

# Ways of grounding imagination

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## Abstract

This paper discusses and evaluates use of different participatory design methods in relation to addressing the challenge of grounding imagination. It presents reflections on the use of three participatory design methods, deployed in the WorkSpace project: future laboratories, in-situ prototyping experiments and bricolage. The analysis examines how the methods differ, and how they complement one another, in relation to supporting the process of grounding imagination. The paper introduces 'future laboratories' as a participatory design method, specifically aiming at promoting interdisciplinary collaboration and grounded imagination.

## Keywords

Grounding imagination, analytical triangulation, PD methods, future laboratory, in-situ prototyping experiments, bricolage.

## 1. Introduction

In this paper we present a system development process that started out with an intention of close user involvement with professional landscape architects, and ended up as a process of mutual engagement and a clear notion of shared goals. Over a three-year period of folding real world working experience into technology design, and technology into real world experience and practice, the collaboration came to full effect with the 'users' presenting and showing the various technologies and ideas developed at the final project review.

### 1.1 Multidisciplinary participatory design approach

The WorkSpace<sup>1</sup> project was part of the European Union's Disappearing Computer programme, a long-term basic research initiative running 2001-2003, aiming at developing technologies and scenarios of use reaching 5-10 years into the future. The WorkSpace team set out to create an integrated environment and a suite of prototypes aimed at supporting collaborative, co-located as well as distributed work activities, and to focus specifically on the challenge of mixing digital and physical materials. We were primarily interested in application domains characterized by collaboration and work (Schmidt & Bannon 1992). We take an ethnomethodologically informed participatory design approach, and one of the characteristics of the project was the close cooperation between architects, computer scientists,

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<sup>1</sup> <http://www.daimi.au.dk/workspace>

ethnographers, and landscape architects. The successful close collaboration was developed over the lifespan of the project.

### 1.2 Grounding imagination

imagination	observation	One of the primary challenges in most research and development projects is the dual nature of the job at hand, as illustrated by the pairs of opposites on the left. That use and users play an important role in designing interactive artefacts and computer systems is a well-known and widely acknowledged fact in many areas of research and development. However, grounding in use – whether through participatory or ethnomethodologically informed design – does not automatically provide the firm footing one would like to negotiate the pull of many opposite forces (Luff et al. 2002, Bannon 1996). Design takes place on shifting ground, where new technologies encourage continuous transformations of mundane practice. Innovation is an integral part of everyday life. As the challenge for technology design is to find fit, we need to anticipate and design for future practice whilst remaining, 'grounded' in an inescapably and continuously changing environment. This requires an iterative approach and evaluation of technology-in-use. However, the more radical the changes envisaged or the more farsighted the vision, the more difficult it is to engage in such an approach.
present	future	
innovative	mundane	
repetition	change	
experiments	consequences	
analysis	intuition	
footloose	grounded	
doing	planning	

'Grounding imagination' is an approach that seeks to work with rather than against the challenge of meeting contradictory demands on shifting ground. We say *grounding* deliberately, to express action or a state of being rather than a static fact. In line with many anthropologists, philosophers, and design theorists we are conscious of the tensions between doing and reflecting (Heidegger 1988, Argyris & Schön 1978, Schön 1983, Dreyfus and Dreyfus 1986, Suchman 1987, Polanyi 1967). When it comes to design, these tensions are important. We need to:

- design by doing and design by reflecting
- design in a way that enables the invention of new practices by doing and by reflecting

While the former has received concerted attention from within the design world, the latter has had less consideration. Yet, practical creativity – or the invention of new practices – and analysis of such emerging practices is crucial for 'artful integration', for anticipating and designing for the future. Grounding imagination

is not a matter of finding ground and building on it, so to speak. It is a matter of continuously maintaining a footing on shifting ground. How can it be done? How can we create the conditions for the emergence and analysis of new practices, and for folding them into design?

### 1.3 Paper outline

The focus of the paper is to explore and understand how various participatory design methods deployed in the WorkSpace project have been, and in other projects may be, fruitfully combined, complementing one another in approaching the challenge of grounding imagination. We describe participatory design methods in relation to the challenge of grounding imagination through an analytical model for triangulation. Examples of three different participatory design methods: future laboratory, in-situ prototyping experiments and bricolage are given. We place an emphasis on future laboratories, because this method has not been described before for system design (cf. Abowd et al 2002).

## 2. PD in WorkSpace - triangulation

We have applied a wide range of techniques supporting interdisciplinary work between various subsets of competencies in the project ('users', 'software developers', 'interaction designers', 'work analysts', 'hardware developers', 'managers', and many more). They include scenarios (Bødker and Christiansen 1997), video prototyping (Mackay 1988), experience prototyping (Buchenau and Suri 2000), breaching experiments (Crabtree 2002), grounded imagination workshops, fieldstorms (Büscher et al 2003a), speedays (Agger et al 2003), provotyping (Mogensen 1994).

