed by human actors within the different domains. I hope this will become clear as the stories unfold.

Theories on creativity that involves engagement and transformation of artefacts or conceptual spaces are common in different disciplines. Far from taking a cognitivist perspective, I think that in several aspects cognitive psychologist and practitioners from other disciplines, such as anthropology or ethnomethodology, can agree on the role of transformations be it in individual thinking, collaborative work or engagement with material artefacts or matter. My motivation for excluding studies on the individual mind can be illustrated by the pictures below.

Parts of the exploration of the work of design students included using a kit of cultural probes, inspired by the work of Gaver et al. (Gaver et al., 1999). Pictures like the two above came back as answers to the task of taking pictures of places they found inspiring, where they went to be alone and daydream, or as some student put it; “to generate ideas”. We have all experienced such encounters of inspiration triggered by being in places that are outside of our ordinary everyday settings. Looking at these kinds of places while reflecting them to be inspirational it is easy to be seduced by older romantic ideas of the individual genius exclaiming “Eureka” having had a mental instance of innovative thinking springing basically “out of nowhere” or as a product of the own individual mind. Psychologist Anette Karmlioff-Smith writes on creativity and knowledge and how both children and adults when practicing new skills spontaneously develop external representations of knowledge already existing in implicit forms (in Boden, 2004 pp.76-77). This is a line of research that has received much attention in cognitive psychology. I do not doubt the existence of implicit conceptual spaces residing inside the individual, but I have not aimed at gaining access to them. That would have required a totally different methodological approach. Instead the focus has been on the following pictures.
Figure 4: Two different kinds of design representations.

To the left is a print out of an old book on hand signs used as inspiration in a project about a tracking system, recognizing hand movements. To the right is a kind of representation that most often is of a later project date, an UML model illustrating the inheritance of classes. Though not being from the same project in this case, these kinds of representations most often co-exist within the same project.

As they are elaborated and talked-upon in different situations they undergo many translations. This has been my focus and I find that the same processes of Metamorphing are at play also in the cases of patient learning and in artistic work.

“….life is not contained within things, nor is it transported about. It is rather laid down along paths of movement, of action and perception” (Ingold, 2000, pp.242)

This stance is of course grounded on a view where human action is situated in social and material contexts. Anthropologist Tim Ingold analyzes the concept of skill while reflecting the making of artefacts and the relationship between form and substance (Ingold, 2000). His perspective, while defining some points about the skill of the craftsman exhibited as he uses different tools to make artefacts out of specific materials (Ingold, 2000, pp.352-361), is similar to the more often cited work of Donald Schön regarding the reflective practitioner (Schön, 1983). He claims that instead of thinking of making as something happening when two separate things are put together (the maker with a certain intentionality and plan and instrument with certain functionality to manipulate materials with certain properties), we can think upon this situation as a foundational condition of involvement of the craftsman, his tools and the raw materials. So intentionality and functionality are thus not pre-existing properties in the user and the used, but rather immanent in the activity itself. Since skill then is not just a question of applying mechanical force to exterior objects, it also includes care, judgment and dexterity in a fine-tuning of movements that can reach the rhythmic fluency, which is the trademark of a skilled practitioner. From this perspective materials, representations and agent, be it a designer, patient or artist, are all parts of a force-field, in where the interface between
them is emerging rather being constituted from inherent properties residing in the different parts.

So, my study has taking these rather concretely observable situations as a starting point. In chapter two I try to describe my methodological perspectives for approaching a stance where design research is carried out as a process of understanding and transforming places and where design and prototypes play an essential role. Especially I stress how inspiration to different phases of this process have been borrowed from ethnography, ethnomethodology, action research and participatory design. In chapter three I try to elaborate a view on objects and spaces that are open to this process I call Metamorphing. Reviewing the work of different scholars gives a theoretical platform where multiplicities of objects and spaces are performed and enacted. In moving between these enactments I try to show how interaction design can enhance and strengthen our relationship to our co-actors, objects and spaces. This is illustrated with examples, mostly from the Atelier project. The notion of how design work is carried out as an aspect of Metamorphing, and how this can be supported from the discipline of interaction design, is further elaborated in chapter four. Being aware of the studied settings educational character, I still conceive the examples being more or less characteristic for design work even if not carried out by professionals.

Three examples from the Academy of Fine Arts in Vienna are included in the chapters three and four; the “Saw story” from a project called the “Tool’s exercise”, different usages of the Texture Painter in students’ various works with scale models and the conversation under the heading “Transformations in dialogue”. I have analyzed and contextualized these Vienna examples in another joint writing project. For that I am heavily indebted to Giulio Jaccucci, Ina Wagner and Andreas Rumpfhuber for sharing their material from these occasions. The Texture Painter, developed by Imagination Computer Services, might require a brief explanation. It is an application, which uses a tracking system and makes it possible for the user to virtually paint, pixel by pixel, physical objects. The media which are projected upon the objects and used for painting can be images or videos retrieved from a database. It is possible to save states and configurations of the painting in the database.

In chapter five I continue to explore issues of Metamorphing within the context of rehabilitation after hand surgery. Even though this setting provides some quite specific characteristics I find the arguments valid in more general contexts where patients move between different institutions and the home, encountering a variety of different perspectives with different representational habits and practices. The arguments of how digital media can quickly produce new formats of representations, that helps to promote patient learning and align the different actors active in
the rehabilitation process, is presented. Even more the argument, of how interaction can provide visible and meaningful ways of achieving these new representational formats, is stressed and illustrated in a designed functional prototype.

In chapter six I describe the co-operation with artist Lena Mattsson and our performances that explore the concept of Metamorphing through the use of tangible interaction with digital media in performances and different strategies for projections on different surfaces. Finally I try to make some concluding remarks on the research carried out.

1.4 THE PROJECTS

A major claim in this thesis is how interactive objects, spaces and the design of them and their interfaces, or more precisely the interaction with the objects and spaces, can contribute to issues of creativity, learning and communication. In the stories I report they do so by supporting various instances of transformations; of artefacts and spaces and of our very understanding of the performed changes implied by enhanced technological possibilities. I will here give a brief description of the three projects that have provided opportunities for observing and taking part in the stories that will be narrated in this thesis.

1.4.1 Atelier

The EU-funded Atelier (Architecture and technology for inspirational learning environments) project (http://atelier.k3.mah.se/home/default.asp) was part of The Disappearing Computer initiative of the Future and Emerging Technologies activity of the Information Society Technologies research program. The project ran from December 2001 to May 2004. The project aimed to contribute to inspirational learning environments, which were grounded in an understanding of creative practices within design, architecture and art. The project cases were the ongoing practices of two complementary design educations and master programs, the architectural education at the Academy of Fine Arts in Vienna and the interaction design program at the Malmö University. Participating in the project were members of academic institutions in Malmö, Vienna, Milan, Oulu, the research institute Interactive Institute and the company Imagination from Vienna. Starting out from exploring interactions between people and material artefacts in physical places, we turned to asking how we should enhance such an environment with digital technologies to turn it into a resource for inspiration and creative learning by an integrated design of learning materials, interactive technologies and architectural space. It
should be stressed here that the project concerned educational settings. The Atelier project, where I’ve put in most efforts relating to what will be reported here forms a foundational basis for my research. Three of the appended co-authored papers, “Embodied Interaction – Designing Beyond the Physical-Digital Divide”, “Playful Collaborative Exploration: New Research Practice in Participatory Design” and “Exploring relationships between learning, artifacts, physical space, and computing” were written while I was working in the Atelier project. I was involved in many parts of the project work, including initial field studies, development of scenarios, ongoing design, evaluations, reporting and reflection. In the chapter three, “On objects and spaces; real, virtual or both”, and four, “Metamorphing and the power of transformations - the case of design work”, several projects carried out with the students are mentioned. The student projects from Malmö are in chronological order the Augmenting spaces project, the Ubicom workshop and the Semi-public spaces project.

In one story, of how the architect students used the Texture Painter to transform the traditional white model, it is illustrated how transformations and intentional or playful change of an object changed fundamental conditions of the design space. It is claimed that objects or artefacts do not exist in isolation, but that they are performed, emerging, shared with other people and in constantly changing relations with other constituent artefacts and spaces. The concept of mixed objects, that can be performed or enacted, extends the role of the material artefact as to blend physical properties with mixed media as a platform for performing artefacts within a design environment. This will be elaborated further in chapter three and four with a focus on how the role of transformations goes on a deeper level than manipulations of a single object. Design can be characterized as a continuum of transformed representations, but since this can be interpreted as an act of linear manipulations of objects in singular moments, I will use the concept of Metamorphing to describe a more profound process of change that involves the overall time span and where Metamorphing is the guiding principle in general. Metamorphing implies that it is not only the objects being transformed, but that the complex interplay between human actors, material artefacts and space means that to transform the objects is also to transform space or to create fundamentally new conditions for situations for learning and communicating. The Atelier project was a highly collaborative effort and well integrated. My research could not have been possible without the interaction with some of the other researchers in the project. I would like to stress that the voices of Pelle Ehn, Thomas Binder, Bo Peterson, Mette Agger Eriksen, Simon Niedenthal, Ina Wagner, Giorgio de Michelis and Giulio Jaccuci forms relevant circulating references in my research.
1.4.2 Palcom

I will also try to uplift the concept of Metamorphing to a more general level by including stories beyond the case of design. Exemplified in the story of patients learning about injuries and changed life conditions, within the domain of rehabilitation from hand surgery, transformations is described as a constant alignment between different actants through the transformations of hand representations. This work has been carried out within the frames for the Palcom project. The Palcom project (Palpable computing), (http://www.ist-palcom.org/), is an integrated project in EU’s 6th Framework Programme under the proactive initiative The Disappearing Computer in Future and Emerging Technologies, part of the Information Society Technologies. It has been running since January 2005 and will do so until December 2007. The project aims to research and develop a new perspective on ambient computing denoted palpable computing. Palpable denotes that systems are capable of being noticed and mentally apprehended and they aim at supporting people in understanding what is going on at the level they choose. Furthermore palpable systems support control and choice by people. Often the default mode is to suggest courses of action rather than acting automatically. Participating in the project are members from academic institutions in Malmö, Aarhus, Siena, London, Lund and company members from Siemens and Whitestein Technologies. An initial project focus for contexts of use has been health care settings and the theme patient empowerment, and in Malmö we have been working in co-operation with the Hand Surgery clinic at the Malmö University Hospital. I have been involved in on site studies at the clinic, concerning the practice of rehabilitation both from staff and patient perspectives, design of a couple of prototypes of which just one is mentioned in the thesis, evaluation of the prototypes as well as theoretical discussions on the notion of palpability. One of the starting points for the Malmö participation in the project was the work by Per-Anders Hillgren and Erling Björgvinsson, in the project Everyday learning within health care. They have made promising experiments in where it was observed how digital media has the potential for easy and instantaneous documentation that renders a situated character to information. Media produced “on-the-fly” during consultations proved to be an efficient way of strengthening the Metamorphing carried out by the patients as they are making sense of a variety of information related to their injuries. In preliminary experiments we have looked at possible ways of making patients produce media that are brought to the clinic. But a major part of our work has approached the process from another perspective; how interactive technologies have a role in engaging in the life cycle of digital media. When recording, editing, storing etc the role of interaction gains different meaning in different settings. We have looked at the instance of recording videos.
during consultations and we designed a prototype that addresses qualities of what we call collaborative articulation. The prototype and the related work is described in chapter five, “Metamorphing as aligning actants – the case of hand surgery” and in the appended paper “Collaborative articulation in healthcare settings – Towards increased visibility, negotiation and mutual understanding”.

1.4.3 Artistic installations and performances

A third story of the power of transformations will be elaborated in chapter six, “Metamorphing as space transforming - the case of artistic work” where artistic endeavors to transform the space of performance and mixed media installations works through Metamorphing space in a combination of transformations and projected surfaces. In co-operation with Swedish artist Lena Mattsson I have used the same principles for tangible interaction, as described in the case of design work, in combination with different strategies for projecting moving images, in a series of performances taking place during exhibitions of Mattsson. This work is also illustrated in the appended (or downloadable) dvd/video “Moulding Space” which is made by Lena Mattsson. To clarify references to the performances and exhibitions I here mention them in chronological order. We enacted the mixed media performance “Carrying a load” together at Konsthallen Bohusläns museum, Sweden, in 2003. During her exhibition “Beyond the surface” we enacted the mixed-media performances with the name “Diagnoses” Part I and II at nordiska akvarellmuséet in Skärhamn, Sweden at the 9th and 10th of October in 2004. The referred projection “A study in scarlet” which is a work by Lena Mattsson, was carried out at the same occasions. On the 21st October in 2006 I enacted a mixed media performance and poetry reading called “Carrying a load Part II” during the opening of her exhibition “Mirror, mirror” at the gallery 300 m³ Art Space in Gothenburg, Sweden.

1.5 CONTRIBUTIONS

This being a doctoral thesis and a reporting of research, I now find my self obliged to claim some contributions to the field of interaction design. Apparently carrying quite a portion of rhetoric character I still find that the concept of Metamorphing is a kind of contribution. The focus on performativity of objects and spaces, and how interaction design is what constitutes a platform for a specific form of performativity; (one that stays close to the movement between the physical and digital), is a different perspective than much other research on tangible interaction. Focusing, less on specific applications, and more on the openness of the combination of tracking
and tagging technologies, permits me to move between different domains. While I might lose some rigidity with this take I hope it can make an interesting reading.

The appended papers are peer reviewed. Even if they are all co-authored I validate my contributions as proportional to the number of authors and they make for one kind of contribution. They are appendices and the content is overlapping quite a bit with parts of the chapters. Still, some points are elaborated in them and I include them for possible extended readings. The main text is not dependent on the appendices. The appended papers, where the naming of authors is done alphabetically, are:


The paper argues for embodied interaction as a useful stance for designing beyond this physical-digital divide. The perspective implies that the design materials for digital artefacts are both spatial and temporal. Furthermore with the perspective of embodied interaction both the social dimension and our bodily experiences come into focus in the making of place. The paper addresses and partially overlaps issues taken up in chapter three.


In the paper we describe how game-like approaches can be used as a way of exploring a practice from a design point of view. Thinking of ethnographic fieldwork as a base for sketching, rather than as descriptions, creates openness that invites collaborative authoring. The paper elaborates the concept of design games and gives a detailed example from a game undertaken between researchers, teachers and students of interaction design. The paper addresses issues taken up in chapter two.

In the paper we report on the development of an interactive learning environment in support of students of architecture and interaction design. Based on ethnographic fieldwork we specified a set of qualities of the learning environment, which guided the development of physical interfaces. We report from the field trials of the Atelier project, which showed the value and some means of mixing evolving artefacts with digital media. In interactive installations students used the space as a stage to experience and explore aspects of places and situations. The paper addresses issues taken up in chapter four.

Apendice 4; Hillgren, Per-Anders and Linde, Per (2006), Collaborative articulation in health care settings – Towards increased visibility, negotiation and mutual understanding, in proceedings of NordiCHI, October 14-18, Oslo.

The paper is written as part of the Palcom project together with Per-Anders Hillgren from the Everyday Learning within Health Care project and thus bridges the two projects. We describe the work of both projects at the rehabilitation ward at the hand surgery clinic. Our aim is to contribute to patients possibilities to learn about the injury and the recovery process. Furthermore we seek to contribute to the field of interaction design by showing how physical forms and explicit interaction can facilitate collaborative articulation processes. The paper addresses and partially overlaps issues taken up in chapter five.

Apendice 5; DVD movie “Moulding Space”. The movie provides highlights from the performances Diagnoses and Carrying a load pt.II, performed together with artist Lena Mattsson, as well as the video projection on a cliff, which are reported in chapter six. The movie is made by Lena Mattsson. The DVD will be included in a limited number of the thesis edition and can also be downloaded at http://webzone.k3.mah.se/k3peli/thesis.htm

I have also made contributions to the design of a couple of prototypes, artefacts and use situations that are described in the thesis. This is important since the discipline of interaction design in my view should be regarded as a design discipline. Just as the papers the exemplars are mostly a collaborative effort where I think I’ve made a substantial contribution. Those design exemplars are;

-The Cowall; which addresses how interaction can afford the connecting of multiple artefacts into a unified experience that is not disconnected from the experience
of space. Other substantial contributions to the CoWall installation have been from Pelle Ehn, Tomas Binder, Peter Warrén, Bo Peterson and Mette Agger Eriksen.

-The Tracking Game Table; which addresses the plasticity of digital media and the interweaving of voices and stories in a material setting. This specific set-up is also a slightly different take on the notion of design games than many others reported. Other substantial contributions to the Tracking Game Table have been from Peter Warrén, Mette Agger Eriksen and Martin Johansson.

-The docking station; which stresses the notion of visibility of actions and how interaction can be a visualizer of rhythms in what we term collaborative articulation. It also reflects a model for designing for ecologies of artefacts and devices where we can design physical nodes as mediators in settings that are rich with service based resources. Other substantial contributions have been from especially Tomas Sokoler, but also from Stefan Olofsson and Jonas Löwgren.

-The staging of the poetry readings; in where I’m the user myself in situations that I do have a professional experience from and I can rightfully claim that this is a new and alternative way of working for the performing poet. The performances were carried out with contributions from Lena Mattsson.

Feeling humble in claiming these contributions I now invite you to judge for yourself whether these claims are valid and if the stories I can provide have strength enough to carry them.
2. ON METHODS AND DESIGN – UNDERSTANDING AND TRANSFORMING PLACES.

Design is the art of the possible future. The very nature of change is in many aspects in contrast to that of recognition of the already existing and this fact partially covers up for the difficulties resonating in scientific inquiries into the design discipline. This chapter will provide a methodological view where I elaborate a perspective on design as a process of understanding and transforming places. From this perspective I think it is important to make some instantiations of design. With “instantiations” I mean to stress the role of research prototypes, the staging of situations of use and iterative cycles of ongoing design.

While this aims at mobilizing imagination of change among designers and users, it is a possible transformation of practice that is grounded in understanding of the current state of the practice. On the one hand it is a matter of taking practice and users seriously and gaining a rich understanding of what constitutes the driving forces when “doing” a practice as it unfolds in co-operation with other people and using material objects and space as resources in that process. On the other hand it also carries an innovative perspective as design not primarily driven by defining problems within that practice that can be addressed by incremental fixes. Rather it is an attempt to view design as something that might constitute a fundamental change and transformation of the practice. Ideally this can construct a design knowledge which may not hold true in the same way as the truths of natural science, but one that can be transferred to other situations, similar to the one at hand but different enough for demanding alternative takes on previously successful designs. I will fetch inspiration from ethnography, ethnomethodology, action science and participatory design in a bit of an “unfaithful” way. Not fully immersing into anyone discipline but having them all as resources. As it comes to methods and techniques they are used both, in what usually are referred to as context of
discovery and context of justification. I will also try to convince of the necessities of accepting narrative accounts as a format of reporting.

My view on this process of both understanding and transforming places can be related to the concepts of pro-searching practice, as elaborated by Krippendorff (Krippendorff, 2006) and to how Fällman conceptualizes a design-oriented research (Fällman, 2003, pp.98-104). Industrial designer Klaus Krippendorf advocates strongly for a design discourse and a science for design in his book The semantic turn (Krippendorf, 2006). He makes the distinction of a science of design, which aims at accurate representations of its object (the design practice as such) and a science for design, which is pro-active. Being pro-active and pro-searching of the not yet existing such a discourse cannot limit itself to apply methods and observations on the already existing.

Thus we can, as designers, not have the same foundational platform as the natural sciences, and to my understanding neither as the social sciences. However the social sciences can have a profound impact since visionary futures must acknowledge the visions of others – the users, stakeholders or whatever we would like to call the humans who will inhabit that future. Without going into further depth of this rich and fascinating book I think that the content can, quite crudely, be summarized around some points of reflection;

- A design discourse is not resting upon facts, but is pro-active.
- Design concerns the meanings artefacts can acquire by the users rather than the artefact itself or the designers intentions.
- A design discourse must be defined in its own.

These points are part of why the relation between design and research is often awkward. Design is pro searching more than researching. Our understanding is of a second order, in the sense that it’s not the designer’s appreciation of artefacts that matters but the users (an understanding of an understanding). A design discourse will always be dependent on the languaging of others, such as clients, users, other stakeholders, or other academic disciplines.

So collaborative skills are highly needed; but at the same time designers must take responsibility for developing a meaningful language for design that does not merely “serve the discourses of others”. Ideas from other fields can help, but can also enter parasitic paradigms into the discourse. One example of that is the fascination for measurableity, which has heavily influenced the HCI tradition. Pro-searching aims at change, not on correct descriptions of the already existing. My view on this process does include ethno graphically inspired fieldwork, concurrent
design, user collaboration and evaluation of use in a homogenous process, whose scientific value might be understood in terms of different levels of interventions. It is clear that design research has a strong sensitivity to practice and making of artefacts. A design space can only be partially theoretical or conceptual, if it is to be thoroughly reflected.

Donald Schön is a well-known advocate for focusing on the practitioner’s making, as opposed to describing practice as primarily technologically rational. According to him knowledge production takes place in reflective interaction with situations, not as the end of a logical chain of thought. Becoming informed by interacting with the design material can only be acknowledged by reflection not only on-action, but also in-action (Schön, 1983).

This closeness to and engagement with the materials of design brings forth questions about the role of the prototype. Daniel Fällman makes the distinction between design-oriented research and research-oriented design (Fällman, 2003, pp.98-104). The research prototype plays a central role in both. Design-oriented research can be seen as an academic discipline, where the goal is knowledge on design. The prototype is a means rather than goal. This means that the gained knowledge is of such a character, that it could not have been articulated without the prototype. The prototype plays a central role in two aspects.

The level of possible analytical engagement is different when working conceptually or actually implementing. The process of implementation brings forth closeness to the design material, which reveals, in many cases, unexpected material behavior and possibilities. Most often these situations cannot be reflected in mere conceptualizations. On the other hand we must also be able to use methods that support imaginary situations of use which is far beyond the current state of art. I will report on design games as such a possible method later on in this chapter.

Ideally designers can master both perspectives, handling methods for staging both “close to the actual” as well as fruitful communication around quite imaginary situations of use. Following but one of these forking paths does not lead us far enough. The process is one of problem setting and creating a space of possibilities, rather than problem solving.

Research-oriented design, on the other hand, is typical for applied research or design in industry. It can relate to, or benefit from, research, but has the product as a final goal. Here the process is one of problem solving within a given domain. Prospecting practice or design instantiation is relative to design-oriented research. It has a wish to contribute to design knowledge, but in doing so implementation is central. We might not stick around long enough to observe full appropriation, but when prototypes are functional enough for setting up situations of use we have
a possibility to observe unanticipated things occur. This is not only due to users’ interaction with the prototype, but also to the designer’s deepened interaction with the material when developing the prototype.

A view on design, which focuses on change and innovation, is not consistent with incremental addition of pieces to an existing body of knowledge. Rather, such a view, must express the difference the design instantiation has made. These interventions can be reported in papers or books using stringent language and academic logics. I think they can also have quite a strong narrative flavor. A phenomenological approach to access “things as they appear to us” could well benefit from a narrative account that does not aim at absolute truths, but one that still will be credible. Narratives are not a common trait in the philosophy of science but as they also constructs a driving force in social processes and individual self-reflection I still think they can give valuable complements.

Jerome Bruner relates narratives to scientific truths as ““not truth but verisimilitude” (Bruner, 1986, pp.10-12). This verisimilitude does not carry generalizations, but they might carry quite a lot of transferable principles, which if reflected and re-worked comes close to design patterns. Considering the iterative process of design it becomes evident that design work has no given centre. While the researcher in general collects data to build general models, the designer must synthesize in each specific case. They deal with different models of generality. It is important to claim that a science of design is still possible, but the designer should rather aim at potential of transference, from one case to another, rather than total generality of methodologies. This is part of the concept of design knowledge as having a repertoire of examples, such as described by Schön (Schön, 1983).

There is no general solution to design problems, but experiences from one case can be transferred to another. Design knowledge resides in the tension between the differences. This transference of knowledge and dealing with the tension between different cases or situations is at the core of what I mean by Metamorphing. It is not just a matter of translation. Throughout the thesis I return to Bruno Latours concept of circulating references. With the concept he tries to re-structure the representational dilemma inherent in the relationship between words and things. He places the problem within the domain of scientific knowledge production and how scientists use an array of scientific methods and instruments to transform pieces of the world to shareable data. As the sampled world moves toward knowledge representations, such as written articles or diagrams, it undergoes a series of transformations. Latour calls these transformations of different representations “circulating references”. All the references put into play is a way of keeping something constant through the series of transformations it is undergoing. The different transforma-
tions bear little resemblance to each other and the coherency of the different stages, of what we call things, depends on how well the steps are articulated. This can be applied to my methodological approach. How well I succeed will be dependent on how well I can connect the references, going from stories of use to prototypes, from one prototype to another or moving the technology between the different cases.

The effort and reflection required is quite substantial and the movement is by no means fluid and is full of potential pitfalls. At times it can be explicated and enriched by material affordances, as I will elaborate in the case of design work. In other instances it requires a production of new formats and juxtaposition of devices and technologies that requires a visibility of actions within an environment, as I will illustrate in the case of rehabilitation after hand surgery. At yet other occasions the movement constructs a hybrid aesthetic space charged with wonderment, as I will highlight in the case of artistic work and performance.

Referring Schön’s notion of transferable design knowledge and repertoires of examples we can also observe how schemes or abstracted themes emerge within case-driven research. This is observed by Löwgren who terms these abstract conceptualizations inspirational patterns (Löwgren, 2005). An example of an inspirational pattern might be for example “Material objects are tokens of virtual information” and Löwgren illustrates each pattern with an embodied example. However the examples are somewhat detached from their contexts of use. Using the concept of inspirational patterns in a workshop with quite mature design researchers many participants found it useful but lacked the contextualization of them. This can be achieved I think by using narrative accounts of use, which are not driven by a sociological understanding of practice but reflects tentatively how designed artefacts might transform practice.

I include narrative accounts in this thesis because I believe in their strength. Describing what I have experienced due to the different designs is one way of honestly reporting; “This is what I’ve seen and since I’ve spent serious time and effort for understanding this practice I realize that the design artefacts we introduce to the practice makes a difference. They have the potential to transform it.” I complement these narratives with more traditional writing, such as the appended papers, and with references to scholars of relevance. Trying to do this in a systematic way with conscious use of methods is my response to scientific requirements.

The holistic view on the process is troublesome for design’s relation to research, but maybe significant for the field. But there is no one to one relationship between social sciences and design outcomes and laboratory evaluations cannot replace actual use if we want to reflect on the process of appropriation of artefacts by users. My view on design instantiations is that a variety of elements should be included;
- understanding of the context intended for design
- recognition that design transforms the notion of place
- user collaboration
- situations of use in actual settings
- academic reflection for dissemination of knowledge.

This involves three levels of methods, each constituted of a variety of methods residing on another scale (they might be closer to specific techniques such as video observations or interviews etc);

- Field studies
- Field trials
- Evaluation

I will in the following address these three levels and give brief accounts of how borrowing methods and inspiration from other disciplines have informed my research.

2.1 FIELD STUDIES - A LINKAGE TO ETHNOGRAPHY AND ETHNOMETHODOLOGY.

What I refer to when using a concept such as field studies are studies of practice taken place within the practice. The role of observer and participant often gets blurred, especially if the researcher’s position is close to the objects of study, which is the case for me in relation to the fields of design and performance. If we want to work with interventions in the design process, and have a focus on design as pro-active and transforming practice, instead of adding incremental pieces of support to the already existing, it follows that we should well know existing practice.

To understand potential emergent qualities can be grounded in an understanding of the current qualities and flows of practice. Social aspects of computer technology have, during the last decades, become a growing field of exploration. During the eighties, Human Computer Interaction (HCI) focused on “usability,” and developed techniques for evaluating computer systems from a cognitive perspective. The ideas were strong, and the techniques have been progressively developed. In the mid-eighties the interest for collaborative work grew and sociologists and anthropologists entered the field. It was within the Computer Supported Collaborative
Work (CSCW) tradition that sociologists and anthropologists came to have the strongest impact.

The HCI approach was criticized for not considering social dynamics. Numerous field studies have been carried out and been reported, all advocating the need for considering social aspects. An underlying perspective of how the social is ordered, not only by conscious intentionality but also in emerging and improvisational behavior and communication, can be found for example in the widely referred work of Lucy Suchman and the concept of “situated actions” (Suchman, 1994). Plans and actions are taking place within a larger context of ongoing activity which is most often of a practical nature. You might well go as far as to say that plans are representations of actions. This perspective is a kind of subversion of a spontaneous understanding of intentionality where plans precede action, instead looking at the evolving character of human action. Sociological and anthropologically inspired work has been good at observing these kinds of ongoing activities within practice. Likewise ethnography provides theoretical framings as well as practical methods for performing such research.

Blomberg puts forth some characteristic properties of ethnographic work (Blomberg, 2003, pp.964-985). It occurs in natural settings, which is motivated by people’s limited ability to describe their doings when lacking access to the social and material aspects providing resources for the activity. Ethnographical studies also try to apply a holistic view on activity as they appear within a larger context that also must be reflected and connected to the activity. Furthermore accounts aims at being descriptive and not prescriptive, values of the observer or potential change shall remain outside of the accounts. In relation to this follows that what’s interesting is the view of the member of a certain practice, setting or community (Blomberg, 2003, pp. 965-967). This final property is at times at odds with qualitative research which wants categories to be known in advance of the study.

I have used these guidelines while carrying out extensive video recorded analysis mostly of the work of design students but also during consultations at the hand surgery clinic. One aspect of ethnographically inspired field studies is how you can’t be following a group of practitioners all the time. I have complemented my own observations with self-reporting techniques such as for example cultural probes such as referred by Gaver et. al (Gaver et. al, 1999). Using self-reporting techniques I have found that it is crucial to communicate findings with the reporters. This principle of going back to the objects of study, for communicating analysis and negotiating the meaning, have been a general principle in my work with future users.
A related but slightly different discipline is the branch of sociology of ethnomethodology. Ethnomethodology as defined by Garfinkel (Garfinkel, 1967) turned against abstract theorizing as basis for sociological analytical account and claims that understanding of how social order is constructed must turn towards detailed analysis of how people use common sense methods to manage and organize everyday behaviour. That they are “common-sensical” methods for sense making implies that they are shared and explicable within certain communities of practice. They are also subject for constant change and production of meaning. So, one effect of ethnomethodology is that contextual understanding must be situated within practice rather than being gained from an outside view. Suchman’s account of situated action fetches much inspiration from ethnomethodology, which stresses the illusionary character of rationality in social activity. What appears as socially ordered can actually be quite chaotic, but since practitioners are great at managing their everyday activities they can appear as having a robust structure. But as sense impressions and experience makes a confrontation between social actors and society the actors organize these impressions into coherent patterns as “they go along”.

An important process in this is the use of documentary methods which might be explained by how we can look at certain facts from a social situation which conforms to a probable pattern. Then we can make sense of them in relation to that pattern and use that for understanding of new facts occurring in similar situations. Especially interesting here is how, what is termed, indexicality is put into play. Making sense of speech or certain actions is done in relation to the situation where they have taken place including the circumstantial. For me this has especially been a point of observation of how people use objects, artefacts and space when carrying out their activities.

Being fine instruments for a designer, these theories have also been object of criticism. Chalmers reflects a constructive critique from Giddens (Chalmers, 2004/Giddens, 1995). If structure of the social emerges in the course of the actors’ interaction and the understanding of context is viewed as an isolated and subjective phenomenon we will lose the long-term dynamics inherent in temporal processes. Such processes are for example also dependent on historical and cultural influences.

We do rationalize at times in everyday activities and activity is in many cases dependent and relying on objective structures such as organizational procedures, legal inscriptions and from almost invisible authoritarian inscriptions such as will described/referred to by De Certeau later on in this thesis. I think that there is a danger on loosing not only long-term dynamics but that it also can be about shorter temporalities. By a too strong focus on the evolving and moment-to-moment as-
pects of activities we can also be blinded of the occurring and observable and thus miss past interaction that affects the ongoing modes of conduct. Phenomena such as heterogeneous interaction include not only how we mix formats and media in the present, but there is a complex relation of what we have used before. A tool such as conversation analysis can be an excellent way of penetrating what’s happening, but if used without thorough reflection it also leave out things that have happened before that does have an impact on the presence.

Still these disciplines have been inspirational for me when conducting field studies on design work and rehabilitation from hand surgery. Participant video observations, conversations, interviews and different modes of contextual inquiry have helped me to gain a rather firm understanding of what’s happening in those domains. It is not my intention to here provide a rich description of them. Fuller descriptions I’ve taken part in elaborating can be found in the two Atelier deliverables, D3 Pro searching practice and D11 Evaluation Report on Prototyping (available at http://atelier.k3.mah.se/publications/). But if I would pick just some themes that have affected the work when it concerns the work of design students that could be;

- **A diversity of representations**
Designers work with a huge variety of different representations, materials and formats, each displaying different qualities. It is a challenge for the designer to handle this multitude. They often evolve simultaneously and in different versions. The transference from one media to another without losing essential qualities is often a crucial issue.

- **The space for learning and creative work is important**
This space has many meanings; it refers both to the physical environment as well as to the social and organizational setting. Ways of using the actual space differs a lot, and the way material and ideas are used makes part of the configuration of space. It also has a temporal stretch in the sense that the students try to “re-perform” former project activities in present time. Also ideas are transferred from individual spaces to collaborative settings. Feedback in form of reviews or other meetings with teachers are of course also an integral part of the learning space.

- **Exploring context is important**
Different methods for exploring the context for design are a major challenge in design. Collaboratively negotiating that meaning helps narrowing down the problem/space of possibilities at hand and is crucial for seeing different situations of use. However it’s not only a question of contextual knowledge and inspiration, but
connections to sites outside of the study environment can also imply active interventions.

- **Exploring materials is important**
  Materials, their physical properties and qualities, play a large role in architecture. The work with models also is significant for the education. Searching for the right material and examining how the physical properties of the material affect modeling are major issues. The properties of digital material on the other hand might at first hand be hard to grasp, but nevertheless different genres have certain characteristic qualities. In both architecture and interaction design engaging in close contact with the design material strengthens the process.

- **Seeing things differently is important**
  The ability of seeing things differently are essential to both, architecture as well as interaction design. This ability responds to a creative need of imaginative alternatives. But it’s also a matter of keeping various practical issues present at the same time. Shifting between concrete solutions and creative possibilities often requires handling design material in different ways. Architectural components or parts of interactive systems often demand that interpretation is not fixed.

These themes helped to understand the qualities of a design environment that then could be discussed and used in scenarios and the development of prototypes throughout the project. It should be stressed that this was not a linear process, but iterations are necessary and to re-formulate and re-evaluate is crucial. All the mentioned themes have also been assessed with students during different forms, one of which I will report in shortly.

Considering rehabilitation of hand surgery the mode of working for gaining an understanding have been basically the same. Fuller descriptions I’ve taken part in elaborating can be found in the two Palcom deliverables ER12-Deliverable-12-10[1].1-Initial-Work-Analysis-Report and Deliverable-33-[2.13.1]-work-analysis-pd-and-evaluation (available at http://www.ist-palcom.org/). If I should pick a couple of themes that have stuck out, thus having an impact of our design in the project, it could be about;

- **Acknowledging and understanding the injury**
  A recurring theme in the patient’s ‘work’ of recovering from hand surgery is the importance of acknowledging and understanding the injury. This involves getting past initial expectations of speedy and complete recovery and starting to understand the
nature of the rehabilitation process: extremely long duration; requires extremely hard and tedious work, both in terms of exercises and in terms of coping with everyday life; may never lead to complete recovery of strength and mobility; may have life-long social and professional consequences. Rehabilitation times are very long and progression is at times very slow. For the patients to be engaged it’s crucial to be able to connect to the passage of time in the process. Motivation is difficult because progress is slow and can be hard to perceive. It is a question of receiving patient feedback of progress, which might seem slow but also to understand the necessity of slowness.

-“Owning” the rehabilitation is important
Acknowledging the injury is related to the patient’s taking responsibility for the rehabilitation process. The relation is somewhat causal: it is not possible to assume responsibility for rehabilitation unless you have acknowledged the injury and its implications. To take responsibility means to prioritize the injury and the rehabilitation work, which the caregivers view as a necessary condition for successful rehabilitation.

-Vast amounts of new information must be absorbed
Stress limits the capacity to take it in. The amount of information confronted is complex and formats differ a lot. Much is paper based or mediated verbally and different information might have different meaning for different actors.

-A whole network of actors and actants needs to be re-aligned.
Patients confront a multitude of different actors at the clinic such as doctors, nurses and therapists. Equally important are networks outside of the clinic such as families, friends, employers and regional health care staff etc. For the therapists, but also for family and work colleagues it is difficult to learn about the patient’s circumstances.

- Technologies will be used in many different contexts, in many different constellations.
Despite impaired work capacity and functionality of the hands, patients are highly mobile and moves frequently between different places. While some of the places are related to their rehabilitation others concerns patient’s social life. There is very little time for consultations (15-20 min). Producing, finding and showing multi-media content must be very easy.
New social relations
The patients’ conditions for taking part in the social relations they are used to often change after the injury. They are on sick leave from work, play new roles in their family lives, not being able to do their usual tasks at home and very often they feel marginalized due to their injury. Not the least is it often hard to communicate the nature of their injury outside of the clinic.

I find it helpful to elaborate themes in this way for gaining understanding. But what is then happening? Certainly it would be naïve to believe that these could immediately be translated into scenarios or specifications of requirements. I have argued for design as an act of change and innovation. It might be that we at times make more incremental design, observing a problematic situation while working with these methods for understanding. In other cases handling these “smaller” problems is to fixate the practice rather than developing it. Paul Dourish observes quite amusingly in a paper how many papers for the HCI community by researchers, who have carried out impressing ethnographies, ends the paper with a subtitle of “Implications for design” (Dourish, 2006). What he reflects is how such a “implications for design”-thinking places the object of study outside of the design process. It becomes an end point in the inquiry. By doing so, we actually leave the potential users outside the design process despite our costly efforts for respecting them. Dourish answer is that “Ethnography has a critical role to play in interactive system design, but this may be as much in shaping research (or corporate) strategy as in uncovering the constraints or opportunities faced in a particular design exercise” (Dourish, 2006). In that I agree; such studies can provide a way of thinking about practice and infuse certain ways of including the site in the process. But there is no one-to-one relationship between field studies and design, but understanding is part of the process. However the process continues and we must make further use of yet other methods.

2.2 FIELD TRIALS AND EVALUATION – A LINKAGE TO ACTION SCIENCE AND PARTICIPATORY DESIGN
The meaning of field trials in general refers to a process resting upon collaboration with users as reflective co-designers together with us researchers. In the Atelier project we started this collaborative effort already with explorations of practice and the earliest ideas on possible interventions. Further on the field trials gradually integrated scenarios and prototypes in an iterative process. This demanded that
different configurations and development of prototypes often took place on site and during use situations. Being a quite demanding effort it also gives rise to rewarding occurrences of unexpected design ideas. A programmer from the project was present during long periods, providing a resource to instantly modify code, configure hardware and internet protocols etc.

**Figure 9:**
One of the project programmers, was constantly crawling around inside installations or next to them fixing hardware or modifying the code.

Action science is one discipline that explores the nature of making and knowledge production. Phil Argyris claims that “Action science must devise some process (1) that will allow participants to make explicit the data they select and the meanings they impose and (2) that will enable them to negotiate the differences in meaning that arise so that they might reach agreement” (Argyris, 1985, pp.237). My research in general cannot be said to rest on design as problem solving. It is rather an issue of creating spaces of possibilities for change. The two perspectives intertwines in as much as that there is a focus on specific practice.

My understanding of practice is that it concerns both an established and specific context of doings and also the common understanding which permeates the doing in sometimes tacit ways and thus makes it possible. It is both activity and the reflection necessary for understanding it. This is a knowledge that must be understood socially. It is produced but also re-produced since it includes traces of previous practice. Action science differs from normative science in recognizing this focus on practice. Argyris et al. present an image of normative science as one of a “two-step” process; first it generates data and develop theories then leave it to practitioner’s and applied social scientists to solve the problems (alternatively applying potential possibilities) (Argyris et al., 1985, pp. 106).

This creates a differentiation between research, theory and practice that might be hazardous for all endeavors. Dangerous for research and knowledge production since users often relies on tacit presumptions of the world, when carrying out activities. These can be hard to detect and are neither easily falsifiable. Dangerous for users since generalized assumptions about activity makes for designs which might not
fit into practice and theories that are hard to put into play into real-life conditions. Especially if the design is aiming at future change of practice, the object of study of course disappears, but also limits the user’s understanding of what can be achieved with the design. Action science seeks knowledge that serves action. Inherent is that the knowledge is developed with, not only general knowledge in mind, but also with the human in mind; in this case the user. So the discipline also tries to facilitate learning about change from within practice.

The knowledge achieved should be relevant also for forming purposes just as much as achieving purposes already formed. In doing this, forming of purposes, the actor also enacts values. Answering the question “What shall I do?” gives rise to formulating an intentionality that might be congruent with the existing or it might express a deviation from the current normative of practice. (Argyris et al. 1985, pp. 36-37). If we have a view, and I will conform to it, that the outcomes of design are not things or products in a general understanding of how they are “dead” objects, but that they participate as actors in our interaction with and shaping of reality, then this process of learning and value enactment is of great importance. If we add to this that our conception of users and what they do or might be able to do, can only be partial it follows that in actual use a lot of unexpected things can happen.

Participatory design tradition has developed a variety of methods for involving users in different stages of the design process. It is partially a question of acknowledging users as a resource, gaining insight to tacit dimensions of their everyday settings and setting up a language game that can be shared. The PD tradition also has democratic perspectives, letting users be part of forming their own practice. Much HCI research has concerned situations of use in laboratory settings, while the concept of field trials concerns use in the actual settings or intermediaries designed as carefully as possible. Appropriation of design by users, which is unexpected by designers is a rich resource for development. As said earlier it is naive to believe that we can stage actual use or that we can observe appropriation in a full sense. But a lot of unexpected situations are likely to emerge and in my view we can observe small scale patterns of appropriation by iterative prototyping together with users.

