Vision on the move: Technologies for the footloose

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Figure 1: A landscape architect on his way to a site visit …

Figure 2: … inspecting and docmenting work in progress

Figure 3: … adjusting design decisions

Jobs don't always get done in the office. Getting up to speed in a taxi (Fig. 1) is not unusual for many professionals. They are nomads even though their work is highly information intensive, requiring people to carry their work materials around with them. Creative work, central to many professions in aesthetic design and architecture, is a particular case in point. Close observation of the how, why and where of creative work can be an inspirational resource for a parallel group of designers - those concerned with the creation of future technologies. Drawing on an ethnographic study of landscape architects we - an interdisciplinary team of work analysts, practitioners, and system designers[1] - present a scenario of how we are trying to support creative work on the move.

Vision on the move

Imagination seems footloose - not only conceptually but also geographically. Ideas might surface anywhere, and it is not difficult to capture them. A notebook, even a napkin will do. Yet, at the same time, the ability to envision new forms of material culture can be deeply dependent on a sense of place and context. Where and how might people use a new product? How will they inhabit a new building or public space? Should your design fit smoothly into its surroundings or attract attention by standing out? Questions like these permeate the whole of the design process, from initial concept design to decisions on details later on. They often surface in situ - as part of a planned excursion or as a result of being in a relevant place by happenstance. But they also require the designer to 'bring a place home', to create a sense of place in the studio workplace and share it with colleagues.

Out on site, landscape architects generate and record information (Fig. 2), they take sets of documents and

[1] WorkSPACE (Distributed Work support through component based SPAtial Computing Environments) IST-2000-25290. http://www.daimi.au.dk/workspace

Figure 4: Regenerating the waterfront.

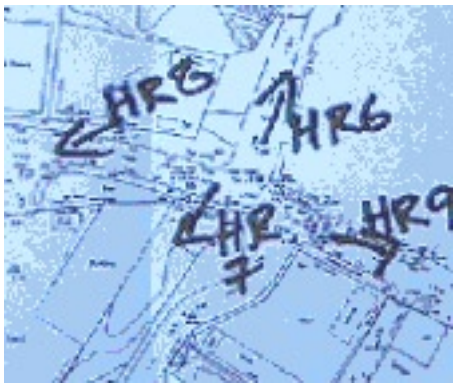

Figure 5: Survey plan with annotations.

drawings with them to build a picture of existing conditions and their own visions of change right there in the field (Fig. 3), combining textual and mediated visual information with their experience of actually being there. Sound, smell, a proprioceptive sense of contours, a more comprehensive field of view, and the experience of different forms of sociability in different kinds of spaces provide knowledge that often proves crucial to good design. A glimpse of current practice in landscape architecture will reveal some of the difficulties they face, which in turn ground our vision of technological support.

Taming the wild: visions in the studio

Richard has just taken responsibility for a 'visual impact assessment' of a new housing development. It is part of a plan to regenerate the waterfront in a major British city (Fig. 4), and his work involves a comparison between existing views and prospective views onto the new development. But it is not just a matter of assessing these changes. A list of 'mitigation measures' that suggest how the design could be improved forms part of the assessment.

Richard visits the site and takes photographs of existing vistas, marking their position and orientation on a site survey (Fig. 5). On his return to the studio, he prints, groups and annotates the photographs, and carves the space into areas based on existing patterns of buildings, use and vegetation. His workspace is a purposeful, dynamic assembly of working materials. He has placed the photographs on his drawing board and draws up a map of different landscape character areas. On the desk to his right, he has arranged various drafts of this map, his notebook, and a printout of a visual assessment prepared for a different project. This serves as a template for the current project. A passing colleague glances at this collection of materials. Richard looks up and explains (Fig. 6). The particular collection of materials Richard has around him renders his concern of making sense of the waterfront site publicly available and easily intelligible.

Such displays of interests, aesthetic design options, and ongoing work can also be observed in Richard's colleagues' workspaces (Fig. 6). This 'aerial' view of the design studio also reveals the prohibitive and clumsy nature of desktop computers in such an environment. It is not easy to gauge what is happening in the electronic 'extensions' of the workspace (note the designer 'hidden' behind her workstation), and it is difficult to draw electronic documents into collections of work materials that allow the landscape architects to make sense of a place. One such difficulty - the fact that only one document can comfortably be worked on on the screen - surfaces when

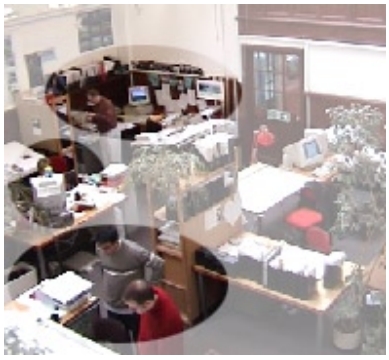

Figure 6: A passing glance.

Richard tries to share his work with Mike, a colleague who will create photomontages of prospective views on the waterfront site.