In the following we will focus on three participatory design methods/approaches that have been particularly useful regarding the ongoing collaboration between 'development' and 'use', the productive combination of the various competencies and backgrounds in the project, and grounding imagination:

**Bricolage:** the assembly and integration of various technologies and devices in order to make them work in practice (Shapiro et al 1996, Hartswood et al 2002).

**Prototyping experiments in-situ:** trial experiments of various prototypes in real settings with selected scenarios of use.

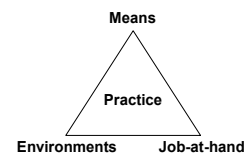
**Future laboratories:** bringing practitioners into the laboratory, where they appropriate prototype technologies by working seriously on a particular, authentic job for a prolonged period.

In order to highlight the various strengths and weaknesses, and to show how these approaches have complemented one another in our work, we present a particular view on some of the aspects involved in developing for (and thereby) changing work practice.

When we are talking about work, it is usually meaningful and important to talk about people's *practices* of accomplishing *jobs-at-hand*, with some *means*, within *environments* (Heidegger 1988, Gibson 1986).

We are aware that designing for practice entails a situated understanding of a multitude of multifaceted dynamic activities in concrete circumstances. However, a more simplified view may highlight what we regard as important aspects of many work practices and, therefore, important aspects for design & development projects. But also, and most importantly, it may help

to identify important similarities and differences between the methods discussed.



The figure on the left schematically depicts those aspects and shows that *jobs-at-hand*, *means*, and *environments* are brought into their various relationships via people's *practices*.

The figure depicts a given point in time. Over time all four elements will change, and hopefully through reasonably synchronized 'artful integration' (Suchman 1999). When we, in the following 'fix' one corner at a time, it is with this goal in mind and in the sense of utilizing a particular instance in time and one of those aspects as a vehicle to explore the possibilities for changing the others.

**Bricolage:** In most examples of bricolage in the WorkSpace project, it was a question of trying to organizationally implement particular means (for example, a particular tool for demonstrations, for collaboration, for experimenting with the design of wind farms, etc.). So, in a sense, the means were kept fixed in the process, posing challenges to the environments, jobs-at-hand, and practices. Quite a lot of work had to be put into changing the physical surroundings, surrounding technologies, exploring new "jobs" as well as developing new ways of mixing those into what eventually might develop into new work practices, in turn, posing new challenges for designing new means (tools). So in order to, in the long run, improve the means, it pays to 'freeze' them and see how their relationships with practice, environments, and jobs-at-hand develop. What parts of the environments and jobs-at-hands should/could/might be changed? How? Through this experience, new ideas, as well as ideas for going back and redesigning the means are developed.

**Prototyping experiments in-situ:** Over the course of three years, we conducted a number of prototyping experiments at the premises of the landscape architects and on a number of local site visits. In all of these experiments, what was taken as given were the environments and the specific environmental conditions (e.g. on site, the sunlight making it difficult to see the screen, the heavy traffic of lorries making an awareness of one's surroundings very important, the need to be able to climb ladders while still using, or at least carrying, the prototypes), whereas what was at the core of the experiments was to find proper mixes of potential means and potential jobs-at-hand (e.g. visualizing the future buildings on top of the real world when exploring the site, being able easily to capture the site by taking digital pictures and store them in correct positions in correct directions, being able to communicate with people back in the office by talking and sketching, etc.). In these situations, one might say that we kept the environments fixed in order to explore possibilities for new configurations of means, jobs-at-hand, and practices.

**Future laboratories:** The idea behind the future laboratory is on the one hand to explore new possibilities regarding means and environments (e.g. various parts of 3D software being interacted with and displayed on interactive walls, tables, floors, etc.), and on the other hand to ensure grounding by experimenting with the possible technologies as part of doing real work (examples will be presented in the following section). In these experiments, it is fair to say, we have utilized a real and fixed job-at-hand in order to provoke and probe imaginative ideas for new configurations of means, environments, and potential practices.

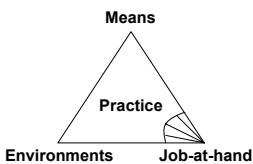
The above description of these three more or less well known techniques within participatory design is not meant as a recommendation that, say, prototyping in-situ must try to fix the environment, that bricolage should always hold stable the means, and future laboratories can only be used by grounding imagination in a particular job-at-hand. Nor is it meant to indicate that only one particular method can be applied when trying to use one aspect or corner to explore, or change the rest. The exploration is meant to provide

- an example of one, apparently successful, way of mixing the methods so they complement one another;
- an argument that the overall development challenge may be addressed fruitfully by approaching from the various angles;
- an example of approaching by fixing one aspect, using it to challenge the rest, to spur the imagination and to ground design.

All three approaches, from their different angles, are addressing the aim of grounding imagination, and all attempt both to ground design and spur the imagination.