The process of understanding and transforming have so far proven to develop and use methods inspired from ethnography, anthropology and ethnomethodology, but also from phenomenology and actor network theory which I have not discussed so much here, for providing a rather firm understanding of what is really going on in a practice. So the understanding part seems to be in place but the human-centeredness carries a price to be paid. By trying hard to understand what keeps practice going it can become hard to imagine innovative transformations. So we must also
question what the user can be about, not only what he currently is. Descriptions of
practice tend to be rigid and respectful for the scientific demand for stringency in
the use of language. The achieved clarity can be viewed as a sincere respect for the
users and their working conditions.

But ambiguity can well be used in a respectful way that invites different perspec-
tives. As an alternative in design, Gaver and colleagues reflect on how “contextual
ambiguity can question the discourses surrounding technological genres, allowing
people to expand, bridge, or reject them as they see fit” (Gaver, Beaver, & Benford,
2003, p. 237). We can also see methods such as working with extreme personas,
imagining a user as being a pope or a drug dealer, emerge. I will soon describe
design games as another option and the chapter on design work illustrates to how
performative aspects of objects and spaces, which is the central theme of this thesis,
are used to connect the processes of understanding and transforming.

It becomes a matter of shifting between convergent and divergent thinking.
Converging synthesis is needed for forming the understanding and diverging imagi-
nation is needed for innovation. This shifting might illustrate one aspect of Meta-
morphing. It is not an issue of transforming the one to the other, just as field studies
is not translated to design specifications. It is an ongoing process where they are
intrinsically intertwined and aspects of both understanding and transformation are
emerging along the way. The potential trap of getting stuck in our potential under-
standing of the context for design is coming more and more into focus and voices
are heard advocating stronger focus on design and the objects of design.

Wolf et al. goes as far as to title a paper “Dispelling design as the black art of
CHI” (Wolf et al., 2006). Taking offspring in a distinction by Jonas Löwgren be-
tween engineering design and creative design (Wolf et al., 2006/Löwgren/1995),
they try to approach how the HCI community more or less hides design aspects of
work since scientific rigor of that is hard to achieve. While engineering design refers
to perspectives of problem solving where the problem is precisely and comprehen-
sively described, creative design is more about understanding the problem as much
as the final artefact. The interplay between problem setting and problem solving is
engaged in a tight interplay and the design space is extended by developing many
ideas simultaneously and in parallel.

This is of course a characterization of extremes, but it does include a seed worth
reflection of where research tends to stress reporting. That will most likely be where
scientific rigor can be found. The arguments are partially valid for another pair of
polarities, the one Fällman makes between research-oriented design and the one
I’ve mentioned in this chapter which I also like more, that of design-oriented re-
search (Fällman, 2003, pp.98-104 ). In research-oriented design the artefact under
production is the motivation, and in the process research related problems are answered. In design-oriented research the emphasis is on an exploration and production of knowledge, in where the prototypes and design are the means. This implies that we can study use as a part of design in ongoing development. The design object as such is not a final end but still plays a central role that must be reflected.

Redström convincingly elaborates a short design history which comments on the potential trap of getting stuck in the existing while performing user-centered design (Redström, 2005). Drawing up a historical account that goes from a focus of the object of design, via an understanding of how intended use differs from actual use, to a current situation in where designers goes as far to claim designing of the experience of the design object. Acknowledging the shift of focus from object to use is valuable, but it also bears an interesting paradox namely that; “Trying to optimize fit on basis of knowledge about use and users, we risk trapping people in a situation where the use of our designs has been over-determined and where there is not enough space left to act and improvise.” (Redström, 2005, pp.123). How can we embrace both this perspective while still confessing to Krippendorff’s semantic turn at the same time. Redström’s answer, which is by no means complete, is that “We need a foundation based on an understanding of use as achievement rather than as reproduction; of the object as experienced, rather than the experience as object.” (Redström, 2005, pp.137).

It now seems rather obvious that we cannot be lazy as design researchers and that the process of understanding and transforming places is at least as complex as first imagined. It also seems more plausible with a methodological platform that “borrows” from diverse disciplines while still aiming at a coherent reporting of knowledge for design. Coherent, but including diversities, which is my reason for including different domains of use, design work, rehabilitation and artistic work, while putting basically the same technology into play. This responds to a rather strong trend in current research in development that is one of not designing fixed artefacts with unalterable functionality and meaning. The Palcom project for example explores, both technically and sociologically, how we can experience ecologies of devices and services, making it possible for users to construct assemblies where devices/services exhibits new functionality when so wanted. The chapter on hand surgery should be read from that perspective.

The openness of the design artefact could then be re-appropriated within yet other contexts where the researcher must again re-formulate what kind of knowledge that is emerging. The chapter on artistic work could be read as such a complement. It could also be read from the perspective of an arising and possible alternative research to qualitative respectively quantitative research; that of the practice-led or
performative research. Taking the name from J.L. Austin’s speech act theory Brad Haseman tentatively draws some lines of a possible methodology to be (Haseman, 2006, pp.98-106). While qualitative research prompts for scientific methods and the elimination of the individual perspective of the researcher, quantitative research can well apply a multi-method approach, but will still rely on written text, even though numerical data is not required, as the primary outcome of research.

The methodologies are also both driven by a formulation of research problem that drives the study. By contrast Haseman reflects how many practice-led researchers are driven by an enthusiasm for practice, they “dive in” and sees what emerges (Haseman, 2006, pp.100). In many cases these researchers are designers or artists choosing to let their making and love of doing it be the starting point, the practice is thus not an object of study but the actual driving force performing the study. Still they might have a larger agenda as well as including elements of reflection and participant observation. Very much overlapping with quantitative research Haseman concludes that it’s the nature of reports that differs the two from each other. The reports include material forms of practice, such as a documentation of a performance, and do not require words in discursive text.

The DVD appendice “Moulding space” could have been such an argument. For me the poetry readings, which are described in the chapter on artistic work, are the most obvious connection to my background as poet and the current position of a design researcher. It provides me with the insider’s view of an understanding of action in context and I have not felt obliged to provide a formal evaluation of the performances. However being partially cowardly in front of an established community of research, and partially recognizing that the documentation is not of good enough quality, I’ve fallen back to writing a chapter as well on the case of artistic work. Still I think Haseman’s arguments motivate the narrative character of reporting including the use of many images and the personal voice. We’ll see how this perspective will be accepted for the research community within the coming years. For now I’m inclined to agree with Haseman that practice constructs a principal research activity and that the perspective is plurivocal and including multiple constructed realities (Haseman, 2006, pp. 104).

It can also be related to the concept of field trials as described here in the sense that unexpected things happen when making development part of the ongoing activity and the personal engagement in the making of artefacts. This will be apparent in the design of the Tracking Game Table, which follows in shortly.

However, before leaving Haseman aside, I would like to bring forth a connection between his prospect of a possible performative research tradition and a possibly constructive approach to the described potential pitfall of being stuck between
understanding and transforming. As mentioned Haseman’s paper rests in part upon Austin’s speech-act theory that lends itself to comparison with Wittgenstein’s theories on language games that were central in the canonical work of Pelle Ehn and others in the early days of participatory design. Participatory design, as developed in Scandinavia in the 1970s, had a strong political motivation and an urge to let the development of computer artefacts be integrated in a way pertaining to the democratic movement. Considering the tacit knowing residing in the unfolding character of practice and use of mundane artefacts it can also be said to have an epistemological motivation. If the existing skills within organizations shall be a resource we should let the practitioners themselves be part of an engaged participation in the development process. Ehn took Wittgenstein’s abundance of the picture theory of language as theoretical motivation for talking about design as language games (Ehn, 1988, pp.103-122).

No longer claiming that language should represent reality in a pictorial way, Wittgenstein in Philosophical investigations (Wittgenstein, 1953) developed the idea of language games as the meaning of words being developed in how language is used rather than having an inherent meaning in them. Language games are multiple and intertwining voices of the humans acting in the games. If the meaning cannot be fully shared it can still be common enough as the use of language can bear a family resemblance to how others use the language. Relying then on enactment and expression, rather than mere description, innovative visions of reality and practice can be included in the showing of what a participant in a language game means. Like in ordinary games, Wittgenstein propose that participation in language games is made possible by following rules that are not formulated a priori but can be followed in unanticipated but still appropriate ways.

If we then, as Ehn and others did early on, claims that these language games does include not, only the use of words but also things, artefacts as well as the use of computers, we have a means of talking about a practice that cannot only be understood, but also “linguistically” (as in enacted or shown) innovated or transformed. “Our purpose is not only to reflect, but also to advocate change. We do not leave things as they are, as according to Wittgenstein philosophy does. This doubleness we share with other design sciences.” (Ehn,1988, pp.121). This inspired, among others, to stage participatory design processes where paper mock-ups and design games were used as stand-ins for prototypes not yet developed.

This is clearly one way of performing design-oriented research without having an operational prototype at hand. Even though I have argued for striving towards implementation as to stage actual, or close to actual, use, the process thinking urges us to balance open ended mock-ups and conceptual devices at different times. Not
only because a prototype is not existing at the time, but also because they are easier to imagine being quite different.

The design games mentioned were set up to facilitate imaginary situations that complemented reflective understanding of practice. They did so by introducing a playfulness that follows from the non-constraining use of language. The use of games as mediating tools in participatory design processes has been explored, for example, by Ehn and Sjögren. They argue against correctness of descriptions and focus on how linguistic artifacts are used rather than what they state to be true (Ehn & Sjögren, 1991). Meaning arises not in how exactly a statement is formulated, but rather by the intertwining of different voices that shapes language in the specific situation.

I have too been part of setting up design games that have been used for evaluation as well as collaborative design and change oriented sessions. In the research here described, we have used these kinds of more exploratory approaches in combination with more traditional evaluating sessions. This was for example the case with the hand surgery clinic where the functional prototype were tested and assessed by staff and patients in an evaluation sessions with many participants which lead to tentative conclusions on use.

In the Atelier project we linked action science and field trials to the staging of design games in as much as we used new combinations of the technology developed in the project. In such instantiations the methods of design became design; it spurred further development and use. An elaborated view on design games with a detailed example can be found in the appendice “Playful Collaborative Exploration: New Research Practice in Participatory Design”, but another example including ongoing development and use of technology will be illustrated briefly here.
2.3 METHODS AS DESIGN –AN EXAMPLE; 
THE TRACKING GAME TABLE

After the Semi-public places project we wanted to set up a session together with the students where we could evaluate both the project and the prototypes. Design games were used during several instances in the project, at times with a change oriented focus. At this occasion the agenda was more one of evaluating project experiences. We wanted to encourage narrative styles of talking about the experience of the project and our prototypes. The goal of the game was to tell good stories about practice and not to achieve an ultimate description. Narrative styles of analysis of ethnographic studies are a discipline of inquiry in itself, which will not be reflected here. Howard Becker (1998) advocates asking ‘how’ rather than ‘why.’ While ‘why’ seems to prompt for answers without logical inconsistencies, ‘how’ encourages a more straightforward storytelling. This makes part of the playfulness that eases up participatory design processes. Another agenda was then to have more change oriented discussions on the prototypes and the practice of design. This was a matter of being able to synthesize the impressions of practice into a divergent understanding and to be able to re-converge that understanding into hitherto unforeseen new combinations.

We had decided to work with the montage like character, we had previously used in several games. A combination of digital media and game cards are used as material for the game. Images and video snippets are associated to RFID tags on paper cards. The content of the media used have varied in the different alternatives of the games, considering the intent with playing them. In many cases it has been material from observed situations; at times it had been complemented with more open ended cards that could be fueled with meaning by the player.

Using video as design material, or in games, has been explored in several writings. Buur, Binder, and Brandt give us some examples of how it is possible to do “design in video.” They exemplify with video portraits, improvised scenarios, and a video card game. The use of video as reflecting material is a way of “maintaining
reference to the context” (Buur, Binder, & Brandt, 2000, p. 28). After all the cards have been dealt one player lays out three cards as to commence a story he had found interesting or just found up while looking at the cards. The next player continues to lay out three new cards, connecting them to one element in the “story” laid out by the previous player. Before a card is laid out it is put next to the RFID reader, thus displaying the associated media. In this way the cards on the table/game board evolves into a “hyperlinked” pattern that are jointly analyzed and formulated into a themed story which summarizes the smaller stories laid out on the table. This is one general scheme of rules that we have used before. We picked out approximately 20 short video snippets and 20 stills that showed something that we thought could be interesting to examine. We created plastic cards for each of the video snippets and for each still image. As mentioned each card functions as a placeholder for a photo or a video snippet and, when discussing the photos or videos, the card can be a reminder. The cards were augmented with Radio Frequency ID (RFID) tags that maintained correspondence with the videos and images. By placing the card on a tag reader the media were displayed in a large projection that could be seen by all participants.

We had for some time experimented with software displays that on a computer could show many different frames that could each play video, thus making a variety of smaller displays within the larger display/window. Some days before the planned session we found out that the Texture Painter application, using a tracking system, could be used to move the smaller frames playing media. We decided to use this set-up for the game and we came later to refer to this configuration as the Tracking Game Table. The combination of RFID technology and the tracking system was due to our use in the field trials and the efforts to configure it differently according to the wish of the students, thus stretching the boundaries of the developed applications at times, such as on this occasion, producing new artefacts.

By fastening the tracking system as to be positioned in the very same direction as what were displayed from the projector we ensured, after some experimentation, a way of receiving co-ordinates of what was displayed from the projector. It was also
possible to scale the smaller frames up and down and they could be moved around. This was possible by using a wireless mouse, since manipulating the objects required pushing a button, with a reflector fastened to an extension of the mouse.

The extension was a simple ruler but it was needed for ensuring a free “line of sight” for the tracking system. If the reflector had been put on the mouse it might have been hard to read for the tracking system in many situations. Furthermore it was possible to save a configuration of frames/displays in another tagged object. This included not only what was being on display in the frames, but also their inter-relational position within the larger display/window. For this we used a cylinder with a tag at the bottom. By making annotations, such as commentating on the collection of media, on an ordinary piece of paper and putting that into the cylinder, an object emerged with digital content, analogue comments and infused with dialogical perspectives. If the “container” with the collection of media were place on the tag reader all the frames with movies or images were displayed with their original position and scale.

Testing both projection on a wall and projection from above, displaying on the floor or on a table, we decided to use a projection from above displaying on a table. This had the drawback of people having to position themselves on the same side of the table if they were to view the display in the same way. Projecting on a wall did not have this effect, but at the same time the players have to stand up most of the time. This could not have been solved by using a back-projection, since the tracking system in that case could not communicate with the reflector on the interaction device which is necessary for calculating the co-ordinates, and we decided to go for the table set-up.

This assemblage of technological components and conceptual framings, such as the notion of design games, could hardly have been achieved without our intense engagement with the technology as it were configured in ongoing ways during the field trials. This description of the development of the Tracking Game Table is somewhat technical, but I would like to stress that the qualities of the set-up is foremost not
of a technical character. These qualities are more thoroughly elaborated in appendix 2 – Playful collaborative exploration. The participative character of the game and the collaborative evaluation was the goal. But adjusting the technology and the space for the game was important for us as well. The transference to different situations is an instance of design knowledge that thrives off transferability rather than generality and it is dependent of previous engagement with the materials of design. Knowing the boundaries, flexibility and potential of the material requires an experience of use that motivates a practice led research in where the network of references for the domain is explored by doing and communicating.

This network includes both human and non-human actors, designers, users, technology, space, objects and the design process itself, in an intertwined process. The transferences also illustrate how Metamorphing is directed to issues of form giving in this thesis.

In the process we make use of diverse methodologies inspired by different disciplines. From ethnography, ethnomethodology and actor-network theory we elaborate ways of understanding a practice in natural environments including the use of mundane objects and how space is configured. From action research and participatory design we can fetch inspiration and nourishment to mobilize a process of imagining and tentatively trying out future transformations of what we have come to understand of the practice together with the users. We can stage these processes as a “linguaging” of design where the different perspectives are understood as they are enacted in communication. The understanding will not be completely shared between participants, but strong enough to carry work forward. At times we use non-functional props to enact ideas and meanings whereas we at other times include prototypes, maybe pointing into another direction for how work can be carried out. If we intensively engage in reflective conversation with the materials of our design, we can unfold a component based understanding of the material thus being able to construct through de-construction. If we succeed we can tell stories about what has happened that should be accepted as valid design knowledge.
3. ON OBJECTS AND SPACES; REAL, VIRTUAL OR BOTH.

A thing was the governing assembly in Germanic societies, made up of the free men of the community and presided by lawspeakers. At the thing, disputes were solved and political decisions were made. The place for the thing was often also the place for public religious rites and for commerce. This original “thing” from the pre-Christian culture of Scandinavia and in North Germanic languages, was then a place to assemble and negotiate. Being but one example of how processes have been subject for reification in western culture, this example inspires aspects that does not define objects as singular, final or cut off from human relations.

This chapter takes as a starting point how the social is ordered and structured through objects and materiality. Parallel to the increased interest for materiality within the field of interaction design, we can also observe how an interest in conceptualizations of space and place has enriched the discourse in recent years. With this in mind I review different scholars as to find conceptualizations of objects and spaces that uplifts them from being “dead materiality”, uniform and with well marked boundaries. This aims at being able to talk about them as what are performed and enacted. The arguments leads to looking at how mixed objects, being both physical and digital, and transformable spaces are used in the context of design work. Several examples from that context illustrate the argumentation.

Objects constitute an everyday material for experiencing and making sense of the world. We develop our skills in language and embodied action by actively relating to, and engaging with, things and material objects. Different disciplines such as philosophy, linguistics, semiotics, post structuralism, cultural materialism and several others, make use of different types of inquiries. Issues on how the social is ordered and structured through objects and materiality - what things do, and the relation between objects and representation - what things mean, has received enormous attention and efforts including classical debates such as realism vs. con-
structivism or idealism vs. materialism. The phenomenological tradition gives us some tools to approach everyday life by returning to concrete things and occurrences rather than abstractions describing them. Bread on a table is not a meal – it’s also the hands weary from a full day’s work dropping the knife, the children telling stories from school, the remembrance of youth in the taste of a familiar dish. Phenomenology as a theoretical backdrop has influenced computer scientists like Paul Dourish and the much referred concept of embodied interaction, but it also bears strong acquaintances to much artistic work. For example Merleau-Ponty perceived the work of Cézanne as a phenomenological project. Rather than distancing meaning from objects through imposing styled affections, Cézanne tried to reduce the surface between consciousness and its intentional object. The French poet Francis Ponge expressed in his “thing poems” how presiding over the world deprives one of the experience of it.

“Kings do not touch doors……and so are deprived of the pleasure of grabbing the midriff of one of these tall obstacles to a room by its porcelain node.”
(Francis Ponge, from Le Parti pris des choses)

For him, to describe the simple and concrete, was a way out of the abstract generalizations imposed by a long philosophical tradition that constrained his artistic expressions. Leaving aside the emotions of the subject he turned towards the object, but the focus of attention was really the interplay between them. The blending of words and things was of utmost importance and in contrast to dominating dichotomies of subjects and objects. Even though the turn to materiality and things, his strategy was to infuse signs, names and letters into the things. This intertwining gave rise to a new object, the “objeu”, from object and the french jeu, to play (Cornell, pp.67). The objeu however are not permanent and lacks the definitive character of the physical object. It’s character is more ephemeral and it’s more a sketch or a draft that gives rise to new objeux.

Such a perspective resonates well with a culture that favors bricolage and performativity and we have learned to cope with indeterminacies in constructive ways. Actor-network theory (ANT) can be understood as a semiotics of materiality (Law,ANT & after, pp. 4-14) and analyses in well reflected ways relational and non-singular aspects of objects. Properties and forms of entities (things, objects) are acquired in relations to other entities. That it’s a semiotics of materiality distinguishes the discipline from some post-structuralistic versions that turns to language and immaterial entities and we can reserve the idea of artefact for material things. If objects are seen as an effect of an array of relations it follows that they do not exist
in themselves, they are performed and emerging. They are also spatial in as much as they establish the necessary conditions for creating and transforming space, which is also, not given or fixed, but performed as well.

Bruno Latour writes (Politics of Nature pp. 18.24) on how we are accustomed to smooth and risk free objects that are characterized by having clear boundaries with a well defined essence, in which the producer becomes invisible when for example a product is released. In contrast he puts forth the concept of tangled objects, or risky attachments, with no clear boundaries to the environment and where the producers are part of the definition. They are subject to constant translation and re-definition and are not detached from the consequences they trigger.ANT speaks of humans and non-humans alike as forming alliances, translating each other’s interests. I have already referred how Latour describes our use of technology as a collective of humans and non-humans instead of the traditional subject/object ontology (Latour, 1999, pp. 174-235). He defines technology as a mediator, not a means and not an end but both at the same time.

One of the meanings of his concept of translation is used for describing a drift or mediation in our intentionality while using technology. When an agent (a human, a user) gets hold of a tool in order to achieve a certain goal, the agent gets modified by the potential capacity of the tool. So what happens is that a slight shift emerges in the identification of not only agent and tool, but in the goal as well. The non-human (the technology) can have a goal as well in terms of its intended function. When humans fall back on technology in order to achieve a certain goal he makes a detour according to Latour. The intimate coupling of actants in this situation gives rise to a third actant, a combination of the two and as mentioned the goal is translated as well. Thus action becomes a series of associated entities and nested sub-programs.

This line of thinking, defying the simplicity of the singular, deprives objects of essential inherent qualities and there’s a risk of the object imploding to anything that is evoked by the object. Law proposes the notion of fractional objects, using the metaphor of the fractal, to find a definition that is neither singular nor plural. A fractal is a line occupying more than one dimension but less than two. This is clearly not straightforward and we must look carefully into characterizations and try to find good exemplars. Law (2000, pp.1) also proposes that a term gains significance in relation to its neighbors. The difference from the other constitutes the identity.

This resonates well with the also referred conception of circulating references (Latour, 1999, pp. 24-79). There is no singular meeting point between words and things, in form of a distinct phenomenon such as the Kantian philosophy makes us believe, neither is it a matter of two completely different domains, mind and nature, such as the Cartesian philosophy makes us believe. The different transformations
might bear little resemblance to each other but the coherency of the different stages, of what we call things, depends on how well the steps are articulated. The quest for correspondence is quite different in this perspective and by acknowledging the transformations we can see, not only natural matter, but even more the designed object in another light. Along the path of circulating references new conditions emerges and even actual spaces. Within this trail some confusion will arise as we institute our language into the references. Concepts such as objects, artefacts, things and representations will gain loose boundaries and our spontaneous use of them in everyday language is workable most of the time, but looking closely at them requires some reflection. I have here referred to some different perspectives that forms background for the stories that will be elaborated in the following chapters.

From Latour I borrow the concept of actants as objects are not “dead, soulless” things. They play an active role in our experience of and how we act in the world. When objects are integrated into human experience they are no longer smooth or risk-free and as they enrich human experience and communication they are transformed and entangled. Law’s notion of fractional objects tell us that they are both constituted of a collection of related things and at the same time they make for a container of these things, they sign out their boundaries. The complexity of the loose boundaries can be handled by humans as the objects are used in specific situations with specific intentionality that helps to frame the interaction around objects.

As boundary objects they support cooperation and align different perspectives of actors. But there’s also an aspect of how the tension between objects can stimulate a creative development of something new in a playful way that really does not care about strict definitions. That we can learn from Ponge and his notion of objeux, who also stresses a coupling with objects and our use of language. These are all for me characteristic properties of objects and will help to understand how they are used and how the discipline of interaction design can contribute to create meaningful things that also are computational.

I will try to be consequent in my use of the concepts but will here try to make some distinctions. Let’s start with the distinction between objects and things. Maybe the difference between space and place as put forth by Dourish and Harrison (Harrison and Dourish, 1999) can help to shed some light to the difference. There spatial metaphors are used as organizing principles for the design of virtual spaces, whereas the notion of place is used to reflect on the emergence of social practice as the shared experience accumulated over time in space.
A consequence of the evolving nature of practice and the making of place is that it is relative to a particular community of practice, perceived differently by different actors at different times. Sub-nested places occur within the actual space. So what constitutes place is a complex totality of social engagement with other people, use of artifacts, information, and lived experience that is hard to pinpoint. Hence, place is experienced space. For me objects can be put on the level of place, they exist in themselves but mobilized by humans they evolve in different versions when they are integrated with human experience and practice.

This is the same way Christiano Storni, an Italian sociologist, treats the concepts in his recent dissertation (Storni, 2006). He also defines a dialectical opposition between the two while having a similar object of study such as the major case in this thesis – the design process. Design can be seen as a movement from thing to object. Things are an indifferent starting point that constructs places for negotiation just like the Nordic and Germanic places called “things”, towards the object that has more stable boundaries. Stable but not fully enclosed since they also become objects of use and while being appropriated by users they continue to circulate like Latours references. So the designed artefact can be said to start out as a “thing”, being open for negotiation, multiple interpretations and change, before eventually being objectified into a rather stable “object” at the end of the design project. As the product or artefact is released a new process of divergence starts. As it is used and gains meaning for users it is again a “thing”. Even though a dialectical relation can be observed they do not exclude each other. As Storni reflects; “the thing/object dialectic does not mean that we witness either an object or a thing….. they are always fused together; they are components of the material existence of a whole in-its-making: a thinging part which tends to diverge and an objectifying part which tends to converge” (Storni, 2006, pp.164).

We also have the related notions of artefacts and representation. Artefacts (the artificial fact) are one outcome of the movement from thing to object and can also be on the same level as the “final” object. They are more like built spaces, they are produced with a specific functionality in mind, like an object or space can be, but as they are appropriated by users they will gain different meanings as they are situated differently. As the concept of representation generally embodies a range of different meaning, they have a common denominator in “something standing for something/someone else”. Either it’s an act of “stepping in the place of”, such as politicians representing the people – speaking for them, or it’s an act of “putting something there instead of”, such as an image portraying the original thing. These perspectives are for example kept in the German language, in the difference between Vertretung and Darstellung. Take for example a design representation which can be both, ad-
vocating needs or desires for user groups or it can express imagined states of the actual design. But it’s always means, never end. They are not foremost particular kinds of objects, but more like works of art in as much as they are not originals or copies, not spokesmen of missing citizens. They are parts in series without original belonging. As they embody different aspects, sometimes incommensurable to each other, designers need representations open for transformation but with possibilities for maintaining connections between them.

I will try to be consequent on this but slippages might occur and the complexity of definitions illustrates Wittgenstein’s widely referred thesis about language games and how meaning is not primarily inherent in language but gain meaning as it is interwoven into life, practice and actions (Wittgenstein, 1953/1992). It is unified by family resemblance and using language is part of activities or even constituting a form of life. The cases that will be described in this thesis could maybe be seen as a sort of object/space games from this perspective.

In the Atelier project we made observations on how representations and artefacts are subjects for Metamorphing by the design students and how the transformations of design artefacts constitute a driving force in design work. This will be further elaborated in the following chapter, but I would here like to bring forth a central finding in the project and a fundamental concept in this thesis that might add to the confusion but also strengthen our reflection on things and objects; that is an interesting perspective of a special class of objects that might be termed mixed objects, which also can be mixed representations/artefacts depending their degree of maturity or how they are situated.

The term mixed refers to how they are technologically augmented and how they are integrated with digital media. Having a material body, while at the same time carrying links to digital media, they have the potential to address a new multimodality in design representations and materials that can change the conditions for design work in a radical way.

### 3.1 A NEW MULTIMODALITY IN DESIGN REPRESENTATIONS & MATERIALS

The settings we considered in the Atelier project are characterized by evolving environments – designers configure and re-configure their workspaces, they adapt them to different uses and identities. Moreover, designers’ field of work is highly complex and they constantly invent and probe techniques for representing this complexity.
As a consequence, the design artifacts they produce evolve and are changing. What is inspiring and meaningful for designers depends on context. Objects or a place, for example, are not inspirational as such but may be so in connection with a specific project, idea or particular task. Experiencing design material from different perspectives or in different scale is important for gaining an open design space where ideas can be stretched in any direction before narrowing down in realization. Materiality and diversity are significant qualities of design representations. Embodied interaction rethinks the borders of the digital artefact. Starting from the position that our experience of artefacts, also digital artefacts, is experiential I suggest accepting that there is no such thing as an entirely digital artefact. Instead the design materials for digital artefacts are both spatial and temporal. With digital technology we can build digital temporal structures and behaviour. However, to design these temporal structures into artefacts that we can experience and interact with almost any material can be of use in the spatial configuration. Hence, design of digital technologies deals with a kind of mixed objects, including ‘border resources’, beyond the physical-digital divide. The value of maintaining the diversity of representations and strengthening the connections between them can be obtained by addressing a new multi modality in the representations. The creation of mixed design objects through use of barcodes, RFID tags and touch sensors opens up the possibilities to interact with them in relation to other representations of relevance in the project, different actors, human bodies and the surrounding space.

The term mixed addresses the fact that they do have a material body that can be interacted with in a familiar way, such as for example how a map is usually read and interpreted, but through the interaction, reading with a barcode reader or placing next to a RFID reader, digital media is played or displayed. The design process unfolds like a continuous flux where digital media enriches the expressions. Interaction in a design studio must support different levels of concreteness and one way of affording that is by including space in design and by letting it be inhabited by mixed design objects where integration of the physical and the digital happens within one single object. They might be augmentations of known representations or they might appear as more genuine hybrid forms, invented for a special purpose.

**Figure 15:**
Mixed design objects: The CAD plan with barcodes, models augmented with touch sensors, and objects with embedded RFID tags, illustrating aspects of a workplace are all examples of ways to animate the environment by playing media.
One example of mixed objects that is an augmentation of a known representation is this map of a hospital ward made by a group of students developing a design for such environments. They had performed a rapid field study and back in the studio they had the task of representing the context they had studied. They had approximately one hundred still images, a couple of interviews and some video footage. Jointly going through the material, analyzing it and making a selection within the material is an important part of design work and a matter of representing context for design. It is a matter of keeping the material persistent as work proceeds. This group made a map of the ward, placed RFID tags in the map and associated the selected media to the tags that could then be displayed/played by placing the RFID reader close to the tags that were visible on the map.

Whereas this example illustrates how a known format is augmented, we can also see how a format is changed into a hitherto unknown format for a medium. This is the case with the video sketches produced by all the student groups in the Augmenting Spaces project. Video is a common design material at the School of Arts and Communication. The concept of video sketches refers to “quick and dirty” recordings the students made of different scenarios. As constraints, they were not supposed to do any editing of the videos, outside of the camera. The idea was to keep the open form of the sketch that can be interpreted in various ways and used as a shared object of discussion. After recording, the videos were connected to cards enhanced by tags, thus being available for immediate playback any time. In this way the sketches could be used just as traditional design material, such as a pen/paper sketches.

Some examples of representations invented for the projects are the field cards, which we saw in use in the design games, and a game board. One group of students attached media objects to strings and hanged them in front of a projection
surface on which movies from the field study was displayed, when a tag reader was brought close to the cards. They indexed the different strings by putting keywords, such as process, design, communication etc, on to fibre glass signs furthest up on the strings, thus constituting a physical database “floating in the air”. The game board was produced by a group of students working with a design concept for a fire brigade station. Like the hospital ward map the placed tags, associated to selected clips from the actual site, on a horizontally oriented object, but this time on a game board – the fire brigade game. The tag reader was put into a moveable game piece and rolling the dice decided how many steps the piece could be moved, this introduced the element of chance into the process of viewing site specific media.

We also observed how organic things were mixed with artificially produced artefacts. One student group was developing a concept for a specific urban place, the urban park. They built an installation that connected to a park where they had made visits. This time they put the tags on ordinary leafs collected in the park. These tags where associated to views from the park and interviews with people visiting it and they were mixed with leafs made by themselves that carried associations to the first design ideas, which were associated to barcodes as to further stress the difference between the two kinds of leafs.

The adjustment of space and material could be seen as creating different situations that fits for different phases of design work. In the initial phases the space was adjusted for getting in close contact with the field studies, where collaborative analysis could be carried out. These installations often had strong narrative elements that supported the imagination of use qualities other than mere functionality. Levels of material from the field visits varied.
Some of the material was more descriptive, some mere video observations, providing a view to a place, but some of the material had a narrative nature, such as a worker telling his wife what happened during the day, when he comes home or informal social communication between workers. The mix of different levels provided a fragmented overview, which was not only focused on work tasks. The students seemed to get a feel also of the social dimensions of the environments. Having the 3D collages around you was inspirational, but also made the material available in quite another way than having to go to a PC workstation, boot the computer, find the right software and browse for the right file. The surrounding space for the students turned into one telling different stories about actual places. Entering the studio it was possible for anyone to take part of the stories. As concept development continued these stations were adjusted for doing sketching and building lo-fi mock-ups. Later stages were built for enacting scenarios. When used in physical representations, such as field studies connected to tags, video sketches “on paper” or models enhanced by barcodes, the design material makes part of a design world that can be used as a support in the process. Different configurations of the material create different situations on which the designer can react and make new interpretations of the problem. The result can be related to restrictions such as educational goals, economy or technology. In series of iterative steps the process continues. If the design material has a physical body as described here, then the re-programming of space and objects also becomes a re-programming of the whole design process. In creative thinking this series of new configurations experiences and material can be used in non-structured ways, not always with a certain goal in mind.

3.2 THE TEXTURE PAINTER EXAMPLE

Let’s take a look at how the Vienna students used another example of a mixed object, the architectural scale model. Taking a step beyond the traditional white model, animating it using the texture brush, models became subject for many different transformations merging with the design studio as to instantiate a multitude of design situations. Using the Texture Brush, an application for ‘painting’ virtual textures on physical models with a real brush, students experimented with changing the properties of a model, by applying colour, inserting movement and context, and varying its dimension in relation to other objects in the physical space.

Loading different textures, video clips or pictures into the menu of the Texture Painter could be performed by using a barcode reader to barcoded samples. It was then possible to select textures or other media from the menu bar, which can be seen at the bottom of the table. It was possible to save textures and configurations
as a digital file. Barcodes were also printed as shortcuts to commands for specifying which printers or projectors to use.

Here we can also see a certain amount of configurability taking place as the relationship between object (model) and space (projection screens and projections on the tabletop) creates a specific spatial expression. By placing the model on the “mixed object table”, which is a table with a semi-transparent tabletop for projections, the students were able to change the environment surrounding the model by changing the projections. This was further fine-tuned by moving the table carefully as to adjust to the projections.

A group of first semester students used the Texture Brush on their 1:50 and 1:20 scale models of famous architecture made from white polysterene. The played with the model by painting different textures onto it and by projecting video upon it. To achieve different effects the material for some parts of the model could be changed. Systematically, but still playful, altering of textures and background projections helped to explore the “seeing” of an architectural object. This “seeing” includes interpretation, analysis and criticism that were part of the exercise.

The major part of the material had been prepared by the students themselves. They had collected pictures, videos and plans found in books on architecture and journals. They had also collected pictures of materials, landscapes, textures and nature pictures of sky and trees and so on. They linked the digitized media to barcodes that they prepared in any way they liked; one of the students had glued his barcodes on a piece of carton that he brought to the presentation. Short one-minute video loops had been prepared by the research team. The content was for example the flow of water, grass moving in the wind or traffic moving by. The videos were dominated by different colours.

Giorgio de Michelis has elaborated further some characteristics for mixed objects (Binder et. al, 1994), namely that they have as qualities openness, multiplicity and continuity. Continuity refers to aspects of the previously mentioned sampling. This quality should provide possibilities to move seamlessly between artefacts and appearances without interrupting in space and time. This is quite visible in the way the architecture students explored the models applying the Texture Brush. There are many possibilities to play around with the model by deploying different textures that does not have to refer to the properties of the construction material; they can
also be pictures of furnishing, interior design or gardening. In a continuous way it is possible to transform the model to something conceptually different. In this example the model was made to look like a Las Vegas gas station by painting neon signs on the model and using different background projections.

Openness refers to the potential of combining different objects and the way they can be used and perceived in many different ways. Designers have learned to work collaboratively and across disciplines. Parallel to this transition another, perhaps more radical alternative, strives to abandon design as problem-solving and rather turns to an open-ended design process in which the exploration of the design space leads to the outcome of the design process. The outcome is the result of a series of transformations of different representations, which illustrates how the penetration of digital media and explorations of the flexibility of objects, is at the core of contemporary interaction design. One consequence of the openness is that the artefacts have to be appropriated by the users; they have to be interacted with.

As mentioned some students played with the material of the model to create effects such as using aluminium foils. Others painted people and cars together with a texture, making a collage on the model. While some tried to achieve different architectural views others focused more on playing with concepts and ideas. One student called the Texture Painter a perfect tool for exploring and analysing proportions. Every applied texture or media changes the visual proportion of the model. Since it
is possible to scale textures up and down and rotate them proportions are open for viewing in a variety of perspectives and scale. Every change creates a new view.

One example of how the model was mutated into something completely different can be seen in this example where an architect painted many different textures onto the model. The object of the session was a building for which a new attic was being planned and the topic was the relationship between the base and the attic. Projections of different textures changed the meaning of the building quite substantially. Painting a looped video of waves on the base transformed the model into a cliff, making it look more like a bastion with a sculpture on top. Here changing the context (the water projection) also changed the scale. In this way the projections are part of changing the students’ preconceptions of their design objects helping them to see it in alternative ways.

Changing the background projections from jungle to forest to desert continuously creates new reading of the models. Reading should here be understood as a process both of perception, performance and construction at the same time. The model is not perceived as an object in itself, it is performed and the perception is gradually emerging as the model is being changed.

It is possible to save states and configurations of process as a digital file in the Texture Painter, but a lot of the times the students just took a photo with a digital camera thus a kind of double-digital-processing documented the work and this turned out well for them, providing a representation that were quickly printable or maybe object for further manipulations or annotating.
Multiplicity concerns aspects of how different components with different qualities and affordances can be assembled to perform a joint spatial expression. Combining different sensor technologies with different display alternatives creates new mixed objects that mobilize further different changes of the objects.

While painting the model with virtual overlays actually is a rather direct way of manipulation with immediate and tactile feedback, through the use of the brush, more complex ways of interaction is also offered by the possibility to use optical markers. They are printouts of a pattern that can be placed out on the table. A web cam captures the model and its position to the markers and position and orientation of the marker in relation to the camera can be estimated. Markers represent real world objects, such as for example trees, and when position and orientation of the marker is known the corresponding object is added to the projected image.

So students can place the model on the table, project a “ground level image” on the table, paint the model with virtual textures or media and change the background projections. In addition to this they can place the markers, in the form of paper cards, around the model. This is recorded by the web cam which also adds the virtual objects to the movie which is displayed nearby. In this way the composed scene can include 3D objects (trees, cars etc.) that pop up from the markers. This is a more complex interaction that affords multiplicity.

In the final example with Texture Painter the architects used a 1:5 model of a furniture design by Andreas Rumpfhuber, made from artificial stone in combination with virtual 3D models. At one point the model was accidentally turned upside down. What was previously talked about as “an altar” now became an unknown object. The original meaning disappeared. In combination with other furniture pieces, represented by virtual markers, it could now be interpreted quite differently.

While multiplicity and openness have partially contradictory foundations they can be combined through the notion of continuity. Mixed objects can be said to be
blend several polarities, the physical/digital, the spatial/temporal, but nor the least they way it is perceived in different ways, by different actors, common enough for a at least partially shared understanding while still being diverse enough for accessing them from different points of view and allowing expressions from different perspectives.

3.3 SPACES, PLACES AND APPROPRIATION

I hope to have illustrated here how the social is affected and structured through objects and materiality. Parallel to the increased interest for materiality within the field of interaction design, we can also observe how an interest in conceptualizations of space and place has enriched the discourse in recent years. The language of space and place has been developed within different domains, mostly within architectural theory, urban planning, sociology, and by scholars of human geography. In the example with the Texture Painter it is easy to see how the interaction with mixed objects extends into a spatial expression, transforming the surrounding space. We can look at the interplay between space, objects and human actors as assemblies of temporary and short-time events and at place as emerging through ongoing practice and perceived as shared experience by the actors within the practice. Intermediary spaces emerge when artefacts, people and spaces are meshed into specific instantiations of the evolving activities within a physical location. As spaces they are crossroads of intersecting mobile elements that are unified in ephemeral, short lived and performed events. So what constitutes place is a complex totality of social engagement with other people, use of artifacts, information, and lived experience that is hard to pinpoint. Hence, place is experienced space. Doing and knowing always happen within a context of artefacts and people, within an ‘ecology’ of organizations and institutions and we have to think of place as constitutive of social practice.

This is what Norberg-Schultz alludes to when he takes a poem by Rilke as a starting point for discussing the character and spirit of place, the Genius Locii (Norberg-Schultz, 1999, p.103): "And it might well be that the intent with us is that we will learn to say, house, well, door, window, olive tree – and apart from that: pil-
lar, tower”. Here, a perspective on space arises, that articulates space through our familiarity and interaction with things and objects, such as in the example with the Texture Painter, where an intermediary space emerges around the interaction with the architectural model.

A trivial example is how we order our workspaces by structuring things. My desk is by no means an example of perfect order, yet when I close my eyes I’m able to find my notebook, turn the laptop on or off, reach out for the book I’m currently citing etc. Also the window and the beautiful view on the harbor is part of my experience of space.

These examples of objects are mundane work tools, but as I live with mixed objects I also learn to integrate them in my conception of space. Other spaces such as homes needs other types of configuring but likewise our ordering and interaction with things is an important part to how “we feel at home” and when being far away, I think of my garden when recalling the large hedge in front of the fence.

By contrast the artist Char Davies writes about how much of her work is grounded in her own experience of having an impaired vision. Having extremely myopic eyes, craving thick lenses on the spectacles, she has experienced how, when not wearing the correction lenses, she enters into another, radically different, spatiality. This is a space where the boundaries between objects and surrounding space are dissolved in light. Distinctions between separate objects and surfaces disappear into ambiguous luminosities. She found that this changed sensibility bears resemblance to how Merleau-Ponty describes how the night evolves a spatiality without things and the perception is cut off from the world. Davies describes how this makes herself the centre point; the world is all around her, no longer in front of her visual focus.

“In this perceptual state, rather than being mentally focused on the future and thus inattentive, even absent, to the present, one becomes acutely aware one’s own embodied presence inhabiting space, in relation to a myriad of other presences as well” (Davies, 2004, pp.75). This full body immersion in a space with increased auditory perception has been part of her work with virtual environments such as Osmoses and Ephémère. She concludes her arguments by referring Gaston Bachelard, who wrote on perceptually and psychologically transformative potential of places like the sea or the desert. They are invigorating because they are unlike the ordinary spaces;
“By changing space, by leaving the space of one’s usual sensibilities, one enters into communication with a space that is physically innovating…For we do not change space, we change our nature”
Gaston Bachelard, The poetics of space (in Davies, C, 2004, pp. 102)

The work of Davies concerns virtual spaces while the example with the desk at the workplace is a material space. The intermediary spaces I refer to in this thesis are, very much like the mixed objects, a kind of mixed spaces, being closer to the concept of augmented reality. They are material places, but heavily affected through the use of digital media and light.