Mike needs to know where exactly the photographs for the montages should be taken. He has a digital terrain model (DTM) of the site into which he has inserted a model of the new housing development. Moving through the model, he determines strategic viewpoints for photographs. To avoid having to toggle between the DTM and other resources on the screen, Mike prints screenshots. In Figure 7 we see him and Richard discuss these viewpoints. A DTM snapshot is juxtaposed with the master plan and an aerial photograph of the site on the screen. Against the background of Richard's experience on site, documented in the photographs and area maps on his lap, they adjust the locations for the photographs.

The PC screen provides an impoverished environment that impedes professionals in organising their materials in a 'senseful' way, in sharing the 'sensefulness' of their workspace with others, and in relating digital and physical materials.

Figure 7

Figure 8

Where to go?

Where are we?

What would we see?

Where exactly are we?

Figure 9

Figure 10

Airing the plans: vision on site

The following day, Richard, Mike, and Cath visit each viewpoint. They discuss their final assessments of changes to views, and take the photographs for the montages that will document the rationale for their decisions. Close analysis of existing conditions goes hand in hand with imagining how things could be different. There are three particularly important questions:

Where are we? This is a relational concern. The landscape architects need to place themselves in relation to existing features and those envisaged for the future. By mapping their respective positions in the real world, on the master plan, and on an aerial photograph they put themselves in the picture - present and future (Fig. 8).

What would we see? To envision how the new development will fit into the landscape,

the landscape architects use the DTM snapshot (Fig. 9). However, this visualisation only shows a 'bare ground' version of the view, and the screening effects of existing buildings and vegetation have to be imagined; no easy task.

*Where **exactly** are we?* Photomontages are no longer seen as mere artists' impressions. With the help of visualisation technologies and increasingly rich geographical data, they can become accurate enough to convince at planning hearings and public enquiries. However, to achieve a sufficient degree of accuracy, precise location information is required (Fig. 10).

This brief glimpse into the design process shows that creative professionals combine traditional technologies (paper maps, plans, photographs) with digital technologies and more recent mobile technologies (GPS, mobile telephony) to enhance their perception and imagination. Professionals need to relate their position on the ground to its location on a plan or model, with varying degrees of accuracy. They need to create and change documents based on what they can see on the ground. However, at present they have to work hard to 'augment' their vision with technologies that often do not lend themselves easily to the task.

Technologies for the footloose

There is much scope for innovation to create more functional, practical, enjoyable and exciting mobile and stationary technologies. Grounding technological innovation in observations like those above draws specific challenges to our attention and allows us to address them in a targeted, yet integrated fashion. Through participatory design and prototyping we also rely on the active involvement of professionals. Together, we have created a software architecture and a set of appliances and interaction devices to support creative (and other forms of) work in the studio and on the move. All these technologies are in various stages of completion and over a further two years of development we will seek to refine and extend our efforts.

A digital workspace

Figure 11

In the studio, a sense of place is achieved through the manipulation of work materials, by bringing them into dynamic spatial relations, and referring between them. These relations are not just a context or prerequisite for getting the work done, but an integral part of it. A major challenge in supporting the spatial organisation of digital material is to find a proper balance between on the one hand mimicking our experiences and intuition of physical spaces and on the other transcending its constraints (Büscher et al 2001).

We have designed a collaborative virtual environment (Topos) that allows people to arrange, read, edit and manipulate their digital work materials in an unbounded 3D electronic space. Topos allows for manipulation and maintenance of relationships among materials in this 3D environment. It integrates with existing applications on the given platform, supports collaboration between people across the Internet and runs on

Windows 2000, SGI IRIX and Linux. Figure 11 shows a screen shot of a Topos client. It depicts an open workspace containing a set of documents and sub-workspaces with more documents.

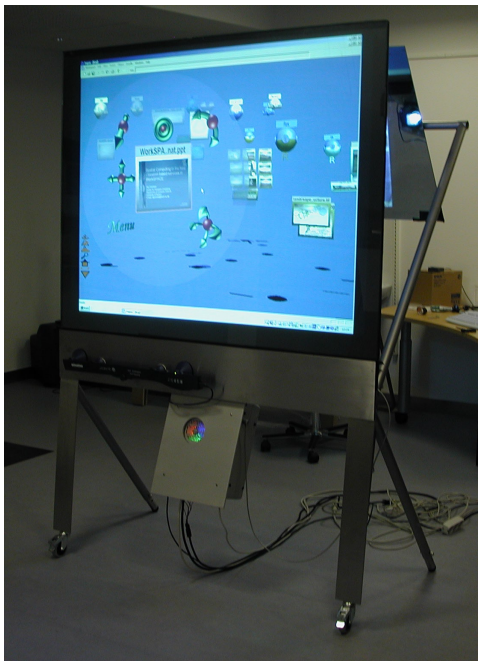

Figure 12

Double clicking any of the documents will launch it in its appropriate application, and changes to the document will be reflected within Topos in near-real time. The two-tone spheres represent open sub-workspaces. The upper hemispheres are proxies referring to the workspace underneath. The 3D objects can be moved, sized, rotated etc; light effects can be applied; documents can be made semi-transparent; manipulated as groups; and so forth. In this way, Topos provides a digital collaborative working environment which has many of the 'affordances' of physical workspaces, together with all the functionality and power of digital systems. This certainly will not do away with physical materials, but gives new choices for 'flowing' work between digital and physical environments.