Both bricolage and prototyping experiments have been extensively treated in the literature (Grønbæk et al 1995, Shapiro et al 1996, Hartswood et al 2002), future laboratories less so. In the following we give, therefore, two extensive examples on future laboratories and shorter examples of bricolage and prototyping in-situ. The examples provide an understanding of our way of accomplishing and combining them and serve as a basis for further discussion. The prototype designs are not described in detail in this article. In the sections below, we refer the reader to other articles for a more thorough account of their design, implementation and evaluation.

### 3. Future Laboratories



Like in many other workshops, the idea behind future laboratories is to experiment with and imagine possible new means and environments. And also like many other approaches, the activities take place away from the premises of intended use, for example in a laboratory setting. In that sense, future laboratories, share goals and settings with a range of ‘brainstorming’ techniques.

What is particular to future laboratories, though, is the

- deliberate attempt to ground the imagination in the accomplishment of a real job-at-hand, and
- the insistence on actually doing the job, instead of merely discussing how to do it

Although it is often preferable to experiment as close to the intended use context as possible, there may be many reasons for choosing the context of a laboratory instead of a ‘real site’: a deliberate attempt to abstract from existing technological constraints, the aim of trying out radically new practices, the ability to control the technologies to a much higher degree, etc.

The danger, of course, when detaching the imagining from real sites of use is that it 1) becomes irrelevant, or 2) lacks the sparks that arise from real problems that are not easily brushed aside.

The strategies of taking real jobs-at-hand and of actually doing them are attempts to avoid those pitfalls, and maintain the context

of imagination. Below we provide two examples of such future laboratories.

#### 3.1 A cycle of landscape design work, May 2002

In May 2002, one year into the project, the WorkSpace team have gained a good understanding of current work practice. We have brought together different perspectives in a productive way, and have many ideas, prototypes, and scenarios of how landscape architects might work in the future. However, we need more than ‘might’ to be able to seriously anticipate and design for the future.

We decide to try to create the conditions for an as-authentic-as-possible artful integration of means, environments, and jobs through (emerging) future practice.

Aarhus University has a building site on its doorstep. The department is being extended, and there are plenty of external spaces in need of a landscape architect’s attention, e.g. the courtyard right outside our laboratory (Fig. 1)



Figure 1 Working on the courtyard design brief.

The work analysis, system design, and interaction design members of the WorkSpace team create a prototype ‘design studio of the future’ around all existing WorkSpace prototypes. They draw up a brief for the courtyard design and send it to four of the landscape architects, who prepare some ideas in their home studio in Edinburgh (Fig. 1). A week later, the landscape architects colonize the prototype future design studio at Aarhus to carry on working here. They present and discuss their ideas with the rest of the team, who, amongst other things, act as the client. The landscape architects then work for two full days through a complete, albeit speeded-up, cycle of design work. We describe the flow of work and the dynamic configuration of people, spaces, materials and prototype technologies in (Büscher et al. 2003b). Here, we focus on collaboration around visualisations (like the session seen on the right in Fig. 1) as a particular issue we need to address through grounding imagination.



Figure 2 Sketching.

Work analysis studies show that in such design sessions, gaze, orientation, gestures, pointing and other forms of embodied interaction with materials and colleagues are crucial for getting the work done. Some actions (e.g. gestures) do not leave a mark on paper,

while others do (like the sketch of a tree in Fig. 2). Any kind of technology we develop will have to support or consider these existing forms of embodied interaction and expressions around work materials. But by changing the means for the accomplishment of collaboration around visualisations, we change the ‘ecology’ of interaction and expression. For example, the balance between leaving a mark or not may change (Büscher 2004). In order to fit, new technologies must work with such

changes. The process of grounding imagination provides a footing on such shifting ground.

By May 2002, we have implemented some ideas and the future laboratory now provides an opportunity to explore what works, what doesn't, what might, and why. Below, we outline some of the issues we explored.

*Integrating physical and digital materials and support for collaboration via joint discussion, pointing, gesturing, sketching:* Issues like linking, anchoring, scaling, and aligning physical and digital materials were explored



**Figure 3** The landscape architects continue their discussion around an augmented table in the future laboratory design studio.

*Remote collaboration between 'offices', mixing interactive digital shared workspaces with live video of the others:* Pointing, the emergence of 'gestraws', shared manipulation of materials, common foci, etc. were investigated. 'Gestraws' combine gestures and sketches. On paper what they express would most likely take the form of a gesture (like the one in Fig. 1). Here, it leaves a mark (Büscher 2004).



**Figure 4** Ross and Geoff see Martin and Andy's actions on their panel and their embodied orientation and gestures on the video projection (arrows).

*Remote collaboration between people on-site and people back in the office:* Questions included the design of physical device(s) for use on site, what and how much to transfer over limited bandwidth, how to support a shared understanding between people who are in very different environments.



**Figure 5** Ross and Geoff explain what they envisage on an image Andy and Martin sent from on site. All four collaboratively discuss and annotate using mobile telephones and their respective prototype technologies.

*Using video tags to bridge between physical and digital environments:* How to place and discuss various configurations of landscape design elements with video tags in the physical environment, stability of video tags, and overlaying real world with digital information were issues explored here.