In the Atelier project we wanted to support students in configuring the space in accordance to the activities carried out, but also for Metamorphing space as to have the possibilities to move between the described polarities of ordered space and a more ambiguous space with diffused boundaries of objects and people. While the ordinary desk illustrated the former the picture below might illustrate the latter. The two pictures put together are taken from the same occasion; an experimental workshop that intended to encourage use of space and material called the “story-telling room”. The different groups were supposed to illustrate something important that had happened within the visited environment, by configuring their space. The task was formulated as; “Something crucial happened when you arrived at work – show the visitors what happened”. They were not supposed to use any verbal expressions, but could use their bodies as props. One of the aims of the exercise was to ground how a space can be used in a diversity of ways.

An architectural space is not static; it undergoes constant changes in relation to the inhabitant’s activities. The discipline had seen that function survived through exchanging contexts. A fast-food restaurant becomes a pawn-shop and libraries turn into swimming pools. Rem Koolhaas described an Athletic Club as “Eating oysters
with boxing gloves naked on the ninth floor” (Tschumi, 1994, s.256). To this rapid exchange of movements in space we must add a diversity of cultural, economical and individual perspectives. These disjointed conditions were the topics of many post-modern philosophers in the 80s.

Architect Bernard Tschumi was one of several that fetched inspiration and methods in that movement and maybe especially from Derrida and his concept of deconstruction. Instead of excluding functionality, which in his terminology is called event or programme, he has stated that there are no hierarchical cause-effect relationship between form and function and that that very condition is the strength of architecture. He defines program as “a list of required utilities, it indicates their relation but suggests neither their combination nor their proportion” (Tschumi, 1994, pp.113). So instead of providing continuity in urban spaces in the old form of streets and plazas he sees fragmentation and juxtaposition in cities like New York and Tokyo as a sign of vitality, making an event out of urban shock (Tschumi, 1994, pp 246). Superimposition, juxtaposition and de-familiarization have become key devices. For Tschumi architecture is both concept and experience, space and use, and they are never separated. Instead they are merged into unprecedented combinations of programs and spaces. He calls this cross-programming. An example would be to take the spatial configuration of a prison and combine it with that of an event park. Elsewhere he talks about “architecture not as an object (or work, in structuralist terms), but as an ‘interaction of space and events’” (Tschumi, 1997, pp 214-218).

In close resonance this perspective has also been coined as ‘use-as event’ (Lainer and Wagner, 1998) which stresses the evolving, temporary and sometimes performance-like character of activities in space. The performative aspects of space address how a situation must be considered as a whole, which is of great importance in design of interactive systems and spaces. Meaning is created in use of shared objects and social interaction is related to how we engage in spaces and artefacts. In this interplay the body has a central role, in many ways the body can be seen as the medium for having a world.

In a seminal paper for the HCI and CSCW communities, Harrison and Dourish highlights the critical distinction between space and place (Harrison and Dourish, 1996). Their observation is how many developers of collaborative and communicative environments use a spatial model to frame interaction. The critique from Harrison and Dourish stresses how a notion of place should be preferred rather than space. They define the place as; “cultural or communally-held understanding of the appropriateness of styles of behavior and interaction, which may be organized around spatial features but is, nonetheless, quite separate from them.” (Harrison
and Dourish, 1996, pp.75). In other words place is the experienced, lived, shared and communally understood space. One effect is that also “spaceless places” can give a feeling of place, which of course gives hope to designers of media spaces.

This was the issue for the authors even if the proposed distinction was a conceptual one rather than grounded in design. Now, ten years later, Dourish has re-examined the paper and he comments on some common misreading (Dourish, 2006). One is the issue of how many has come to think of place as “layered on top” of space, how several interpretations has thought of space coming before place in a temporal sequence. It is actually not the case that space is pre-given and place comes afterwards as a product of social practise. Instead also spaces are a product of the social and Dourish argues that our first and immediate experience is of places and that both space and place are products of embodied social practice. This might seem rhetorical, but what it suggests is that we must understand how spatiality arise and how multiple spaces might intersect. In my view these are the important lessons to learn from the discourse.

This resonates well with parts of the thinking of de Certeau, which is quoted to a large extent in the paper. De Certeau, in a central chapter in his The practice of Everyday Life, quotes Virgil; “The goddess can be recognized by her steps” (De Certeau, 1984, pp.97). In the chapter he elaborates the example of the pedestrian appropriating a city by walking. Walking in the urban system is equalized to what the speech act is to language. It allows a play with pre-defined systems. Referring to goddesses is actually a bit inappropriate since De Certeau is concerned with power relationships and how the “weak” turns systems designed by authorities to their “own”. The walker uses “tactical” strategies as his walks offers “tours” and “de-tours” in an operation on space. On the opposite, urban systems are developed through “strategical” tactics as the governing authorities infuses power programs in the city plan and its monuments. So, as Dourish also picks up, spaces and places are both products of social practice, but of different practices. They are produced within each others and not “layered on top”. As everyday practices encounters spaces a variety of places emerge. If we, as Dourish suggests, views design as a “strategical” tactic it follows that use is a “tactical” strategy. We can as designers properly speaking not design artefacts or spaces, but for the appropriation of them.

Both De Certeau and Henri Lefebvre, who has written from a similar perspective in his The production of space (Lefebvre, 1974/1991), inspired the artistic avant-garde movement of the French Situationists, that developed a method mentioned as détournement. Détournement is the reuse of pre-existing elements in a new ensemble. It might be seen as negation of previous organizations of expressions and at the same time the organization of a new meaningful context. Whereas the
Situationists have used it as an artistic-political weapon, it’s also quite common in the language of commercial advertisements. The idea is also closely related to that of bricolage.

An example could be The City Joker project realized by Austrian architect Dieter Spath in Graz in the 90s. He and his colleagues simply drew a straight line on the city map across the city and decided to travel the line with the aid of the inhabitants living on the line. A map is one of many references to a city, and of course a straight line on a map crosses buildings, canals, churches, walls and so on. The project turned into a spectacle engaging the whole town but especially the people living on the line. When the line crossed actual homes they made interviews with people and produced postcards portraying inner feelings of the inhabitants. The postcards where sent along the line. What happened was an emergence of a new neighbourhood in the city and people living on the line proudly referred to themselves as “line people” and kept staying in touch after the end of the project. It was a re-programming of the urban plans and an unconventional use of the environmental knowledge learned at architectural academies.

I think this re-programming capacity is something that is inherent in interaction design and I also see it as an extension of participation when handed over to users. Also use can’t be pre-articulated. Consider this naïve analogy of fruit from the Snowhite fairytale; The witch is “poisoning” the apples, Snowhite, also being naïve, is “eating” them. But if she pulls on a hood and throws them on a hunter passing by, in an attempt to reclaim the forest, she is “stoning” the apples. Clearly this would be a borderline case in the use of apples, but an important one in that informs us about the state of eating fruits.

These ideas can be applied to objects as well as spaces and might say something on the relationship between artefacts and space. Para-functionality is the term Anthony Dunne use for describing a diverse functionality that are within the scope of utility but overrides conventional functionalism. Some of the examples he gives are old and eccentric design ideas such as; “Walking sticks that become a card table or a seat show how simple props can transform architectural space. They conceptually colonize the functional possibilities of pre-existing space. The user becomes a protagonist in a new narrative where a lobby or park becomes a casino” (Dunne 1991, pp.45).

So by throwing these kinds of props into the everyday environment people can participate in stories and change conceptions of reality. It’s also an act of configuring and reclaiming space as opposed to pre-formatted space/environment. Configuring, adapting, appropriating, tailoring are different shades of an expression that has became one of the most important and dominant design parameters today. Bill
Hillier explicates that space is not neutral; “the built environment is not simply a background to social behaviour- it is itself a social behaviour. Prior to being experienced by subjects, it is already imbued with patterns which reflect its origin in the behaviour in which it is created. These patterns are reflected first and foremost as spatial configurations” (Hillier, 1996, pp.388-389). The concept of configurations is a unifying theme in Space is the machine and what he claims, in reflecting a common architectural metaphor, is that it is not the buildings that are machines, but that space is that machine.

In the Atelier project we wanted to support the design students in this appropriation of space and their design artefacts. The RFID tags and readers provided to them proved to be an efficient mode of producing mixed object. Spatial Metamorphing are continuously performed by movements of equipment and people and reflects performative/choreographic elements in how space is integrated into different activities. Along with the technologies for producing and performing mixed objects, we also supplied the students with a number of components for configuring space. These were;

- The Grid
- A large amount of physical material
- Modular building blocks
- A light system
- Equipment such as cameras, video cameras and projectors, for transforming space through use of digital media

The grid is a system of crossing rails and measured ca. 6x6 meters, and was fastened to the ceiling. By using ladders it was possible to attach things hanging from above. A set of spotlights (18 overall, evenly distributed) was attached to the rails. The lights could be controlled by an easy-to-use light board.

The system provided means for isolating smaller partitions of the room to be used for smaller groups. More important it supported furnishing the project spaces for the different groups in whatever way they wanted, and re-arranging of the spaces
whenever activities changed. Another thing achieved with the grid, was that it could be used as a “back stage”, having cables and wires being attached from above, thus keeping at least the floor wireless. When designing interactive spaces almost any material can be used. To support freedom of combinations of material we provided the students with a variety of different materials such as fabrics, cloth, plastics, wood etc. An important place for working with material was the existing craft shops. This supported building varied topographies that made possible to see things from above as well as from below.

Figure 32: Configurable topographies

An important part of a space is lighting conditions and changing light also changes the experiences of space. The easy-to-use light board made it possible to instantly experiment with different lighting and colors of the light. This was used at several occasions, for example by the group working with a concept for mobile workers, while they were exploring what it means to sit in a car for major parts of the day.

Figure 33: To the left the light-board which made it possible to play with lighting as part of space.

The focus on integrating the physical space permitted us to explore the performative elements of a space, with technologies helping to re-create aspects of places and situations in what can be called mixed spaces. They are also intermediary spaces since they have an ephemeral character. Partly the spaces helped to connect to visited places that were the object for design, but they also were used to materialize aspects of future places that have been subject to change through design interventions. The studio space, constantly configured and re-configured, became just as well a way of connecting the understanding of a place and its transformation. From this perspective, an important aspect of a design space is how it can be configured through use of digital media into a place for enacting design ideas. To enact design
concepts in performed scenarios brings forth situations where designers relate to technology and space with strong presence of the body.

To have the body as reference to space or a situation of use brings forth a perceptual presence to the model or situation that also addresses tacit dimensions of user reality. It addresses needs for intuitive evaluation that cannot or need not to be verbalized and raises questions beyond mere functionality. Scenarios are a technique used in many different areas of design, but typically to express future situations of use. Stories around current and future use of technology can be staged with characters and props in order to drive the design process. Scenarios are often of a narrative nature and help to build a shared vision of what the new domain of use should be. The configurable space provides a setting that allows designers or users to act out different situations of use. Coming back from their field studies, the students in the Augmented Spaces project used their experience from the different environments in combination with recordings to simulate situations of use. The work was supported by other collected media and materials from the prop store. The grid in combination with lighting and projection facilities provided opportunities to arrange these building blocks in many different ways. The simulated contexts provided three important aspects for enacting design, such as illustrated in the pictures below;

- A full scale mock-up of the actual environment, in this case a driver cabin for mobile worker
- The possibility to perform for several actors at the same time
- A natural way of expressing interaction by placing a mock-up of the design artefact in the scene.

In this way different combinations of stories and props made out narratives that took place in physical space. These narratives were supported by the easy configurability of the studio thanks to the grid and the amount of different material provided. The narrative element framed negotiation not only of technical functionality, but also of the social activities within the actual context. Working with scenarios in this way is reflective, since it explicitly engages with the user environment. At the same time it’s experimental in the way it supports imagination of future activities. The setting can also be used for presenting a concept to teachers or users.

However it is still a simulation and a lot of details as well as social activities within the space cannot be experienced. But the value of immersion is not the im-

**Figure 34:**
The driver’s cabin
mersive feeling per se, but how it creates a stage for negotiating meaning of design. Also the goal is not to make the simulation as realistic as possible, but how it can activate and visualise processes around interaction. It is a simplified version of reality that must be concrete enough for resemblance but open enough for active creativity. To do this in collaborative settings demands different sets of design tools which allows shifting between different perspectives. In this sense full scale modelling is complementary, not superior, to other more abstract ways of conceptualizing. To be able to shift from different representations, such as sketches, maps or large scale models, at the same location is clearly beneficial from a communicative point of view.

Performance artist Ulay refers to the space in which he performs as “edited life” or “choreographed existence”. While using the same body that sleeps, makes loves etc., it’s also a matter of stepping out of the ordinary body and into the performance body. This stepping into a “mental physical space” was of utmost importance to him and his partner Marina Abramovic (Pejic, 1998). This might be similar to how a designer can step into a semi-real space that resembles everyday-life, but leaves room for imaginative acting.

Other examples of “re-programming space” activities observed was changing a scenario by use of light, moving for example the “warm and cozy living room into the cold sterile setting of the bath room”, and perceiving use quite differently. Another example was that of filming a situation of use and mimic the whole sequence as a pantomime, experiencing for example just how long time it really takes to fill gas into the tank. The process was one of a series of constant “setting up-re-program-dismount-set up again” character. The studio supported quick re-configurations both of the space itself and the re-programming of different design situations.

A shift towards embodied interaction is motivated by the recognition that to incorporate even further human skills requires moving computation “out of the box” and “into our environments”. A consequence of moving from procedures to interaction is that we as designers no longer have a single point of control in the interface (such as having only one active window at the time, the cursor just having one x/y axis on the screen at any given moment). We no longer know where the users are in their series of “interactional steps”. This makes feedback and communication a crucial issue. The tag system provided the students with a tool for mocking up environments with tangible interfaces.

I think this is preferably done in a full scale setting, where the natural movement of the user body actually makes a difference. Some observations made, was that the field of designing digital media and interaction has previously relied on screen
based interaction and that fact influences our thinking. The separation of screen and point of interaction calls for an awareness of how the users position themselves in physical space. This positioning could be included as actively reflected use situations in the studio, not just represented, but enacted. The pictures below illustrate a situation where the separation of screen and point of interaction gets problematic. In the left picture everyone is focusing their attention on the interaction area, a map enhanced by push buttons. The output is projected in another direction behind their backs and the feedback is by no means immediate.

Moving away from the screen gives us possibilities to project visual output anywhere in space. Still a lot of interfaces for tangible computing rely on a horizontal level of interaction and in front of that a horizontal display area. While moving away from screen/keyboard based interaction, the model of the desktop computer thus easily persists. The students turned out to be very creative using the space for different projections. No general displays where used, but projecting could be done almost anywhere in space. These kinds of displays could be called ambient displays, being spread out in the environment, but since the term is usually referring to an ambience of displayed information, sculptural displays, a common reference in art discourse is maybe a better term.

By masking the projector lens the students could project on round or curved surfaces. Arrangements for placing projectors in different directions and angles were supported by the grid and a fairly large amount of different material provided building blocks for suitable non-traditional screens. This trained the student’s sen-

![Figure 35: Where are the users directed?](image1.jpg)

![Figure 36: Projecting in space](image2.jpg)
sibilities for integrating space into their design and we observed several different strategies for doing this.

Johan Redström makes a very fine grained and elaborated use of the concept of displays (Redström, 2001, pp.31). On the one hand he rightly claims that aesthetics has been reduced to how things look. On the other hand he realizes how displays have been reduced to a meaning of visual output. So there seems to be some strong signs of our culture as being a visual culture. In general I agree on how Redström uses displays in a sense where they can be understood as objects for multi-modal perception even though the examples shown here refers to visual displays. Another good reflection in Redström’s thesis is how LCD displays dominates the overall expressions which is not the case when projecting on fabrics. Of course the domain of art and spatial installations offers a rich variety of examples of non-traditional displays, which can provide powerful inspiration.

This became clear in one concept developed by a group of students who were introduced to a projection technique used by the artist Tony Oursler. Oursler has worked extensively with projections on different surfaces and the example shown to the students was of a projection on a dummy taken from his project “System for Dramatic Feedback” which dates back to 1994. That project was a ten-channel video/sound installation with nine small video projectors that animated a group of rag dolls in combination with larger projections. While performing the aforementioned workshop exercise on using space as a storytelling device, they created a projection

![Figure 37: Two examples of sculptural displays produced by the students. The one to the right is from an on site exploration of where to find a proper display surface at the Train station.](image)

![Figure 38: The “Oursler dummy” patient.](image)
on a curved surface portraying a patient in pain. Being more a play with the possibilities of space, they had no clear concept underlying the installation.

As work continued they did not let go of the projection which acted like a carrier of direction in their design. It was the form rather than collected material from the site that grounded their final design of a bracelet relatives could use for communicating with a patient being distant or not being able to communicate. In order to communicate the signals to the dummy, the visitor had to grab the tagged bracelet hanging from the grid and press the tag. Only then would the dummy’s face change into a state of temporary relief.

I will not go as far as to claim that this environment encourages compassionate design, but it is noticeable that three of the four groups, in the Augmenting Spaces project, ended up with concepts that supported informal communication between users through the design more than they tried to improve the technical capabilities for work function on the sites they had visited.

### 3.4 AS I TRAVELLED TO VIENNA WITH A SUITCASE FULL OF FIBRE GLASS.....

I have argued for how objects can be seen as non-singular entities, blending with situations, spaces other artefacts and users and how the transformation of them is at the core of at least some creative work, exemplified within the domain of design work and learning. In addition we can see how the creation and performance of mixed objects might constitute a powerful complement to interacting with traditional representations. Included in the concept of Metamorphing is how the performative elements of space also must be seen as something evolving in relation to activities taking place and the people and objects populating it. Intermediary spaces, or places using the terminology of Dourish and others, emerge as they are appropriated, used or lived by people. I want to conclude this chapter with a final story from the Atelier project, illustrating the tight coupling between mixed objects and spaces. The story is about how the table, in the picture below, bending from the burden of a vase with withering flowers came about.

As shown in the previous section The Grid installed in the ceiling was a rather powerful tool for transforming space, adapting it to different activities and expressions. Our inquiries were also motivated by the argument that if we are to integrate people's skills in handling material...
and social everyday settings with their use of computers, we must come out of the box instituted and held in place by the desktop computer. It worked out very well and we could see intense periods of activity being carried out in collaborative and embodied ways within the studio. We could also be amazed by the fact that four groups could share a 6x6 meter area for a variety of different purposes throughout several weeks. It actually worked too well because what happened was that they never or very seldom left the space. The students never re-visited the sites and as the space changed along with the emerging concepts, the immersion was so total that concepts were only slightly and marginally challenged.

Iterative cycles of immersion and distancing is a valuable temporal cycle in design work. While interacting with the materials and objects of design requires an intense engagement there is also a need for analytical distance at times, which can be performed not only by adapting space, but by also actually shifting spaces, putting one site partially into or against another, in a way that addresses the relational tensions and differences between them and not only equalizing them in a linear serialization. Consider the possible different levels of complexity in mixed objects. A USB pen or a centaur is something put on top of another thing, a USB onto an ordinary pen or a human torso on a horse's body. This is a more simple operation than for example the Texture Painter which more generates a state of mutual dependency, the one cannot be perceived without the other. Perhaps the distinction can be illustrated by two different montage techniques. While “collage” could describe juxtaposition by putting one thing next to another, the concept of “sampling”, such as explored by many contemporary musicians and artists, constructs hybrid entities of a more complex character on a more “genetical” level.

I think this also illustrates parts of Metamorphing as compared to a phrase such as transforming. Transforming can, but is not confined to be, collaging, turning the one onto the other. Metamorphing addresses a more reflected merging of affairs, addressing the relational tensions and differences, going back and forth between the one and the other until a decision is made that we can agree on an altered state.

In a similar way, while reflecting how site-specific art has developed over the years, Miwon Kwon puts it; “Today’s site-oriented practices inherit the task of demarcating the relational specificity that can hold in tension the distant poles of spatial experiences ….. This means addressing the differences of adjacencies and distances between one thing, one person, one place, one thought, one fragment next to another, rather than invoking equivalencies via one thing after another. Only those cultural practices that have this relational sensibility can turn local encounters into long-term commitments and transform passing intimacies into indelible, unretractable social marks—so that the sequence of sites that we inhabit in
our life’s traversal does not become genericized into an undifferentiated serialization, one place after another” (Kwon, 1997).

One student commented, on the use of the space in the Augmenting Spaces project, in a story generated by the previously mentioned design games that; “All activities were performed in the studio. It was the room that was our heart. So the activities were carried out in a core. One becomes so affected by the fact of being involved in an environment that is so intense, so condensed. But if we had been thrown out in another environment... Sometimes one should get out from the environment, and by doing so obtain distance and bring new things in.” We wanted the students to be able to work in different places outside of the studio such as in the café area of the school or even on places outside school. This required us to provide some physical building blocks apart from the technological components. A large amount of glass fibre discs (48x48 cm) together with a set of different ready-made connections turned out to be a flexible system for building modules that were associated in different shapes, even though they were limited to working in 90 degree angles.

In parallel we started to explore how the project’s technology could be used in assemblies configured by the students themselves. Our focus on configuring had leaded us to a view on how parts of the technology should be able to “take away”, just as any craftsman takes his tools off his shelf when he intends to use them. How to do this and for what mean was however not straightforward for the students. RFID and barcode technology is not extremely complex technologies and most people have made some acquaintance with them in their everyday-lives. Still it requires some skill to set them up and even if many have a vague notion of their potential it is still not obvious how to use them.

This also coincided with our preparation for building a demonstrator at the Disappearing Computer jamboree, an event that included demonstrators from several European projects, and found that the fibre glass modules could work fine as material for the demonstrator. In a two week workshop with students the issue of how to use the building blocks, the technologies of RFID and barcodes and how to use projectors for displaying on “any surface” was explored. It turned out that the modules in combination with the grid, the RFID and barcode system, and the hyper media database from the project became a rather powerful kit for construct-
ing rough prototypes that were not limited to a singular piece of technology but one that also could include a spatial mock-up.

This of course also demanded some creativity from the students in how to build different types of displays and how to transform space by playing media, such as described previously, and they were very successful in doing this. Everything mentioned was used to mock up situations of use for ubiquitous computing, just like for example Macromedia Director has been used for prototyping screen based interfaces.

Examples of mocked-up applications ranged from “Sound and Image Game for kids” and alternative digital bulletin boards to information kiosks using tangible interaction. Mocked-up spaces were for example the public square, a city park and the public library. All these were used as backdrops for design work. But in some cases what was built did not include a specific design, but rather made backdrops for collaboratively reflecting the impact for design such as for example a ‘Ubicom Doorway’ – illustrating a vision where persons are tagged and invisibly scanned when walking through the doors.

An emerging issue from the workshop, our work with the demonstrators but also a general issue for tangible computing is how to construct the affordances of interaction with mixed media objects. The barcodes are easy to recognize, but the RFID tags that can be either embedded inside the objects or easily concealed don’t signal their computational potential. Not penetrating the much discussed concept of affordance, I here stick to a basic and common use as defined by Norman (1988) as the design aspect of an object which suggest how the object should be used, which to my interpretation implies a visual clue to its function and use. But most important is to stress that affordance in my opinion is not an inherent property but emerges in and through interaction.

Starting from what could be parts of a life cycle of digital media; produce/view/edit/organize/translate to other formats/donate to a collection, we designed different zones in what was now called a “Wall”. Using simple geometrical shapes
such as rectangles, circles or triangles a language can be constructed as to indicate possible pairing of objects. For example a lot of objects used in the project, such as maps, material samples, diverse design representations etc were tagged by either a barcode or RFID tag. The RFID tags were attached to a rectangular piece of fibre glass which fitted exactly into the shape at the zone were the linked media could be viewed.

A couple of “Command cards” were also present at this zone which we called an Organizing zone. Those card instantiated some simple commands like print, delete or copy. This is of course another level of interaction than just playing the associated media, for example putting the command card “delete” into a “play” slot at the zone had the effect of deleting the displayed media. For this reason the command cards had small circular holes which fitted just to the pins sticking up from the “command choice” slots as to avoid confusion. Being just a simple demonstration I think that using physical forms and shapes is a promising area for ubiquitous and tangible computing. Included in our demonstrator were other applications from the project, such as the Texture Painter described here, but also others. Two organizing zones were in the wall with related displays.

An entrance zone was provided that were basically just a USB cable sticking up and a slot for putting an object we called “carousel”. The carousel was a cylinder formed object with a RFID tag. Connecting a digital camera to the USB cable when a carousel was placed at the slot poured the content of the camera into the database and associated all of the files to the tag at the carousel. You could also enter new media by sending an e-mail or MMS. The associations could thus be shuffled around to other objects, media could be printed, a tagged object could be associated to a barcode which could be printed and you could explore objects viewing the associated media and copying what you wanted to a carousel, thus making your own collection.

All in all, the demonstrator worked fine and the modules provided a “backstage” for the technology hiding the computers, hubs and cables. A movie illustrating the functionality of this version of the wall can be downloaded at http://atelier.k3.mah.
But they also provided a way of building the installation in different ways, adjusting it to the available space.

The component based structure of the installation ensured that parts of it could be withdrawn or added. Since then we put up several demonstrators at different sites using this equipment. Scary was the moment of checking in to a flight to Vienna, on my way to a hastily organized demonstrator event, with a suitcase that could hardly be lifted from the ground. It was packed tightly with the modules and the price for the overweight was quite substantial, but it was doable. Once arriving to the Academy of Fine Arts in Vienna, where we would install the demonstrator, I recognized a vaguely familiar object lying in the room. The object had a tag fastened to it, and I understood that it had been part of previous experiments. Once the demonstrator was up and running I tried out the object at the organizing zone and to my joy it was still in the database so images associated to the object, now recognized as belonging to a former student project, were being displayed. Objects, as well as spaces, travel.

The Ivrea demonstrator showed that the software infrastructure and applications developed at different sites now had reached a maturity where the different components, that now had become rather robust and rigid, could be well integrated with each other, forming different assemblies of components when so wanted. With the fiberglass modules we now also had a generic building block for constructing spatial installations with the technology. At the school we put up a version of the wall which we called Cowall. Inspired by the concept of the 16th and 17th century cabinets of curiosities, the Wunderkammers, and the virtual Wunderkammer described by Büscher et al. (Büscher et al, 1999), the intention with the Cowall was to set up a spatial project portal, merging collections of digital and physical material related to specific projects carried out at the K3 school.

As have been clear in this chapter, and will be further elaborated in the following, design work proceeds through manipulating and developing a variety of design related material which becomes invisible once the design artefact is produced. This

Figure 43: To the left the entrance zone where a camera is connected to a USB cable. The images will be entered into the database and associated to a tagged object. To the right an organizing zone where the command cards can be seen to the upper right. They fit just into the slot with an extruding circular pin.
eventually disappearing material constitutes important parts of the life cycle of the designed artefact and can be presented as a “memory space” of the artefact consisting of digital media files such as movies, sounds and images, but of course also physical objects that have resided within the project. Cowall was a mixed-media database linked to a collection of chosen objects from projects. Each object was augmented with RFID tags or barcodes thus constituting its own index to associated files in the database and when invoked triggered playing of the media files. As the Ivrea demonstrator a visual display was placed within sight of seeing from the organizing zone, where image files also could be printed, barcodes could be printed as a new link instead of the RFID tag. Viewed files could be collected in a special tagged object thus supporting making a collection from the overall collection. The personally constructed collection could be printed as an URL to a webpage where the collected digital material was displayed and could be downloaded. And of course an important value was to explore the physical objects in the collection.

Once a workshop was taking place in the studio and a design game, utilizing the facilities of Cowall, was one planned activity. That very day it was impossible, due to some later fixed bugs, to have it running properly. After re-booting the system a couple of times we gave up and performed the game with just the objects, without their digital content. It worked fine and such are the qualities of mixed objects that even though the one goes down the other remain persistent. The decision of choice of objects was left over to participants in the projects, sometimes they were representations more symbolically “standing in place” for the project, in other cases the objects were mock-ups or prototypes from the projects but also inspirational objects or textual descriptions of the projects.

The original Wunderkammers were collections of objects we most often regard as being quite separate and that can be said of the objects populating the Cowall as well. But one meaning with the Wunderkammers in the Renaissance was to explore the boundaries of the collected objects.

Likewise we can view an exploration of the Cowall objects as an exploration of the boundaries between design projects, at times explicating patterns and transferable inspiration. From this perspective I would like to see an installation such as Cowall as a learning space. The Wunderkammers often mixed fact and fiction and included mythical objects such as for example the horn of a unicorn. It is striking how “wonders” - matters of God, such as abnormalities and mythical content, were blended with the artificial traits of man such as strange mechanical devices, sculptures and paintings - man made “wonders”.

85
One effect of juxtaposition of extremes is a certain sense of shock and how the experiencing subject must question underlying conceptions of reality. Such questioning has also been a strategical tool for much artistic work springing from the concept of collage and montage such as the early cubist paintings, Dada artworks or the cut-up prose of William Burroughs. Apart from triggering imagination, which is of course important since it’s a matter of a space for wondering, this in several cases constituted the starting point for scientific explorations. This was the case with the cabinet of Ole Worm who was the first to define the narwhal’s tusk as coming from a whale and not from a unicorn. Other contemporary forms for collaborative collections that resemble the Wunderkammers conceptually could be Weblogs or Wikipedias. Just like weblogs and wikis the learning aspect is two-folded, objects and material can be accessed in an exploration of boundaries and play with cross-programming, but they are also donated to the collection instantiating an analytical process of evaluating materials and objects, enforcing decisions on what to disseminate to the collection. It is a showroom for design objects and a space for informal learning and collaboration, but it is also a documentation tool.

This installation was up and running for quite some time and was used as a demonstrator of course for guests etc. But it also served another role namely as what could be called an inspirational pattern. Inspired by Alexander’s notion of design pattern, Jonas Löwgren writes on inspirational patterns as being close to the example, but being more purified and abstract (Löwgren, 2005). This level of abstraction is aiming at reaching a certain amount of transferability. Being part of the designer’s repertoire of design examples, he can transfer the design into another setting which is only partially overlapping. The adjustment of the design and social negotiation around the new setting is an act of Metamorphing and does include an aspect of design knowledge, a knowledge which is generative but never perfectly fitting to specificities.

It was clear from our experience with introducing the Texture Painter to the interaction design students, who don’t work with architectural models and never
appropriated the application for use, that good examples are needed. However these examples should not be too specific. It is a matter of finding a conceptual core in the design that can be transferred into another context, something that can be understood as having the potential for being something different as well. With the Wall and the zones a schematic pattern for using the building blocks, physical as well as soft- and hardware, emerged that had a certain amount of conceptual clarity. To understand our set-up of the Wall in this way is a matter of Metamorphing; transforming and re-programming ideas as to fit into the own design. Cowall became itself a pattern that captured ideas of a tangible mixed media setting that could gradually be transformed into a prototyping environment for new spatial set-ups. This became obvious in the workshop described but also quite clearly in this example from the Semi-public spaces project. The students decomposed Cowall in the studio to support semi-public place making games at a railway station. Developing a version of refrigerator poetry they re-used the same physical building blocks and technological components as in the wall in the studio. By now the Cowall in the studio has been demounted. The majority of the modules, which have traveled to many settings to be set up in many different variations, were so much liked by some appropriators that they never returned. Others have been cut into smaller fragments forming parts of other designs than the wall. But yes, the small table, hardly bearing the weight of the flower vase and set up by someone finding the remnants while wanting to refine the space before an important visit, remains persistent up to the moment of this writing. They are a thing and they are a space. They have actually been many things and many spaces in a process of Metamorphing which I will continue to explore in the following chapters. I'm inclined to say that they have now been fully appropriated.

Figure 45: To the left Cowall and to the right the refrigerator installation on site.
In this chapter I will continue arguing for Metamorphing as a concept that can describe important parts of design work. It will be described as something different than “mere” transformations of representations in as much as it refers to a situation in where the subject (designer) engages with the object (the object of design or design material) in such a way that it transgresses a traditional view where a subjective agent acts upon inert objects. It also refers to a whole chain of “circulated references”, not just singular instances of transformations, and it includes a view where manipulating objects also changes the surrounding space and the conditions for communicating within the space.

This is not to imply a linear process, in where design starts through a “mental seed” eventually growing to an implemented artefact. In my view design is a process of understanding and transforming. Understanding of a currently existing situation or artefact, transforming it into something new has no given starting point. It is possible to start building from “the middle” between understanding and transforming, having an assignment, a space of possibilities or a specific practice as the starting point. What you’re developing is both the artefact as well as the motivation for doing it. In any case we can claim that the process proceeds through manipulation, articulation and objection of material representations. As the changes are reflected the ideas are subject to metamorphoses and conceptual change and they are subject to further materialization in new representations. They are done so in relation to the previous expressions and they circulate like Latour’s references, not only until the designers make a final decision, but they are also subject to change through the appropriation of the users and integration with culture and everyday life.
4.1 INQUIRIES AND REFLECTION.

So, the concept of circulating references can well be used to describe how ideas are transformed throughout the design process. Design ideas gain material properties as they are expressed by the designer in the form of different design representations. As the changes are reflected the ideas are subject to metamorphoses and conceptual change and they are subject to further materialization in new representations. They are done so in relation to the previous expressions and they circulate like Latour’s references, not only until the designers make a final decision, but they are also subject to change through the appropriation of the users and integration with culture and everyday life. Latour’s line of reasoning rejects the sharp division between a world of facts and human thought and knowledge.

One way of linking this line of thought to design work is by borrowing two concepts from the philosopher John Dewey, as they are elaborated in two of his major works, Art as experience (Dewey, 1934/1980) and Logic: The theory of inquiry (Dewey, 1938/1980), namely the concepts of experience and inquiry. Dewey’s critical stance to empirical and rationally inspired epistemology emphasises how knowledge production takes its starting point in doing. Experience does not stem from passive observation, but is developed through creative investigations and interaction with the environment which is continuously changing. These investigations are not performed as a random process, but inquiries can be said to be a controlled attempt to change an intermediate and vaguely understood situation. The inquiries and interactions produce consequences that have to be framed and integrated in our understanding as to be part of a provisional solution to situations that formed starting point for the inquiry. For Dewey inquiry is resolution of a puzzling situation, it is not a change in beliefs or confirmation of knowledge in the inquirer that is the goal, but answers to problematic situations. This gives a perspective of creativity which includes reflection on everyday practicalities, artistic work and scientific investigations through engagement with the material world in a process of controlled inquiry.

Dewey’s ideas were, foundational for Schön’s search for a structure in professional inquiry such as performed by for example a designer “reflecting in and on action”. In The reflective practitioner (Schön, 1983/1981, pp.128-167) he analyses how a therapist respectively a supervisor for design students engage in their inquiries. Despite the occupational differences both of the practitioners share several similarities. In both cases, the therapist controlling the conversations with his patient and the supervisor directing the work of the student, the practitioners treats the situation as unique and acknowledges that no universal methods or techniques are applicable. This is not to say that they start out from scratch, having no previ-
ous valuable experience. On the contrary they use their professional experiences in artistic ways while still confronting a situation they consider not fully understood. They can both hold several ways of looking at the problematic situation at the same time without disrupting the flow of the inquiry. Both the student and the patient have tried to resolve their problematic situations but have failed. What the practitioners try to do is to reframe the situations in order to understand them better. This process is highly experimental, the consequences of the reframing has to be investigated in on-the-spot experiments. In doing this unexpected and new situations arise that have to be further reflected. The unintended changes infuse new and sometimes surprising meaning to the situation. In transforming representations and design as Metamorphing the designer must engage in how the interaction with materials shapes a situation and talks back to their inquiries. The back-talk is manifested both in communication with others, with individual inquiries into materials and situations and in the inevitable transformations of the surrounding space.

4.2 ATELIER – DESIGN AS METAMORPHING

Design work is characterized by gathering and mobilizing a great quantity of materials in different formats, both material and digital. This diversity of material is highly inspirational, but the importance goes beyond mere inspiration. Design proceeds by expressions of ideas, needs and opportunities for design. In many ways envisioning and realizing concepts is carried out through objectifying and manipulating a variety of representations of design. The materials and objects of design are more than singular and unified “things”. Design artefacts and representations involve the user interacting with them and they reach out into spaces and environments as to create specific situations. In engaging with the objects of design the designer creates design spaces which go far beyond what we traditionally conceive as an object. Design is an act of Metamorphing, to create the metamorphoses of the objects of design and to reflect on the effects of the changes is at the core of design work.

The communicative role of design representations and the fact that important design situations occur in the transformations and translations between these representations have been addressed by much design research (such as for example Büscher et.al, 1999, Hyysalo, 2002, Ostwald, Goldschmidt, 1997, Brereton and B. McGarry, 2000, Hendry, 2004, Cross, 2002, Saddler, 2001, Keller, 2005 and many others).

Large parts of the creative dimension in design seems to reside in what’s between the objects of design, ideas have to be transformed in a non-trivial way. As-
pects of ideas are transferred into new design representations, but the new representations can’t be bound by the structure and content of the previous ones. They must be open for metamorphoses created by the designer. A major part of the design representations concerns objectifications of ideas, gradually narrowing down the concept. But it is not just a question on the relationship between the signifier, the representation, and the signified, the thing represented, but a complex network of expressions, all of them not concerning the actual design idea.

Just as in Latour’s case, where it is made clear how one science hides another; there is also a variety of other kinds of material residing in the design process. Some of them are representations of work or context, some relates to project organization and some are inspirational artefacts that seemingly might have no relationship at all to the design task at hand. In the light of this it, it makes at a first thought, sense to make a distinction between design material and design representations. It is easy to see how a design comes to life, gradually evolving from early ideas, represented for example in ambiguous sketches, to more and more refined and detailed representations, such as requirement specifications or construction plans.

But the design material that precedes ideas is also subject to transformations. Design is the art of the possible future. In rendering the existing into the possible the distinction between them disappears. The one is kept constant through a series of transformations until it becomes the other.

So, at a second thought, all instantiations of design material are nodes in a long chain, where the connections must be forged and maintained throughout the design process. The artefacts used in a project are numerous. During the projects students develops in parallel sketches, detailed plans, drawings showing atmospheres and situations, 3D models, and collage of visual and tactile material.

These heterogeneous representations are often manipulated simultaneously. They often evolve in different versions. As different representations exhibits and clarifies particular and different aspects of the design, it is important to forge and maintain connections between them. In many instances, students configure and re-configure design materials so as to read and re-read the configuration from different points of view and to be able to go back to a moment where a particular issue emerged. In the process of conceptualizing and detailing the design representations
and their relationships change continuously. Arranging and re-arranging material in the workspace is an essential part of this process, with the physical landscape of things on the walls and tables being in constant movement.

The transformations of representations is not a static sequence, the relationship between them evolve over time and an important part of their impact is how they are arranged and re-arranged in relation to each other.

“What emerges is that manipulating the presence and absence of materials and bringing them into dynamic spatial relations in which they can confront each other are not just a context or prerequisite for doing the work; rather, they are an integral part of accomplishing the work itself. To manipulate the context is to do the work. Typically, what is important is not just to create or change a document or other materials, but to do so in the presence of and in relation to others.” (Büscher et al. 1999)

In this way the design studio turns into a landscape with an ever changing topography of design representations. Towards giving form to an integrated whole, the ambiguity and complexity is intentionally kept open ended by the designer. He/she creates a design world, a narrative of the imagined artefact, to act in. The expressions and representations precede the posing of problems that follows from them and new interpretations creates yet new design worlds.

The act of transforming representations is a process of making a place for design. In appropriating these places designers use both divergent and convergent thinking. They zoom in and out in the different representations, play with foreground and background and juxtapose the narrative connections between them. It is a creative enactment where previous experiences are combined with “what can be seen and what can be imagined”. Experiences are combined in a non-structured way, at times without certain goals.

On the other hand methods and constraints are used to narrow down and elaborate. Much time is spent on collecting data, processing and distributing information. General information is transformed into details, mediated and communicated to others in ways that leave less space for ambiguity and fuzziness. In this evolving landscape of design representations the transformations of the representation is at the core of work. As each representation can contain a seed to the eventual design, they carry something growing but not yet existing. In a way they are “pre-presentations” rather than representations. Every one of them has material aspects that are of importance, they do not make sense until they are materialized. To transform
them is to do the actual design work and the distinction between material and situation often gets blurred.

I will here try to illustrate these ideas, and how work is enhanced by technologies for tangible interaction, by an example observed in Malmö as part of the Atelier project. The interaction design students had a design assignment, in where they were supposed to design an interactive installation suited for a place being public with a specific purpose, but also carrying private dimensions. They were supposed to exhibit a working demonstrator at the Railway station in Malmö, which meant that the design could not stay put at a conceptual level. The starting point for the project was to in groups and individually exploring the railway station as a place and traveling as such. Videos, still images and sound recording were made at the station, produced from several different perspectives. Interviews with shop owners, commuters, security guards etc. were mixed with footage of work on the tracks or diary-like notes from observing whatever was going on. It was pre-requisite that anything produced were to be associated to RFID tags that were to be integrated in a shared model of the station.

Some exercises, inspired by architecture and city planning, were focused on mapping different flows of movement. The students were equipped with a 2D top-view plan of the site, some sheets of semi-transparent paper and a selection of colored pencils used to add annotations and indicate different patterns of flows such as where wheel chairs were possible to push, where it was possible to talk in a cell phone or the densest flows during rush hours. Certainly, all of the transformations mobilized in a design process might be hard to experience. Including artistic work, information analysis, social understanding and technical experimentation, the process is iterative and lacks a clear centre. Shifting perspectives, controlling the process and at the same time wanting to expand boundaries to imagine the unexpected, requires maintenance of connections. Stolterman and Nelson (Stolterman and Nelson, 2003, pp.68-69) write on this interlinking of stability and creativity as beneficial for design and being at the core of work. They refer to Csikszentmihali’s concept of flow in the terms of tension and how a designer’s intuition is dependent on the ability to grasp the wholeness of the situation, including understanding with
imaginations of change. The same representation can in itself contain several interpretations and might occur in many versions.