**Figure 6** Andy and Ross place a pergola using video tags and digital overlays on real-time video.

Future laboratories can enable and encourage everyone to become a co-designer through intense shared experiences. The landscape architects did so by using their expertise of doing the 'real job' to evaluate the means through experimenting with the technologies in this setting with lots of backup. Programmers got familiar with present and possible future practices of landscape architecture. Work analysis 'lessons' were brought home through new ways of working that breached taken for granted practices. In the process, both 'grounding' and 'imagination' are enhanced. Analysis becomes more attuned to emerging practice, practical creativity is linked to actual experience and new practices are invented by doing them (as well as by discussing what might make sense), and design has a better chance to find fit.



**Figure 7** Making it happen.

As mentioned, the workshop was prepared by designing and building a prototype 'design studio of the future' and by carefully preparing a brief for the landscape architects. Prototypes were in various stages of development, reaching from mock-ups to working technologies. It was

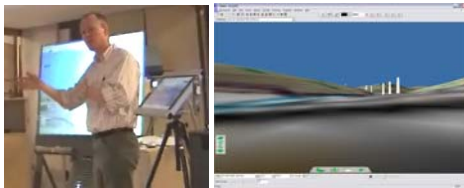
crucial to convince all of us that we were serious about doing a real, albeit speeded-up, complete landscape design cycle. Fig. 7 illustrates the intensity of actually making things happen, observing and experiencing work in progress. In the agenda there was room for reflection at specific times, but many ideas and challenges were addressed as the job was being done.

### 3.2 Work between different resources, Nov. 2003

A final future laboratory and public project review in November 2003 provided the end point of our collaboration in WorkSpace. This time, two landscape architects brought two real jobs into a new prototype future design studio at Aarhus University. Jim is working on a large wind farm project in Scotland, while Martin is overseeing the design of exterior spaces for the international headquarter of the Royal Bank of Scotland, located opposite Edinburgh airport. They do not know much about each others' projects – a state of affairs quite common in large design practices. However, it is equally common that colleagues may suddenly need to take on responsibility in projects they know little about. As a result, briefing sessions are a familiar feature of landscape architects' working life, and Martin and Jim will use their time in the future laboratory to brief each other on their respective projects. Thus, again, *what* they will do – i.e. the job-at-hand – is real; whilst we will experiment with and investigate *how* they may do it using new means, new environments, and developing new practices. We outline some of the main points of this exploration below.

*The integration of OS coordinates, terrain models, visualizations, 3D models and work materials:* We treated issues such as the way in which the prototype supports collaboration and the production of a shared understanding of complex (changes to) spaces,

navigation, manipulation, maintaining orientation in large spaces, accuracy, and the ability to support experimentation with design layouts (Fig. 8).



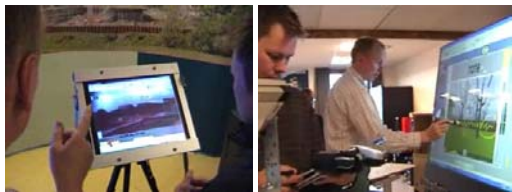
**Figure 8** How to fit the power grid connection into the complex topography surrounding the windfarm.

*Augmented tables and video tags and their use in manipulating and aligning multiple layers of visual representations of a space:* issues such as accuracy, combining the same paper sketch with many digital ‘backgrounds’, and vice versa, layering of digital sketches, collaboration in the course of discussion around these materials were experimented with (Fig. 9).



**Figure 9** Trying to understand and explain the issues at the Bank HQ.

*Co-present and remote collaboration based on dynamic insertion of models in real time site video (Fig. 10):* sketching on top of snapshots of live video with overlay for collaboration, use of visual overlays, when to use different tracking mechanisms, the diversity of use situations and environments were all central.



**Figure 10** Discussing issues ‘on site’ with co-present and remote colleagues.

The future laboratory work is punctuated by critique, brainstorming, discovery and discussion. We are able to ground imagination in now evolved and – after two-and-a-half years of WorkSpace – to some degree tried and tested emerging practices evolving around the new means and new environments of this future laboratory. Work in this final (for now) version of the future design studio also produces a plan for our final project review: Martin and Jim will demonstrate the prototypes with a version of their briefing exercise. As a result, the review becomes an extension of the future laboratory, generating observations and ideas for later discussion (Fig. 11).

*‘Flowing’ work between different resources and tools in the new environment of the design studio of the future:* Service discovery in general, and location based service discovery in particular, remote activation of devices, and remote manipulation of material as part of collaborative work were issues raised.



**Figure 11** Working together using different resources.

An impromptu event occurs, when Jim’s colleague Lynda calls to say that two wind turbines have to be moved urgently, could Jim advise. She sends coordinates for four options and, while Lynda moves the turbines in Edinburgh in the 3dimensional digital workspace of Topos (the underlying software for all the experiments) to assess the visual impact, Jim does the same in Ivrea. They discuss the effects on the phone (Fig. 12).

*Remote collaboration without a network:* although not intended, the incident explored ways of manually replicating the remote actions of others (e.g. repositioning wind turbines), ways of checking that the two models at the two sites were synchronized as well as showing the value in, from a landscape architect’s point of view, being able to change design layouts and inspect the consequences immediately.

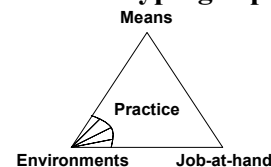


**Figure 12** Responding to a design emergency.

We hope to have demonstrated that by taking as point of departure a specific and real job-at-hand, future laboratories can be a powerful method for grounding imagination. The focus is on developments in means, environments and practices. Naturally, there are lots of analyses, designs, experiments, etc. leading up to such demarcated events. The events themselves provide crucial input for further iterations. In our case, we made heavy use of prototyping experiments in-situ and bricolage.

#### 4. Prototyping experiments in-situ

When we are talking about prototyping experiments, we are talking about using experimental prototypes (Floyd 1984) and experimenting at the premises of the intended use.



Although the project had quite long-term technological goals, we were determined to get running prototypes out into trial experiments in the real environments as early as possible, with three main objectives:

- Seen from a grounding point of view, it offered the first real ‘tests’ as to whether our ideas and prototypes came near what might be solutions, and whether we were pursuing solutions for the right problems.
- Seen from an imagining point of view, by insisting on taking the various environments seriously, we were confronted with a host of challenges to our current designs, creating new insights and sparking new ideas.

- Seen from a collaboration point of view, the trial experiments in-situ offered an excellent shared experience and common reference points for all the competencies involved

Below, we give two examples of prototyping experiments in-situ.

#### 4.1 Collaboration between offices, December 2002

The experience of remote collaboration supported by WorkSpace prototypes during the May 2002 future laboratory convinced everyone that this was a design thread worthwhile pursuing.

Creating the conditions for an in-situ experiment requires careful management of a whole of set of activities (design, work analysis, investment in machines capable of running the software, training and familiarisation with software changes, timing). In December 2002, one of our experiments addresses the fact that the landscape architects' studio occupies a five storey building. There is plenty of demand for support for short bursts of remote collaboration to complement face-to-face collaboration within the building. The landscape architects pick the design of their backyard as a sample job where such support would be useful.

Martin and Ross draft some ideas for how the outdoor space could be turned into an asset for the studio. In this session they utilize Topos' remote collaboration support. A brief excerpt from their discussion provides a glimpse into the potential and problems of this approach.



Figure 13 Designing the backyard.

What we experimented with in this session was a reasonably mature prototype that was installed in the office environments (on the office machines, with their screens and input devices, and over their network). We learned a lot about the interaction and ways of improving the interface, we experimented with improving the mechanisms for initiating collaboration (it should be faster than walking down two stories). The prototype was exposed to different input devices, display capabilities, bandwidth, etc. than

Ross (dark grey speech bubbles) tries to argue for an idea by balancing seating on the left with similar seating on the right (lines at 69). The screen images show what Martin sees and the slightly delayed appearance of Ross' 'gestraws'. Markings were, at this point in time, not sent until the pen was lifted.

While Ross expounds his solution (arrow and squiggle at 71-72), Martin does the equivalent of picking up a pen, which in face-to-face interaction can indicate a desire to speak (see Fig. 1): He chooses a colour to draw with. However, this is invisible to Ross, who - nevertheless - asks 'is this making sense?' (73), most likely picking up on the lack of continuers ('mhm', 'mhm'), anticipating the disagreement that follows (74).

in the development environment. Likewise, it was also an attempt to get a firmer grasp of jobs-at-hand suitable for this kind of collaboration and to imagine – in words and through doing – how jobs and practices might change.

#### 4.2 Digital overlays on real world, June 2003

Out on the building site of the Royal Bank of Scotland HQ with the 'sitepack' prototype. Martin, the landscape architect in charge of work here suggests scenarios of work.

He and his colleague Andy are adjusting their design of external spaces to the contingencies of actually building them. One difficulty this involves is imagining non-existent structures into existing spaces with an eye towards creating attractive future views. In Fig. 14, we are inside the building, looking out towards a little knoll, an attractive feature in the view from that window.

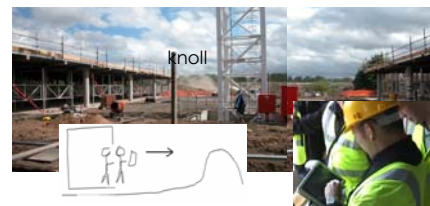


Figure 14 Imagining the view from the ground floor.

Below is what the landscape architects see on their site-pack screen. It is a live video feed as background and a superimposed, correctly located, 3D model in the foreground.



Figure 15 The dynamic composite view.

They discover a problem. The hedge is too high, obstructing the view of the knoll. They discuss how to improve their design in a remote collaboration session, using models and snapshots from their site visit inserted into the Topos environment on their desktop computers (Fig. 16).