As pointed out by Akin (Akin, 1986), this doesn’t mean that the meanings they carry are contradictory, but that they enlighten different aspects. In many instances decision making is inherent in on of several twists of a representation and back-tracking can be of great importance. This means that the representations are subject to juxtaposition and superimposition in a bricolage-like way. Often they are presented dynamically and inventing hybrid forms of representation is common in the field of work.

It is important that this kind of design representations has the potential for connecting work that is distributed, not only in time and space, but also conceptually. This gives possibilities to ways of re-programming materials, places, atmospheres and scale, to play around with instantiations, where qualities from one environment are expressed into another one, creating a cross over situation that enriches the design opportunities.

As we wanted a balance between observing and experiencing another exercise was formulated as “The Constrained Trip”. The task was a role playing trip that lasted for a full day, going to an airport in Denmark and a stop at the Copenhagen. Each of the students played different roles such as backpackers, commuters, tourists or homeless, using places as shelters. At the central station in Copenhagen railway station, a place less familiar than the Malmö Station, the students were supposed to perform tasks such as managing going to the toilet blindfolded, walking down the stairs to the platforms with a stiff leg or buying tickets with ear phones, not being able to hear, thus simulating different ways of being impaired. This was an experiment that clearly was not as comfortable for the students as the more understandable method of doing ethnographically inspired observations. Still a lot of interesting reflections were acquired and accounts were integrated into the model.
Gained was a combination of spatial overview, abstract patterns of movement and a collection of different voices of people attending the station for a variety of different purposes. The model worked as common ground for an initial dialogue and informal sharing of insights and reflections. It also highlighted all the places and information that were still undiscovered, and thus worked as a tool for deciding what to do next. The mixture of properties of the representations was of all sorts, some concerned information issues others acoustics or use qualities interacting with ticket machines etc, but many accounts were of narrative nature. The model was a placeholder for all representations produced.

As the students now were divided into two groups for moving into a more design focused way of working, they started to withdraw some representations of particular interest, transforming them into new ones. The model was but a link in the chain as understandings of the place were tentatively turned into transformative imaginations of it. One of the outcomes was how different zones at the station turned out to have different qualities, exhibiting the station as a conglomerate of “places within places”.

The shared model was an instance of a mixed object, having digital media linked to physical spots of the material model. Mixed objects are also mixed socially since they are shared. But the fact that they are expressed in a chain of interconnected events, through the ability to blend the physical and virtual, move these mixed objects beyond the notion of boundary objects as expressed for example by Susan Leigh Star (1989). Leigh Star writes on different kinds of boundary objects, repositories, ideal types, terrains with coincident boundaries and forms (Leigh Star, 1989, pp. 47-51). According to her definitions the shared model was not a repository, since there was no explicit indexing, the content was not standardized enough to be part of a form or label. It is more close to the other kinds and shares some of their advantages. It resembles the ideal type in as much as it is a kind of a map, which not accurately describes details of anyone locality. It does refer to the same physical site, but content are from different domains and is sometimes vaguely related. One advantage of this is adaptability, it was a sufficient road map for all groups, yet open and flexible enough for specific perspectives to be applied. This is similar to the final kind of boundary objects described by Leigh Star, the terrain with coincident boundaries. They arise since different means of collecting and aggregating data is used by different groups. The result of interacting with it can be conducted autonomously by the different groups while they all still can refer to the same area. The advantage with this is the resolution of different goals that bears similarities to those of adaptability. Metamorphing thrives on the balance between openness and reification. While the rhythm of design changes, so does the properties of the mixed
objects. The time for the shared model was one of collaborative exploration that required an open repository. As data was “poured” into the model it grew more and more complex and heterogeneous, becoming more a sub-system of objects, some of the shared and some of them having meaning for specific groups.

One day one of the researchers put a number of plastic animals beside the model as a kind of intervention. Would they be disregarded by the students or would they be integrated in the model? What happened was that they were put into the model, their faces heading in the direction of the observers view of the linked media. So the lion in the picture above provided a perspective of views, it was a stand-in for a visitor to the site. Next to the right paw of the lion there is a paper icon, which indicates the format of the linked media (sounds, picture or film). So after an initial phase of gathering data the work with the model as such started to take over. The surroundings of the model also was designed with projectors, loudspeakers, post-it notes to place on the model and more tag readers as to be able to provide interaction for several users at the same time. At times this created confusion about which tags triggered which media. This again implied further work on the structuring of the model. It went from a very open object to a more indexed and ordered one.

This started a phase when the two groups “withdrew” some of the content from the model re-working it into design sketches, scenarios, enacted or written, or other formats of representations. Taking fragments or sub-systems from the model seemed to generate a greater freedom of imagination. Instead of working on the joint model more design and change oriented representations started to emerge.
One of the groups focused around the concept of privates space within the public space, the starting point being their observation how people started talking in their cell phones at the station and while moving about most often stopped at a specific corner of the Malmö Station where the acoustics were good while the corner also were less populated, providing some privacy.

That the design representations maintain their materiality gives them a persistence in the design studio, they can be manipulated and interacted with directly, without introducing desktop computers and screens and they can thus be integrated in the flow of work throughout the space. The way space and objects intertwine creates pre-conditions for embodied and performative ways for interacting with them. It’s a strong characterization of these objects that they have to be interacted with, they do not speak for themselves and this implies that use are not detached from the surrounding space and the human body, they are engaged in an interplay together with the mixed objects.

The first ideas were concretized in video recorded and enacted scenarios. Using the grid in the ceiling and its lighting facilities they created pillars of light while they at the same time looked for different ways of isolating sound. The pillars were translated into several paper sketches which eventually gained the form of a tent, which they carefully detailed in 3D renderings.

**Figure 52:**
The first scenario filmed from above where one of the groups played with pillars of light and sound (to the left) which they then transformed in ideas and sketches of a tent, eventually turning into a 3D rendering (to the right).

**Figure 53:**
To the left transportation of the building blocks for the installation that eventually was built at the station (to the right).
4.3 TRANSFORMATIONS IN DIALOGUE

In a spiral of appreciating, reframing, experimenting and re-appreciating the inquiry continues until a satisfactory coherence between artefact and idea is achieved. Failing to reflect on the backtalk will not yield the changes in the situation that drives the inquiry forward. In many cases the transformations acts as common ground for communicating with other actors. In learning environments for design this is of course very important situations. The differently used materials for design are used for aligning the participants in the conversation.

In this example from Vienna in the Verdichtete Gemeinschaft project a student, H, is having a critique session with her supervisor in where she presents her project. She was working on an underground parking space in her project of re-vitalizing an area with immigrant workers. Examining the translations, going back and forth, the supervisor wants to push the student forward, making her transcend conventional views on the unsolved design situation. The supervisor tries to challenge her conceptualization of the problem and tries to make her see the problem framing differently and to work with untraditional views of known problems such as much traffic being problematic for city life. Another issue is the nature of her Metamorphing. The evolving nature of her models is condensed and many perspectives are contained in one model, instead of having several versions.

On the table are a large model, her laptop, several books, pictures, and a large map of the Brunnenmarkt area on which she places a much smaller sketch model. She mentions that she read a lot since the last critique session. During the session focus changes on different material and different versions of the model. The dialogue is like a negotiation, in where different props are highlighted, put aside and then brought back again.

One of her topics is the street with its parking cars and the question where the children may run around and play. But first she points to the larger model, explaining that the main problem here is the ground floor – maybe the building could reach across the street since during winter time it is cold and people get sick. Placing shops there is not an option –

![Figure 54: Different models combined with plans.](image)
H;... since rents would be too high and the whole works since it is so narrow. A stall costs ATS 800 and this works. One could turn this into a 'Wohnstrasse', change the communication between street and living ...“

The next thing is that she would like to open up the park, construct a second level so that people may park their cars underneath. They should have enough space for doing the things they do in the street like doing repair work on their cars. Her model shows a construction which leaves space for the old trees.

The supervisor argues that this second layer with the openings for the trees will be far too expensive - did she make calculations how many cars would fit into the space?

The student looks at her model saying that she no longer finds it useful. The supervisor alludes to internal strata and layers and the different territories that may be created – what would be their qualities, how may a combination of private-public, noisy-calm work, since these are the parameters that define the structure. One might, for example, lead the street up to the living space (on the second level), thereby letting the public space come closer.

Figure 55: Searching for complementary material to back up arguments.

H listens while opening her computer. She is looking for material for backing up her arguments.

Supervisor: Maybe you plan for an underground garage, opening it to market and street and here you add some terraces - (H hesitates).

H: First build models of cars and test how they drive in –

Supervisor: You may let them gently enter the park - this is also a certain quality, those cars, with their windows pulled down and the music –

H: But it doesn’t work like this (points to a picture with parking cars) – the cars block everything –

Supervisor argues against this ‘orderly garage culture’, one might see the car with its super stereo as part of people’s living – the point is to question the separation...
of functions – look at Mies who tested his ideas in a rigorous way (He refers to a project in which Mies creates „staples of one-family houses“)

Here the supervisor tries to reframe the problem and see positive potentials in unintended effects, such as blending of private and public. The student insists and cannot accept to re-formulate her original problem of children not being able to play in trafficked streets. The session continues with discussions on the park. Among other things one of the supervisors tries to explain that the overall situation might be too complex for her one model. That maybe she should build several models, one for each problem. For successful transformations each metamorphosis has to be reflected. But the student is not open for the change of the situation and sticks to her original problem framing.

H. opens her computer again – a drawing shows parking for 77 cars between the trees. She insists:

H: I'd like to separate children’s playing from the traffic so that there is no need to watch them.
Supervisor: Why not play on the street?

H: I read that most accidents happen with children who run between parking cars.
Supervisor: Do you have data?

H: In this book – look at this picture and be honest, a street with parking cars, nothing ever happens there.

While this example tries to illustrate the necessity of reflecting each step in the series of transformations we find inherent in design, it also reflects how the supervisors tries to use their experience from previous design cases to fit to the special situation at hand. In reflecting, not only in, but also upon action a repertoire is built for the designer that allows for transferring experiences from previous situation to the situation at hand. This transferring will overlap with the new situation only partially, but in the tension between the situations new and unique design knowledge can be formulated. It is a question of seeing the unfamiliar in a familiar way.

But the unintended effects due to the differences must be observed. It is a “seeing as” that can change the underlying presumptions. The supervisors know that
periods of profound engagement with materials and engaged dwelling with design representations have to be balanced with a certain amount of distancing. To perform the transformations of the currents that are at the heart of design requires fulfilling the Metamorphing and letting go of sometime defining characteristics. It is true that heavy traffic must be taken into account when doing urban planning and not wanting to judge this specific case, it can be stated that the act of Metamorphing implies moving ahead and taking decisions. It is a matter of not getting stuck in the evolved environment of design representations.

The example with the Texture Painter from the previous chapter is clearly illustrating the act interacting with a mixed object, transforming it in various ways, changing scales, backgrounds and textures. But when is it transformed, when is representation X Metamorphed into representation Y? Just like in Latour’s case of circulating references it becomes a matter of which reference that becomes the current focus. In the example with the Texture Painter you could save a state (a performed configuration of the model and used textures/images), take a photograph of it or such as when the model was unintendedly turned upside down you could start to talk about it, not as an altar but as something completely different.

When the designers start to use the taken photograph as a focal point, saved states are loaded instead of starting out from the beginning or they talk about “the cliff” instead of the model, then the Metamorphing has taken place as a full transformation. It is no longer one of several experimental transformations, its state is altered and the representation have gained a new meaning which then drives work forward.

The designer has to detach himself from his activity and current engagement with the design artefacts in order to reflect upon them and their continuation. Transformations cannot go on in endless iterations. The representations populate the design studio and provides the necessary conditions for a true design engagement, but as Ingold puts it; “...to free up the qualities of objects themselves...is done by distancing ourselves from, or stepping outside of the activities in which the usefulness these objects reside” (Ingold, 2000, pp.417).

This is very similar to Schön’s previously mentioned ideas on reflection-on-action, where the acting subject takes a step back from reflection-in-action, so that the
two modes of activity can complement each other in producing not only the object of design, but also the designer’s knowledge of the artefact as well as the process of developing it.

### 4.4 METAMORPHING A SAW INTO A DESIGN CONCEPT

An important aspect of design work is to gain a conceptual understanding of the design that is solid enough for carrying work forward, but flexible enough for innovation. It is a matter of extending and opening up the design space in such a manner that the existing can be imagined in a new way. The concept of re-programming refers to how ideas are generated by the factual but recognized and transformed into something different. Transforming the representations is one way of re-programming their underlying ideas. Experimenting with scale, dimensionality, colours or social perspectives are all examples of re-programming activities.

Let us have a look at a final example of design as Metamorphing, how Tim, one of the first semester architecture students that was followed in his work, observing how he transforms different representations of an object - a saw. This example is not about developing a design solution to a problematic situation but about exploring materials and tools, a technique used by many design schools. It has been selected because it illustrates well the diversity of materials in design and how design can proceed through metamorphing - transforming the different representations in a way that makes a constructive inquiry. As a starting point for visual and material studies students selected a working tool, in Tim’s case a saw. Students studied the tool by analyzing its form and exploring the form in a series of drawings; from the movement of the tool in use they created three-dimensional models, and so forth. These studies produced a series of visual and material explorations which students performed in a final presentation.

**Observation and representation**: The first exercise students had to perform was to take pictures of the tool. They had to take ten pictures, representing the tool as an object, caught by the eye of a camera, showing its identity, context of use and meaning, geometrical structure and material quality, and represented by black and white images twice the size of the object. The aim was to make explicit features of the tool that are not obvious and have to be revealed by the spectator, here by the photographer. Tim’ choice of tool was a saw like it is used for cutting trees. In his photos he was searching for the changing of the shadow of the saw according to movement, observed from different angles.
Freehand drawing: The next exercise was about freehand drawing of the tool. The students had to work on their architectural view of objects, including all sides, by rotating the object in space, drawn by pencil. Again Tim’ first drawing focused on the shadow. He drew the different appearances of the saw when moved and rotated. Tim’ next step in his exploration of the saw was to move on to more abstract levels, analyzing his own drawings.

Reading/drawing and analysis /abstraction: Learned and trained at the beginning as a technical skill, the architectural drawing should become a way of thinking and observing objects through abstraction. Tasks included producing representations in plan, section, and elevation, as well as drawing the movement of the tool and the body. After that the geometry of the movement was broken down and drawn in 1:1 or 1:2 scale on paper, considering aspects such as the spatial limits of the tool while at work, the rhythm of the movement, repetition and the passage of time, the geometry of the movement, and the space inscribed by it. Tim described the drawings as a deeper going into the movement, the separation between fast and slow, trying to grasp the complicated geometrical fanning out by creating different drawings.

Translation from drawing to model: The drawings had to be translated into a three-dimensional model, physical, non-moving but representing the movement in space, its repetition in time and space. Some materials were suggested, such as metal wire, wood sticks, paper, cardboard, etc. The scale was supposed to be 1:1 or 1:2. The first small models tried to follow the idea of the drawings, but there was always some point, some direction missing. Tim built different models, connected or disconnected to each other, to find out the most suitable form and the closest identity to the tool.

Movement in context: The exercise that followed was to do a video about the tool ‘in use’ or in movement in its context. Students were supposed to capture the working space, the appearance of the tool, its handing, movement, and so forth. The length of the film was expected not to be longer than one minute; filters, transitions,
Models of a shelter: The last exercise was to create another model from the tool that could be considered a ‘shelter’. Compared to the others Tim’s model was quite big and it was not any more possible to look inside it. Like in the beginning he was still very interested in playing with light and shadow and the possibility of changing the outer appearance. He chose the Texture Painter to experiment with the surface and tried out different textures and videos for the final presentation that was approaching.

The final presentation in a mixed media environment: Tim used the Interactive Stage and the surrounding space of the studio for the presentation of his work. The Interactive Stage was made of three large, movable screens for projections and three projectors on three suspensions. The students had the possibility to either use this preconfigured arrangement or rearrange and extend it. Their idea to add a fourth wall or projection plane as a ceiling so as to create a more immersive space was not implemented due to a lack of time.

Behind the movable screens was a white wall, a perfect place to arrange things like the drawings, photos, etc. Tim placed his drawings and photos on the wall behind one of the screens, moving the screen to disclose materials that helped interpret the created forms. Models were placed on a table and the three large projection screens were used for projecting pictures of these models or of enlarged details of them. This immersive arrangement allowed students to perform studies of their models in a variety of conditions (in movement, from different perspectives, and so forth), exploring the materiality of models. The presentations were guided using barcodes on models and diagrams.

Tim showed close-up photographs of a material feature, exploding the small detail by projecting it onto the wall, thereby giving it an oversize...
spatial dimension. The dents of a saw, blown up and projected, mutated into something else. The projections produced a strong visual effect and a wider space. Tim also performed a live transformation of his model with the Texture Painter. The movable table (Mixed Objects Table) on which he placed the model gave him additional opportunities to experiment with the spatial arrangement. As it is possible to save textures, created before, and load the ready-mades directly onto the model, the quick presentation of different appearances is possible. Tim applied three different textures on his model, pointing out that in this way the model begins to live, seemingly hovering above the pedestal. While Tim explained his work he moved around in the Interactive Stage, changing the projections using the barcode reader.

My view on the Metamorphing process rests on a view on objects, things and representations as not being static or finalized. It is the ‘tangled’, ‘fractal’ and ‘mixed’ nature of design objects that renders them the potential for being performed, not only by the designers, but in a joint enactment. They are mobile, but still localized elements that compose an evolving story of design, with each of the performed translations being reflected upon. That the representations are localized points to the important role of their materiality and how this ‘material body’ extends in space, transforming the space. They are references on a map of the intended design, but transforming and enacting them is a performed narrative that is carried out as a spatial practice. This practice is rich with material actors and augmented with the transformative potential of digital media.

When exploring, interpreting, and expressing features of the saw, Tim (as well as his fellow students) engages in a process of appropriation and configuration which could be called place making. He moves between the constrained space of the studio, the outside space of the park and logs, and the extended space of the Interactive Stage, which offers him the opportunity to place design representations in different media next to each other, expanding them into the space.

Tim’s presentation of his work with the saw points to how design objects reach out into the surrounding space and the people being
present there. Transforming the object is also to transform the space. As the inter-
play between humans, objects and space unfolds, imagination and experimentation
get ‘localized’ as instantiations of places for design. In his installation Tim moved
beyond the 1:1 scale of a staged performance. Enlarging a small detail, such as the
dents of a saw, or scaling a large building down to the size of a person and project-
ing them resulted in spaces that are ‘inhabitable’. Equally, ‘painting’ the physical
model became a performance and part of the design process; its informality and
the imperfections of the product opened a space for associations and spontaneous
changes.

Experiencing how design representations emerge, are transformed and translat-
ed into other media in time, as part of specific events has an important part in how
concepts are developed and understandings created. This ‘expressing’ contributes
to their conceptual understanding and of next steps to take. Tim used a diversity
of material resources for performing his design object, with the different material
features of objects and space in his performance engaging our different senses. We
also saw how he engaged with it through a diversity of techniques of working with
materials – taking pictures, drawing on paper, moving the saw, shaping his concept
of the saw out of different materials, augmenting and joining, and so forth.

4.4.1 Mixed objects - the role of technology

In our observations of designers’ use of material a gap between formats and media –
the diversity of physical objects and materials and the digital objects that mostly re-
side inside the desktop computer – was evident. Printing digital media, using it as a
material resource, and scanning images, transferring them to digital format, is time
consuming, often absorbing designers’ attention to individual work with the PC.
Material which is only available in digital format diminishes the visibility of work
which might let others participate directly, or be peripherally aware. Another draw-
back, just as strong, is the time gap immanent in the translations. When designers
move from one representation to the other, the chain between them gets weaker, as
the transference is both time consuming and mentally absorbing. An open design
space seems to require more fluent movements between different representations,
objects and materials. Extending the functionality of objects supports their agency
in the chain of circulating references and the process of Metamorphing.

Tim’ ways of Metamorphing, using barcode technology and projections for ani-
mating, connecting, and ‘painting’ illustrate how the objects of design are mixed
both in the sense of being both digital and material, as well as being mixed from
a social perspective, being accessed from different actors, both individually and
collaboratively. Interacting with these objects, within a design environment, adds a new multimodality to design representations and materials, one which strengthens the possibility to experience the objects’ metamorphoses. As Metamorphing becomes immediate through the designer’s interactions, the previous chain in the circulating references co-exists with the current in a more direct way. More direct, but still not seamless, since a central feature of these objects is that they have to be interacted with in a ‘non-trivial’ way. We have seen how Tim uses the space of the studio for mutating the design object through multiple projecting, ‘blowing up’, ‘painting’, superimposing, looking at it from different angles, and so forth. While each of these interactions is straightforward, the heterogeneous character of objects and associated media never disappears completely. Hence, performer and spectators remain aware of the fragmentation.

Intermediary spaces emerge when artefacts, people and spaces are meshed into specific instantiations of the evolving activities within a physical location. As spaces they are crossroads of intersecting mobile elements that are unified in ephemeral, short lived and performed events. Tim’s enactment of his work highlights how a space can be practiced as to be appropriated for situated and lived events. While spatial aspects are inherent in all stages of the design process, I will conclude my arguments with taking a closer look at Tim’s final presentation to see what the constituting parts of this kind of place making are. A central part of my argumentation is also how design proceeds through transforming different representations produced in the process. Latour’s concept of circulating references stresses how coherency does not reside within the different references, but in how well they are connected.

This might be at the core of the idea of making place within a design context, that a space supports moving between different aspects of design, exploring them from different perspectives in a way that makes sense to other people being present. This is also what is performed by Tim as he mobilizes a variety of representations that can be perceived within the narrative framework he had scripted.

It is obvious that the emergence of place in this case is very much like a collage, mixing digital media into spatial expressions and in relation to artefacts such as the model. This points to configurability as most important for the act of appropriation of space. Hence, one quality of a mixed or intermediary space is its potential for dynamic adaptability. We can see this from the way projections were mixed, layered, and configured in the Interactive stage. They were not performed as slide shows, shifting in a linear way from the one to the other. The simple barcode technology enabled Tim to perform complex collages in immersive ways.

I have also argued that this is an inhabitable space; people can encounter artefacts and objects in a meaningful way. This is partly due to the properties of the
mixed objects, permitting also them to be configurable by using the Texture Painter. Chalmers has addressed how the ‘seamfulness’ of mixed reality systems and media might be crucial for individual’s learning and how “ongoing feedback loops of interpretation and understanding... affords variation in people’s understanding as well as consistency in behaviour” (Chalmers and Galani, 2005, pp.245). This resonates with our understanding of mixed objects and how creativity can be said to; in parts at least, reside in the variations in perception and interaction with different polarities of a mixed object. They have the potential to turn into something else, but they do not lose their form since the metamorphosis is reversible. They are configured into various shapes but within a fairly stable set of links to other entities (the walls, the performer, the light facilities of the projector, etc.). Placing them on a moveable and configurable table makes it possible to change their relation to these entities, at least to some extent.

The studio becomes a space for embodied action, with Tim as the focal point in the performed narrative. Moving around in the space he is an active reference to the interweaving of materials and space, changing the focus of materials positioned differently in the space. Present in the space is also a multiplicity of perspectives of fellow students, teachers or other visitors. This space has strong narrative elements rather than being merely descriptive. It may be (and is) used by the students for simulating other places, but it is foremost a space which is created as it is performed. It exists as a place in its own right and since it is adaptable it is not restricted to one narrative, but supports the mixing of micro stories.

So forth I’ve argued for Metamorphing as a concept that can describe important parts of design work. It is something different than transformations of representations; in as much as it refers to a situation in where the subject (designer) engages with the object (the object of design or design material) in such a way that it transgresses a traditional view where a subjective agent acts upon inert objects. It also refers to the whole chain of “circulated references”, not just singular instances of transformations, and it includes a view where manipulating objects also changes the surrounding space and the conditions for communicating within the space. Stories of use have illustrated how interactive technologies and augmented, or mixed objects, can strengthen these processes. The term can also, as in the case with Tim performing his work, be said to be central for the making of a place for design. The way he configures the media expressions in space, the metamorphoses of the model through the use of the Texture Painter and other orchestrations of the ensemble of mobilized design material all point to Metamorphing as the potential for manifesting phenomena into new appearances and as central for the making of a place for design.
5. METAMORPHING AS ALIGNING ACTANTS – THE CASE OF HAND SURGERY

The spatial aspects of Metamorphing that were hinted at will be further elaborated in the following chapter. Here I want to proceed reflecting the concept of Metamorphing by showing how artefacts are transformed and used in different ways and in different formats within a completely different domain, that of recovery from hand surgery. The case of hand surgery is more fully elaborated in the appendix “Collaborative articulation in healthcare settings”, but I would like to address a notion of interaction that I find has a valuable role in the context of transforming and Metamorphing; namely how forms of interaction can contribute to shared understanding of what’s going on in an environment and how Metamorphing at times requires the visibility of actions. Even though the cases of design and hand surgery apparently seems to reside in completely different domains, there is a clear analogy in the sense that rehabilitation, just as design work, proceeds through engagement with material and artificial set-ups in a way that can be described with the concepts of transforming representations and Metamorphing.

It is not only a question of translating sketches into scenarios or understanding processed rehabilitation data as real life activities. It is not the subject designer working on top of an inert design object and it is not a passive and obedient patient understanding his body through general information leaflets. Metamorphing tries to capture the deep engagement with objects and things in situated instances in a way that diffuses the distinction between subject and object.

I will now again use the concept of actants, borrowed from Latour, to illustrate how they align other actants, human and non-human, in the process of rehabilitation. Especially I have a focus on how digital media can serve as a boundary object in these processes. This idea is the offspring and continuation of the work carried out by the “Everyday learning within health care” project, and has been carried out partly in co-operation with that project. As an interaction designer I try to
make a contribution by showing a possible framing for how handheld devices can be used to access various central resources mobilized when interacting with the various states in the life cycle of digital media. This is exemplified in the design of a “docking station” that can be used during video recordings taking place during consultations. The design is another example of how the RFID technology travels between different domains, now having quite a different expression. The act of Metamorphing relates not only to how representations are transformed, but is here also illustrated as a transformation of devices, interfaces and computational resources. Related here is the issue of how we can experience immaterial resources, individually or collectively, such as wireless connectivity. On a conceptual level I try to make contributions through the concepts of collaborative articulation and explicit interaction, which are addressed by the design which we developed in the project group.

Again taking offspring in the writings of Bruno Latour, on how we talk about the body and the concepts of actants referred to in the previous chapter, I will try to apply the idea of circulating references to the case of rehabilitation. In an article Latour brings forth the story, as described by Geneviève Teil, of the odour kit that is used to train noses for workers in the perfume industry (Latour, 2004, pp.205-229). The kit is made of series of distinct fragrances, arranged in such a way that it is possible to go from the sharpest to the smallest contrasts. Registering the contrasts is trained through a week-long session in where the participants end up becoming, as he writes, “noses”. They are called “noses” because they acquire a body organ while at the same time learn to use it in a world of fragrances. So acquiring a body is from this perspective a progressive enterprise that produces at once a sensory medium and a sensitive world. The point is to show how “…bodies are learning to be affected by hitherto unregistered differences through the mediation of artificially created set-up.” (Latour, 2004, pp.209).

Of course every difference in smell won’t be perceived by every nose and to deal with the differences in perception and the relation between perceiver and world he uses the word articulation rather than referring to accuracy of reference. The odour kits articulates the students rather than, at a particular time, giving them, a once and for all, accurate indexing of fragrances. So the local, materialized and artificial setting is not a mere intermediary. It is rather the case that it is the artificiality of the kit that allows the subtle perception of differences. Again he makes a case against the subject-object model inherent in Kantian or Cartesian philosophy. While accuracy of reference is a true or false statement the concept of articulations allows for a discourse that is progressive and which never converges into single statements, and contrary to statements they are propositional.
5.1 THE ENACTMENT OF “HAND TALK”

Typically rehabilitation times are very long, in specific cases up to several years. Success of rehabilitation of injury is dependent on engagement and active training by the patients themselves. Even though there is no archetypical patient, some major groups can be observed such as younger men subject to trauma, related to accidents at work, and patients around 50-60 with worn out tendons due to work related activities.

This means that the process of rehabilitation most often is critical for the patient’s life-situation in a long time perspective. Patients often confront a situation in where they have a major part of their working life still ahead, but no guarantee whether they can return to their profession. In other cases everyday life situations are getting most cumbersome due to the injury. Undergoing surgery and rehabilitation you meet a variety of different actors, doctors, physiotherapists, occupational therapists etc. In addition to this, patients living in other parts of the region might consult local healthcare as well.

For patients it is not uncommon to meet, and receive information from, all these actors at one single appointment at the clinic. This means that during several short-time meetings, patients might go back home with a complex set of instructions that is of importance for progress. Progress is typically slow, with low feedback mechanisms apart from staff judgments. Most of the indicators of progress or drawbacks stay in the formal patient record. Different patient narratives are common during consultations and can give information on why rehabilitation does not work. From this point of view the social dimensions of the process, for instance patients’ possibilities to adhere to instructions, are of importance.
The concept of collaborative articulation is addressed as a situated negotiation of the state of the injury and the necessary steps for successful rehabilitation. With collaborative articulation, we do not introduce a new concept to health care. It’s rather a perspective that stresses the act of mutual agreement in consultations. Health care literature has used the terms compliance and concordance to discuss different degrees of patient empowerment.

Whereas compliance refers to a traditional/conservative model where the doctor decides on the treatment and the patients should comprehend and follow instructions, concordance concerns how patients take an active stance in rehabilitation. Rather the patients participate as partners in consultations where mutual agreements are the goal. Patients understanding of their injuries and trust for the caregivers’ competence is viewed as supportive for adhering to instructions. For the caregivers it can be a challenge to understand circumstantial problems that might cause problems for the patient to follow the treatment plan. Patient narratives are one way of easing this understanding.

This “Hand talk”, evolving during consultations, is performed rather than spoken. A number of tools and log sheets are used to assess and monitor the flexibility of hand and fingers, grip strength, tactile sensitivity and pain. They also serve to make progress visible, which can otherwise be almost imperceptible to the patient. Therapists and physicians also use other artefacts to articulate the stories they want to tell. During a consultation, the physiotherapist uses, for example, a poster showing the anatomy of the hand to reveal and explain what kind of injury the patient suffers from. In conjunction with the poster, he complements the story by pointing at corresponding parts at his own hand. The patient might respond with a story of how he feels strange tickling when taking a shower. This in its turn urges the therapist to take a towel starting to rub the patients hand while explaining perception, pain and how he must get used to different surfaces. In many cases they use everyday metaphors or relates to the experiences of other patients. Considering this and the fact that there are specific outcomes even within the same type of injury, it is easy to see that general information is
hard to use, but also to produce. The diversity of artefacts & instructions can at times cause a stressful situation for the patient in where memory easily gets over-loaded.

During the patient’s trajectory of his/her recovery process and different encounters with healthcare professionals and their diverse forms of artefacts, a picture of the patient’s overall situation is gradually taking shape. From the healthcare professional’s point of view, the patient record works as a centre of gravity for this evolving image. However, in our work it became clear that the patient has no explicit tool to rely on regarding the creation of this image. And patients do have their own agendas preparing by writing down questions or just mentally going through the consultation to be.

During several instances processed data must be understood and translated by patients into “real-world” facts. One example is illustrated in the picture above, where a patient is doing exercises in the work simulator. The work simulator is a set of machinery which simulates real activities such as climbing a ladder, driving a car etc. The strength used is measured in numbers and logged in individual sheets for each patient. The log sheets accounts for how rehabilitation is going, but can be hard to relate to actually performing the tasks in real life.

Another example of data that can be hard to translate and understand is in the picture below. Measuring the flexibility of the hand is done by using a goniometer, the measures are put in the status sheet that is a central part of the patient record which can tell how rehabilitation is going.

So, meetings and artefacts help the patient to form a picture of his/her recovery process. Much of the relevant information is embedded and of a situated character, revealed with the help of aligning different artefacts to the patient’s injury. The evolving picture is negotiated between the parties forming a unique story for each patient and
during consultations learning and instruction is mutual and negotiated in interaction.

5.2 BUILDING A DISCOURSE AROUND DIGITAL MEDIA AS BOUNDARY OBJECT

Per-Anders Hillgren and Erling Björgvinsson, in the project Everyday learning within health care, have made promising experiments (Björgvinsson and Hillgren, 2004) to capture such situated occasions, by various ways of recording and documenting parts of consultations that can follow the patients. Digital media has the potential for easy and instantaneous documentation that renders a situated character to information. While resting in between the general and the particular, it can be related to the specific moment in which it was conveyed.

In the first experiment, they used a DV camera on a tripod to film meetings between a physiotherapist and different patients recovering from the same injury (an incision to a tendon). The movies were about 15 minutes long and you could easily see both the patients and the physiotherapist’s hands and the poster they use as illustration. The contents were to some extent similar between the movies, but there were also important differences. The patients received the movies on regular CDs after the consultations, and they used them several times in ways that were not anticipated. They all used them to show their relatives what they experienced at the hospital. A professional athlete showed the material to his regular physiotherapist. The movies were used as references, in order to compare movement capability with previous rehabilitation exercises. One patient explained that this was much easier to refer to than, as he put it; “the cryptic numbers filled into the status sheet”. The patients also used the movies while doing their exercises. Exercises include fine grained movements which are easy to understand while seen, but hard to recapitulate afterwards. Used today are paper templates that are slightly individualized from case to case. The movies has potential to act as a memory re-enforcer, enriching the crucial situation at home where training must succeed only on behalf of the patients’ ability to re-enact the instructions.

Another experiment from their project included the use of screen capturing software. Often during consultation sessions, a physician and a patient collaboratively watch the patient’s X-ray pictures on a computer screen between them. In those cases, the physician uses the X-ray pictures to explain what kind of surgical procedure he is planning to perform. The software used allows the physician to draw and mark the X-ray pictures to emphasize the patient’s status and what the surgical procedure will be about. All this was recorded as an animated movie together
with their discussion. The format is playable on all Windows platforms and the patients received CD copies before they left. Similar to the previous experiment with the movie recordings, they found differences in the explanations and discussions among different patients also when patients suffered from similar injuries. All the patients also used the material to show their relatives.

I find these experiments as enriching patients’ landscape of aligning artefacts. While traditional clinical representations often circles around general, and for patients often abstract, information, the movies and screen recordings refers to the situated nature of communication that can support translation and Metamorphing between all the artefacts used in the process. Looking at the picture below we can see how they fit into a chain of “circulating references”. From left to right are different representations of the hand; the anatomical poster which is “the idea of the hand” in a Platonic sense, the X-Ray picture which represents the invisible individual hand, the status sheet which is the “processed hand”. The final pictures are from the Everyday learning project; the X-Ray augmented with the physician’s drawings and recorded an explanation which is the “talked about individual hand” and finally the “video hand”.

Mol and Law highlight in a text on hypoglycemia how the sickness is performed and ‘done’ rather than being described and known (Mol and Law, 2004, pp.43-63), including treating the patient as a human being far beyond the sickness or disease. They propose that healthcare take an ethnographic turn that is not accounting for general states of bodies but rather looks into pragmatic ways of dealing with the state at hand. The use of the “ethnographic” label indicates, to my interpretation, that it:

- addresses how dysfunctionality of the hand is performed rather than being described as a finite or general state of the body

-tries to capture these doings of hand surgery in the instant and specific moments of rehabilitation rather than being instructional and generalized

-includes the patient’s body as a lived human body, including the life-world of the patient from healing of tendons to work ambitions and love life, rather than treating her as primarily “ill”
I think our observations at the Hand surgery clinic confirms the aspect of performing and that the experiments from Everyday learning within health care addresses capturing parts of the doings of hand surgery. In the Palcom project we’ve made a first round of experiments trying to address the inclusion of the patient’s life-world by reversing the media stream, letting patients bring media to consultations to see in what way that can strengthen the articulations and the overall process of Metamorphing. In a first exploration of how pictures taken by a patient were brought to his meeting with an occupational therapist it seems like they can contribute in several aspects.

The patient, that had undergone repeated surgery after a severe injury, had been in rehabilitation for more than a year. He had been one of the patients that received CDs recorded during consultations and is enthusiastic about the idea of recording videos and using images as part of rehabilitation. Having spent a lot of time at the rehabilitation ward, he knew the staff quite well and especially the occupational therapist, which had supporting his adjustment to everyday-life after the injury for a long time. He was at this period about to start work-training at his regular job, coming back for a limited time each day, performing only limited tasks. This meant that the therapist is supposed to write a work place description, which is handed over to the national insurance office as basis for evaluating the patient’s ability to come back to his old profession as a caretaker at a school.

This document is another example of a rehabilitation artefact that is used to align the different actors involved in the process. They are produced by the therapists based on their judgment of the injury and recovery, and it is balanced against the patient’s narratives of how work is performed. It used to be the case that the therapists went to on site visits at the workplace while preparing this document, but due to financial reasons this is no longer possible. It is often a challenge for therapists to evaluate how the injury affects a work situation, to which he/she has a limited understanding. While we as researcher had asked the patient to bring basically any pictures he found would enrich the consultation and especially things he wanted to share with others, the therapist had asked him to take some pictures from his workplace. Though being a quite simple way to enrich the therapist’s under-
standing it is not a common procedure and she asking him to do this was instantiated by our experiment.

It is not surprising that the pictures taken made up for new possibilities for discussing the issue. They of course provided the therapist with a broader basis for understanding. They also shifted the focus from how she usually asks the patients questions, to a situation where the patient was the most active, storytelling with the support of the pictures. According to the patient, taking the pictures was also a way for him to organize his narrative. It enforced him to search for situations which now might be troublesome for him. For example, he had previously not mentioned that he at times had to climb a very steep ladder or how small his office place was.

However, the content of the picture he had taken went far beyond his work situation. An apparent area of concern for patients undergoing hand rehabilitation is how they no longer can perform tasks as usually. For example such a trivial situation such as buttoning the trousers is far from straightforward. This is certainly an unwanted social situation, but also not good from a medical point of view, since not using the hand makes the parts of the brain, which is connected to the hand, passive and thus further prolonging rehabilitation. The patient had spent considerable time to find workable solutions for several such troublesome situations. Among other things he had bought a construction for hanging drying laundry which permitted him to take care of the laundry without having to stretch the arms upwards, which caused him severe pain. He had also bought a basket which didn’t strain the hand too much; he could carry it with his injured hand. He found that this was an example he wanted to share with other patients. The occupational therapists know professionally, from her education, catalogue browsing and commercially arranged demo events, about a lot of products that can support patients with hand disabilities. But in her work she also hears a lot of informal stories on solutions created or found out by different patients. Looking at the pictures and discussing opportunities with us researchers, she found that she wanted to create a database of
examples that she could share with patients. For this she found the patients themselves a rich resource.

Finally, the patient also had taken pictures from his home and the surrounding environment. He used them to give a brief encounter of how he lived, but also to talk about his trauma at the occasion of the injury. The picture to the right above is taken from the site where he was injured in a machine related accident and where he had been laying waiting for help for a long time. These are also important aspects of rehabilitation and staff at the ward spend time working in groups with patients suffering from especially severe injuries. They often have a strong urge to talk about their traumas.

The therapist found that in cases where she knew she would have a long standing relation to the patient, she could well imagine to spend the extra time needed for viewing pictures taken by patients and listen to stories, that were not “needed” from a strictly clinical point of view. Concerning the idea in general, that patients can bring media produced by themselves to consultations, she states that; "...I see lots of possibilities to increase communication and understanding through such a way of working".

The case of hand surgery illustrates how a diversity of artefacts, materials and representations are used in different settings and talked about in different ways. Translating, understanding and communicating around them are other aspects of Metamorphing. A challenge for the field of interaction design within the domain of patient empowerment is to devise a set of devices, services and content that can, through appropriate interaction, support the health care staff, the patient and his surrounding social network to collaboratively articulate the state of the injury and the necessary steps for successful rehabilitation and patient learning. The experiments from the Everyday Learning project and our experiment with patients producing media shows how a discourse could be built around the use and production around digital media in a way that supports patient learning and empowerment. But the interaction around the life-cycle of digital media poses several interesting questions.
5.3 DEALING WITH HETEROGENEITY

Heterogeneity of formats and representations is inherent in the concept of Meta-morphing. They might be digital or material and have different forms. They also reside on different devices and are used differently. As networked digital media is becoming more and more ubiquitous in our environments we can also observe how heterogeneity of devices and interaction is becoming a crucial issue. Chalmers and Galani highlights in a widely referred paper (Chalmers and Galani, 2004, pp.243-252) how a too narrow focus on one tool or medium is contra inductive to how everyday activities involves an interweaving of media and formats, but also devices. As should’ve become obvious by now I share their view that “Social people, in their environment, continually mix and couple media in everyday communication: walking, gesturing and pointing while one talks, and referring to places and what people did in them as one writes.” (Chalmers and Galani, 2004, pp.244).

Since Weiser’s original vision (Weiser, 1991, pp.94-110) of ubiquitous computing a widespread goal of development has been a notion of seamless interaction and the computer being “invisible” in our environments.

This is partly due to an overemphasis of some of Weiser’s formulations such as “literally visible, effectively invisible” (Weiser, 1991). One example of how this has influenced research is the naming of the European research initiative The Disappearing Computer, in which Atelier was one of the projects. An underlying assumption, which also has affected much HCI research, behind the idea of invisibility and disappearance is Heidegger’s definition of tools being either “present at hand” or “ready at hand”. In many cases “ready at hand” (Heidegger, 1927/1996) has been an ideal because not being distracted by technology users have the possibility of completely focusing on the task at hand. While discussing these concepts Chalmers and Galani suggests that; “The ongoing ‘feedback loop’ of interpretation and understanding integrates these two modes, and affords variation in people’s understanding as well as consistency in their behaviour. For example, creativity can be considered as the variation of an individual’s subjective understanding from his or her prior understanding and from others” (Chalmers and Galani, 2004, pp.245). They put forth the concept of seamful design as an alternative approach. This would include emphasizing a revealing of differences and limitations of systems as a way of supporting social interaction. One example is how they, in the design of a mobile game to be played in urban environments, reveal areas of bad network connections instead of hiding them (Chalmers et al., 2005). Network connections are otherwise typical examples of system properties that often are hidden, being transparent to users.
The Palcom project (www.ist-palcom.org) tries to explore a new take on ambient computing called palpable computing. That a system is palpable denotes that it is capable of being mentally comprehended by the user. States and processes should, when needed, be made available to the senses to promote control, understanding and appropriation. Six dimensions from the vision of ambient and ubiquitous computing are challenged by opposing concepts such as invisibility/visibility, heterogeneity/coherence, automation/user control etc. (more information about the project is available at www.ist-palcom.org).