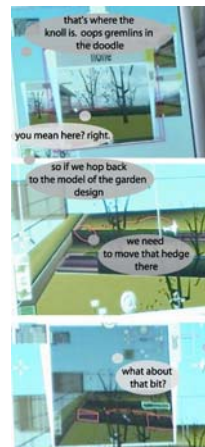


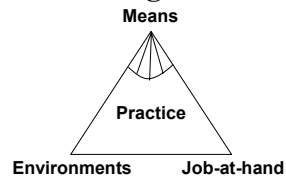
Figure 16 Designing for a view.

Issues identified and challenges encountered in the course of this experiment include sketching directly onto a 3D environment, ways of taking snapshots both as a way of enabling sketching and as a means to record particular situations, possibilities of utilising degrees of transparency to allow seeing foreground but also hinting at background. Another important issue was the utilisation of various tracking mechanisms in differing situations. In order to produce the digital overlays, it is necessary to know where the user is standing and ideally being able to track when he or she moves. We experimented with visual tagging in the environment, two strategies for feature tracking as well

as GPS. They all differ with respect to precision and they all differ with respect to their 'expectations' towards the environment: GPS requires line-of-sight to enough satellites, the visual tagging requires line of sight to tags and only functions up to a certain distance, while the feature tracking strategies we tried out either require large plane surfaces or curtail the ability to move around freely while maintaining the correct positioning of the superimposed model. Balances between various jobs-at-hand and the constraints and possibilities of the proposed means were one of the major outcomes of this experiment.

Future laboratories and prototyping in-situ allow quite substantial amounts of 'blue sky' to be part of the research. This is due to the special nature of the events, the special allowances and efforts made to make things work, as well as the special mode of thinking about and doing work as if one really was in some future where all these prototypes were normal working technologies. The power of these methods lies in the creative tension they generate between authenticity and future artful integrations envisaged and actually, seriously made to happen in the here and now. By 'turning up' the authenticity of the work in which we seek grounding through bricolage, the potential of this creative tension can be drawn into full view.

## 5. Bricolage



Bricolage in the WorkSpace project has been focussed on the work necessary to get various prototypes into real, daily use at the premises of the intended users. Over the past two-and-a-half years we all (landscape

architects, developers, work analysts, interaction designers) have worked ardently towards supporting the landscape practice in setting up/changing their environment to support and sustain real day-to-day work with the prototypes. This includes teaching possible uses of the prototypes, assisting in redefining some of the jobs-at-hand (the technologies offered the landscape architects the possibility of offering new 'products', new ways of collaborating with their clients, new ways of presenting their material, etc.), installing and maintaining prototypes, responding to feedback.

- Seen from a grounding point of view, it offered real use of the prototypes, and therefore opportunities for in-depth evaluations, redesigns, and re-implementations.
- Seen from an imagining point of view, by the prototypes becoming an embedded part of the practice of landscape architecture, it offered to an extent hitherto not possible that the practitioners probe the potentials of the technologies.
- Seen from a collaboration point of view, the joint bricolage became the vehicle for moving from periodic workshops or trial experiments in-situ, to if not daily then weekly, interchange over problems, concerns and ideas.

### 5.1 Workshops with clients December 2002

After the May 2002 future laboratory, the landscape architects decide that the Topos software and the large display panels are stable and desirable enough to invest in. In September 2002, they purchase a panel and install it in their board room, initially using it mainly for PowerPoint presentations to clients.

The landscape architects experiment – alone, with work analysts, developers and interaction designers (physically present or easily contacted by phone, email or chat), as well as through in-situ prototyping experiments like the one in December 2002. These experiments, the ease of communicating feedback and actually influencing design in the process boost the landscape architects' confidence and enthusiasm, their sense of ownership of the prototypes and their assurance as co-designers.

A commission to write a design brief for housing across a municipal authority provides an incentive to use the panel, the Topos software, and pen interaction for a real job. The landscape architects wish to hold a workshop with the councillors, urban planners, and traffic engineers. Their experience as WorkSpace 'users' and co-designers has made it clear that workshop participation might be supported more suitably by the prototypes they have at hand than any other technologies.

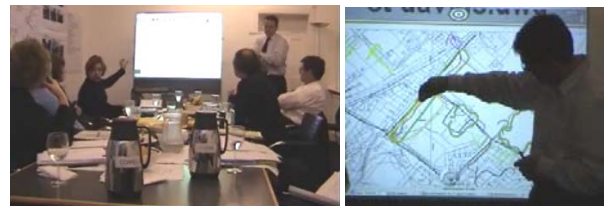


Figure 17 Inviting comment and collaboration.

Issues revealed by the preparation for, and use during, the meeting include: It is a massive job to learn to use Topos and pen interaction with the panel, the preparation-mode is unfamiliar, tried and tested paper based methods duplicate and compete with new ways of using materials.

In spite of this, the overall experience is very positive. Using Topos and the panel made dynamic combination of digital and physical materials possible, and allow presentation of digital materials in a way that invites engagement. The landscape architects could bring in information flexibly in response to client comments. They could sketch publicly, making it easier to communicate and discuss ideas. This impresses the clients.