Most often users will have to explore their way as to find a position somewhere between these extremes. The project’s goal is foremost to develop software architecture for palpable systems and a conceptual framework for such computing, but also to develop a range of application prototypes that illustrates the ideas and benefits from the developed software. As people inhabit shared spaces, they elaborate their means for talking about it and interacting with each other as well as the artifacts populating it. In consequence, an emerging design principle is not to design dedicated spaces but to design for the appropriation of space. This calls for reflecting the physical spatial conditions for interaction and for possibilities to configure objects and actions within the space. These aspects have been addressed in much HCI research concerning end-user composition. A promising area for these configurations is the possibility to work with assemblies of devices and services. This can be dealt with either by de-construction of existing devices/services or through construction of new open-ended assemblies either via parts of existing assemblies or via components exhibiting new functionalities. Especially we have been interested in how using personally owned handhelds in combination with central resources such as cameras, servers, sensors, displays and databases and so on. Because we are gaining ability to dynamically construct and deconstruct assemblies from constituent resources. And it becomes a question how users perceive heterogeneous devices appearing as coherent but temporary hybrids.

The problem of invisibility of systems has also been addressed by many other researchers such as for example Rehman et. al. They conclude some problems of invisibility; the lack of a good conceptual model, loss of control, lack of feedback and breakdown of traditional models and put forth the principle of visibility as a possible solution (Rehman et. al, 2002, pp.213-216). Visibility is related to materiality in several ways. Most often artefacts have an intended functionality, but as they are appropriated through use, border resources are emerging. Consider the use of doors and how public buildings more and more are using automatic doors. A design ideal seems to be a level of implicit interaction, you do not have to open the door, you just walk through it. An example of a border resource residing in the
use of doors, is given by Andreas Lund (Lund, 2003) when he refers to a movie by Jaques Tati. In the movie, which is a silent movie, the lead character, frustrated over some disagreement, wants to express his anger when leaving the room by slamming the door shut, a sound which we all can refer to as embodying the dissatisfaction felt by the person shutting it.

It is not a property inherent in the design of doors to express emotions, but none the less it has evolved into a border resource comprehensible for most. In the movie the character bangs the door again and again, but since it’s a silent movie nothing is heard, the border resources can’t be evoked. And the materiality of artefacts does play a crucial role in our everyday sense making. Albert Borgman (1984) uses the term commodity to illustrate how just one of several aspects are maintained when an artefact is replaced by technology. One of his examples is how central-heating well provides opportunities for securing warmth, but how wood-burning fireplaces also related to the amount of wood needed, the work with chopping and drying wood and the need for keeping the fire burning. Those might be border resources in relation to ‘warmth’, but important ones as they also provided a rhythm of everyday life.

But visibility as such has to be carefully designed if we are not to be overwhelmed by a huge amount of choices to make. It is also not sure of which interaction styles to apply, whether it should be appliances in the real world or graphical representations. Probably we’ll see quite an amount of hybrid interfaces, depending on shifting between tangible interaction and graphical interfaces, develop in the forthcoming years. In the following I will highlight a design of ours that try to use the virtues of both – a kind of a mixed interaction space. The design can be seen from the background of Metamorphing as aligning actants, the idea of seamful design, the described Palcom challenges and the idea of short-lived assemblies.

5.4 EXPLICIT INTERACTION

Mobile devices with capabilities for handling the whole life-cycle of digital media are becoming widespread. Sarvas et al. observes in an analysis of the mobile photo life-cycle how must include all the involved terminals and devices and not only focus on individual devices and interfaces (Sarvas et al, 2005). They emphasize how the life-cycle of mobile photos, which they describe as capture-transfer-share-view and archive, is distributed over several devices and how some of the transitions require substantial user effort.

This became very clear in our observation of how the patient, bringing digital photos to the clinic, had to start his meeting with the occupational therapist by try-
ing to connect his memory stick to the TV at the ward. He knew this was possible and had managed to perform the task before. The therapist had no experience at all of this and it took about twenty minutes before they gave up and used my laptop instead, since there was no computer in this room.

This issue of connecting refers to a very practical aspect of understanding of how digital media is transferred and how different devices co-operate, but there are also several social aspects involved. Collaborating within the environment, which has an lay out similar to those of open offices where many therapists share the same space, is both patients and therapists in their specific meetings, but also the whole amount of actors in the space. The issues of privacy and perception of the actions of others is a general question for every shared space, in where activities around are staged around the use of digital media. Recently voices of concern have been raised against the possibilities of taking photos with mobile cameras.

Recording of videos is one aspect, but also the displaying and sharing of media of a private character is a sensitive situation. While the experiments from the Everyday Learning project showed promising results, we found that the CD/DVD format does not fully address the potential of networked digital media and also the asymmetrical relationship between staff and patient remains since it is the therapist or physician unilaterally deciding on when and what to record. To manage video recordings the set-up has so far consisted of a video camera with a built in dvd burner mounted on a tripod. The tripod and camera has been carefully set up in advance by the therapist. To control the recording the therapist uses the remote control for the camera. He usually turns the display of the camera so he can distantly view what's
being recorded, but it’s a limited view, being a small display viewed from some distance.

We took as starting point to use mobile phones as central devices for interacting with an environment that has constituent resources in the form of displays, cameras and sensors and so forth. For practical reasons we used PDAs instead during implementation, since, to our experiences they are easier to program. It was important for us to keep the concept of collaborative articulation in mind, supporting empowerment of the patient while at the same time developing a useful tool for the staff. Another object we introduce in our scenarios is the metaphor of a docking station—a physical object that in combination with a phone or PDA provides a framing for fulfilling some specific intention such as recording, viewing or sharing digital media. It is motivated by desirable use qualities such as augmenting the generic device with activity-specific functionality when needed, and supporting visibility of activity and intentions.

The name docking station is not an ideal name and it has also been talked about as a physical proximity descriptor or pairing device. Initially we were inspired by docking stations physical shapes and affordances, it is generally very clear to understand how to put the device in the docking station since the slots fits nicely and it has became an accepted mode of joining devices, for example a PDA to a PC.

Apart from the slots for holding PDAs/phones the docking station has an RFID reader on the inside and the PDAs are carrying RFID tags that are detected by the reader unit once the PDAs are placed in the slots. This is actually unnecessary since the detection is made by bringing the units (tags and reader) into close distance and we could just as well have used a dedicated area of the table for example. But in this specific situation, as well as in many others, we think that the materiality of artefacts have a role to play. When the tags are detected it is possible to determine the identification of the patient as well as the therapist and it thus becomes possible for a proper way of storing and associating the recording. It is a prerequisite that the phones/PDAs have been registered and augmented with tags and the proper software at some point in this scenario. Our yet unimplemented idea is also that while entering the hospital the device is used for registering the patient’s arrival, a procedure which today is
performed by “checking in” at the reception desk. Entering the hospital the phone’s signal is turned off as not to interfere.

The motivation for not allowing phones today at the ward is of a social character that the phones should not ring during consultations and at the ward. It is still common that patients forget to turn them off, but it is really not a big problem and the staff claims that there is no problem of interfering signals such as phone/pace-maker or other equipment.

The docking station has been designed for the sole purpose of making a video recording, but in the future it might well be developed as to have potential for other activities such as displaying or sharing. Instead of an ordinary tripod and video camera we have used a webcam of good quality mounted on a desktop lamp. This gives a quality of “physical zooming”, by moving the lamp holding the camera closer to the object of recording you zoom in and vice versa. Once the both PDAs are placed in the docking station they are connected to the camera and the video feed is displayed on the displays of the PDAs. We chose to make it necessary to use both PDAs during this first iteration as to enforce the shared decision making on what to record.

As it is possible for the patient to start a recording the nature of interaction is more of a shared interface.

So, instead of using the remote control for initiating and stopping the recording, the act of placing the PDA in the docking station connects it to the camera. The video feed is displayed in a low-resolution version on the PDA (which eventually also will store the media. This is not yet implemented). The screen of the touch-sensitive display replaces the record and stop buttons and tapping on the display thus controls the recording. When the PDAs are taken out of the docking station, the connection with the video camera is ended.
Though not fully evaluated in actual use at the clinic we think the design responds to a notion of very explicit interaction, which might seem unnecessary, but still has some interesting features which have been assessed in sessions with the staff;

- Placing is not a physically demanding interaction, which actually is an issue for people with hand disabilities. Neither is it a cognitive demanding task, compared with browsing for the right application and navigating in a typical PDA interface with many choices.

- It is performative in the sense that both partners can relate to a ritualistic series of actions that reflects a change of rhythm in the consultation. It is agreed that they now are about to start a recording. It also supports other people present in the room that can peripherally perceive that a recording is taking place, in adjusting how they perform for example deciding not to disturb or make loud noises.

- It is personal in as much as viewing the recording on the personally owned display gives a feeling of ownership and access to the digital media.

But what is more important; the collaborative nature of interactions enforces the shared and negotiated nature of the decision on when to record and what to record.

I hope to have shown here that, an important aspect highlighted here is how there also can be an aspect of transformation of devices and interfaces that has to be understood and perceived in an environment. This has here been dealt with through the concept of explicit interaction and an illustration of how short-lived assemblies can be constructed and interacted with. I have contributed to the design of the docking station which exemplifies how physical forms can serve as mediators in creating assemblies. They can act as physical nodes in a landscape of activity based services. Being physical nodes they also have potential to manifest awareness of intentionality and actions for others present in the space. Continuously performing interaction with a variety of timely introduced, ready-made or invented, representations and the human body is to move ahead. Certainly there are maps but wayfinding and navigation are localized moments of real world interaction.
This chapter will continue to look at how mixed objects and transformable spaces can develop alternative and ephemeral places, now within the context of artistic work, and how they take part in Metamorphing that have another agenda than design work. While I in the previous chapters tried to elaborate how Metamorphing and transformations of materials, artefacts and representations drives design work forward as well as plays an important part in patient rehabilitation, I will here focus on the experience of space transformations as the goal. The case of design work similarly focused on the “in-between” states of transformations, but was still directed at future states of design representations. In performance the visitors’ experience of the “in-between” is of even more importance. It is still a space for embodied reflection but here the fluid movement as such is the focus more than the next link in a chain of circulating references.

I have in a series of events and performances co-operated with Swedish artist Lena Mattsson in an exploration of how these links can be used foremost as the artist’s tool in performance. The DVD appendice, “Moulding space” to be found in this thesis, visualizes parts of these explorations. It includes parts of the exhibition Beyond the surface which included our joint performance Diagnoses and also some footage from the exhibition Mirror, mirror where I performed the piece Carrying a load Pt.II. Starting from reflecting how contemporary art have been driven from the mentioned desire to expand from the framed painting, I will try to show how this is inherent also in diverse image formats and how experimentation with the picture plane can be achieved through projections of digital media onto natural surfaces. Apart from exemplifying space transformations I will give examples of how mixed objects can be actors in Metamorphings of a variety of formats and materi-
als. The theme of relating materials and formats will be addressed by the concept of remediations as the exhibited work in many cases is dependant of a referring to that which is not present at the exhibition. Also I will use the concept of liminality as to address what kind of spectator spaces that are put into play in these processes. My own artistic contribution to these examples, apart from the co-operation with Lena Mattsson and her works, consists of poetry mixed media performances where mixed objects provide the rhythm in the performance.

In an influential book artist and critic Brian O’Doherty challenges the “white cube” model persisting in galleries and museums (O’Doherty, 1976/1999). He challenges a modernist illusion of spatial neutrality, which he claims to be an illusion, concerning gallery spaces. The neutrality is supposedly constructed as to let the artworks take on lives on their own and relies on schemes such as white walls, controlled lighting, the minimal framing of mounted works and the exposure of the works completely residing within the gallery space, which often is “shut out” of its surrounding environments, or as O’Doherty puts it; “A gallery is constructed along laws as rigorous as those for building a medieval church.” (O’Doherty, 1999, pp.15). Underlying such a taxonomy of space according to him is the idea of the easel painting as a self-contained “parcel of space” which is further accentuated by the boundaries of the work, the so psychologically important frame. The frame contains the artist psychologically just as the space for viewing contains the spectator in these works. The boxlike character of the frame easily brings forth the metaphor of a window, which O’Doherty reflects as making the easel picture resemble a portable window to the world. While rigidly positioning the spectator it creates a viewing where what’s in the picture is positioned along a cone of space, a deep space on the wall which creates an illusion and a disembodied experience against which the frame acts as a grid. “The greater the illusion, the greater the invitation to the spectator’s eye; the eye is abstracted from an anchored body and projected as a miniature proxy into the picture to inhabit and test the articulations of its space.” (O’Doherty, 1999, pp.18).

While this spatial model remains for smaller galleries, we have seen for many years now how contemporary art are quite successful in breaking the boundaries of the frames and including the exhibition space as an integral part of the experience of a work. This is at the core not only of what’s called site specific art, but also for a major part of installation based art which nevertheless must be transported to and integrated into a space only partially known for the artist. While remembering Peter Greenways “Flying over water” in 2001 in Malmö, what sticks out most of the exhibition are the large interventions in the gallery space. Basins filled with water were built in the floor, rare books where loaned from the National Library,
huge iron casting that were later disregarded by the artist etc fleshes out an image of
the artist as a director of space more than anything else. This kind of magnificent
staging is possible for larger institutions, even though the one in Malmö suffered
from the economical consequences for the successful exhibition for several years.
For smaller galleries and for artists without the worldwide reputation other strate-
gies must be found. Installation based works and the use of projectors have became
a successful way of integrating art and space for many artists. I will in this chapter
elaborate how Metamorphing can be used to describe also central parts of artistic
work, especially within the fields of performance and installation based art. Re-
search on new media and interactive art has come to focus, and rightly so, on the
interactive meeting point between viewer and the art object, the way the viewer be-
comes an agent of change and participator by using interactive technologies. It is of
course necessary to explore the intrinsic characteristics of new media and interac-
tivity. But in doing so there’s also a focus on singular moments extracted from time.
Other definitions might give way to how the metaphors and models could integrate
how art can evolve over large temporal spans including an internal referencing to
different and central nodes within these temporal spans.

One of the characteristics of contemporary art can be seen as a reaction against
the oil painting as the prime mode of representation of visual arts. Like much cul-
tural development a chain of reactions against and mediations of older formats and
expressions has been at play up to date. Impressionism tried to capture the instan-
taneous impressions of ephemeral moments in everyday life and their impressions,
thus dispersing of eternal themes in art. Manet worked deliberately with the can-
vass as an arrangement of different areas for painting, undermining the idea of the
painting as a representation and a “window to the world”. Rejecting warm colors
and using outlines around figures his paintings often had a character that differed
much from the central perspective. Figures might appear as cutouts pasted on the
background, a background which often is blurred and out of focus. The questioning
of the traditional oil painting has also been a strong theme in much work of other
modernist movements such as Cubism, Surrealism and Conceptualism.

Early on in the twentieth century painters such as Braque and Picasso included
everyday materials such as newspaper prints and clothes in their paintings, dispers-
ing the material of the oil painting (Rush, 1999). Use of mundane objects also gave
way to a specific art object; the ready-made object perhaps most known by the work
of Marcel Duchamp.

This freedom in expression paved way for installation art, which finally freed
the art work not only of the canvas painting but from the very frame itself. Spa-
tial expressions in exhibitions are nowadays common goods more than the framed
painting. From the early days of photography technology has provided intense inspiration and new tools for artists. While this of course has affected the development of new formats such as web-based art, virtual realities and interactive screen based works there has also been a tremendous development of how to render spatial expressions to the new formats through new modes of screening and installations that thrives of embodied interaction. Often the ambient character of installation uses architectural strategies and techniques that structure and organize perception. Veikos reflects that some of these strategies includes the territorialization of the entire site for the exhibition that viewers can enter, using real materials rather than representations and stressing the viewer’s interaction with the work (Veikos, 2006, pp. 71-80). In her article she traces the origin of installation art to radical attempts by painters to spatialize the picture plane rather than to land art, conceptual art or minimalist sculpture, as others have done.

It is not my intention here to trace such origins, but I do wish to highlight the aspect of spatializing the picture plane since it relates to a theme of playing with and relating to older formats, materials and techniques. Such a theme deals with connecting to a diversity of formats and use of materials which is not unlike the evolving design process described in previous chapters. This is something most artists do as a part of their work process and it is in many cases also a part of the exhibited work. An internal referencing to art history and older formats, materials and underlying concepts of perception is at play in much work of Lena Mattson that is not uncommon to the notion of bricolage. The video “Breakfast for everybody” could be seen as a simple paraphrase of Manet’s original painting, but the transformation includes a play with identities and gender issues.

In Mattsson’s work it is the men, one homosexual with makeup and one with the body covered with tattoos, which are naked. It is also a matter of spatialization and territorialization. Originally exhibited at the Louisiana Museum of Contemporary art in Denmark, the video was recorded in the museum’s widely known garden. Most visitors combine a visit to the museum with a walk in the garden. Recognizing the scenery of the video mobilizes a relation to the visitor’s own walk and prompts for reflecting the viewer’s relation to the work. For every day of the exhibition she also had a performance in front of the video that were displayed in large format on the wall. The performance, which was held during mornings just after the daily opening of the museum, consisted of a version of the scenery where spectators were invited to have breakfast with the artist and some of the participants in the video.
The objects in the video, such as the blanket and the picnic basket etc, were also present in the performance. In this way the visitors joined in a re-enactment of the video, but also of Manet’s original painting. Mattsson often uses this strategy of having a performance which is a displacement of her works at the exhibition. Often the performance is not a self contained piece, but rather part of the overall experience of her work, work present at the exhibition but also what might have been exhibited elsewhere. The performances always forms part of communication with visitors, leading to direct conversations and discussions either as a part of the performance or as a natural extension of it.

This is an interaction relying on face-to-face meetings between artist and spectator more than focusing on just the visitor’s interaction with the exhibited work. It is also a strategy for making different spectators interact with each other, at one occasion during the Louisiana exhibition elderly ladies joined Hells Angels in such a breakfast discussion with the artist. But as the artistic practice develops the internal referring and continuous displacements of previously used artistic components continues in a way similar to Metamorphing as I’ve described it. In the pictures below we can see, apart from the Louisiana performance, a version which was staged in a hospital with staff from a psychiatric ward.

The picture was later exhibited in an installation at the ward, now as a framed image on an easel with the palette in front and referring back to Manet. In other instances the objects have circulated like references to her work, taking part of other videos, paintings or performances and gradually taking on a meaning on their own.

Figure 78: To the left Manet’s “Le Déjeuner sur l’herbe” and to the right a still from Lena Mattsson’s video “Breakfast for everybody”.

Figure 79: A series of Metamorphed “Breakfast for everybody” occurring at different occasions.
Digital media is of course an extremely well-suited medium for this kind of moving between not only images but also formats, materials and modalities. New media art have also experimented quite a lot with transformations of representations like visuals having audio output or tracking technologies having a tactile expression etc. Strategies for performing the transformations differ a lot and have become an integral part of the artistic expression. In many cases the interaction that triggers the transformation is the art work.

The metaphor of the window is picked up by Bolter and Gromala who uses it to distinguish new media from older forms of art (Bolter and Gromala, 2003). The metaphors of “windows” and “mirrors” are a unifying theme for the book and stresses how design of interaction has gone from “windowing”, searching for transparent interfaces with little intervention for the user, to “mirroring”, reflecting the user and his context. The polarities are used to position a design view differing from the still dominating HCI community, but also to explore the potential of digital media and how artistic work with digital media might enrich design of interaction.

Three concepts stick out as important for new media art in the book, that in my opinion also holds true for much contemporary art; remediation and diversity of media, materiality of media and the role of context. The concept of remediation concerns how new media formats reformulates the experience of previous forms. New media formats, such as the DVD based multimedia encyclopedia, have relations to older forms of media such as for example the print based encyclopedia, and the strategies for relating them to each other differs. In some cases the difference is not accentuated at all, the digital format is “just” another way of accessing the content. This of course does not hold true since for example viewing a painting in a gallery will never be equal to that of viewing it on a computer screen at home.

Experience is experiential and is always happening at particular places providing a specific view. In other cases the new format can be referred as similar to an older format, but enhanced such as the notion of interactive TV. Yet another strategy is to be rather aggressive about the difference, stressing it in such a way that the older format is completely refashioned while still maintaining some presence. In some cases the older format is taken away from the original context; “This tearing out of context makes us aware of the artificiality of both the digital version and the original clip. The work becomes a mosaic in which we are simultaneously aware of the individual pieces and of their new, inappropriate setting. In this kind of remediation, the older media are presented in a space whose discontinuities, like those of collage and photomontage, are clearly visible” (Bolter and Grusin, 1996 pp.341).

The latter perspective can be related to that of Metamorphing, which stresses dif-
ference as a potential creative space being “in-between”. From this perspective seamless translations and transparent interfaces are not the ultimate goal. This also implies that convergence of media not is an ultimate goal; the diversity is maintained and used as a springboard for work. The diversity of media is also, just as in the case of design work, a characterizing way of working for many contemporary artists. As the user in the case I will shortly describe is the artist herself it also promotes a reflective way of moving between materials and formats, which is a driving theme in the works of Lena Mattsson, but also for many other artists.

Another issue in Bolter’s and Gromala’s book, and what I argue for in this thesis as well as being a rather strong emerging theme in contemporary art, is the role and importance of the materiality of media. Media as well as computational artefacts are placed in physical environments and the theme of embodied interaction stresses the relation between body and interface. This is of course not only relevant for performance art but is the issue and theme that drives the artistic work. Just as site specific art performance is carried out within a context and the surrounding environment is not excluded from the experience of the art piece/performance act. Bolter returns in different writings to the theme of remediation and also in reflecting the genealogy of the concept of hypermediacy, which refers to the different strategies for remediation described, how we historically can observe this as not only a visual trait reached through the juxtaposition of media, but how it also can refer to contradictory spatial logics that plays with the visual perception of depth in images (Bolter and Grusin, 1996). The example used is how altarpieces in cathedrals, the cathedrals being hypermediated spaces themselves by mixing stained glass, sculptures and inscriptions etc, could mix perspectival representational images on the outside of the altar doors with three dimensional carved images residing on the inside of the doors. This is a very common strategy in contemporary art.

Performance art defies general definitions except a desire to take art directly to the public. Goldberg traces some motives for performance art as “a history of permissive, open-ended medium with endless variables, executed by artists impatient with the limitations of more established forms” (Goldberg, 2001, pp.9). Typically performance works thrives off a variety of disciplines and materials such as theatre, poetry, architecture, film and media etc, using these materials in basically any combination wanted by the artist. Even though many performance artists are specialized in doing performances it is noticeable how in many cases artist have an original and strong relation to a specific material such as Carole Schneeman being a painter relating to her own body as an extension of the canvas. Similarly Joan Jonas, who also has worked with media and performance since the 1960s and originally was trained as a sculptor, claims that; “...my experience of looking at the illusionistic
space of painting and of walking around sculptures and architectural spaces.... I was in them as a piece of material, or an object that move very stiffly.... I gave up sculpture and walked into the space” (Goldberg, 2001, pp.42). This perspective can also be reversed for example how we can observe that before producing art objects many artists have experimented with underlying ideas and concepts through performance. Many of the original Dadaists were poets or cabaret artists before they called themselves artists and approached the art objects through embodied performances.

Performance space is a staged being where the artist’s body reconstructs, from the ordinary body to performance body, which constructs an experimental stage. Often this stage is used as an embodied interface to other materials residing within the artist’s toolbox, providing links to them and alternative readings of them. Vito Acconci, who has worked with video, installation and performance, addresses this relationship as; “if I specialize in a medium I would be fixing a ground for myself, a ground I would have to digging myself out of, constantly as one medium was substituted for another – so, then instead of turning toward ‘ground’ .....I would focus on myself as the instrument that acted on whatever ground was available.” (cited from Goldberg, 2001, pp.50). Often the manipulation of materials can be at the centre of performance such as in Jackson Pollocks famous action paintings.

6.1 DIAGNOSES, REMEDIATION AND LIMINALITY

A series of water color paintings was at the heart of the exhibition Beyond the surface by Lena Mattsson, but they were never shown as such. Their expressions were in the form of animated videos, links in the physical objects whose manipulation triggered large scale projections or painted on the artist’s body. They were conceptually clustered, but had no chronological order; they were more like rhizomes of water colors. The continuous flux has also been the model for the archetypical narrative form of digital media.

Networked non-linear narratives have many predecessors from the Chinese oracle text I-Ching to Joyce’s Finnegans wake. The most recognized metaphor is perhaps the rhizome conceptualized by Gilles Deleuze and Felix Guattari; “The rhizome itself can take all sorts of different forms, from branching out in all directions on the surface to the compression into knots [...] Any point of the rhizome can and must be connected to any other point” (Deleuze and Guattari, 1977, pp.11). Likewise much referred to, by the same authors, is the concept of desiring machines. Desiring machines are machines on a conceptual level obeying a binary rule
or set of laws and governing associations. Just like rhizomes one machine is always coupled with another (Deleuze and Guattari, 1983). The associative chain is at the heart of the concept.

These kind of evolving associative networks have also been a strategical model for non-linear narratives which are mobilized for example in hypertext. Mixed objects of course have potential to act as physical nodes in a hyperlinked space, something we integrated in the performance Diagnoses which were held at the opening of the exhibition Beyond the surface. As mentioned water color paintings were not shown as such, but with one exception a tagged painting that could be held and felt by spectators and be used for triggering playing of associated media. Mostly the water color paintings were in the form of animated movies or they were accessed by tagged objects. Therefore the set-up of the exhibition was a mixture of large scale projections and material objects.

The act of animation is one of simulating the infusing of life by interaction, not only one of rendering still images into moving ones. Using video as a sculptural form has long been an exploration by Lena Mattsson. Many of the projections were made directly onto the objects providing a mixed media space that could be experienced only by walking around in it. No single point of perspective provided an overview of the projections within a single room. This is illustrated in the picture below where a large tree log is placed in front of the projection of an animated video, In the Woods. The log is used as surface for projecting yet another version of the video while at the same time providing a strong scent from actual woods, thus introducing some multi-modality to the work and it also serves as a seating place for watching the larger projection.

The spectator walks from projection, to object and to further projections, thus arranging their own stories of the objects, the movies while the body movements create disruptions like rhythms. Jaleh Mansoor refers how Kurt Schwitters in the first meeting with Hans Richter walked up to him and introduced himself as “I’m a painter and I nail my pictures together” (Mansoor, 2002). Painting and nailing seems to belong to different domains, but was integrated in his Merzbau, a gigantic project giving physical form to an assemblage of objects and spatial configurations.

While walking around the exhibition, the spectator body frames the viewing in a
laborious way – nailing, and at the same time performing an act of imagining, in combining the objects into visual stories – painting.

Other strategies used by Lena Mattsson for charging space with illusionary depth is to display large scale videos with perspective depth on existing or specially built walls within the museum space. The disruption of a master view creates perspectives where spectators must find their own position in the interstices between the multiple screenings.

The number of artists working with installation based video and sculptural displays have grown enormously since the early days of video work and includes names such as Douglas Gordon, Eija-Liisa Ahtila, Pippilotti Rist, Gary Hill and many, many others. Strategies differs, but in constructing these embodied spaces for viewing digital imagery has created conditions in where the perception of moving or still images differs very much from the traditional cinema or TV settings, which is more similar to the “framed” viewing described in the beginning of this chapter. Dual, or more, screenings works from the assumptions that meaning is created from individual perspectives emerging while confronting art rather than as an act of interpretation (of the artist’s intentions) for the viewer.

Finding interstices and focusing on a spectator engagement on what is between two images is close to the concept of Metamorphing. Hansen reflects Deleuze’s conception of the time-image as an opening to the outside as the operative basis for an image which seeks the flexibility of embodied perception rather than the rigid order of the cinematic image (Hansen, 2004, pp.240-250). These images are what can be perceived “between the images”, outside of the image proper. Deleuze, hard to understand as he might be, is also questioned by Hansen since the time-images are conceived as contained in a purely mental space. In comparison he brings forth the works of Douglas Gordon, often working with dual projections in a very deliberate and strategical manner. In Gordon’s works a physical and spatial embodied negotiation with the interstice between images is mobilized in the real exhibition space, through deployment of physical displays, and not as cognitive processes. In an essay, in relation to the opening of an exhibition, Lynne Cooke characterizes the works of Gordon; “The reflected symmetries of the double projection similarly
serve to restructure vision; for the flow of enantiomorphic images constantly oscillates, sometimes splitting apart to insist on dual contradictory points of view, sometimes dissolving into a fully coherent if illogical space, or a single, unified entity. Often a new reality supervenes over the inverted pair of images, a reality that metamorphoses out of the seam, the junction between the two frames, and conjures yet a third vantage point: elusive, fluctuating, subliminal, it evokes a consciousness resistant to the twin claims of hypnosis and psychoanalysis.” (Cooke, 1999).

Being a common strategy in contemporary installation art; film and video, molded into spatial expressions and juxtaposed with the presence of the own body, has been primal working material for several years for Lena Mattson and this was how the space was set up at the exhibition Beyond the surface. The formal opening of the exhibition was initiated with a curator’s talk. Immediately after the talk the lights were turned down and the performance begun. A guitarist was improvising while the artist stood in front of the spectators, her hair hanging down to conceal the face. Asked at beforehand to pick one watercolor painting that could act as “hyperlink” to the other works, she had chosen a painting of an eye, a symbol continuously used in her works. The eye painting were loaded as a texture in the Texture Painter database, which was configured as to use it while painting with a real water color brush that were enhanced with a reflector in order to be recognized by the tracking system.

I used this set-up to paint the dress worn by the artist while reading the poem “On her dress she has a body”, by Blaise Cendrars. The dress had been carefully chosen since it is made of a reflective material, which made the reflected light glitter on the walls behind. Inspired by the simultaneous dresses worn and designed by artist Sonia Délaunay, Cendrars wrote the poem. The dresses, which Délaunay called simultaneous dresses, were a play of surfaces that resonates well with the work of Lena Mattsson. Conceptually the idea was that entities gains identity through con-

Figure 82: To the far left rehearsing the performance followed by two stills from the actual performance.
trast with another. The dresses were designed with patterns of different geometrical colors and tones that juxtaposed.

The poetry reading lasted only for a couple of minutes while the artist stood still. This was met by a certain amount of wonderment from the spectators not understanding and not knowing about the underlying technology. To charge the spectator space with that feeling was also the goal. However in our experiments we have also strived for to create a common ground for discussing both art and technology and “blackboxing” technology might be part of performance but should be revealed as being “just a trick”. Therefore this part of the performance ended with the artist walking away, leaving the projection on the wall behind as “yet another rabbit from the magician’s hat”. It was clear that the act of painting was an illusion and many in the audience wanted to ask about it as well as try it out after the performance.

This part of the performance illustrated an example of how to stage the mixing a diversity of elements and materials without superimposing structural values, which has been elaborated earlier. Through contrasting surfaces a quest for a holistic depth was elaborated. The surfaces in these kinds of experiments can be material; like canvas or water color, social; like role playing or gender specific or conceptual tools for construction of meaning like the doctor’s journal or a deck of tarot cards. Anatomy, image, artefacts and architectural space are sub-components in a place making game where aesthetics, undermining the surface/depth dichotomy, are fleshed out. After the short poetry reading the guitar faded and Mattsson walked away from the spot for “painting the body on the dress” towards a table where a variety of things were laying in piles. I joined her at the table, which had a tag reader underneath. This gives possibility to use artefacts’ autonomous identity as elements in the performance. We took turns at the table, putting thing in proximity to the reader and in such a way displayed further of the work at a large scale projection directed behind and above the table. Picnic baskets and coffee cups that have been conceptual parts of works were no longer elements in a still life, but activators of the configurations of space that took place in the performance.

Traditionally objects have played a signifying element in theatrical performance since the middle of the nineteenth century. Anne Ubersfeld claims that; “Rather than blending with the background (the object) has taken on its own autonomous identity as an element of both the dramatic action and the overall meaning of the work. Its mobility permits it to become flexible and multifunctional for it ceases to be a single thing and becomes whatever the actor and the dramatic action require it to be on any given moment of the performance” (Ubersfeld 1984 in McAuley 1999, pp.170). This potential of the object increases with the mixed objects. They play
multiple roles in a language game that tried to access a plasticity of the performance space.

Again an object with the performance was to discuss art and technology and I was lucky this time. A school class that had attended the opening was at the time having a physics course building radio transceivers showed an immense interest in the RFID technology and the intense discussion raised interest from several visitors. Blending artefact body, human body, art work and the surrounding environment was an act of transforming space and Metamorphing.

A network of material connections was put into play that emerged as nodes in the performed narrative. The performances bounced of a deliberately weakly organized narrative, the goal was less to tell a story, than to explore the shifting boundaries between space and body, human or non-human, to investigate both artist body and spectator body in exploration of what’s beyond the surface of the exhibition. The basket and cup has been part of for example the video installation Breakfast for everybody which was again projected along with various watercolor paintings. Other tagged objects were for example the original painting of the eye that triggered the displaying of alternative versions and a deck of tagged tarot cards.

What kind of space is being transformed here? Gregor White writes in an article, *The extended logic of interactive performance spaces*, how traditionally the stage provides a formal structure within which the relationship between the performer and audience can be cultivated and sustained (White, 2003). He claims that the ability of the audience to rationalize the space through reproduction of internal space rather than observation of external space is fundamental to generating a meaningful event. Success of interactive performance spaces is then dependant on the ability for individuals to internalize and objectify their experience of technology as to construct meaning in the performance. If the conventions of the technology not yet have reached a state of familiarity, then there’s problem with assimilation.

Here I think the face-to-face meetings discussing both art and technology, have an important educational, but also aesthetic role to play. But still the assimilation is not a process of recognition, but a process of embodied learning of new forms of spatial logic, including the staging of objects and animation of space. White cites
Ivanov in his talk, to reflect this process of assimilation; “Any activity assumes a repeated sequence of assimilation of an object by a human actor followed by generating another object intended for being assimilated in a particular way” (Ivanov, 2001 /White, 2003). I interpret this as that a process of appropriation is more important than immediate understanding. For performance purposes it is not a focus of an objective environment but on an operational and transformable one. The issue of control and interaction is mediated by the performers who deliberately stress the mode of interaction such as painting or placing. For engaging in this mediation the feeling of wonderment is just as important as recognition and immediate understanding. Artists are skilled at creating this wonderment and the concepts of mixed objects and adaptable spaces expand the toolbox for doing it.

Victor Turner picks up the concept of liminality in his work on anthropology and performance (Turner, 1988). Liminality can be described as a passage and a “no man’s land” between the known and the potential. Typically the concept can be referred to a transitional space or state of identity, such as in initiation rites passing an individual from childhood to adulthood, or a public space for a little while turning into a site for a carnival. Fragmentation, estrangement and hybridization are all qualities put into play in liminal acts. Turner writes on the learning of metapatterns as; “Metapatterns are akin to what some calls ‘frames’, the metaphorical borders within which the facts of experience can be viewed, reflected upon and evaluated…” (Turner, 1988, pp.103) and “They are liminal, in the sense that they are suspensions of quotidian reality, occupying privileged spaces where people are allowed to think about how they think, about the terms in which they conduct their thinking, or how they feel about how they feel in everyday life” (Turner, 1988, pp.102). Focusing on the shape shifting qualities of space is to charge it with liminality in an attempt to include a wonderment of spaces and objects in order to think about them in new ways. It is a space, perhaps staged by the artist and perhaps “just” observed, but ideally assimilated, by the spectator, but it belongs to what’s between the two. The juxtapositions are not focusing on the duality of opposites but on strengthening a dialectical interaction between them.

Ending the opening night of the exhibition and the performance was concluded by integrating the surrounding space of the museum. A large projection, using one of the currently most powerful projection machinery available in Sweden, overlaid the cliffs of Bockholmen, just outside the museum. A video installation by Lena Mattsson, A Study in Scarlet, showing a face subtly moving in slow-motion was then overlooking the museum since the cliff were “facing” the museum with a narrow strait between. A slow twisting of the head and the eye slowly blinking, before a brush stroke rendered the imagery into a scarlet texture, was what could be seen
in the two minutes loop. The projection lasted for 4 hours and included not only the cliffs and the sea. The setting of the sun infused a temporal animation of the scene. As darkness grew denser, the resolution of the image and the reflections in the water was in constant transformation. As it was completely dark the projection was as clearest and the volume at the loudest. Video, nature and passing of time performed a new expression of the water color painting.

This shift of scenery could of course be described as a movement from indoors to outdoors, but the purpose of transforming the perception of images for the spectators did not simply add time and nature as elements in the art work; it aimed at specific experiences of time and space that were charged with liminality. Tuan reflects how time and space are intrinsically related (Tuan, 1977, pp.118-135). The creation of spatio-temporal structures is evident in the way we speak about time as having a certain “length”, how appointments in everyday life includes both a time and a space or in expressions such as “here and now” as opposed to a “there and then”.

Recently moving from the inner city and a flat on the highest floor with the view of a “God’s eye” to a house in the suburbs where I look at the sky from below instead altered my quotidian experience of time radically. This is easy to recognize for most. Tuan writes on different perspectives of time and space, but I would here like to mention but two; directional time and untoward events. Intentionality and activity makes for specific spatial-temporal constructs. Directional time is what is perceived when humans are driven by goals such as “I have a two hours drive to the office”. Directional time can also be related to a concept such as “oriented space”; “Historical time and oriented space are aspects of a single experience. Intention creates a spatio-temporal structure of “here is now,” “there is then.” “(Tuan, 1977, pp.129)

Many of these intentional activities are so integrated in every day life by means of the habitual that they do not generate any reflection on them, they are “ready at hand”. As oppositional Tuan puts forth the “untoward event” as what can make us reflect on experience in a similar way as when Turner talks about “thinking on the
thinking”. The space occupied by the parts of the performance, where we placed the tagged objects for displaying paintings or videos, were an operational and controllable one and the time produced was clearly a directional one. The exaggerated focus on interaction (painting, placing) aimed at stressing this. The projection on the cliff moved visitors towards “the untoward”, the undifferentiated space and time beyond human intentionality. So, even though it would be easy to say that time was inserted into the viewing on the cliff projections, time as we normally refer, directional time, to it were more observed in the inside space with focus on direction and control. It is this movement between oriented space/directional time and the untoward event that, if carefully staged, have the potential to integrate the world of self with the world of objects and events in a way that might liberate human capacities of perception and creativity from normative constraints.

Are these modes of displaying then really an issue for interaction design? Where is the computer and where is the interaction? In the chapter on methods I referred to Redström and Hallnäs and their distinction between use and presence. The discussion on presence vs. use is a beautiful formulation of where I think HCI should extend its research area. It is a matter of including large temporal spans in intimate life worlds. The concept of Slow technology, as put forth in Redström’s thesis addresses this. In his work time is a central variable. To think of computation as composing in time is to view time as form and it also implies that we can turn to film and music rather than “design-by-drawing” for inspiration.

The examples used in his thesis draws on our ability to understand and attend to very subtle changes in places for dwelling such as our homes, for example observing a barely visible pile of dust in a corner. I think this makes cases for designing some very subtle displays, which often should avoid heavy interaction. Maybe slow technology could be concerned chiefly about displays, with mechanisms for easy configuration by the end user. Another related theme in the thesis is how we could view computers as display of the execution of programs (that is programs as in running code). I think this can be achieved by spatial expressions. Maybe it’s inherent in the concept of slow technology that space & time gets tightly coupled. A second is not well fitted for a having spatial instantiation, but falling leaves in the autumn signals something different. That is actually life displaying its programme execution. And that expression is not well suited for the abstract appearance in an ordinary clock as is the second. The concrete spatial expression is natural for the larger cycle of time that is the domain for presence.

I should say that the future for pervasive computing is to treat computation as a temporal composing for spatial expressions. From the art world we can as interaction designers learn an awful lot about spatial expressions and subtle displays.
6.2 THE SUITCASE ONCE AGAIN - NOW ON STAGE

The issue of staging and carefully directing a performance utilizing interactive technologies can be rather complex and at times demanding an utterly new way of thinking about the content. While the use of tagged objects described earlier in this chapter was rather playfully developed, the preparation of the poetry readings Carrying a Load Part 1 and 2 demanded more reflection. Having writing poetry for many years and having a special focus on live readings, at times including performance, I’ve developed a strong desire to read my poems by heart, or not looking into books or paper excessively while reading. In live poetry readings different strategies for achieving this have been used for correcting the reading when memory falters, something that often happens. In the old bardic tradition that belonged to an oral culture there was an insurance about to include certain thematic units, constructing a “minimum of what should be narrated”. Details could vary during the narration. This is one strategy for preparing a reading.

What I, and many others in modern times, have complemented with is the rhythm. If you don’t remember the lines keep the rhythm steady as support for improvisations. This is similar to the way jazz musicians play solo parts. Strict meter are more and more seldom read but this is not to say that free verse lacks rhythm. Free verse often has a much accentuated rhythm that has evolved during writing and it is further accentuated during reading the poems aloud. Using mostly associative but dense language in my poems another device searched for is the node that anchors different themes. This can be a matter of rhythm but are in many cases content based or relying on other tricks such as for example metonyms. So, finding nodes and a rhythm are for me the basic platform for writing and reading poetry aloud.

Tuan reflects the use of rhythms in perceiving experiences of time and place (Tuan, 1977, pp.128-129). What he stresses is how music can negate a person’s awareness of directional time and space. Especially when synchronized with body movements, or in the case of live poetry body movements and the read words, musical rhythm cancels the sense of one’s own purposeful actions. As an example he brings forth how soldiers marching to military music tend to forget their weariness and also an eventual goal which might include their death. A dramatic and compelling example, but I think the argumentation is valid for poetry performances as well.