The draft brief is to be discussed at the clients' premises a few weeks later. This time, a developer joins the landscape architects and the work analyst for the preparation.



Figure 18 ... in a different environment.

Issues explored as part of the endeavour to fold what are still very much experimental prototypes into real work include: The structure of workshop workspaces, support for creating workspaces, the transportability of workspaces and affordances. Again, participants agree that the use of the technologies makes for a more collaborative and engaging meeting – something the clients now have almost come to expect.

These early bricolage attempts show that there are many missing links in terms of technologies (e.g. displays), practices and skills,

money and time. It takes considerable effort to make prototypes productive parts of real world practice. However, this in itself is a powerful engine for design. The commitment, the determination and skill to improvise successfully, and the shared experience of making something quite unprecedented work generate not only invaluable concrete as well as more futuristic design ideas; they also shape a collective imagination. Collective imagination means that ideas and initiative come from all perspectives, yet are reliably focused on WorkSpace design goals, because these are collaboratively formulated and owned goals. Our final example illustrates the collective nature of grounded imagination as fostered through the combination of future laboratories, in-situ prototyping experiments and bricolage.

## 5.2 Understanding and communicating space May 2003 and ongoing

In May 2003, the landscape architects raise the idea that putting a set of possibilities explored as part of the WorkSpace project together might provide significant new support for understanding and communicating spatial designs. They argue that by integrating OS coordinates (and later GPS), terrain models, maps, plans, and specialist visualisations with an ability to create and position models – e.g. of wind turbines – accurately, and the ability to manipulate and navigate flexibly, a tool for – e.g. wind farm – assessment and design could be created. Martin and Jim convince their board that to embark on an exploratory design journey with the rest of the WorkSpace team would be a worthwhile and low risk endeavour. It would produce better quality designs and assessments in the context of a real and just starting-up job, at low additional cost.

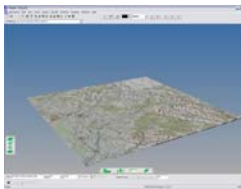


Figure 19 Map on terrain.

Milestones for an evaluation of progress are set and work on pursuing the idea begins. The job is an environmental impact assessment of a proposal for a large wind farm in the moorlands of Scotland. The site is 80x80 kilometres large, with almost 40 important viewpoints. This means site

visits, with two/three landscape architects at 800 Euro each per day, plus expenses, become prohibitively expensive. The landscape architects envisage, and the whole team collaboratively create (amongst other things) support for:

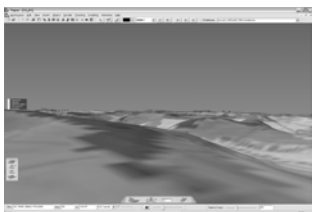


Figure 20 ZVI draped over terrain.

*Understanding complex topographies and cumulative effects:* A zone of visual influence visualisation (ZVI, Fig. 20 below) shows where no turbines would be visible (white), from where the proposed wind farm would be visible (medium grey tints in

the distance), from where other wind farms in the area would be in view (light grey), and from where both could be seen (dark grey areas in the foreground). There are a number of small slivers of dark grey, which is puzzling when looking at a 2D map, but easily understood when seen as ridges in the 3D model.



Figure 21 Viewpoints.

*Planning site visits:* Viewpoints and existing materials – e.g. photographs, wire lines etc. can be inspected prior to site visits, routes can be planned, new viewpoints can be identified by moving freely through the environment. OS coordinates dynamically display precise location as one moves

*Experimenting with design layouts and explaining design decisions:* It is often difficult to comprehend the effect of even small changes – moving a turbine 5 metres to the left, for example – on close and distant views from within an undulating landscape. It is even more difficult to communicate and exhibit the care that goes into such decisions. Being able to experiment flexibly and compare different layouts helps (Fig. 22).

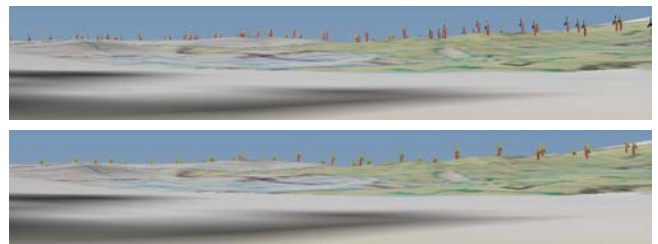


Figure 22 Comparing different layout options.



Figure 23 Discussing wind farm designs with statutory consultees.

The landscape architects use this support in meetings with clients and consultees. This use for real is close to future laboratories and in-situ prototyping experiments in that it is unprecedented, and because we all are inventing what we are doing in rapid design cycles. The landscape architects find

new ways of designing windfarms – e.g. designing for the fact that most people will experience them in motion, driving along motorways and long-distance routes. The developers respond to requests for changes, their own ideas of how the design could be taken further, and work analysis of emerging practice.

Although the work involved in actually getting the prototypes into real use is substantial for all parties, at least in our case, it also proved extremely beneficial.

- With respect to collaboration, it was an important part of a larger endeavour to build up mutual commitments, mutual trust, and shared goals and experiences.
- As for grounding, it became the ultimate test bed, and the number of development cycles were substantially increased in number and reduced in length, allowing for much faster turn around times and maturing the prototypes considerably.
- Regarding imagination, to a large extent it was the bricolage that made experiments with prototypes at earlier stages interesting and worthwhile for the landscape architects (it was clear that the early experiments might lead somewhere beneficial and concrete).



Also, by getting the prototypes into real use, a host of smaller suggestions for improvements, changes, and additions came forward. Last but not least, bricolage allows us to gain a firmer footing in the future. The use of, for lack of a better word, 'futuristic' prototypes in authentic work in the here and now allows for analysis and test of emerging, viable new practices, paving the way for successful artful integrations of means, environments, and jobs-at hand.

## 6. Discussion

The challenges of grounding imagination throughout the lifespan of a project are many, not least when working in a distributed multidisciplinary PD design team. There is, of course, not one way of making it happen, not one method, which can do the job alone, but with combinations of a variety of methods and with a focus on *means*, *environments*, *jobs-at-hand* and *practices*, our experience is that it is possible to productively ground imagination.

The three methods described and exemplified above make up the core of methods used within the WorkSpace project. In this paper we have used triangulation as a tool to differentiate and evaluate them. They each come into their own through combination: approaching design challenges from various foci at different stages of development. As mentioned in the introduction, it is important that in WorkSpace we were not only working on one specific product, but on a suite of products/prototypes. Likewise, we did not focus on one situation. This meant that at any given time we had prototypes in various stages and could almost simultaneously work with all three methods, which was crucial in producing the kind of synergy we needed. All three methods provoke (Mogensen, 1994) and probe emerging new practices and prototype designs, and foster collaborative analysis and collective imagination. All three techniques take departure in doing and ground reflection in shared experience. Each method has its own advantages and disadvantage:

### Bricolage:

- Pros: Supports establishing real use situations.
- Cons: Easily too conservative given that it is resource demanding. Too slow. Too many missing links.

### Future laboratory:

- Pros: Supports quite radical solutions.
- Cons: Commitment is a prerequisite, risk of loosing ground. Authenticity is difficult to do.

### Prototyping in-situ:

- Pros: Provocative, tempting.
- Cons: Does not beg for radical solutions and does not support real use. Can be dangerous/impossible to do – the real world does not often allow you to try twice.

A key synergy effect of combining future laboratories, bricolage and prototyping experiments in-situ is that we get beyond breaching experiments. Breaching experiments 'expose' people to new technologies, usually briefly, for example in experiments, through studies or research installations in art or science and technology museums (e.g. Hindmarsh and Fraser 2002, Büscher et al. 2001, Crabtree 2002). The advantage lies in numbers and in the relative ease of organising and analysing a compact event

visited by many people. The disadvantage is that visitors do not have time to dwell; they do not get a chance to bring considered and sustained hands-on practical creativity to the design. Analysis can use breaching experiments to highlight taken for granted practices, but not to examine the viability and potential of newly emerging practices for design purposes. Within WorkSpace, from the beginning there has been a shared interest in not only studying existing practices but also to provoke and develop new practices with the aim of artful integration.

When mainly grounding imagination through hands-on methods of 'doing', like the ones we have described in this paper, it may become extremely hard to distinguish who 'drove' grounding the imagination. Everyone present was part of it. This highlights a problem with an approach committed to grounding imagination: it is difficult to scale up. Not everyone in a large multidisciplinary team *can* be present, yet they still need to be a part of the events. How can they become involved and share at least some of the experiences. There seem to be many methods within PD to engaging users in the process of design in various ways, but far fewer aimed at supporting collaborative grounding imagination.

## 7. Summing up

In this paper we have introduced the concept of *grounding imagination* as an overall focus in the process of designing new technologies. The aim of this is to bridge the gap between the dual aspects of practice and imagination. We use triangulation to explore and analyse three specific examples of participatory design methods applied in the WorkSpace project. None of the methods could produce successful grounding of the imagination on their own, but in combination with other cross-disciplinary activities and by complementing each other, the combination of future laboratories, in-situ prototyping experiments and bricolage has proven particularly useful. The analysis illustrate how the methods complement each other by 'fixing' either *means*, *environments* or *jobs-at-hand* while experimenting and changing the other parameters. Specific experiences from the WorkSpace project illustrate how the different methods, and the specific mixture of them, have proven efficient regarding: mixing competencies and backgrounds in the project, creating shared experiences among the team members, the intertwining of 'development' and 'use', and last but not least grounding the design works and anticipating future practices.

## 8. Acknowledgements

Thanks to all our colleagues within the WorkSpace project for making it a challenging but fun experience. The work has been funded by the EU, IST, FET, Disappearing Computer project WorkSpace (IST-2000-25290)

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