In my performances with Lena Mattsson the poem “The rememberer’s interface” was chosen since it relates to thematic issues in the exhibitions “Diagnoses” and
“Beyond the Surface”. The first occasion was a first try on performing the poetry reading. An explicit goal was to see how we could link our individual parts of the performance through use of tagged objects. The set-up consisted for the poetry reading consisted of two suitcases positioned in front of each other. One was hiding the projector with just the lens sticking out. The other suitcase was opened and the surface displayed the imagery from the projector. This suitcase was half-packed and concealing a pair of loudspeakers for the sound output. Concealed was also the tag reader and each object that were packed into the suitcase had to be brought in proximity to the reader for recognition of the tags. This movement was rather easily achieved as a natural act of “packing the suitcase”. Next to the suitcase was a pile of clothes and things that were all tagged carrying links either to sound files or images. While the images were the works of Lena Mattsson, the sounds were half-minute loops sampled or edited by myself, but also from the sound artist Son of Clay. The scheme was to trigger images first and afterwards sounds, so that there was always an image displayed with the sound played “on top.” Next to this set-up was an ordinary table used by Mattsson for sketching a variety of sketches. The performance started with Lena Mattsson doing sketches of eyes on ordinary paper. As she disliked all of them they were crumpled and thrown on the floor before the audience.

While doing the last sketch she switched to using the texture painter which displayed the evolving sketch on the suitcase display. Again it was thrown on the floor; or rather an at-beforehand tagged and sketched copy was thrown. This was picked up by me who walked into the room. I looked at it and packed it in the suitcase, which was an event that triggered the displaying of a photo of the “model eye”. Then, the poetry reading immediately begun. This tagged sketch was what linked the two parts together conceptually. It also introduced the multiple representations of the eye as special metaphors in the exhibition.

Including multimedia as explicit elements, which could be controlled during the reading, provided an extension of the rhythm. I could now use digital imagery and sound as integrated parts of the reading. This also provided me with a set of nodes for how the spectators accessed the poem. The nodes and rhythms were the multimedia content, but most important was how the objects and the embodied act of packing them into the suitcase played these roles. They were not only actants in a Latourian sense, they were actual actors in the performance. This put multimodal perception instead of reading/listening as most important for experiencing the poems. I believe firmly in how a totality of experience includes all, or at least several,
senses as well as an active and reflective mind. Again, we stayed in the performance space to discuss content as well as means with the visitors, who also could try the set-up for themselves. I think this mode of face-to-face discussions is a kind of interaction that could be supported, but never easily replaced, by technology.

The poetry reading was repeated in an improved version at the exhibition “Mirror, mirror” which now included the theme of mirroring and reflective visions of the self – a theme that was to be integrated in the poetry reading. An explicit goal this time was also to work a bit more with the coupling between the tagged objects and the media output. The first experiment was well received by the spectator’s but several had problems with understanding the logic in the performance. Earlier in this chapter I reflected the process of assimilation of the performance by the spectators. My idea was simply to provide a tighter coupling between objects and output in the beginning, repeating the sequence for a couple of times. For example packing a pair of shoes triggered the playing of a sound of shoes sharply echoing on a wooden floor while walking away into the distance or an alarm clock triggering the sound of a clock. This type of tight coupling, I think created an opportunity for assimilation and understanding of the patterns of interaction. The suitcase became an “everyday object”-computer with facilities for output as well as input and it created a temporary sub space within the gallery space. Furthermore it provided possibilities to shift from the tight coupling, focusing on the interaction and directional time-space, to more loose couplings between object and output, going more in the direction of the “untoward event” and undifferentiated space.

This I think is one strategy to support a Metamorphing process residing at the spectator’s side of the performance. Here the objects were both easily recognized, such as ordinary things that usually are packed into suitcases, and as well more abstract devices for traveling such as maps or photographic memories. They were also mixed with more symbolically charged objects such as Crowley’s Book of the law. Reflecting the intertwining of time and space as previously referred, this was to me as performer an issue of making time visible as a rhythm in space, not punctuating or in milliseconds measuring time but spreading out in space.
Ending the performance was the “mirroring part”. This was done by two simple placings of objects. I packed a shirt which triggered the displaying of me packing the suitcase. While I read the line “If I will live for another hundred years, how will I then imagine the measuring of time” I packed an alarm clock into the suitcase. This triggered displaying an image of myself reading the poem. Packing the final object triggered the playing of a sound file of a released record, edited down to the final verse of the poem. I then walked out of the room (before re-entering for the usual discussions). An image of the poet in the suitcase and a recorded voice from the suitcase concluded the reading.

I have here tried to elaborate how Metamorphing can take place in artistic work and performance through the use of mixed objects and the notion of adaptable intermediary spaces, which I believe is my contribution to the discourse referred in the chapter. Different from the case of hand surgery, but actually not very unlike the case of design work, the scientific approach have differed. Not having done any field studies, such as in the other cases, I have here used the perspective of the artist-designer and the artefacts as such are constructs the arguments. Also lacking are forms of evaluation; a freedom I’ve taken, replacing it with engagement in the process and face-to-face meetings with visitors. Not having written much new poetry since the performances described here, I think that the performances have provided me with a new way of thinking on how to write poetry, focusing as before on finding nodes and rhythm, but now with an extended and different view. Starting from how contemporary art have been driven by a desire to “come out of the frame” I’ve used the concepts of remediation, liminality and some reflections mostly from Tuan as vehicles to elaborate a picture of artistic work that works with a play with, and diversity of, materials, formats and expressions. The experiments with an artist, Lena Mattsson, are my practical contribution to the field in the way they illustrate how the performances must be carefully staged and directed. In the final epilogue I will try to draw some concluding lines on the different cases and my view on how interaction design can support what I’ve termed Metamorphing.
I have tried to articulate the concept of Metamorphing while moving between some different practices of creativity and learning. As the focus on creativity and learning has become explicit as interaction with others, this has meant that communication also has been an important activity in the interplay. The enterprise has not aimed at illustrating originality through an uncommon phrasing. It has been my way of, not unifying but rather making a meaningful relationship between the diverse stories through articulating what can be said about some of the prototypes. The prototypes play an essential role in the stories and I have propagated for and tried to apply a stance of design oriented research as described in chapter two.

As should’ve become clear by now this does not imply that they are to be studied as a machinery par excellence floating around in nowhere. Fundamental for me have been to override traditional subject-object ontology in where artefacts and technology are simple means and tools for achieving a rational goal, at beforehand known and defined by a human actor. Inspired by constructivist and phenomenological approaches I have tried to look at how human action is co-shaped with artefacts and technology as we perform specific tasks or simply go on about our living and making sense of the world.

The overall umbrella Metamorphing have been used to investigate an act of web building around certain themes present in design work, patient learning and
artistic work. This process has been narrated as different arrangement of actants, human and non-human, and it has been observed that people are skilled in such arrangement whether computers are being present or not. I have been looking at how computational artefacts can play a role in this. These artefacts provide a special case of study but are not separated from “analogue Metamorphing”. On the contrary it implies that these artefacts most often must find their place within existing ecologies of already existing artefacts and human actors. This calls for explorations of how people interact with the objects and spaces that constitute such important resources in creative practices.

Being designers we should also reflect how our design have potential to transform practice and how it can be “lived” in quite another way. Not that we always want to fuse such paradigmatic interventions, but we must look at possibilities for innovation and reflect to what extent we really want to provide them to practitioners, and in the end it is up to people to make use of our design or not, and in any way they want. As designers we don’t create use, but we offer possibilities of acting in the situations of use and I have tried to show especially how we can enrich the performance of objects and spaces through tangible interaction with digital media in a way that makes the objects and spaces even more “mixed”. I have called this design perspective a process of understanding and transforming.

7.1 REFLECTING SOME CORNERSTONES

A colleague of mine, Tomas Sokoler, have been using a triangulation of enabling technologies, ideas on interaction and domains of use as a kind of framework for performing and talking about interaction design projects, and in the middle stands the process of prototyping (Sokoler, 2004, pp. 49-53).

Figure 92: A possible matrix for some final words.
It is similar to my view and I like the phrasing of technologies as enabling and the focus on the possible space of interaction. If we add to this my perspective of transforming and possibly innovative aspects of changed practices, or rather divide the use domain pillar into understanding and transforming, we have a picture looking like the one below. I would like to conclude this thesis by giving some brief reflections to each of the cornerstones in that picture.

\subsection*{7.1.2 Technology}

Technology is actually not an adequate phrasing since my focus has been on interaction with technology. I cling to the word since I find it important for the field of interaction design to stick to computation as one of the material of choice. The discipline needs distinctions towards other fields of design just as it needs a strong design discourse distinguishing it from pure engineering or computer science approaches. We are adding to the body of technological devices, but they are not themselves our focus of interest. They are enabling technological artefacts. However, in designing the artefacts basically any combination of materials is within imaginary reach.

Still, thinking in terms of technology makes sense. Considering the emerging character of use and my focus on the temporary alliance of humans and things, it seems extremely relevant for designers to twist and turn the materials of design in situated engagement. The prototypes described are things, not only when we use them, but also in themselves; they are combinatory effects of fragmented parts. If we look upon them only as form and use we will miss how they could have been different.

The genealogy of Cowall, as described in chapter three, illustrates this. The parallel work of building a good demonstrator and supplying embodied examples of interaction patterns to the students worked and supported the students in appropriating a portion of the Cowall turning it into a “Refrigerator poetry” installation. There was however a severe, but as it turned out creative, constraint to overcome in doing this. As the database was a multimedia database there were no implementation for using text files except as meta descriptors. The work-around was to put the words in the database as jpgs.

This in its turn craved for providing several (software) displays, one for each word, to combine into sentences or lines. After the fridge poetry installation we started playing with playing videos in the new array of displays, displaying as much as thirty videos at time, which was still a feature some years ago for ordinary processors. When we combined this with the tracking system the Tracking Game Table eventually arose. The movement from Cowall to the Tracking Game Table via the
Refrigerator Poetry could not have been achieved without the lustful exploration of the openness of the technologies of tracking and tagging. Neither if we have been interested only in form and use, disregarding the technological aspects. It is apparent that a promising future for computer applications relies on stripping bare the components, constructing through de-construction and vice versa. Especially if we want to approach the process of appropriation in use and make “design for design” as when humans configure and instantiates design during use time, we must understand technology as a technology of components. This is a form of Metamorphing as moving components around, exploring their boundaries in any direction.

Having said this, I want to return to the issue of formgiving, now commenting on the issues of interaction and especially tangibility. Research on tangible interaction is by now quite mature and the examples in this thesis are by no means extra ordinary. Research in HCI and CSCW are also full of analysis of what we might achieve through tangible interaction. Most issues observed in my research also can be found elsewhere. In design work it was quite clear how tangible aspects supported collaboration quite differently from working with workstations and ordinary displays (yes, I do regard typing and mouse clicking as tangible interaction, but...). It provided flexible ways of working, distributing the ownership of media and access to it such as described in several examples in chapter three and four.

Many reports on tangibility address embodiment and how we can extend human capabilities beyond visual perception. This can be motivated in design work by students in similar arguments as those of “engaged conversation with materials”. Experiencing issues of scale and space and having the body as starting point as a complement to design-by-sketching is a fine way of working. You explore the boundaries and possibilities of the material and approach design as design of possibilities in spaces and situations rather than as applications. Also I observed a creative act of projecting on surfaces instead of through hardware displays that provides means for true integration of media and space.

Noticeable is also how tangibility adds to an increased and extended visuality; the peripherally visible and the visible periphery, which I think is one way of re-strengthening Weiser’s original vision. Tangible interaction supports being peripherally aware of the activity of others just as it permits letting others be peripherally aware of your own activity. They are options that in many cases will be wanted and in other cases to be disregarded and shunned.

Apparently, complexity of technology also is the reason to many deviances from Weiser’s vision of the computer moving gently between background and foreground. The devices and technology used is often extremely attention craving. An obvious strategy is to through formgiving merge computation with everyday objects
and spaces. In the thesis there have been many examples of mixed objects, illustrating a variety of complexity. Some, like the game cards, have been especially produced for a specific activity. Others, like the map with barcodes and similar examples, have piggybacked on a known form, infusing yet other mediations to it. In yet other cases, such as for example when the texture painter was applied to white models, we can see a more integrated object emerge where there is a degree of mutual dependency of the digital and the material and where the temporal and ephemeral character is typical. In those cases memory, to speak the language of the human actant, or state saving, to speak the language of the technological actant, arise as crucial. Interestingly enough the save function was less used in favor of simply taking a photograph. People find their ways and it is good to provide alternative options. In the case of “packing the suitcase” in the poetry reading completely ordinary objects such as shoes and shirts were used since that was appropriate for that situation. Much of this point to the relevance of providing means for producing the objects rather than providing the objects themselves. Many of the examples in this book relied on hard-coding and substantial efforts and I see a future in work on simple interfaces for doing this.

The “docking station”, described in chapter five, is of another character. It is not triggering the playing of media (even though it is distributing a video stream), but provides a “mixedness” of quite another kind. The prototype illustrates an idea of accessing different parts in the life cycle of digital media by tangible interaction. A world of increasing complexity is an issue of concern in relation to the visions of the so called “internet of things”. As things are more and more having capabilities of communicating with other things, the state of affairs is well expressing some of the dimensions of Metamorphing. By entanglement with each other they come to exhibit a broad range of behaviors and functionality, far beyond the capabilities of single devices and artefacts. While I have tried to stress the intertwining of humans and artefacts that can be observed in human activity and how action often concerns the use of interdependent things, this interdependency will become even more obvious in the following years on a very pragmatic level.

It seems as our life will be more explicitly concerned with the use of, more or less temporary, assemblies of artefacts and services, of which many will be of an immaterial character. High are the hopes for the potential in scenarios where cars are communicating with homes, devices from workplaces sharing data with personal non-work related devices, people connecting to publicly available services while being on the move etc. The connectivity between computational things is conditional in these scenarios and a variety of wireless options is available. Though still having further ground to gain in the areas of bandwidth, device identification, resource
and contingency management, to name just a couple, the research is rapidly becoming more competent. But issues of users' understanding and perception of wireless networking is still in its cradle.

The “docking station” is an example of the personal handheld device, the PDA, accessing a central resource, a high resolution camera, performing a task in combination. A third mediating device, such as the “docking station” is strictly not needed. But it provides an interesting model of interaction that approaches dimensions of hybridism in a couple of aspects. Firstly it signals in a rather explicit way the temporary alliance of the PDA and the camera. It thus also provides a suitable visibility surface for the connection between them. While it shows how one device has potential for being something quite different, it also poses questions such as on what device feedback should reside.

Furthermore the prototype addresses interactive inter-human communication in two ways. The interface is shared between the therapist and the patient, actually enforcing a shared decision making. In their communication the interaction with the PDAs, “docking station” and camera provides a rhythm; “Now we will make the recording”. It also provides a visual clue to the surrounding environment; “Those two are making a recording”. The value of this second sort of visibility will be different from context to context, but surely there will be situations where we tacitly rely on knowing what others are doing. Finally, the prototype illustrates a model of hybrid interaction. It adheres to a visible trend in manipulating the body of the device in contrast to a completely GUI based interaction. It does so, but just in steps. Once the PDAs are placed in the “docking station” their graphical interfaces changes and provides access to a stripped, less distracting, set of options. Those are accessible through very simple actions since the only available choice is a button that fills most part of the screen. By lifting one of the PDAs from the “docking station” the circuit is broken. I think these kinds of interaction, mixing tangible and accommodated screen based interaction are an interesting way to go for the visions of the internet of things. I also think that the idea of physical mediators might be a valid strategy in many cases when it comes to providing understanding of wireless connectivity.

7.1.3 Understanding and transforming

Serious field studies have been foundational for my research. It is fair to say that I have also been motivated by a fascination for the design material, such as the RFID technology, and also that a more lust driven engagement sparkled the performance projects described in chapter six. However, both the ATELIER and the Palcom
project commenced with hundreds of hours of observation, interviews, video recordings and the thereafter following analysis. In both cases participatory events together with students, health care staff and patients have been staged throughout the projects. Initially carried out because as a fresh PhD student I thought that research should start with empirically based gathering of data, the processes have been rewarding far beyond that initial assumption. I have not in this thesis reported extensively of the field studies, but each of them carried some findings that could have been a focus of yet further analysis. But my interest has not been the studies in themselves, but how they have a place in a process that rather evolves around design, prototyping activities and possible future ways of working. Their place within these processes can be motivated from several perspectives.

Firstly I do believe that, if properly performed, field studies are generative for design even if there is no one-to-one relationship. Considering how the social is ordered, not only by conscious intentionality but also in emerging and improvisational behavior, communication and use of artefacts and spaces, especially ethnographically inspired methods for conducting studies within practice are helpful. They can help us to understand how actions are taking place within a larger context of ongoing activity which is most often of a practical nature. This helps to pinpoint ways of Metamorphing such as it is already carried out by practitioners and grounds ideas of how it-support and material design might extend the capabilities.

One aspect is how the design can take a place within an already existing ecology of artefacts, tools and services. For me it has been a matter of extracting more general themes from our observations of practice that are open for innovative change and negotiation together with users. For example, while studying the work of design students, the formulation of themes such as “A diversity of representations” and “Connecting and augmenting (to sites and the representations of the sites)” was what helped us in the project to start talking about Metamorphing in design. Analyzing the studies and making representations of them in the form of themes, selections of videos, transcriptions or written papers or reports have many folded meanings. One is how it sparks and inspires ideas within the core design group.

Another, equally important, is the collective fostering of understanding the possibilities for change that lingers in the foot trails of the design. This is actually most important for the practitioners themselves, but an issue where the designers take responsibility in setting up “language games” of design, in where the effort is a collective one, shared between users and designers. These “language games” of design can take the shape of the previously reported design games or “Future Laboratories” together with users. What is required is to produce open ended representations of work, that can both inform and challenge, and open artefacts such as for
example lo-fi mock-ups that can be used for embodied enactment of the not yet existing design along with open forms of communication of what practice is and how it might change. Methods from participatory design fuels these processes, not only through informing design, but also in deliberating imagination in users. I would like to repeat a previously mentioned argument inspired from action science on the kind of knowledge produced. The knowledge achieved should be relevant also for forming purposes just as much as achieving purposes already formed. In doing this, forming of purposes, the actor also enacts values. Answering the question “What shall I do?” gives rise to formulating an intentionality that might be congruent with the existing or it might express a deviation from the current normative of practice. (Argyris et al., 1985, pp. 36-37).

So, field studies and participatory methods is one way of letting issues of use be present throughout the research, not just as initial information gathering. The diversity of domains, design, hand surgery and artistic work have provided, as I think about it, a richer, if slightly messier, story. It have provided a way of moving not only concepts, but also the objects as such, making possible to see what kind of different expressions they might take on in another setting. It is a way of reporting design that focuses on appropriation and acts of Metamorphing and thus giving a larger focus to use as opposed to the technology itself.

Concerning the possible transformations of practice; are there any implications? I think there are some possible, if not yet taken, creative leaps to be made if so wanted. The focus on design as Metamorphing, as described in chapter four and three, is a pragmatic and phenomenological perspective on how design work is actually carried out and a different take on the process than “design-as-problem-solving”. I find that the notion of mixed objects and strategies for adapting space in design work bears significance that I hope to explore further in the future. Considering the work with patient learning and empowerment, as described in chapter five, as well as therapeutically issues in using digital media as part of rehabilitation, we can also observe possibly new ways of “enacting” rehabilitation.

Firstly, the ideas are put into play on a conceptual as well as pragmatic level at the clinic and are appreciated among staff and patients. Secondly, the concept of collaborative articulation, which is performed through joint use of a technological artefact (the docking station), is a strong deviance from traditional staff/patient hierarchies, opening up for a larger degree of patient participation and engagement. It has also opened eyes at the clinic for possibilities of patients using mobile phones for receiving information during face to face meetings and for the staff how they can use their mobile phones for handling digital media of relevance for their work.
We can also observe a more general theme of accessing central resources with personally owned handhelds through mediation of physical nodes that can have implications for many settings outside of the health care domain. When moving to the domain of art, as described in chapter six, we can observe new ways of integrating an extended network, underlying the final pieces, in the exhibition. Especially, that can be achieved through the presence of material objects as actors in an exhibition. For me, the idea of integrating those actors in poetry readings and how that provides a new kind of rhythm is a theme that will be explored further. I also find that interaction designers can learn from artists’ skills in using different strategies for projections on a variety surfaces as well as using multiple “fragmented” displays.

7.1.4 Reflection

I have explored how interactive technologies and digital media can be used as transformative mediators and tools. Not mere tools that is, but actually playing a very active role in how human action is co-shaped together with artefacts and technology. They have been discussed as having potential to strengthen and enrich the experience of different transformations that have been discussed as being important for practices of creativity and learning, where the engagement and relationship to processes of change is fundamental. These kinds of processes are characteristic for all the three domains that have together formed my story of design and use. Fundamental elements in the story have been the flexibility of digital media and how forms for tangible interaction constitute a platform for collaborative practices.

What has emerged is how we as designers can support the performativity of objects and spaces, not really focusing what they do or what they mean as signs or carriers of symbolic qualities, but rather on how we can stage situations where people can engage in direct interaction with them and then observe what patterns of possibilities that evolves. From this perspective, and through means of embodied interaction, the mediating role of artefacts and configured spaces is not characterized as one of representation; it is taking place and is happening. Metamorphing have been used for articulating how that role is happening as a way of dealing with the heterogeneity and multiplicity of objects and space and interaction design have been discussed as support for connecting the multiplicities and how we configure them in relation each other.

I’ve put forth many examples of Metamorphing on objects and space, hybridizing material properties with digital media. Characteristic for all of them are a distinct degree of participatory creation in use. They are designed but can only be experienced as one interacts with them. Examples of spatial Metamorphing in-
cludes how design students engaged in embodied sketching in media spaces. This was complemented with going back and forth between enactment, representative work and collaborative negotiation of ideas. Practical arrangements like the grid, the lighting facilities and presence of lots of material as well as projectors helped to adapt the space in relation to the activities carried out. Transforming the space for fitting the doings is of course a common trait in any practice, but mixing media with physical space creates lots of opportunities. In several cases we can also observe how space transformations are not only an issue of “fitting”, unifying space and activity, but also a process of dispersing present space in order to imagine it differently. This is common in many design activities related to re-programming, starting in the familiar diverging fragments until it can be experienced as something new.

This becomes most clear in artistic work where the “untoward” event is the searched for and wanted space, residing in the in-between and the deliberating reflections you might take on there. Metamorphing can be convergence in the making of a web, but also rupturing and opening. Artistic work also showcases a variety of means for projecting onto natural surfaces and objects, creating ephemeral experiences of sculptural displays. One example is the projection on the cliff, which included the passage of time. Another issue observed, is how the configuring of objects in space creates distinct situations, such as in the use of Cowall and the shared model, which was an example of connecting to another space, the Central station. The use of the shared model was part of a rather special representative spatial practice, where a large group of designers collected, made input to and retrieved around a physical object. The docking station illustrated how configuring of objects in space creates awareness of others sharing the space and how it provides rhythms in joint actions.

Examples of Metamorphing on objects have also been varied. We could see how the architectural model no longer was only a white model, how maps no longer were isolated representations but contained further sets of links for the web building and how basically any object was possible for including in production of further “mixed objects”. The “possibilities for becoming anything” also stresses how we in the design of these objects, not only can think of them as bundles of functionality, but how we must reflect the design of them as material artefacts. Another design consequence is how we must reflect how they are integrated in the existing world of objects and spaces. We can no longer afford to think of design objects in isolation.

One example is how we did not create new specific objects for the art exhibition, but rather tried to augment the already existing and known, such as sketches, objects from older performances or the very body of the artist. The design games
and the cards used illustrates how the objects, the game cards, are not the interest as such but how they are part of staging meaningful activities, gathering human actors around things of different meaning and even conflicts of interest. The design games also showed how technology changes pre-conditions for performing tasks. The pattern of “place one thing-play one media”, reported in appendix three, was overridden in the Tracking Game Table, reported in chapter two. It became possible to simultaneously play and manipulate a variety of files that made for quite another kind of game.

Metamorphing have also been used as a story device in this thesis. It was articulated in the diverse stories, helping to make one coherent story of them. The narrative nature of the accounts helped in accompanying context with general examples of tangible interaction and to some extent supported revealing a rhizome of design, such as how there was a clear relationship between the Cowall, the Refrigerator Poetry installation and the Tracking Game Table. This relationship would hardly be visible if they were to be described in isolation and stresses how we can look at technology as building blocks as opposed to monolithic artefacts.

Moving between different domains made the story richer, focusing on use and appropriation not on technology itself, and also illustrated how the same objects gain different form in different domains. The transferability has been a kind of evaluation of the concepts. Initially I had hopes for observing the emergence of specific design patterns when moving between the domains. The movement didn’t perhaps give a clear set of patterns but articulated processes of configuring of the design object. Still, some patterns are recognizable and some of the examples in the thesis can be related to some patterns expressed by Löwgren (Löwgren, 2005);

- Virtual information is tied to places in the material world. (Place specific tags and barcodes)

- Material objects are tokens of virtual information. (Cowall)

- Virtual information forms objects in the material world. (Texture painter, docking station)

- Material object qualities shape interaction qualities. (Docking station)
Virtual information and functions are limited to certain times.

(Cliff projection)

All the examples in combination with the evolving stories have formed answers to the initial research question. How the direct engagement with material artefacts and physical space constitutes powerful resources and how the sharing and joint enactment of these resources creates processes of collaborative meaning making evolved as answers to the question on what the driving forces are in creative environments. This craves for a performativity of objects and spaces that can be enriched through computational resources and the mixed objects and configured hybrid spaces, which are numerous in the thesis, are embodied examples thereof.

They provide a way of integrating the parallel work with material objects and digital media within the same artefact. If carefully designed also as a material object, interacting with it is one way of moving between the divide of formats in a meaningful way. In almost all the examples it is a matter of rather explicit and tangible interaction, which I find suitable for collaborative practices. The practices are not only dependent on ongoing material processes. They are also spatial practices, utilizing the multiplicity of space as a resource. While artists have developed a subtle sensibility for space transformations I find that sensibility being a highly needed focus of training also for students of interaction design. That is because if our designs relates to this performativity of objects (or space) we will stage so distinct situations that they will be hardly differentiated from space itself. In my examples there is a pervasive presence of a ubiquity of digital media that is a powerful possible allied when engaging in space transformations.

The docking station is one example of how we can access this ubiquity and the notion of landscapes of physical nodes for activity based services is to me a promising strategy. It has also been shown how different material forms part of a cross referencing over time which are part of the experience of the designer or artist. In the performances and exhibitions the use of mixed objects showed how the material could be part of the experience of the user/visitor-spectator as well.

I have tried to show how human activity is not only affected by, but is actually co-shaped by properties of artefacts and technologies. As an implication, it emerges in the meetings between people and things different programs for action, rather than a picture of human activity as driven by intentionality and rational acting. That people interacts with the world and that they affect each other while doing it, is an underlying ontology for the concept of Metamorphing. However, in my attempts to apply ANT, especially through Latour’s concept of mediations, I have also tried
to approach a position where humans and the material reality do not only affect each other, but actually constitute each other. That is not unproblematic and if this had been a thesis in philosophy I would surely had been expected to give a fuller answer than I now am able to. To late to use in my writing I came across a fine book by Peter-Paul Verbeek, “What things do”, which elaborates a standpoint of post-phenomenology and the role of artefacts in material culture (Verbeek, 2005). He actually takes on a similar take on dispersing the subject-object ontology as I've done myself. In a review of the book, Albert Borgman criticizes the position;” For assume the constitution of a person is resolvable into its constituents, i.e., into its subjective and objective elements. Then we are back in some sort of realism. Or assume the constitution is not analyzable into its elements. Then it is invisible as a constitution and no longer properly so called” (Borgman, 2005).

I do not solve this, but a focus on Metamorphing as it is taking place and something different than mediations and transformations is one possibility of studying the in-between. Borgman himself talks about commodities, such as “warmth-by-central-heating”, which makes warmth instantaneously available, and focal things that draws together human involvement and act as a centre for it such as for example a fire place, which requires substantial efforts from a whole collective. The availability in the case of central heating comes with a price; the detachment from context and a move from participation to consumption. Devices like central heating depend on distributing participation to machinery. Pipes and radiators replace the laborious work with chopping wood, drying it and the necessity for keeping the fire alive. Most of us gladly conforms to this state of affairs and do not miss chit-chatting with the coal delivery man. Still, this does not have to imply a process of disengagement.

I have in this thesis not approached interaction design as a discipline of constructing systems of information, but rather as one of exploring possible interaction with material and actual things and spaces. We can study the mediations of technology and the concrete interventions they make in our lives from a designer’s perspective. I find that the mixed objects I’ve put forth carry conditions to be “focal things” more than is usually attached to technology. The reasons are that they can also be everyday objects, the double character of physical/digital permits them to be used in different ways even without the digital properties. If the machinery goes down they will still have persistence in the world through their material participation in it. They are also fully created trough interaction with them, which can well be coupled to engagement and experience. The concept of appropriation is an inherent part of
the design. Likewise the different spatial configurations that have been embodied examples of adaptation depend on users engaging in their transformations.

While searching for the ending lines, my background as a poet might be supportive. I do not anymore remember the actual poem or by whom it was written, which sparked my fascination for poetry. It did something to my experience of the world that nothing else had so forth done and it constituted a language which was that nothing else was. The poem, which might have been written by the French poet Eugène Guillevic, went something like;” The cupboard was made of oak and was not open.......Many dead, much bread”. The citation is probably incorrect and one or two lines are missing, but that is what I now remember. What was happening for me was that I experienced something invisible and endless within the realms of the direct and graspable. When I looked up from the book and viewed my room anew, the things carried possibilities of being something different. Apart from the richness of possible variations I was also stricken by how my very relation to these concrete things was a reasonable way of thinking about what we often talks about as our “inner lives”.

The experiential way of looking at life works just as fine as thinking in terms of an inner life. This element of surprise and recognition of novelties in familiar things has become a huge subject of joy in my life. Be they messy wunderkammers, cupboards of oaks, PDAs or maps with barcodes; if carefully designed the use of them can make them possible subjects for engagement. I do not want to end in a religious appraisal of design as a discipline. Therefore I want to again stress that the examples in this book have taken their starting point in what I have seen evolve as practices that are carried out in the world as material practices. The prototypes are simple things and means of adjusting space, meant to support experiencing different processes of change. The tangible ways of performing them makes them suitable for collaborative experiences of event like situations. The flexibility of digital media makes them suitable as transformative devices and transformed they will be as they enter into new relations and interaction with other humans and networks of other things and spaces.
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APPENDICE 1

EMBODIED INTERACTION – DESIGNING BEYOND THE PHYSICAL-DIGITAL DIVIDE.

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Published in proceedings of Future Ground – Design Research Society’s International Conference, in Melbourne, Australia 2004
Introduction

Functionally and aesthetically well designed tables and chairs, ergonomically crafted workspaces and on top of this a black static digital screen – no integration and definitely no interaction. At the same time a graphic display with human-computer interaction via a desktop metaphor according to at that time novel principles of direct manipulation and ‘you see what you get’ – a digital world of its own metaphorically mapping the physical world, but no integration with the physical product design. This was our first encounter between product design and human-computer interaction in the early 1980. It happened in the UTOPIA project where systems designers and product designers collaboratively designed a system for page-make up and image processing for newspaper production based on the ideas of digital tools for skilled work [5].

The physical world and the digital were wide apart. Much has happened during the two decades that has passed since in bridging the physical-digital divide and in our understanding of the design of computational things, especially with the emerging discipline of interaction design merging human-computer interaction with product design, graphic design and other design disciplines. In this paper we will reflect upon this development with a focus on strategies for design beyond the physical-digital divide. The main thrust of our argument will be that design – physical as well as digital – always is about designing for things that make sense as claimed by product designer Klaus Krippendorf [8] or the creation, manipulation, and sharing of meaning through engaged interaction with artefacts in the words of system designer Paul Dourish [4]. Here we will however in particular and conceptually deal with a new kind of emerging ‘mixed’ objects and places uniting spatial aspects of physical things with temporal aspects of computation and exemplifying with how we have encountered this in ATELIER, a current research project on design of physical digital studio environments for architecture and interaction design students.

Ubiquitous computing and the paradox of Demassification

The design for ‘mixed’ objects and places that we have in mind should be seen against the technological vision formulated by Mark Weiser in his significant 1991 paper The Computer for the 21’st century were he introduced the concept of ubiquitous computing and the idea of designing digital technology as an integral part of human activities in our physical surroundings [13]. This was an idea very much in contrast both to the isolated desktop computer ‘world’ as well as the dualist idea of
a second ‘virtual reality’ and formulated a research program that came to include ideas like augmented reality, tangible user interfaces and information appliances. In the ATELIER project we have designed for such ‘mixed’ environments integrating architectural elements like spatial grids, light and different physical ‘display’ materials with digital technologies especially tagged objects and different kinds of projections in the environment as resources for design students. In this paper we will, however, take a step back in reflecting upon strategies for designing beyond the physical-digital divide starting with the paradox of demassification. This expression was used by John S. Brown and Paul Dugid in a paper already in 1994 [2]. What they pointed at is how digital technology and new media introduces new material and social conditions for the design of artefacts. Demassification concerns the physical or material change – artefacts literary lose mass and can be distributed and accessed globally.

Think of a digital book or a library. But there is also a social or contextual demassification. This concerns the possibility to customize and make individual copies of digital artefacts - a loss of mass in the meaning of a mass medium. Again think of a personalized version of the book or the digital library. Why is this a design problem? Is it not just great with totally mobile and individualized artefacts? As Brown and Dugid suggest with their paradox of demassification this is achieved at the prize of lost intertwined physical and social experiences of the artefacts. The physical demassification deprives the artefact of material ‘border resources’ for shared interpretation. The cover of the book may not be decisive for the content, but its shape, texture, weight and not least ‘wear and tear’ may still be an important aspect of its ‘bookness’ and how we experience it as a book. These ‘border resources’ are lost when every digital copy gets its own form, and hence a relatively established source for interpretation dissolves.

Entangled with this, and adding to the problem of lost physical mass, is the social demassification. The individualized versions of a digital artefact, reaching only a few persons, underline the loss of shared ‘border resources’ by jeopardizing a relatively stable contextual sources for shared interpretations within a community. It seems that a feasible design strategy must find ways to counter this loss of mass. This challenge is in line with the perspective of embodied interaction and the understanding that we today have to design digital technology for interaction that is both more tangible and more social.
Embodiment and embodied interaction

Augmenting spaces and artifacts is about how the augmentations can support shared understanding and meaning around social activities taking place in different contexts. These environments are not constrained to workspaces, but are reaching into public spaces and spaces for living. A challenge for design beyond the physical-digital divide is to integrate computation with existing artifacts, physical space and the social meaning-making taking place in the environment.

To deal with this challenge Paul Dourish introduced the stance of embodied interaction. This stance is grounded in the phenomenological tradition, focusing on the phenomenon of experience. To get to the truth of matters requires describing phenomenon as they appear to the experiencer. A meal is not bread on a table – it’s also the hands weary of a full day’s work dropping the knife, the children telling stories from school, the remembrance of youth in the taste of an old time recipe and so forth. Our everyday life-world just as work practice consists of these concreteness and calls for collecting the paradoxes and complexity of life worlds rather than unifying them in abstractions. While abstraction and generating overview applicable for manipulation in temporal structures seems to be one of the foremost strengths of computation and digital media, it is evident that there’s more to users than being information processing systems. The relation between information and knowledge is one example of how meaning is not inherent in information, but made meaningful through direct participation in the world.

An important facet of Dourish definition is how ‘embodied interaction is the creation, manipulation, and sharing of meaning through engaged interaction with artefacts’ [4]. A shift towards embodied interaction is motivated by the recognition that to incorporate even further human skills requires moving computation ‘out of the box’ and ‘into our environments’. Embodied interaction starts from the observation that computing is getting both more tangible and more social. More tangible in the sense that radically new kinds of digital artefacts are emerging beyond the desktop computer, deliberately amalgamating interactive qualities of physical objects with computational qualities, augmenting papers, pens, toys and all kinds of everyday objects. Computers are more and more becoming embodied as embedded aspects in our experience of our everyday environment. More social in the sense that the embeddedness of artefacts in social practice, community, place and situatedness, beyond the disembodied human-computer interface, is coming more and more into focus. Meaning is found rather in the world than in thinking and that meaning (for example what we understand about digital media) is created by involvement with objects in the world.
While the founders of the phenomenological tradition, Husserl and Heidegger, did not focus especially on the role of the body in this involvement that was maybe the most important issue for Maurice Merleau-Ponty [10]. To him humans are embodied subjects, having a body is the medium for having a world. We describe things in relation to our bodies (this is a big city, the streets are crowded... ) and we acquire skills in relation to our bodily capacities. This is a perspective that differs from “disembodied” use of computers and interactive systems. If the body is central for perception, we are as designers of digital artefacts required to extend the landscape for experiencing and interacting with them. By recognizing the complex interplay between bodies, artefacts, space and human activity, we also recognize that space as such is not a static element which is just there. Space is dynamic, constantly changing in relation to activities taking place, not only there to be perceived, but a place for bodies to perform. In Performative aspects of space are valuable complements to more abstract models of representation. One example from the ATELIER projects is how interaction design students approached the design of an interactive installation at the Central Station in Malmö. Shifting between 3D drawings, sketches and embodied enactment, they gradually narrowed down their concept. Actually starting out from enacting with different zones of light and ambient sound sources they made a 3D model of their installation. The students’ way of working commenced with performing with the body and then got into sketching. Very often the traditional working mode is the opposite, starting out with for example sketching. An acknowledgement of embodiment affects heavily how we engage in design of digital media. New strategies must include a re-thinking of the borders, between material and digital, but also between subject and object.

Figure 1: “The body as interface” – Embodied enactment is one way of experiencing interaction through the body, but in relation to the surrounding space.

Figure 2: Shifting between embodied enactment and more abstract representations, such as 3D models, can support a wider conceptualization of the design space.
Mixed objects

Embodied interaction rethinks the borders of the digital artefact. Starting from the position that our experience of artefacts, also digital artefacts, is experiential we suggest to accept that there is no such thing as an entirely digital artefact. Instead the design materials for digital artefacts are both spatial and temporal. With digital technology we can build digital temporal structures and behaviour. However, to design these temporal structures into artefacts that we can experience and interact with almost any material can be of use in the spatial configuration [7]. Hence, design of digital technologies deals with a kind of mixed objects, including ‘border resources’, beyond the physical-digital divide.

One of the consequences of the concept of embodied interaction is that the materiality of artefacts plays a crucial role in our everyday sense making. Digital technologies have been concerned with the intertwining of virtual and physical for quite some time now. Numerous projects and designs has stressed the importance of maintaining qualities in material and thus supporting the flexibility in use of objects in collaborative activities, rather than replacing them with digital counterparts. Albert Borgman [1] uses the term commodity to illustrate how just one of several aspects are maintained when an artefact is replaced by technology. One of his examples is how central-heating well provides opportunities for securing warmth, but how wood-burning fireplaces also related to the amount of wood needed, the work with chopping and drying wood and the need for keeping the fire burning. Those might be border resources in relation to ‘warmth’, but important ones as they also provided a rhythm of everyday life.

**Figure 3:** “Collaging” – A USB stick combined with an ordinary pencil is a less complicated mixed object, but it does utilize the original object – the pen – since it does get interweaved in the social life of the user. The pen is always carried by the user.

**Figure 4:** “Sampling” – The Texture Painter permits architecture students to virtually paint textures on to models. The relationship between digital and physical is one of mutual dependency. The brush provides tactile feedback to the user.
In the design of mixed objects, where digital content is integrated in the physical object, there seems to be a vast array of possible levels of integration. While in some cases digital media are just “put on top” of a physical artefact, other examples are more profoundly integrated and digital and physical properties operates within one single object [3]. The difference could be illustrated with the concepts of ‘collage’ respectively ‘sampling’. While the older montage form collage is juxtaposition by putting things next to each other, sampling works on a more genetical level and constructs genuine hybrid forms.

An important design strategy for construction of mixed objects seems to be to mobilize a great quantity of materials in order to maintain the border resources. Basically any material could be used and different qualities can be supported with different combinations. One example is observed by Johan Redström [11] in how LCD displays seems to dominate the overall expression more directly as opposed to projecting on fabrics. Freedom in combination of materials will also affect what modalities that will be addressed in perception. A strong visual focus has emerged both in western culture and design of digital media. Mixed objects can well benefit from multi-modal expressions other than visual such as for example sound or tactile feedback.

Another design material that should be recognized is the temporal structure of digital media. To view computation as composing in time is to acknowledge that we can view time as form and it also implies that we can turn to film and music rather than traditional design by drawing for inspiration. The temporal structure includes both longer and shorter time spans. In a larger temporal perspective it is also a question of how technology enters into our lifeworlds. Lars Hallnäs and Johan Redström try to define a shift of perspective as one from use to presence of digital technology. Presence is something different from just being physically present. It addresses the way we let artefacts inhabit our life-worlds on a more existential level. Clearly there is a distinction between describing a table as something “inherited by my grandfather” and ‘a piece of furniture that can bear X kg’ [7]. The difference is essential to as how we express design ideas.

That perspective also calls for another re-thinking of borders, that of subject and object. Bruno Latour [9] describes our use of technology as a collective of humans and non-humans instead of the traditional subject/object ontology. He defines technology as a mediator, not a means and not an end but both at the same time. He gives a multi-faceted concept of technical mediation in where the term society is substituted by the collective, an exchange of human (‘user’) and non-human (‘object’) properties inside a corporate body. Translation is the term he uses for describing a drift or mediation in our intentionality while using technology and the
term actant is used to describe both the human agent and the non-human technology. So it can be argued that the borders of objects should be reflected in several aspects. They are engaged in interplay with human actors, already existing physical artefacts and spaces and a variety of materials and modalities.

**Esemplastic unification of place**

In spatial arrangements scale is an important aspect. Hence, going beyond the physical-digital divide cannot for example be limited to artefacts like handheld or desktop appliances. Space is inherently a physical concept as opposed to place which cannot be thought of without also including social activity. With the perspective of embodied interaction both the social dimension and our bodily experiences come into focus. As Dourish has argued in his plea for embodied interaction place reflects the emergence of practice as shared experience of people in space and over time [4]. The design challenge is not to design space, but to design for appropriation of space to the activities that take place among a particular set of people embodying that place. Hence, place may be different for different communities of people in the same setting.

The question here is what the consequences for this understanding of place are for strategies to overcome the physical-digital divide. The notion of esemplastic unity of place has been suggested by Anders Hedman [6]. This concept for moulding diverse ideas or things into unity, borrowed from Coleridge, suggests design for public places uniting corporal and incorporeal spaces rather than adding a virtual reality to one physical already existing.

The concept of incorporeal public places is by no means limited to digital technology and virtual reality. As Hedman writes ‘humans have always been actively engaged in incorporeal places, whether in art, sleep, through recollection, imagina-
tion or fiction. Incorporeal places have always been part of everyday life. Certain disciplines and traditions have put special emphasis on incorporeal places: in religion—heaven and hell, in architecture—the planned building, in art of memory—the information place, in fiction—the place of action and drama’. The art of memory, e.g. as practiced by Cicero, rests on the capacity for places to be associated with things to remember. An example of a more public and tangible such place was the memory theatre as described in the sixteenth century by Giulio Camillo. This esemplastic place allowed users to enter a cylindric room where the walls were covered with systematically marked and located little boxes and carvings. From a stage the user was overlooking the totality of human knowledge and it was said that anyone entering the room instantly would be as conversant as Cicero on any scholarly subject.

Be that as it may, memory theatre and the art of memory also open up a perspective of story telling and associations relevant to the design for contemporary esemplastic places beyond the physical-digital divide. We are here reminded about the observation by Paul Ricoeur about narrative time and how the story told not only gives a historical account, but actually also takes place here and now organizing the current activities [12].

An example from the ATELIER project of a design for esemplastic unity of place is the tangible project archive. The archive is a ‘mixed’ environment for informal collaboration and inspiration, for presenting and collecting material. It is configured by cube modules of transparent plexi-glass and is accessible from all sides. Some projects have their own cube with a collection of objects, but hundreds of objects from different projects float around in the archive and get eventually related with other objects. Each object in the archive is augmented with an RFID-tag or a barcode associating the physical material to digital material in the form of project introduction, images and video-clips. Materials can freely be collected and the collection can than be reviewed at a special ‘organizing zone’. By placing the objects of interest in the zone the associated digital material is displayed on translucent fabric hovering above the physical material. Digital material of interest can be printed or collected for later use in a specialized object called a ‘carousel’. New material is entered into the archive via an ‘entrance zone’ where physical and digital material is associated.

The use is informal like in a ‘Wunderkammer’ and it is more associative than in a systematically organized traditional archive. Maybe not an environment that makes the users as conversant as Cicero, but an open environment for appropriation of space in the concurrent activities that take place among several people being bodily present when acting with mixed objects as they make sense to the place.
How should we understand the making of esemplastic places. As implied by Dourish in outlining embodied interaction, the philosophy of language-games, as developed by Ludwig Wittgenstein in Philosophical Investigations, is an interesting approach to understand our social and tangible practice [14].

This is in line with a position to design as intertwined language-games that has been the basis for much of the research in participatory design we have been involved in during the last twenty years [5]. The idea of language-games entails and emphasis how we in practice discover and construct our world. However, language is understood as our use of it, as our social, historic, and intersubjective application of linguistic artefacts. As we see it, this is not a neglect of how we also come to understand the world by use of other artefacts. Objects also play a fundamental role in a given language-game. In this view language games are performed as practice with ‘embodied’ meaning within societal and cultural institutional frameworks. To be able to participate in the practice of a specific language-game one has to share the form of life within which that practice is possible.

This form of life includes our natural history as well as the social institutions and traditions we are born into. To possess the competence required to participate in a language-game requires a lot of learning within that practice. But in the beginning all you can understand, is what you have already understood in another language-game. You understand because of the family resemblance between the language-games. This seems to make us prisoners of language and tradition, which is not really the case. Being socially created, the rules of language-games, as those of other games, can also be altered.

In participatory design users and designers are fundamentally seen as related via shared experiences in a common design language-game. This design language game has a family resemblance with the ordinary language-games of both users and professional designers. A fundamental competence of the designer is the ability
to set the stage and make props for this shared design language-game that makes sense to all participants, making the interaction and mediation between different language-games possible. Especially this has been applied in the use of mock-ups, prototypes, scenarios and other design artefacts.

This view should also be relevant for the making of place, and in a critique of the dualism of virtual reality Hedman comes up with an interesting suggestion along these lines: What if we think of the activities going on in a place as a kind of language-games. He calls them place making games and suggests that places allow for multiple place games [6]. In studying an exhibition with similar physical-digital objects as the ATELIER tangible project archive he observes that visitors may shift between different games during a single visit. Moreover, the kind of place games that can occur constitutes an open ended set of activities where the corporeal and the incorporeal elements are joined into an esemplastic unity through the place making games that are played. Is there not a role for the professional designer, similar to that in participatory design, in those games for making esemplastic unity of place?

In the ATELIER project this design challenge to the process of unfolding social negotiations and the appropriation of place was met by the concept of configurability of architecture and artefacts. Hence our wish to support the design students to organize space and tools into assemblies according to the situation at hand, playing with foreground and background, juxtaposition of narrative connections between objects or improvisational movements between private and public. One instantiation of this is how the students decomposed the tangible project archive in the studio to support semi-public place making games at a railway station. They configured for place making games and appropriation around refrigerator poetry reusing

**Figure 9:**
The Tangible Archive is a fixed installation, which can be seen as an assembly of different zones. The zones have an open-ended design, allowing them to be slightly configured.

**Figure 10:**
Here one of the zones have been withdrawn” from the archive and configured by the students into an installation for interactive refrigerator poetry at the Central Station in Malmö.
exactly the same physical building blocks and technological components as in the tangible archive in the studio.

**Beyond the divide**

In this paper we have argued for embodied interaction as a useful stance for designing beyond the physical-digital divide. We have focused on the role of embodiment and place making games in appropriating artefacts and space. This has been done with a special focus on the concepts of mixed objects and esemplastic unity of place. These concepts address both the physical and social threat of demassification by digital technology, and suggests that rather than creating new worlds that are virtual or digital, we should design for experience and interaction in the only social, physical and digital world that that we have. The stance taken and the kind of concepts elaborated on should also hopefully help bridging the divide between product design and human computer interaction, maybe in the emerging discipline of interaction design and in designing computational things that make sense not only to users, but also to both kinds of designers. Embodied interaction is not just a challenge of merging the physical and the digital on the desktop as in our introductory example for the 1980s, but a utopia of bringing the computer out of the box, regarding whatever space there is available as a potential place for meaningful interactions and place making games among people, and architecture and technology as ways to support them in appropriating that space.

**References**;


APPENDICE 2

PLAYFUL COLLABORATIVE EXPLORATION.

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Published in Journal for Research Practice, Volume 1, Issue 1, 2005
Introduction

In this paper we will present how playfulness and games can be used as a way of doing design based on field studies. Rather than aiming at correct descriptions of practice, we try to set up situations that are open enough for viewing practice from different angles. The openness is twofolded; first, it allows that same situation can be interpreted differently by different participants; second, the openness allows to interpret an existing situation to be different in the future.

The way of working in what is described here springs out of a group of design researchers working with developing environments for inspirational learning for design students. The design group was familiar with how the students work. As a starting point for design, we chose to start by doing a field study from which we created design material to start exploring the existing practice of the students and possibilities of changing that practice. In this process, exploration and change happened in an interwoven process. We will describe what we have experienced as beneficial with playing around with ethnography. This concept addresses how ethnographic methods can inspire and strengthen the contextual understanding needed by the interaction designer. The young discipline of interaction design borrows heavily from other disciplines when it comes to methodology, which is quite fine and pragmatically motivated, but can at times suggest new uses of established methods.

The making of digital artifacts or instantiations of interaction design, of necessity, concerns a very rich interplay, in where scientific inquiries are troublesome but important. Industrial designer Klaus Krippendorf (1995) makes some important points on a discourse of design:

- A design discourse does not rest upon facts, but is pro-active
- Design concerns the meanings an artifact can acquire in use, rather than by itself
- A design discourse must be defined on its own, from within the design community

The last point requires a clarification. A design discourse will always be dependent on the languaging of others, such as clients, users, other stakeholders, or other academic disciplines. So collaborative skills are highly needed; but at the same time designers must take responsibility for developing a meaningful language for design that does not merely “serve the discourses of others” (Krippendorff, 1995, p. 161).
These points are part of why the relation between design and research is often awkward. Design is pro-searching more than researching. Our understanding is of a second order, in the sense that it is not the designer’s appreciation of artifacts that matters but the users’ (an understanding of an understanding). Ideas from other fields can help, but can also bring in parasitic paradigms into the discourse. One example of that is the fascination for measurability, which has heavily influenced the Human Computer Interaction (HCI) tradition. The concept of pro-searching is close to that of design instantiation. Pro-searching aims at change, not on correct descriptions of the already existing. It does include fieldwork and contextual understanding, concurrent design, user collaboration, and evaluation of use in a homogenous process.

The confusing boundary between theory and practice is another issue that distorts design's relation to science and the question of making. It is often claimed that practitioners seek knowledge to act rational, while scientists act rational to gain knowledge. The difference between theory and practice seems natural for us, but exploring the origin of the concepts reveals some problems. While Aristotle used the term techne for the intentional act and phronesis for the knowledge or wisdom that was a goal in itself, praxis (to act) was actually a matter of ethics. Techne lingers on in the word technology, but originally housed the fine arts as well. This discussion, as put forth by Liedman (1999), is not merely cultural curiosity, but has affected the scientific tradition and the scientific requirement on knowledge production. Whatever model of knowledge production we prefer, it is obvious that the designer has another agenda, different from that of both the natural and the social scientist.

Social aspects of computer technology, during the last few decades, have become a growing field of exploration. During the 1980s, HCI focused on “use qualities,” and developed techniques for evaluating computer systems from a cognitive perspective. The ideas were strong, and the techniques have been progressively developed. In the mid-1980s, the interest for collaborative work grew and sociologists and anthropologists entered the field. It was within the Computer Supported Cooperative Work (CSCW) tradition that sociologists and anthropologists came to have the strongest impact (see Plowman et al., 1995, for an overview and critique). The ethnography that has been the most influential one, is what has been called “ethnography informed by ethnomethodology,” a specific branch within sociology. Ethnomethodology is concerned with the methods that members of a specific group use to make sense of, and act according to, their practice.

The HCI approach was criticized for not considering social dynamics. Numerous field studies have been carried out and reported, all advocating the need for considering social aspects. These studies, on the other hand, have often been criti-
cized for not contributing to the design projects, a criticism that might seem unfair. The CSCW ethnographers are often good at doing studies, but are not trained to do design. On the other hand, designers are not trained for understanding work practices, and voices have been raised for making use of specialists in this area. Setting up a debate, Shapiro writes, “It seems odd to impose the entire responsibility for the redesign of the work on systems designers while those whose specialty is supposed to be the analysis of work run for cover” (Shapiro, 1994, p. 421). The argument appears to be reasonable, but the CSCW community seems to have reached a deadlock.

Our Approach

In this paper, we have taken a designers’ perspective on what ethnography can contribute. Designing is to go into a dialogue with the design situation, something typically done by different ways of sketching. What we have done is to engage in a field study of interaction design students’ practices, as a first step in an attempt to augment those practices through pervasive computing technology. In the research team, we have experience with traditional CSCW ethnography (informed by ethnomethodology), but now we deliberately chose to use the field study to create design material. The idea being that video snippets from the field study could be used as sketching material in collaborative design sessions where designers (from the research team) and the future users (the students we were designing for) could build future scenarios together.

We carried out the field study and made a first selection of video snippets to work with. We used the snippets within the research team as a way of making initial categories (identifying interesting aspects). The result of the internal workshop, initiated a second selection of video snippets that we used together with the students.

The Game

Starting from the assumption that the way one works directly affects the end result, we have worked very deliberately with ways of doing design work, both in education and in our own research. In this section, our process will be described in detail. The Atelier IST project (IST-2001-33064 Atelier--Architecture and Technologies for Inspirational Learning Environments http://atelier.k3.mah.se/home/) has focused on participation and work practice based design. At a time when computational possibilities are leaving the screens and keyboards, design work must adjust
to the fact that technologies are mixing, becoming both spatial and virtual (Binder et al., 2004).

Contemporary designers have learnt to work collaboratively and across disciplines. Parallel to this another, perhaps more radical, alternative strives to abandon design as problem-solving and rather turns to an open-ended design process in which the exploration of the design space leads to the outcome of the design process. Taking an interest in students’ actual praxis, we have done fieldwork on student assignments, from introduction to final presentation. The fieldwork has been carried out in the mode of participant inquiry. With video and still cameras, we have documented a large part of what the students have done during these weeks. When the students did their field visits, we followed them. Our role became partly as more experienced designers and partly as observers.

From our field study, we made a first selection of interesting occurrences. We picked out approximately 15 short video snippets and 10 stills that showed something that we thought could be interesting to examine. We created plastic cards for each of the video snippets and for each still image. Each card functions as a placeholder for a photo or a video snippet and, when discussing the photos or videos, the card can be a reminder. The cards were augmented with Radio Frequency ID (RFID) tags that maintained correspondence with the videos and images. By placing the card on a tag reader, as seen in Figure 1, the media were displayed in a large projection that could be seen by all participants.

Using video as design material, or in games, has been explored in several writings. Buur, Binder, and Brandt give us some examples of how it is possible to do “design in video.” They exemplify with video portraits, improvised scenarios, and a video card game. The use of video as reflecting material is a way of “maintaining reference to the context” (Buur, Binder, & Brandt, 2000, p. 28). Buur and Søndergaard developed a video card game that is a “sense-making” exercise where a design group works with a large amount of short video snippets, each snippet represented by a paper card with a key frame from the video. Categories grow out of the material and the group arranges the cards to frame design problems (Buur & Søn-
Johansson and colleagues (Johansson, Fröst, Brandt, Binder, & Messeter, 2002) used a design gaming approach to facilitate collaboration among several stakeholders. In this paper, our focus is on how the open ended nature of the games forms a basis for collaborative analysis that offers an opportunity for merging ethnography and design.

The video snippets (and the cards) also play a role as communication devices. Since interaction design most often evolves in cross-disciplinary teams, the issue of setting up situations for communication across inter-disciplinary boundaries is highly important. From this perspective, the video snippets (and the cards) also play a role as communication devices and mediators. In the process of playing the game (as described in the paragraph below), the cards became more than mere representations for the stills and video snippets; they also became the carrier of the discussions involving those stills and videos. Leigh Star coins this kind of objects as boundary objects (Star, 1989). The concept of boundary objects can be said to include any kinds of object which facilitate the growing of a shared understanding for participants coming from different communities. The boundary objects can be interpreted differently, depending on each participant’s background. In confronting and discussing the differences, a shared understanding is formed. Henderson has similar ideas on conscription devices (Henderson, 1999).

We invited the interaction design students, whom we had been following, for a workshop. Our intention was to give them a chance to tell their stories of how they work and collaboratively sketch how it could be different. The workshop was arranged around an exploratory design game. The game we played was an associative one, portraying situations, feelings, or other things that had become important in the work. The game has no winner. The goal is to investigate and negotiate images of what happened. It follows the structure of an ordinary card game, played for fun. The participants are each dealt some cards, and play their cards in turn. The cards are laid on the table as the common design material for exploration, framing an evolving theme. While the media attached to the cards were from the mentioned project; the player is free to interpret them in any way they want. In the first round, all cards are placed on the reader; the content is thus displayed. The first player places a card on the table and gives a tentative title to the story that is to be built. The second player will also play one card and continue the story. A player can also pass, just as in poker, if he or she feels uncomfortable with the story or if his cards do not match. After the second player, the third continues and so on. The game is played until there is a story on the table that the group feels is valid. There can only be four cards in a story; when the fifth player wants to add something, he or she has to choose one card to be removed. The rule is that one needs a good argument
for changing the story, and it should add something new. When no more changes are done, the group tries to find a new or refined heading for the story. Each round is completed with a debriefing session where all participants write post-it notes, as can be seen in Figure 2, that comment the story.

An individual researcher or a small group of the research team has done much of the fieldwork. In an ambition to establish a collaborative design process, with participants being equal, rather than working with ethnographic descriptions as an input to design processes, we strive to impose the ethnographic perspective into the design work. Instead of having ethnographers interpreting and offering understanding and/or “implications for design”, we involved a larger design group in exploring the ethnographic material, and using this material to explore the present to see how it could be different.

The games were played both internally in the research group (see Figure 3) and together with the students that were both the object of our studies and future users. The design games we have been working with have rules that are explicit from the beginning; if the rules are to be changed, it has to be discussed as a part of the game. In this way we carefully started to frame the design situation and impose our order to it. In the process of exploring the practice, we started to sketch how the practice could be different, when we introduce technology to support the students
and their learning. The exploration and the evolution of design ideas were interwoven in a collaborative process.

**A Game of Playfulness**

Descriptions of practice tend to be rigid and respectful of the scientific demand for stringency in the use of language. The achieved clarity can be viewed as a sincere respect for the users and their working conditions. But ambiguity can well be used in a respectful way that invites different perspectives. As an alternative in design, Gaver and colleagues reflect on how “contextual ambiguity can question the discourses surrounding technological genres, allowing people to expand, bridge, or reject them as they see fit” (Gaver, Beaver, & Benford, 2003, p. 237).

Descriptions of space in a physical sense only rarely matter for design. The spatial layout of a site is of course of importance, but even more so are the activities taking place there. Paul Dourish (2001) uses the distinction between space and place to distinguish what is really happening in an environment. What constitutes place is a complex totality of social engagement with other people, use of artifacts, information, and lived experience that is hard to pinpoint. One can view place as experienced space. Design is a process of both recognizing and transforming place. But place is a qualitative phenomena more than quantitative.

The phenomenological tradition gives us some tools to approach everyday life by returning to concrete things and occurrences rather than abstractions describing them. Bread on a table is not just a meal--it is also the hands weary of a full day’s work dropping the knife, the children telling stories from school, the remembrance of youth in the taste of an old-time recipe, and so forth. This richness is hard to generalize in descriptive language since it includes variance and paradoxes as foundational parameters. Our everyday life-world, just as work practice, consists of this concreteness that falls between the pure objects of science. Understanding place calls for collecting the paradoxes and complexity of life-worlds, rather than unifying them in abstractions.

The concept of playful collaborative exploration suggests certain ways of interacting with field material that do not constrain analysis in a search for objectified knowledge on user activities. Instead, the ambiguous nature nourishes a dialogue between different actors in the design process. Design can be to create fantasy worlds (worlds of hypotheses) where designers experiment with ideas and concepts as chemists in a laboratory. The design game we created draws upon the studies of practice and places them in what we call the design lab. Donald Schön (1983) has described the way architects work and Louis Buccairelli (1994) have done the same
within Design Engineering. Schön writes about “design worlds,” describing how sketches talk back and how a conversation with the design situation is established with the sketch. Buccairelli (1994) writes about “object worlds” as both the physical place where design work takes place and as the mental images that designers create. In collaborative design processes, the search for meaning is a large part of discussions and negotiations.

The design lab is a place for the fantasy world, and the design game is the structure. This place allows experiments, mistakes, poorly developed ideas, and so on. The rhetoric of such experimentation is typical in the very nature of playing. “The most fundamental experimental question is, ‘What if?’” (Schön, 1983, p. 145)—a question that open up alternative views on how things can be explained.

The arguments are set up to facilitate imaginary situations that complement reflective understanding of practice. They do so by introducing a playfulness that follows from the non-constraining use of language. The use of games as mediating tools in participatory design processes has been explored, for example, by Ehn and Sjögren. They argue against correctness of descriptions and focus on how linguistic artifacts are used rather than what they state to be true (Ehn & Sjögren, 1991).

The argument is in line with how Wittgenstein (1953) developed his view on philosophical inquiry: starting from a view of language as depicting reality, he moved on to a focus on how it is used in context. His idea of language games is close to how design games can form foundations for collaborative exploration. Meaning arises not in how exactly a statement is formulated, but rather by the intertwining of different voices that shapes language in the specific situation.

In this sequence, the player Si lays a card depicting the studio the day after a major clean up. While the story is about the changing nature of the studio, he has no definite analysis ready at hand, but he ‘tries the card out’ and the thread is picked up by Th, another player. An utterance like, ‘I’m not quite sure what that means,’ is far from the stringency most often displayed in scientific reports. Instead it is the way the meaning of the card evolves by the engagement of several actors that is important. By laying out the card, he is pushing the story without prompting analytical excellence—he is playing around with ‘truth.’

Transcript E

*Si: The day after the cleaning it looked just as*
before the cleaning. I am not sure what that means, actually..

Th: We discussed it quite a lot actually, after the project ended. That it was like a kitchen. In a kitchen, when you cook, it is always messy, and you need to clean up, but just as you cleaned you start over again. You do not clean to make it clean but to create the possibility to make something new. And we thought that it perhaps an image of why you had to clean up.

The goal of the game is to tell good stories about practice and not to achieve an ultimate description. Narrative styles of analysis of ethnographic studies are a discipline of inquiry in itself, which will not be thoroughly reflected here. Howard Becker (1998) advocates asking ‘how’ rather than ‘why.’ While ‘why’ seems to prompt for answers without logical inconsistencies, ‘how’ encourages a more straightforward storytelling. This makes part of the playfulness that eases up participatory design processes.

So far, many spectacular methods for inquiry and collaboration have been explored, inspired by domains other than science. Much attention has been given to the concept of cultural probes developed by Gaver and colleagues. They transformed the situationist movement’s use of psycho-geographical maps into a package of devices for self-recording. These were handed over to the users, who made different annotations and recordings, in quite playful forms, which were then returned to the design team. The designers viewed the collected material as inspiration rather than information (Gaver, Dunne, & Pacenti, 1999).

Other art movements have generated similar speculative methods for collaboration in the form of games taking place during face-to-face interaction. Originating from the idea of autonomous writing, the surrealists borrowed methods from academic disciplines such as sociology, anthropology, and psychology to elaborate methods in the form of games for exploring the mechanism of imagination and intensifying collaborative experience. They subverted academic modes of inquiry to undermine rationality and invented playful procedures to release collaborative creativity (Gooding & Broottie, 1991). An example is the game of Exquisite Corps, which made use of open-ended fragments. Drawings were made on a piece of paper that were folded in a way that showed only a part of the drawing and the next player continued the drawing on basis of what he could see and then passed it on to the next player in a similar way.

The open-ended nature of the cards in our game makes interpretation complex, but at the same time, it is also a strength. The cards are representational artifacts
and they do carry a portion of evidential content. Augmentation of the cards is crucial. They are not symbolic game pieces, but before being placed on the table and into the story, the content (video clips, still images) must be displayed to everyone in the game. But they are not stereotyped statements; rather they are placeholders for different voices and trying to create situations where different perspectives can meet. The mesh of different professional, social, or ideological perspectives and interests is typical for design processes. Many professionals and researchers (Saunders & Dandavate, 1999; Star, 1989) have made interesting work on different methods for using objects as mediators in participatory design processes. It is not only a question of blending the different perspectives, but also to create a situation where the participants can step in and out of their own perspective. While watching the media, participants can immerse in their memories of the occurrences. As the conversation continues, they can reflect on what has been viewed from what has been coined as an analytical distance (Karasti, 2001). At the core of the game is to try to build on visions of the others. The final story lies ahead and must be negotiated.

The collaborative nature of the storytelling allows different stories being told on the actual observations, while not going off in any one direction. As the game succeeds, the group narrows down to a version of the story. The rule that says that some cards can be exchanged at the end of the story increases the experimental space.

In Transcript C, the use of different material in the studio is being discussed. Player Be thinks that she is not adding anything to the previous cards; but she is encouraged by the others in two aspects. Player Ol affirms that this is something different to her and player Fr, who now has got a good knack of the rules, reminds that what is being played can be changed later.

Transcript C

Be: I am not really sure how I should take this story further. I am just confirming this. I am saying the same thing as the previous. We have seen this one, where Richard was illuminated. It is a bit of the feeling, new material. How do we do it? What do we do? I mean the experimental state. Just as the tags on the previous picture, so it is not taking the story much further.

Ol: Yes it does, it says something else, doesn’t it?
Fr: *Otherwise we will take it away (later).*

The hybrid nature of the cards makes an interesting prop or boundary object. The physical side of the card acts as gesture. Many observations were made on how the cards are fingered while thinking, waived while articulating, turned towards a specific player while exchanging arguments, and so on. They also form physical nodes in the hypertext that can evolve in the game, something that persists in the room and can be manipulated to have other meanings. The virtual content grounds the storytelling. One can test its meaning out, while any player can argue about the content. So while being representational of practice they are still subject for structural change.

Lucy Suchman (1995) writes that the creation of representations of work is always normative, and does create stereotypes. She makes an important point in stressing that maps and representations are created from a specific location. Field data not only carries a lot of noise in themselves, but the selective way in which it is merged into mappings can never be free from value and interpretation. In collaborative design, it is the design participants that need access to the field material. Those who are expert readers of field material within other traditions are not per se good readers for a design project. Reading field material, for the purpose of design, needs the perspective and attention to details ethnographers have developed. The design game we developed tries to create the preconditions for this, as described in the following section.

**Rules of Freedom**

We now describe in some detail how we set up the (pre)conditions for the playful collaborative exploration we are arguing for. The focus of this paper is on the relation between field studies and design, a relation that, if wanted, has to be created.

Doing design and playing games have many similarities. Using design games as a way of setting up a design process helps one choose what to focus on. Habraken and Gross (1987) made a report about a number of “concept design games” they had developed. The games were used as a tool for research in designing built environments, the aim being to improve the working of design communities, designing buildings and urban environments. By observing the games being played, they studied how designers manipulate and transform artifacts during a design process while negotiating agreements and rules about how to go about their work. By developing a set of games, Habraken and Gross managed to isolate and focus on “single
aspects, each giving a clearer picture of what just some of designing is about” (1987, p. 1-2 - 1-3).

In our work, we have picked up on the gaming idea, and created a set of design games that helped focus on certain aspects (Johansson, 2005). Our ambition is not to study design, but to impose preconditions that (i) set a perspective on designing and (ii) create a ground for collaborative design work. Here we illustrate how an exploration of a design domain could be carried out as a game. In the following example, we can see how the cards are given meaning by the participants.

From the look of it, Ja made his selection of a card, based on the label (see Transcript A). The next card was also chosen from the text written on it. Fr finds that he expected one thing from the video connected to the card, but finds that the content was something else (see Transcript B).

Transcript A

Ja: I have a good beginning. First I want to see what it is.. It is the first day.

Bella: The first day

Thomas: Did it look like this?

Jan: Yes, the first day when we did not knew what we should do.

Be: I can’t remember that it looked like this. Yes, this was the first day when you presented. Then we still had a great distance to the room, still.

Th: So what is the story?

Ja: The story is.. Before we knew anything. When we were to find out what we should do, this became an introductive state. And from this it was shaped further.

Transcript B

Fr: Now I followed the headline on this, ehh. Aha it was that.. It was not at all the same meaning that I..
Th: *But you are allowed to interpret it.*

Fr: Yes.. *What I read from the headline here “everybody looks, no one sees” It was a bit more like in the beginning. Everybody looks but no one sees any connection, but it was not like that. It was about.*

Be: *But it is something with that with insecurity with the material.*

Transcripts A and B are collected from the beginning of a game session. The first two players start with the headlines of the cards (in Transcript A, “the first day” and in Transcript B, “everybody looks, no one sees”). In Transcript B, the person that chose the card realizes while looking at the video snippet that the clip is about something else than he thought, the group then rearranges the story. The situation and the openness of the interpretation allow other participants to take part in the exploration (as in Transcript B). The outcome of the “everybody looks, no one sees” card is a combination of what the card says and what the group remembers from the beginning of their project.

To use games like the one described here is a way of driving the exploration as well as the design process. It sets the rules for how to collaborate, and for how a theme is established. But it is also a process that can evoke resistance from the participants. If you want to say something that lasts, it has to be said with the video card, and need to be related to the actual video; including something new is an act of negotiation. If a new aspect of a theme is introduced, it starts new discussions. We could that the setup with physical representations makes the participants continuously connect back to earlier discussions, pointing at stories created previously and referring back to earlier discussions about a card. Using games is a way for us to set up the rules, and we use this to open for collaboration and to lessen the power differences between people. We found that we did not have to concentrate so much on procedures once the game was underway.

The exploration that we suggest here has its basis in design work and in making changes. In comparison to more descriptive explorative practices, such as Interaction Analysis (Jordan & Henderson, 1995), this approach is more open in the sense that practitioners can bring experiences that are not immediately visible in the video snippets or the stills. This approach does encourage multiple interpretations to broaden the view of the practice explored, whilst more descriptive traditions tend aim at creating one account. The purpose of the exploration is different, what designers have acknowledged as the “turn to the social” (Grudin, 1990). There is
no striving to describe anything but rather to create a starting point for grounded design work. We want to adopt the turn to the social as a perspective with a “flair for practice” (Johansson, 2005) brought into the design process. The perspective is represented by a way of working, assuming relevance of the video material and still photos from the study, and sensitivity for what we can learn from the material.

The role of the game facilitator becomes visible in the next transcript. In Transcript D, Be comments on Ol's move, by saying, “to take over the room.” Being the facilitator, Th repeats this statement and continues, “that is rather good”; later he also refers back to what Be said (in Transcript A) by stating, “I can’t recognize it [the room] either.” This way of repeating what he finds important helps the group connect with what has been said and the emerging theme of the story.

Transcript A

Ja: I have a good beginning. First I want to see what it is.. It is the first day.

Be: The first day

Th: Did it look like this?

Jan: Yes, the first day when we did not knew what we should do.

Be: I can’t remember that it looked like this. Yes, this was the first day when you presented. Then we still had a great distance to the room, still.

Th: So what is the story?

Jan: The story is.. Before we knew anything. When we were to find out what we should do, this became an introductive state. And from this it was shaped further.

Transcript D

Ol: Here it has begun.

Be: To take over the room.
Ol: Yes, exactly. To get to know the material, somehow.

Fr: You could exchange the one I put out.

Th: You could see it like this: If you take these two as extremes. "to take over the room" that is rather good. I would also say when I look at this (pointing at the card Ja put out) I can’t recognize it either.

Th who acts as the game facilitator tries to open up the interpretation and suggests another look at the card (the media) by asking, “Did it look like this?” and later “So what is the story?” (in Transcript A). The facilitator’s role is about making the participants look thoroughly at the material and make them articulate what they are thinking. At the same time, he summarizes what has been said so far. The facilitator has to balance between running the game and letting the participants have control. The game is set up so that no single participant can dominate the story. However, one’s own ideas can be seductive; and every now and then someone is pushing an idea hard.

In this design game session, one of the participants started the round and wanted to keep the theme he had initiated. The first thing that happens in the game is that Ja puts forward a card with the label “the first day” (as shown in Transcript A). By this Ja suggests a chronology. At the end of the round, Ja still thinks of this game as a chronology when he presents an ending following the actual process.

Transcript J

Ja: I am going to ruin this a little. I take this one. It was the last day, so this was about what we could accomplish

Ja, who starts the game, has a considerable impact on which way the game goes; still he is not in control of the story. In Transcript J, he tries to bring the story back to where he started it, but the story is already concretized, by this time. Too much has been said, and an interesting aspect has grown out of it.

At other occasions, the game facilitator has stopped the game, saying “Wouldn’t it be a pity to ruin this story?” and that could very well have been said here too.
However the group had such strong consensus of what the story was about that it perhaps was not necessary. The structure of the design game becomes a part of the design material, as a collaborative sketch.

Schön and Wiggins stress the importance of the medium in the design process. Design artifacts, such as the sketch, reflect design “moves” so that designers can see the consequences (intended as well as unintended) the move generates (Schön & Wiggins, 1992).

The design game is a way of building stories. The format is a durable and available sketch. The process is one of co-authoring and the stories are owned collectively. The material is the narrative physically represented by the plastic cards and the media it links to. The material of the design game can be viewed as an alternative way of making sketches. Video is engaging and a highly participative medium and, therefore, it has great value when used in collaborative design sessions. Material that comes out of a field study helps the designers relate to the context they are designing for. The plastic cards are tangible, easily available, and easy to manipulate.

Conclusion

In this paper we have presented the idea of using games as a structure for playful exploration of field material for design purposes. As a contrast to most of the work done to inform design with ethnography, we have studied participatory exploration done in design sessions. Placing our approach between the ethnographer that creates a detailed description but “runs for cover” and the more artistic approaches that let their material from an inquiry serve only as a source of inspiration, we have found a balance between grounding design work in existing practice and creating the necessary distance from the material. We describe a design process that is exploratory, rather than problem-oriented. This alters what is useful and results in ways of working that differ from the more descriptive inquiry approaches. We are searching for possible future practices; what we need is vignettes that can say something about how things are done and which can be given us the building blocks to create stories. The story becomes a sketching material, with which we can carry out experiments.

The design game and the rules are a way of getting structure in the collaborative design work. The plastic cards have the function as placeholders and mediating objects. Since they are augmented and carry links to digital media, which can be immediately played and viewed collaboratively, the actual field recordings have a strong presence in the game. Story creation is central to our design game; and the co-authoring process is fun while it broadens the perspectives.
Acknowledgements

Our thanks to the Interaction Design students at Malmö University and our fellow researchers in the Atelier project who participated in the sessions and were part of developing the game. Special thanks to Thomas Binder and Simon Niedenthal.

References


APPENDICE 3

EXPLORING RELATIONSHIPS BETWEEN
LEARNING, ARTIFACTS, PHYSICAL SPACE,
AND COMPUTING

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Published in proceedings of CADE 2004 Copenhagen/Malmö and in Digital Creativity, Volume 16, Number 1, 2005.
1. Introduction

The topic of this paper is the design of an interactive, tangible learning environment in support of students of architecture and interaction design. There is a growing corpus of literature on physical interfaces, ranging from working with tangibles and wearables to augmented and virtual reality environments. Much work has been done on stand-alone interaction devices, on augmenting existing objects such as books and workspaces (e.g. Want and Fishkin 1999), as well as on more elaborate designs in support of activities such as story-telling (Stanton, Bayon, et al. 2001) or game playing. Much less attention has been given to the physical environment, the combination of space and artifacts, and to how these shape action.

Within IST project Atelier we: 1) explored approaches to mixing physical and digital artifacts, 2) experimented with ways of integrating the physical space into the students’ learning activities, and 3) investigated the possibilities of configuring the environment. Our study operates with the notion of key qualities of a learning environment to be maintained and supported. These key qualities were identified through fieldwork at the Master Class of Architecture, Academy of Fine Arts in Vienna, and the Interaction Design Studio, Malmö School of Art and Communication. At both sites learning does not take place in traditional classroom settings. It is project-based, helping students become part of a profession through the improvisational development of new practice in a diversity of role configurations (Lave and Wenger 1991). We developed a set of technological and architectural interventions in support of these qualities and carried out field trials with the objective to evaluate and further develop these interventions.

1.1 Computing, space and artifacts

The challenge of tangible or ubiquitous computing is to integrate with the physical environment of artifacts and spaces (cfr Ishii and Ullmer 1997, Mackay 1998, Weiser, Gold and Brown 1999). Dourish addresses this concern with the physical environment, introducing the notion of embodied interaction. People’s bodily interactions within physical space “offer opportunities for a much more direct apprehension of the modulating, mediating effect that computation plays in interaction”, with the active nature of computers being important not as independent agents but “as augmentations and amplifications of our own activities” (Dourish, 2001, 166). One of the few empirical studies of embodied interaction was carried out by Heath et al. in a museum setting.

They use the term ‘active spectator’, pointing to the “relevance of the ecology or setting in which a painting or sculpture is positioned, and to the ways in which the
spectator actively ‘connects’ features of the object to action within the local milieu” (Heath and Luff 2002 11). In a recent contribution on future ubiquitous domestic environments Rodden and Benford (2003) look into work about how buildings change as a source of inspiration for defining research agenda for designing technologies. One of their arguments is that technology designers predominantly concentrate on the interior of stuff, space plan and services, while neglecting the exterior of site, structure and skin.

Among the few design approaches that explicitly include the physical environment is ‘Roomware’ (Streitz et al. 2001). They use the notion of ‘cooperative buildings’, thereby emphasizing that the starting point of their design is the real, architectural environment. Buildings not only support cooperation and communication. They can be made responsive to their users’ needs “by employing active, attentive, and adaptive components”. However ‘Roomware’ are pre-designed tangible computing products for general meeting purposes. Research on developing augmented environments is rarely based on field trials in naturalistic setting (cfr Abowd and Mynatt 2000). Equally unexplored is the issue of how computing can be integrated with artifacts that evolve in the process of work and how it can be used for reconfigurating the physical environment in support of different activities.

1.2 Field study and development method

Although our research activities are held together organically by participatory design principles, they followed no strict methodology, and we made opportunistic use of a wide range of resources and techniques. Extensive fieldwork was carried out at both sites over the course of several months, based on video-supported participant observation of design practice and on interviews with students and professional designers. In this fieldwork we took a view on the environment as a whole, with a focus on the materials and artifacts through which an architectural or interaction design evolves and on the use of the built architecture as a resource for learning. The fieldwork material helped understand design practice and identify key qualities of the two learning environments. Based on this material we looked for opportunities for technology-support, developing a set of prototypes and scenarios of use, and designed field trials at both sites.

Our strategy for these field trials was not to create new and dedicated artifacts and spaces but to motivate students to integrate the prototypes into ongoing project work. This was enabled by what we see as the ‘open-ended’ nature of the prototypes. There is an increasing interest in enriching design practice by using tools and concepts that help raise topics and ask questions. For example, Gaver et al (2003)
work with the concept of ambiguity as a resource for design as it “provides a frame of reference that allows the use of inaccurate sensors, inexact mappings, and low-resolution displays because it encourages users to supplement them with their own interpretations and beliefs”. Hutchinson et al. (2003) propose technology probes as a co-design method, where simple and flexible technology is installed and observed in a real setting.

While technology probes are not changed during the use period, the prototypes we provided are open to reinterpretation by participants and can be tailored by them. We facilitated this process of active appropriation by making extensions to the prototypes whilst students were experimenting with them. Developing for and experimenting in such natural settings is a task that is very different from evaluating tangible computing systems in laboratory tests (e.g. informal evaluation as in Everitt et al. 2003). In Vienna the prototypes were made available from November 2002 to January 2003 to the architectural master class, which had The Stadium as City as its topic.

We also followed the work of three students on their individual stadium projects. During the summer semester we were able to observe students’ work on a large ‘operational model’ of a site for a stadium. During the same period the students in Malmö worked on a design project named Augmenting Places For Collaboration. Prototypes of the technology were available along with a staff of researchers, teachers and programmers acting as tutors but also making adjustment to the technologies in accordance to students’ wishes. After examinations the concepts were exhibited as interactive artifacts and the students were invited to participate in the analysis of the field trials. This was set up using the RFID components for creating game like sessions where episodes from their design work were negotiated.

2. Stories of design and use

Based on the analysis of the observations of student work and on interviews with a small number of practicing architects we specified a set of qualities of a learning environment (see Iacucci and Wagner 2003, where the qualities are introduced using observational data from only one site). These qualities are interrelated and there are many ways of interpreting and supporting them. In this paper we in particular refer to the following qualities:

- Materiality and the diversity of materials and representations – design work proceeds through developing a large number of design representations,
with materials playing a crucial role in envisioning particular aspects of a design

- Re-programming and the ‘different view’—the design process requires to continuously transform and ‘re-program’ familiar settings

- Forging connections/multiple travels—a crucial aspect of the design process is to maintain evidence of all the material that has been produced, to forge connections, and to create and explore different perspectives

- Configuring—the adaptability of a space to a diversity of uses and identities

The ‘qualities’ have proven to be very effective, in guiding technology development and in interpreting the field trials. In the following we present selected episodes from our fieldwork and trials on two different design themes: physical artifacts and digital media, and connecting, configuring, and integrating the physical space.

Within each theme we 1) portray the qualities of the environment we intended to support, giving some examples from our field work observations; and 2) describe our technological interventions and how these merged with the existing design practices and changed them.

2.1 Physical artifacts and digital media

Materiality, the diversity of materials and representations. Both, the interaction design and the architecture students, work with representations in different media. The materiality of some of these representations plays a crucial role in envisioning particular aspects of a design. For example, architects work with a great diversity of models of different degrees of abstractness. The physical features of the material often carry meaning. Figure 1 shows two of several models students built of a mountain resort.

While the plastic implant in the model of a building on the left visualizes “something that flows out of a crack in the mountain”, the half-relief on the right of the section of the same building highlights particular details of the spatial design. Examples such as these convinced us of the need to maintain the diversity of representations and to help students to enhance the representational techniques that are part of their professional practice, providing them with barcodes and scanners, RFID tags, and touch sensors (see Want and Fishkin 2001, for a comparison of tag types). They used these technologies mainly for animating design artifacts through connecting them with multi-media files.
The interactive installation in Figure 3 shows a dummy representing a patient in a hospital. By pushing the button on a bracelet the visitor changed the projected facial expression from pain to relief. One of the projects we observed was about making visual and material studies starting from a working tool (e.g. saw). The architecture students first made studies of a tool by analyzing its form. They would then have to create three-dimensional models from the movement of the tool in use. These studies produced a series of visual and material explorations on drawings and several models for each tool. These were presented interpreting the created forms. Each student placed several models on a table, the sketches and drawing on a board, and showed sets of three pictures of the models on three large projections screen. The immersive three picture presentations, showed studies created through photographing the model in a variety of conditions, exploring the materiality of models (Figure 2). The presentations were guided using barcodes on models and diagrams (Figure 4).
By scaling details of close-ups to large projection screens, they played with scale and immersiveness (Figure 5). These activities also point to the following theme of reprogramming.

Re-programming and the ‘different view’. Creative work requires to transform and re-program – to explore solutions and contexts, to shift perspectives, to carry out experiments, to present and perform, to have time and space for free play and daydreaming, and to generate a ‘different view’. Interaction designers re-program by blending the perspectives of different actors or by disrupting social conventions of interacting. Figure 6 shows two examples of re-programming activities that occurred in the interaction design studio. On the left a scenario was changed by use of light, moving the “warm and cozy living room into the cold sterile setting of the bathroom”, and perceiving use quite differently. On the right a “body mimicking” exercise is illustrated. By recording a situation of use and acting with the video as backdrop, you could for example experience just how much time for thinking you have while filling up the gas tank of a car.

An example of re-programming from the architecture class is a feedback session with a student who proposed an underground parking space in her project of revitalizing an area with immigrant workers. Her teachers challenged her approach, asking her to transcend the traditional categories by trying to combine them in new ways. To, for example, work with contradictions – “the mosque, outside lively, inside an oasis of tranquillity”; to let market and street reach into the park; to use empty shops for parking; to connect living with the car, its sound machine being used in the living space.

Another example can be seen in Figure 7 where students used photomontage for turning a table in a deserted courtyard into an elegant dinner arrangement and for transforming an ugly industrial skyline into a ship. One of the tools we designed in support of re-programming activities such as these is the Texture Brush: using a brush which is tracked with a video camera, this is a tool for ‘painting’ objects
such as models or parts of the physical space, applying textures, images or video, scaling and rotating them. Students started animating their models with the help of the texture painter. As part of the project mentioned above (Figures 3, 4, and 5) in exploring form and material starting from a working tool, one student chose a saw for cutting wood.

He produced a series of sketches and drawings, took pictures of the saw in movement, built different models. A physical model that the student had created out of the movement of the saw was placed on the 3D table. This is a movable piece of furniture with an integrated mirror and a semi transparent table-top, which can be used as a surface for placing objects and a display component. The student used the Texture Brush on his model (Figure 8). The Texture Brush provided a fast interactive way of experimenting with scale, colour, and background. ‘Painting’ the physical model became a performance and part of the design process; its informality and the imperfections of the product opened a space for associations and spontaneous changes.

Multiple travels. Students go back and forth between media and design representations as well as between the studio and places in the outside world – the site of a project, street life in front of the door, people, a significant place in the city. They express the need to forge and maintain connections between materials and places. These connections may be of varying nature and quality: chronological, narrative, driven by the desire to contrast and confront. In many projects, students present remote places in the studio. This student reviews her trip to Ghana where after observing and recording a place she would put up a red carpet watching how this intervention changed the place and people’s behaviour (Figure 9).
The notion of ‘multiple travelling’ refers to the fact that students often repeat their journey in the studio when they review the collected material again and again, with different layers and aspects coming to the surface. Students used and adapted the projection set-ups we provided for recreating aspects of a remote place. Like in this example of a student group who arranged seats like in the underground with passengers that had to stand being provided with a handle made from orange plastic. In this configuration they revisited their trip to the Stade de France (Figure 10). Students recreated aspects of remote sites. Using projection screens and hanging posters they modelled the form and disposition of architectural elements.

**Configuring.** At the beginning of a project, students set up their workspaces, which grow over time. They are dense with design material, which is exhibited on the surrounding walls and on parts of the desk space. Sketches, plans, model, a panorama print of a site, and the computer, are all assembled in one desk space. Students express a strong need for configuring their workspace so that they can exhibit, perform, engage in group work or work alone, build models, have a nap, make coffee, interact with material and odd objects, etc. In architecture the backstage and the garage stand for such spaces in which everything is possible.

One of our interventions in the physical space is the grid (Figure 11). The grid that was installed in the Interaction Design Studio measured 6x6 meters and was fastened to the ceiling. Things hanging from above could be attached to it. A set of spotlights (18 overall, evenly distributed) was fixed on the rails. The lights could be controlled by an easy-to-use light board. The system provided means for isolating smaller partitions of the room to be used for smaller groups. More importantly, it
supported students in furnishing their project spaces in whatever way they wanted and in rearranging them whenever activities changed.

**Figure 11:**
A varied topography – to see from above and below

These arrangements could be performed in a varied topography in the space, with the possibility to experience things from above or below. Another thing achieved with the grid was that it could be used as a “back stage”, having cables and wires being attached from above, thus keeping at least the floor wireless. The students used the grid and projection/light facilities to reconfigure their workplace in accordance with the activities they were carrying out. Moreover, introducing tagged cards and readers enabled them to set up workplaces without the ordinary desktop computer. They turned out to make creative use of the space for different projections, projecting visual output literally anywhere in space (Figure 12). By masking the projector lens students could even project on round or curved surfaces. Arrangements for placing projectors in different directions and angles were supported by the grid. A fairly large amount of different material provided building blocks for suitable non-traditional screens. One benefit of freely arranging displays is that it gives the possibility to suggest social interaction within the space.

**Figure 12:**
Projecting on any object by using the grid

One of the student groups created tagged cards, which they suspended to the grid. Having the 3D collages around was inspirational, but also made the material available in quite another way than having to go to a PC workstation, boot the computer, find the right software, and browse for the right file. The surrounding space for the students turned into one telling different stories about actual places. Entering the studio enabled anyone to take part in the stories (Figure 13).

The students built different stages for enacting design in the same space where the other work was carried out (Figure 14). These full scale mock-ups of an...
3. Discussion

The examples we provided show different ways in which qualities of the learning environment can be concretized integrating digital media and interactivity using space and material artifacts. In particular we showed ways of extending artifacts and using the space as a configurable stage to explore and experience situations.

3.1 Extending physical artifacts

Our objective in integrating computing in artifacts and in the environment was to maintain and support specific qualities of the learning environment: materiality and the diversity of materials and representations as well as re-programming and the ‘different view’. In contrast to what has been designed and explored before, we make use of students’ ‘natural’ learning environment instead of creating sophisticated dedicated objects (e.g. the ‘magic carpet’, Stanton et al. 2001; ‘pawns for creating interactive stories’, Mazalek, Davenport, et al. 2002). The settings we considered are characterized by evolving environments – students configure and re-configure their workspaces, they adapt them to different uses and identities. Moreover, students’ field of work is highly complex and they constantly invent and probe techniques for representing this complexity. As a consequence, the design artifacts they produce evolve and are changing. Finally, what is inspiring and meaningful for the students, depends on context. Objects or a place, for example, are not inspirational as such but may be so in connection with a specific project, idea or particular task.

**Animating artifacts.** Students used the prototypes in several ways: they animated physical artifacts, also creating new representational formats, and they produced. Barcodes and sensors on diagrams or models, objects with embedded RFID tags (spatial collages) where different cards represent different aspects of a workplace, are all examples of ways to animate the environment (playing media). They help keep physical design representations in their materiality at the core of
students’ interactions. They enrich these artifacts by making multiple perspectives, readings, and connections visible. The latter reflects an important aspect of learning environments, that of mediating concepts between students and teachers. By maintaining different perspectives onto a design artifact or scenario, storytelling is supported and narrative elements can blend with others such as functionality or mere descriptions.

Mixed objects. On the other hand the Texture Brush allowed painting virtual textures on physical models creating what De Michelis calls ‘mixed objects’ (2004). This approach goes beyond simply enriching a physical artifact by linking it with content in different media. In this case the link is such that the properties of the artifact itself can be changed, by applying colour, inserting movement and context, and varying its dimension in relation to other objects in the physical space. A characteristic of these animated or mixed objects is that you have to interact to experience them. By integrating barcodes into a drawing, for example, a student created a new way of engaging with the design artifact. The diagram does not speak for itself – you have to physically interact with it.

3.2 Using the space as a stage

The ways the students used the physical environment addressed in particular two qualities: maintaining and forging connections – multiple travels and configurability. The prototypes helped students explore the performative elements of space, experiment with scale and immersiveness, including unusual perspectives onto objects or a space, and create mixed spaces.

The performative elements of space. An architectural space is not static, it constantly changes with people’s activities. The notion of ‘use-as event’ (Lainer and Wagner 1998) emphasizes the changing, evolving, temporary and sometimes performance-like character of activities in space. It is resonant with Bernard Tschumi’s idea of “architecture not as an object (or work, in structuralist terms), but as an ‘interaction of space and events’” (Tschumi 1977). The performative aspects of space address how a situation must be considered as a whole, which is of great importance in deign of interactive systems and spaces.

Meaning is created in use of shared objects and social interaction is related to how we engage in spaces and artefacts. In this interplay the body has a central role, in many ways the body can be seen as the medium for having a world. This is a perspective that differs from ‘disembodied’ use of computers and interactive systems. Elements of performance or experience of an installation is valuable complements to working with more abstract mental models of representation. Performance artist
Ulay refers to the space in which he performs as “edited life” or “choreographed existence”. While using the same body that sleeps, makes loves, etc., it’s also a matter of stepping out of the ordinary body and into the performance body. This stepping into a “mental physical space” was of utmost importance to him and his partner Marina Abramovic (Pejic 1998).

This might be similar to how a designer can step into a semi-real space that resembles everyday life, but leaves no constraints for imaginative acting. To enact design concepts in performed scenarios brings forth situations where designers relate to technology with strong presence of the body. To have the body as reference to space or a situation of use brings forth a perceptual presence to the model or situation that also addresses tacit dimensions of user reality.

It both addresses needs for intuitive evaluation that does not have to be verbalized and raises questions beyond mere functionality. Working with scenarios in this way is reflective, since it explicitly engages with the user environment. At the same time it is experimental in the way it supports imagination of future activities. One group used this opportunity for negotiating the social interaction that can take place in a driver’s cabin and what kind of design that could support such interaction (Figure 14).

Scale and immersiveness. As illustrated in our fieldwork examples, scale and immersiveness are major issues in both areas, architecture and interaction design. In interaction design it enables students to enact a scene/use situation in a life size environment. Architects always work with representations of what may be built in different scale. They may for example carry their models to the site, looking into them with an endoscope. This helps them imagine the design in a life size environment. Scaling may help discover new features of a material or a site, experience how a model or texture looks like when it is blown up.

Real size is to do with bodily presence. It is not scale in the geometric sense that matters but immersiveness and realism. Immersiveness can be obtained with simple means, using several beamers and projection screens, “projecting everywhere”. For architects it is important that projections reach down onto the floor, filling in the edge between wall and floor. Another issue is the unusual view onto a model or scene, using the (web)camera as an artificial eye fixed in unusual positions. Moreover, the web cams can be used for recording changes made to the space or to a model.

Mixed spaces. Grid, projection setups, Texture Brush can be configured so as to produce mixed spaces. One interesting aspect of this mixing of the physical and digital is the transient and ephemeral way in which artifacts, people, and ambiances are encountered. This resonates with what architects see as an important aspect of
their work – the peripheral presence of events or objects, with short time events, fast, assembled, ad-hoc, such as film, video and fashion photography being important inspirational resources (Wagner 2002).

3.3 Summary

We described several episodes, which, despite their variety and uniqueness, contribute to support our view of the environment as a whole characterized by key qualities. The material on which we base our argumentation has been collected in two different learning settings with common characteristics – space and activities undergo constant reorganizations and they are rich with artifacts of different materiality. Although the settings are specific, we consider them as representative of projectbased learning environments. Student and teaching staff were not merely users but had an active role in shaping the technologies and in integrating them into their work setting. The results of this cooperative development are installations, which help understand some salient issues of tangible computing. Our paper focuses on two design themes:

1) The focus on mixing physical artifacts and digital media allowed us to show how technology can be used for extending physical artifacts to animated artifacts or mixed objects and increased our understanding of augmented reality strategies concerning objects. In collaborative work they can be shared across different perspectives and interests. Being objective for change, by manipulating both the physical body and digital properties, they support student’s need for perceiving them differently in different phases of design.

2) The focus on connecting, configuring, and integrating the physical space brought to create stages to experience and explore aspects of remote places, situations, scale and immersiveness. Acting and working in these spaces can increase the perception of places intended for design as being a whole. Not only focusing on a device for interaction or an architectural component, but on the rich interplay between spaces, artifacts and social communication.

4. Acknowledgements

We are grateful to our co-researchers at the Malmö School of Arts & Communication, the Interactive Institute, the Consorzio Milano Ricerche and University of Milano-Bicocca, the University of Oulu, the Academy of Fine Arts in Vienna, and
Imagination Computer Services, as well as to students and teaching staff in Malmö and Vienna. Finally we would like to acknowledge Infotech Oulu for supporting this research at the University of Oulu.

5. References


Collaborative Articulation in Healthcare Settings
Towards Increased Visibility, Negotiation and Mutual Understanding

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Published in proceedings of NordiCHI 2006, Oslo.
Introduction

Learning and communication evolve in a networked interplay between human actors and material artifacts. The role of artifacts in mediating knowledge and their ability to increase the range of what could be made visible has been highlighted by many practitioners and scholars (for example [32]). Related is also the issue of how we engage in interacting with artifacts and how our actions are made visible both to ourselves and to others [27]. People’s continuous interaction with material artifacts in everyday life has a counterpart in information technologies in the way digital media supports understanding and alignment of different human actors.

In two interaction design projects with the focus on supporting patient empowerment with information technology we have addressed these questions. A challenge for the field of interaction design within the domain of patient empowerment is to create a set of devices, services and content that can, through appropriate interaction, support the healthcare staff, the patient and his surrounding social network to collaboratively articulate the state of the injury and the necessary steps for successful patient learning.

This aim—to increase articulation and visibility—needs to take into consideration the situated nature of human action where practitioners adopt to local circumstances to manage their objectives [31]. This is something that is highly evident in the healthcare sector where procedures are deeply embedded in diverse practices and varies depending on the patient’s situation or the local department’s available resources [21]. That procedures are situational and embedded in practice is accounted for by Bruno Latour’s writing on how we engage in talk about the body [18]. He proposes that the body becomes more and more describable as it learns to be affected by more and more entities. These entities are often artificial set ups, such as the use of medical instruments and mediating artifacts.

Learning about the body is from this perspective a progressive enterprise that cannot be described only in generalizations. The deviations in individual cases have to be accounted for and aligned to the general knowledge developed within the tradition of medicine and surgery. This learning can be expressed in articulations which are propositional rather than final or general. We explore how digital content and interaction with digital media strengthens the articulations. Digital media has the potential for easy and instantaneous documentation that renders a situated character to information. While resting in between the general and the particular, it can be related to the specific moment in which it was conveyed.

Further, we propose models for interacting with digital media and associated devices that are understandable for all parties and controlled by the users in explicit ways: the notion of explicit interaction.
Several studies of information technologies within healthcare settings relate to issues of electronic health records [1,13], generalized information accessible online, such as NHS Direct Online, or models of remote communication that promotes caring at home or other distant sites such as described by Perednia and Allen [25]. By contrast, we explore how technology can support the making explicit and visible of vital information captured in situated interaction during consultations or other instances of on-site clinic/patient communication. Drawing on our findings, we propose an interaction model for such situations.

Mol and Law highlight in a text on hypoglycemia how the sickness is performed and ‘done’ rather than being described and known [22], including treating the patient as a human being far beyond the sickness or disease. They propose that healthcare take an ethnographic turn that is not accounting for general states of bodies but rather looks into pragmatic ways of dealing with the state at hand. Inspired by this, and from a point of view grounded in our work, we find that such a turn can include exploring how digital media can enrich a mutual understanding that both the hand surgery clinic and the individual patient can share as a foundational platform for successful rehabilitation. The use of the “ethnographic” label indicates that it:

- addresses how dysfunctionality of the hand is performed rather than being described as a finite or general state of the body

- tries to capture these doings of hand surgery in the instant and specific moments of rehabilitation rather than being instructional and generalized

- includes the patient’s body as a lived human body, including the life-world of the patient from healing of tendons to work ambitions and love life, rather than treating her as primarily “ill”

We have carried out two successive projects in the domain of hand surgery. In the paper they are addressed as two steps exploring different aspects of visibility. Our focus has been on the rehabilitation process, which implies that our concern is the patient’s situation after surgery.

In the first project we will see how healthcare professionals and patients with the support of off-the-shelf information technology collaboratively articulate the patient’s situation, thereby making it more visible for the patient. In this project the patient is getting a better picture of his/her forthcoming recovery. This creates a more balanced/symmetrical relationship with a focus on dialogue where informa-
tion is negotiated between the parties. In the second project, we pursue a different technological approach, focusing more on interaction design where the technology can be controlled by both patient and staff, making the communicative work of rehabilitation clearly visible for both parties as well as other people being present. Finally we will discuss the possible implications of our approach.

**Collaborative articulations**

An extended body of healthcare literature has discussed different conceptualizations and models for patient empowerment and patient learning. On a discursive level, patient empowerment requires mutual agreement in consultations. Our understanding of collaborative articulations takes these mutual agreements as foundational. However we want to stress that those articulations go beyond the situation of the consultation and include participants also outside the clinic.

It is also important to stress that the clinic is not a homogenous actor. Different physicians and therapists not only have different notions of rehabilitation, but also talk and express those notions in very diverse ways. Our goal has been to explore how information technologies and design of interaction supports articulation and aligning all of the participating parties, with the patient as a focal point.

We have found that various perspectives of visibility are needed for how negotiations are performed towards a mutual understanding and these will be addressed throughout the paper.

**From information towards dialogue**

Concepts such as the educated patient, patient empowerment and patient-centered approaches gain interest in the healthcare sector around the world. The educated-patient seems to be in a better position to recover [24]. The basic idea to “educate” the patient is not new; within the tradition of diabetic care this has been the case for some time where patients have to take responsibility for their situation and everyday care. Often the strategy has been to provide the patients with information and to convince them to follow given prescriptions [9].

Recent initiatives within this field include both physical settings where patients can get help in searching for relevant information (e.g., Patientforum UMAS in Sweden) and web-based services such as NHS Direct online in Great Britain or “smärtverkstaden” in Sweden. Today, considerable resources are spent on producing information leaflets to support patients. ”Patient education” often focuses on biomedical information and follows a typical one-way model of communication
Whether leaflets, websites or physical settings are the chosen means, putting too much energy in “information” approaches where the main problem is considered to be how to formulate a message in the right way, will always risk missing critical aspects of communication.

Already in 1979, Michael J. Reddy convincingly showed how the English language often is used in a way that suggests that it can be used as a “conduit” or “container” transferring meaning from the speaker to the listener [26]. Reddy instead presented an alternative to this simplified one-way model of communication that rather emphasized dialog and hard work from both sender and receiver in a communication process. Since then, more researchers within healthcare have argued to go beyond a simplified conduit model of communication if patients are going to be able to make sense of medical information [33].

**Shared responsibility**

The concept of patient empowerment stresses the notions of “informed choice” and the “reflexive consumer” [15] where people get the tools and opportunities to cope with, take responsibility for and make their own choices in their situation as a patient [24]. Some researchers are quite optimistic regarding the possibilities that the Internet will be one of the tools that allow people to take these steps toward empowerment and responsibility for their own situation [8].

Others are more critical, both to the idea that internet as such will be enough to ensure empowerment and to the idea that patients should take full responsibility for their treatment [15]. In a large world-wide study [16], patients regard the physician as the most reliable source of information compared to internet, media etc. The study concludes that the roles have changed significantly in the last ten years from a more paternalistic and authoritarian model to a more mutual partnership.

The majority also rank the patient–physician relationship as the second most important after their own family. Another study [15] also emphasizes the importance of the physician–patient relationship. It was found that many patients do not want to take the full responsibility, make difficult decisions on their own or search for information. They want their physician to make the important choices. Many patients also find it cumbersome to question their doctor’s opinion and report that they experienced resistance from them when doing so.
The projects and methods

The methods employed have been ethnographically inspired, participating as observers during consultations and other instances of rehabilitation, making extensive video recordings and performing interviews with patients as well as staff. We have also been inspired by ethnomethodology in the sense that the material has been interpreted and analyzed with a focus on how artifacts are used under specific circumstances [10].

Patients do not only refer to information as such but make sense of it in relation to how it is expressed, by whom it is mobilized and in which context it is used. Our work has not been descriptive, however, but rather proactive with influence from participatory design [6]. We have worked with staff members and to some extent also patients as participants in change-oriented activities and design sessions.

The aim of the first project, called Everyday learning, was to explore and develop the relation between the patient and the healthcare staff. We investigated how off-the-shelf technology could support patient empowerment and what kind of mediating format would be most appropriate to enhance a collaborative articulation of the patient’s situation.

The second project, which is part of the larger EU-funded Palcom project1 has had a slightly different goal, in trying to develop a complementary perspective to ambient computing. Here, foundational issues have been how the experience of technology within a healthcare setting must be noticed and apprehended and how devices can connect to other devices in joint performances of activity-based services that support the idea of collaborative articulation.

Rehabilitation after hand surgery

We have undertaken studies in the Hand surgery clinic of Malmö University Hospital. The Hand surgery clinic is a specialist clinic with patients from all over southern Sweden, some even from other parts of Sweden and abroad. The hands play an essential part in people’s lives and injuries can be traumatic, life-changing events.

Quite apart from the pain, patients often struggle to understand the complexity of their injuries and the healing process, and it can be extremely difficult to come to terms with the necessarily slow process of recovery, and possibly radical and lasting effects on their everyday life. The stress of the new situation means that it is difficult to take in information. Yet it is crucial for the success of rehabilitation that
patients take charge of their recovery processes. The necessity of understanding the recovery process includes the patient’s surrounding social network such as family and employers. It can be quite a challenge for them to accept that after several months it is still not possible for the injured person to perform tasks that he/she usually performs.

According to the staff, there is a noticeable difference in success between patients with a supportive network and those who are alone or have difficulties in accepting their functional impairments. Moreover, it is a challenge for the staff to understand the patients’ possibility to adhere to rehabilitation. For example, fine-grained movements of the hand used in work tasks can be difficult to understand by verbal reports. The foundational circumstances of how the hand is used in the patient’s everyday activities such as working, carrying out household activities, or dressing are also changed in dramatic ways in many cases.

For patients with severe injuries, the hand may never be the same as before the injury, even after successful surgery and rehabilitation. This implies new ways of living and operating with the hand. Many skills taken for granted have to be re-learned. The hand must be accommodated differently by all parties in the patient’s lifeworld. To change the appropriate pace in rehabilitation might lead to incapacity, so re-aligning knowledge and actions of this multitude of actors and actants is of utmost importance.

This calls for collaborative articulation to a degree that is very difficult to achieve. Together with the doctors and therapists, patients learn to re-train their perception of the hand and how it is used in a situated learning process, which is distinguished by mutual and negotiated interaction.

An evolving picture of the patient’s situation

During the patient’s trajectory of his/her recovery process and different encounters with healthcare professionals and their diverse forms of artifacts such as patient records and x-ray images, a picture of the patient’s overall situation is gradually taking shape. From the healthcare professional’s point of view, the patient record works as a center of gravity for this evolving image [1].

However, in our work it became clear that the patient has no explicit tool to rely on regarding the creation of this image. Still, many sources, among them different staff members (and the patient) and their artifacts provide small pieces forming a puzzle that gradually increases the visibility of the patient’s situation. We will look closer on some of the central factors that we could see played an important role in forming this puzzle.
A network of actants

At the centre of the rehabilitation process is the hand. It is not only the object of the rehabilitation, but also the main means of formulating, aligning and anchoring knowledge, a ‘boundary object’ [29] that has potential for connecting people and perspectives of understanding of the injury across the boundaries of the clinic, the work place, and the home.

Bruno Latour uses the term actant to describe both human agents and the non-human artifacts [17]. Since these non-human actors can be said to have an almost equal impact on the patient’s understanding we will continue to use the concept of actants, including the human body as well as mediating artifacts used in talking about it. The human hand is an always available and highly visible artifact that both the professional healthcare workers and the patient use as an articulation tool to enhance their communication process.

The physician’s own hand serves as a stand-in, a replica of the patient’s hand, and without any specific preparation they have a tool that can help them to improvise a story they think is necessary to tell in the moment. We have seen examples of how physicians use their hands to visualize surgical procedures when they accidentally bump into each other in the corridors, by drawing with their fingers on their own hands where they plan to do the cutting.

We have also seen examples of how they use their hands when they report to a colleague on the status of a recently arrived patient. They use their hands to mark and draw lines of how extensive the patient’s injury is, what parts are affected etc. The hand is also used in several different ways during communication with patients. The staff members use them to gesticulate and emphasize in the same way as many people normally do. They also use them in a more indexical way. As an example, during a meeting between a physiotherapist and a patient, the patient points to troublesome areas on his hand. The physiotherapist in this case uses his own hand to illustrate how to do an exercise:

Physiotherapist: “If you hold like this, and straighten your fingers as much as you can, and then you bend as much as possible with straight fingers.” (The physio-
therapist watches the patient’s corresponding movements and corrects a sequence he thinks needs it by moving the patient’s finger.)

Physiotherapist: “You can move that finger a little bit more. There, so you are able to feel a stretch over here.” (The physiotherapist draws a line with his fingers over the patient’s knuckle.)

Both the physiotherapist’s and the patient’s hands are used as visualizing tools to clarify the discussion. The physiotherapist moves smoothly between using his own hand to demonstrate the appropriate performance and using the patient’s hand to point at critical or important features and correct inappropriate movements.

**Articulating with artifacts and materials**

A number of tools and log sheets are used to assess and monitor the flexibility of hand and fingers, grip strength, tactile sensitivity and pain. They also serve to make progress visible, which can otherwise be almost imperceptible to the patient. They also use other artifacts to articulate the stories they want to tell. During a consultation, the physiotherapist uses a poster showing the anatomy of the hand to reveal and explain what kind of injury the patient suffers from. In conjunction with the poster, he complements the story by pointing at corresponding parts at his own hand. A patient with severe nerve injuries can suffer from strange and unpleasant tactile sensations. One patient describes a feeling of electricity in his fingers that makes it difficult for him to use some of his fingers appropriately.

The physiotherapist starts rubbing the patient’s hand, something the patient initially experiences as very unpleasant. After a while the sensation decreases and the physiotherapist instead uses a towel when rubbing the hand, explaining that the patient has to get used to different kinds of surfaces. The procedure makes it clear to
the patient that the sensation can diminish with this kind of training. The towel helps to articulate and “visualize” these effects.

Throughout surgery and rehabilitation, you meet a variety of different actors, including physicians, physiotherapists, and occupational therapists. In addition to this, patients living in other parts of the region might consult local healthcare as well. For patients it is not uncommon to meet, and receive information from, all these actors during one single appointment at the clinic.

In addition a variety of non-human actors are mobilized such as information leaflets and papers with appointment times, training exercises or instructions for taking care of splints and orthoses. Some information is communicated only verbally. This means that after several brief meetings, patients might go back home with a complex set of instructions that is all important for rehabilitation progress.

**A negotiated picture of the situation**

During the meetings between the physiotherapist and the patient, the former tries to create a picture of the patient’s overall situation. Typically he opens up with a question about the patient’s condition or maybe, if it is the first visit, he may ask about the patient’s occupation. The patients bring in different kind of information to the collaborative articulation. Often it is triggered by different questions that the physiotherapist uses to get the necessary pieces to the evolving puzzle: information about progress, what they have done, how they have used their hands, and what kind of pain or trouble the injury has caused them in their everyday activities or during their occupation. However, the patients have their agendas and ask questions they think are relevant; it could be about things that worry them or why the progress is so slow.

Physiotherapist: “Are you still in pain?”

Patient: “Yes, it is stinging and I got a problem with pressure from this here (pointing at his rehabilitation device at his finger) which caused a swelling”

Physiotherapist: “It’s better out there”

Patient: “I haven’t used it since Thursday” (referring to his rehabilitation device at his finger) […]

234
Physiotherapist: “The swelling is now positioned here, has it been the case since Thursday”

Patient: “There I think it has been a swelling all the time”[…]

Patient: ”There is something hard, is it the bone?”
Physiotherapist: “You mean this? It’s scar tissue that has become hard... everything is in layers when you are not injured. After injury and the bones are repaired with the tendons and skin, healing doesn’t occur in these subtle layers. Instead, the scar is like a lump. Some people get harder scars than others—it depends on genetics. Your scar will soften gradually; it will take about a year.”

In this case, the two parties negotiate the evolving picture. How extensive is the swelling? Is it getting better? Is that a part of the swelling? Both of them are asking questions and the physiotherapist produces explanations addressing the patient’s specific circumstances and worries.

**Verbal strategies promoting visibility**

The physiotherapist uses different strategies to help the patient get a better grasp of his/her situation. They are well aware that it is difficult for the patient (being in a stressful situation) to comprehend all the necessary information. Because of this, they often only tell them some aspects at their first encounter and then follow up on that information on the next occasion to avoid overload. This means that the patient sometimes has to wait a while to get a more complete picture of their situation.

The physiotherapist also often repeats important aspects several times during a meeting with slightly different formulations; “Try to be aware that you shouldn’t put to much burden on.” “Remember, don’t use strong force, it’s not a weight exercise”. Another important strategy is to use formulations that are beyond a technical medical language. As an example, instead of saying that the patient’s tendon is only strong enough to manage X Newton m of force, they try to formulate the information in a way that is more easily connected to the patient’s everyday situation: “Normally, after 6 weeks you’re allowed to carry a bag with one liter of milk.” “You can use the hand a little bit when you’re dressing or washing your hair, but do not use it when pulling on a pair of tight jeans.”

Sometimes they also use metaphors, especially when they are trying to explain the anatomy of the hand: “The tendon works like a piston in a cylinder and if it’s
still for too long, it will rust and get stuck, it will grow into the sheath.” “The muscle is here and when it contracts it’s like a jumping jack.” Many of these explanatory strategies are considered necessary to motivate the patient to do cumbersome exercises, follow troublesome prescriptions and stick to a hard recovery plan. They help the patients to align important information to their specific circumstances and their everyday life and they can build an appropriate picture of their own process of recovery.

**STEP ONE TOWARDS VISIBILITY**

*Giving the patients tools to increase visibility*

We have seen how different meetings and artifacts help the patient to form a picture of his/her recovery process. Much of the relevant information is embedded and of a situated character, revealed with the help of aligning different artifacts to the patient’s injury. The articulation is performed in collaboration between the patient and the staff. The evolving picture is negotiated between the parties forming a unique story for each patient.

During the Everyday learning project we did some experiments where we tried to capture such situated occasions. In the first experiment, we used a DV camera on a tripod to film three meetings between a physiotherapist and three different patients recovering from the same injury (an incision to a tendon).

These movies were about 15 minutes long and you could easily see both the patients and the physiotherapist’s hands and the poster they use as illustration. The contents were to some extent similar between the movies, but there were also important differences. One of the patients was a professional athlete and in his case they negotiated how the exercises and recovery process would affect his training. One patient was afraid of doing exercises and needed extra coaching and encouragement. The patients received the movies on regular CDs after the consultations, and they used them several times in ways that we didn’t anticipate.

They all used them to show their relatives what they experienced at the hospital. The professional athlete showed the material to his regular physiotherapist. The movies were used as references, in order to compare movement capability with previous exercises. And finally, the patients used the movies during their exercises. The
Experiments with digital X-rays and screen-capturing software

Quite often during consultation sessions, a physician and a patient collaboratively watch the patient’s X-ray pictures on a computer screen between them. In those cases, the physician uses the X-ray pictures to explain what kind of surgical procedure he is planning to perform. We did some experiments where we tried to capture those occasions with the help of screen-capturing software.

The software allows the physician to draw and mark the X-ray pictures to emphasize the patient’s status and what the surgical procedure will be about. All this will be recorded as an animated movie together with their discussion. The format is playable on all Windows platforms and the patients received CD copies before they left.

Similar to the previous examples at the rehabilitation unit, we found differences in the explanations and discussions among different patients also when patients suffered from similar injuries. All the patients also used the material to show their relatives. Compared with the material the patients got at the rehabilitation unit, the X-ray drawings covered only a small part of the consultation.

Typically the material was about 2–3 minutes long, compared with the 15 minutes of recording that were done at the rehab unit. Many questions and issues were addressed outside the limited X-ray picture slot. On the other hand, the physician found it appropriate to have a concentrated point in the consultation where he was aware that a recording took place. He was in control of the technology and started the recording when he was prepared and ended it when he thought enough information had been provided.

In both experiments, the patient was provided with a more visible and collaboratively articulated picture of his/her situation. Compared to many initiatives within the tradition of patient empowerment, the focus of our experiments was on dialogue rather than simply providing information. As Henwood et al have argued, the issue of responsibility within patient empowerment is not without its problems where
some patients do not want to take full responsibility for their situation [15]. In our experiments, the responsibility could be seen as shared between the healthcare staff and the patient where they collaboratively negotiate the most appropriate path to follow. It takes as its starting point the relationship and source of information that the patient regards as the most important and trustworthy, namely the physician and healthcare professional [20]. The experiments also take in consideration the unavoidable diversity in medicine [21] and situated character of procedures [31], where the meetings between different healthcare workers, different patients and different local circumstances form unique constellations for every single case.

New possible alignments

During the sessions in the experiments the physiotherapist and physician made alignments between different artifacts, diverse situations and the patient’s specific condition. Latour has suggested that these kinds of alignments between different artifacts can in some instances make it easier to compare and support the evolving chain of actants [17]. The digital material and recordings made it possible for the patient to continue these alignments, now aligning the material to their relatives and friends. It also made it possible to align the story told during stressful conditions to a more comfortable relaxed situation in their home where they could grasp the content more easily.

The video recordings had some advantages compared to the X-ray animations, in that it easily captured all the important artifacts that could help increase the visibility of the situation, including both the patient’s and the therapist’s hands with their diverse communicative potentials. In the video experiment, therefore, the patient could also make alignments in time where they could compare their progress of using the hand with their status at the moment of the video recording.

Step two towards visibility

We have addressed how collaborative articulation can strengthen the emerging aim of patient empowerment. We have argued that increased visibility in the rehabilitation process supports a notion of mutual understanding that we find crucial for collaborative articulation. So far, the visibility aspect has been concerned with visibility of perspectives, how the patients’ voices are part of expressing the current state of rehabilitation and deciding on the next steps to take. This is already inherent in today’s practice, but our observations of these more or less tacit negotiations inspired an approach to how visibility of situated information, that is mobilized
in the consultation, can align to more abstract medical information that is needed for patients’ understanding of the injury and learning to cope with it.

The situated information such as video recordings of “hand injury talk”, training exercises and screen recordings of how X-rays are used in discussion with the doctor, were also used by patients as boundary objects when discussing the injury with family and friends. Thus it was used for re-aligning the overall network of actants, humans and non-humans that ideally are engaged in successful rehabilitation. The experiments from step one showed promising results and the use of offthe-shelf technologies showed that the ideas could be put into play immediately.

However the CD and DVD disk formats do not fulfill the potential of networked digital media and the interaction still relies on the therapist or physician unilaterally determining the recording. In the following section we will address another level of visibility that we find important for collaborative articulation, namely that of visibility of actions and intentions through use of technology. This is an issue we address through the concept of explicit interaction.

An example in our work is how handheld devices can access the functionality of a high resolution video camera through an interaction that makes sense in relation to the concept of collaborative articulation and shared understanding within an environment. (We return to this example shortly.)

The term ambient is often used for describing systems that are pervasive and integrated in an environment. Quite often, it is hard to perceive interaction with them due to their immaterial nature. How do you for example account for the experience of a wireless connection? It is there and if it’s working we have no problem in not being able to relate to it in other ways than text messages appearing on the screen telling about its current state. But in an open environment where several actors access and possibly compete for shared resources, the visibility of actions and services becomes an issue.

Problems of Demassification and invisibility

John S. Brown and Paul Duguid have written about the problem of demassification [3], discussing how digital technologies and new media introduce not only new materials but also fundamentally new social conditions. Demassification denotes
how digital media, unlike, e.g., a book, have no physical body that can be directly accessed. But there is also a social demassification emerging in the sense that the conditions for collaboratively experiencing artifacts have changed radically. Most often artifacts have an intended functionality, but as they are appropriated through use, border resources are emerging. An example of a border resource in a common artifact, the door, is given by Andreas Lund [14] in a discussion of a movie by Jaques Tati. In the movie, which is a silent movie, the lead character, frustrated over some disagreement, wants to express his anger when leaving the room by slamming the door, a sound which we all can refer to as embodying the dissatisfaction felt by the person shutting it. It is not a property inherent in the design of doors to express emotions, but nonetheless it has evolved into a border resource comprehensible for most people. In the movie the character bangs the door again and again, but since it is a silent movie nothing is heard—the border resources cannot be evoked.

And the materiality of artifacts does play a crucial role in our everyday sense making. Albert Borgman [2] uses the term commodity to illustrate how just one of several aspects are maintained when an artifact is replaced by technology. One of his examples is how central-heating well provides opportunities for securing warmth, but how wood-burning fireplaces also related to the amount of wood needed, the work of chopping and drying wood and the need for keeping the fire burning. Those might be border resources in relation to temperature, but important ones as they also provided a rhythm of everyday life. To summarize, we think important objectives for collaborative systems include supporting shared understanding and informed participation.

In our scenarios, a shared understanding is an act of knowing who will use the information and for what purpose. Our case rests on envisioning a ubiquity of digital media, where situations are potentially subject to recording and mediation. Personally owned handheld devices such as smart phones or PDAs become potential proxies for the individual, since the phone is most often carried on or near the individual. The personal device can ensure identification of the owner. It can also serve as an actor in a staging which aligns the participants in a way that can be perceived by others in the periphery. This is the case for the rehabilitation ward which has a spatial layout similar to an open office, where rooms are used by several therapists.

Another object we introduce in our scenarios is the metaphor of a docking station—a physical object that in combination with a phone or PDA provides a framing for fulfilling some specific intention such as recording, viewing or sharing digital media. It is motivated by desirable use qualities such as augmenting the generic device with activity-specific functionality when needed, and supporting
visibility of activity and intentions in order to exploit social skills from existing rehabilitation practices.

What we designed is a PDA augmented with RFID tags, a docking station with an integrated RFID reader, physical slots for holding two PDAs, and software for handling the video stream and processing information about identity of the user, capabilities of the PDA, etc.. Instead of using the remote control for initiating and stopping the recording, the act of placing the PDA in the docking station connects it to the camera. The video feed is displayed in a low-resolution version on the PDA (which eventually also will store the media. This is not yet implemented). The screen of the touch-sensitive display replaces the record and stop buttons and tapping on the display thus controls the recording. When the PDAs are taken out of the docking station, the connection with the video camera is ended.

Though not yet evaluated in actual use at the clinic we think the design responds to the notion of explicit interaction in several aspects, which have been assessed in sessions with the staff;

- Tangibility renders the situation as clearly perceivable for both patient and therapist/doctor in the consultation but also peripherally from other people present in the shared space

- Placing is not a physically demanding interaction, which is an issue for people with hand disabilities. Neither is it a cognitive demanding task, compared with browsing for the right application and navigating in a typical PDA interface with many choices.

- It is performative in the sense that both partners can relate to a ritualistic series of actions that reflects a change of rhythm in the consultation. It is agreed that they now are about to start a recording. It also supports other people present in the room in adjusting how they perform, for example deciding not to disturb or make loud noises.

**Figure 7:**
To the left a therapist and a researcher are making a video recording during an "envisioned" consultation. To the right a close up of the docking station on the table, with two PDAs in place.
- It is personal in as much as viewing the recording on the personally owned display gives a feeling of ownership and access to the digital media.

This is the first design in an exploration of how handheld devices can construct short-lived assemblies with resources that exist at the clinic. In the network of actors they can, when combined with a material form such as the docking station, serve as physical nodes to activity-based services that relate to the life cycle of digital media in different ways (capturing, displaying, sharing, editing etc).

Apart from evaluating the first prototype in actual use, future work includes reversing the media stream to study how collaborative articulation can be supported by patients producing media and bringing to the clinic.

**Conclusion**

Most of the staff’s strategies to articulate and make the case more visible are embedded in practice and cannot be revealed only by verbal explanations. During consultations the dialogue unfolds differently depending on the specific patient and specific healthcare worker in a language more suitable for a medical layperson than, for instance, in the patient record. The first series of experiments helped articulating a deeply embedded practice towards something more palpable using strategies such as recording parts of consultations on video and annotated X-ray pictures.

Together with other artifacts such as anatomical posters, rehabilitation instruments, and the hand itself, they have helped patients to better comprehend foundational issues in rehabilitation. Patients also brought the material to their relatives and other physiotherapists to share their experiences. In a continuation of the experiments we have suggested the model of explicit interaction that introduces physical form for mediating connections between handheld devices and central resources.

Moreover, explicit interaction devices promote visibility of action not only for patient and staff but also for other people being present. The collaborative nature of interactions enforces the shared and negotiated nature of the decision on when to record and what to record.

Several issues in our discussion that suggest a rather strong intervention into current practice have implications that must be explored further. Considering the situated character of consultations, the general impression of the clinic is that recordings have positive effects. However, there may be implications for the staff’s behavior towards the patient as they are possible subjects for being captured on a video that are carried around by the patient. While longer videos have potential for
capturing important information, they might constrain what is actually being said and enforce a “correct” professional behavior among staff members.

This is undesirable since it seems important to maintain a “free” channel in communication that can act as the place for casual, informal talk, maybe expressing hope and sympathy that cannot be supported from a strictly clinical point of view. More focused and concentrated recordings, collecting the most relevant takeaways, can ensure visibility of information that otherwise remains tacit in communication. What is chosen to be recorded is considered as the result of a negotiation between patient and doctor/therapist.

The explicit interaction techniques illustrated by the docking station has been considered so far in discussion with the clinic as one means of emphasizing the act of mutual agreement, and we will explore this further in our research.

Acknowledgments

This paper presents work that has been carried out in collaboration with Mette Agger Eriksen, Erling Björgvinsson, Jonas Löwgren, Stefan Olofsson and Tomas Sokoler from Malmö University. Thanks to the hand surgery clinic at UMAS university hospital and all the participating patients.

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The thesis explores how interactive technologies and digital media can be used as transformative mediators and tools. They have the potential to strengthen and enrich the experience of different transformations that are discussed as being important for practices of creativity and learning, where the engagement and relationship to processes of change is fundamental. The flexibility of digital media and forms for tangible interaction constitutes major elements in the design experiments described in the thesis.

Material artefacts and physical space play a central role in how people make sense of the world. Looking closely at practices where creativity, learning and communication are important for collaborative work it becomes clear that this insight implies that the concepts of objects and space carry quite a portion of multiplicity. They are used differently and with different intentions, they are understood differently from different perspectives and the look and feel of them appears differently even if they can be described as “one” thing or “one” space. Dealing with these heterogeneities challenges the way we use objects and spaces. It becomes a matter of connecting the multiplicities and how we configure them in relation each other. The research discusses how the discipline of interaction design can support dealing with multiplicity, configuring and mixing of objects and spaces. They are not only used or inhabited; they are performed and enacted.

In exploring these issues the thesis discusses the development and experiments with a couple of design prototypes that rests upon basically the same technology which is a combination of technologies for tracking and/or tagging. Studies and experiments have been performed in three different domains: design work, patient learning while undergoing lengthy rehabilitation and artistic work and performances. The diversity of studied domains provides a way of talking about design that focus on use and users’ appropriation of technology rather than reflecting the technology itself. From a methodological perspective issues of participatory design have been foundational to the research.

Some design consequences refers to how we can not only regard interactive artefacts as bundles of functionality. We must also look into issues of giving form to them as material things and the thesis especially reflect how we can override a distinction of things being either material or virtual. Another consequence is how digital technologies often does not replace “analogue” media and material things, but instead are used in parallel and must find a place in an already existing ecology of artefacts, devices and services. In the thesis there is a strong focus on how human action is co-shaped together with artefacts and technology as we perform specific tasks or simply go on about our living and making sense of the world.

ABSTRACT

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