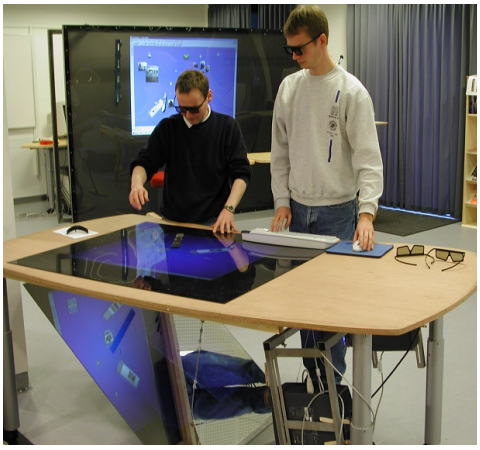

Figure 13

Augmenting the environment

Sharing materials

In the studio, current electronic technologies, rather than fitting into the spatial organisation of work materials, resist, even dominate it by forcing people to arrange everything around their machines. As we saw, if many of the documents involved are in digital form then work loses its public character, closing off opportunities for focal as well as peripheral participation and spontaneous collaboration. The challenge is to provide in the digital environment some of the same affordances currently provided through, for example, drawing boards, whiteboards, walls, etc. Currently, we are experimenting with various alternative ways to display and interact with materials, where materials are displayed on 'walls' and 'tables' and manipulated through a gesture interface and object anchored tools.

Fluid contexts

As we've seen, professionals' work is not static. People and materials are constantly on the move and their contexts are changing. In one and the same day a landscape architect may find herself working with the same drawing in many different situations: detailed design work on her desktop, discussions around various design issues with colleagues, a project meeting in the meeting room, consultation with clients at their offices, checking details on site, and many more.

In these settings suitable support may range from ordinary desktop computers, to interactive tables and walls, to smaller mobile devices for use on site. Besides the

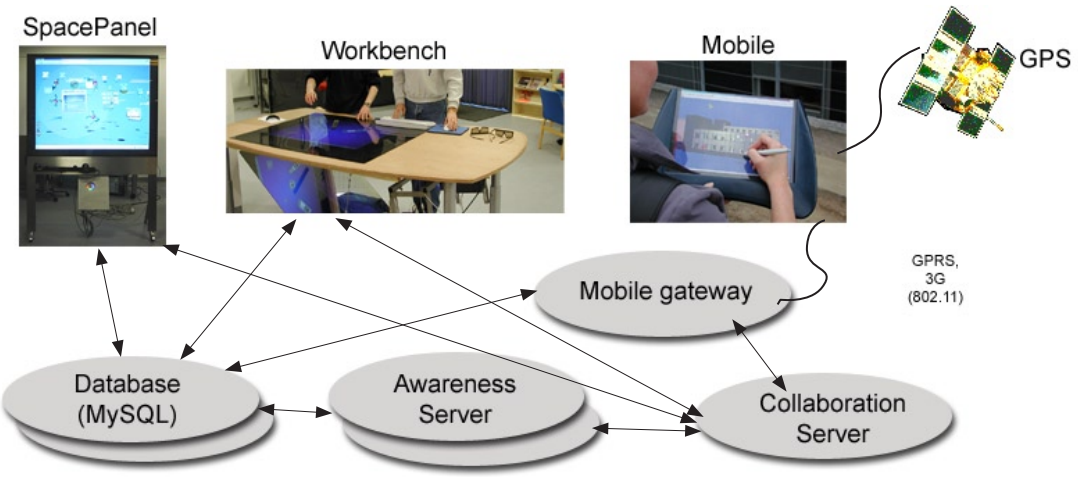

Figure 14

challenges in designing the devices themselves, it is paramount that smooth transitions between them are well supported, so that people and materials can be accessed and interacted with appropriately from the various platforms.

The current software architecture is shown in figure 14. It supports collaboration on and across the various platforms. The corresponding user interfaces are still in a preliminary state and we are still experimenting with different ways of representing other people, how to provide consistent user interfaces for the various interaction styles and devices, how to support awareness without overload, etc.

Relating physical and digital materials: augmenting the object

Figure 15

In landscape architects' offices, as with most workplaces, there is a host of material, some digital and some physical, and much work is spent on bridging between the two - printing and scanning, for example. Apart from digital 'objects', landscape architects work with paper, they collect samples of vegetation and building materials, and they investigate new construction materials. The challenge is to find a way in which the physical and digital material may augment and complement one another, rather than, for example, try to transform the one into the other. We are currently experimenting with various tagging and tracking mechanisms to enable this mixture, for example on the interactive table.

Bringing materials to the site: augmenting the person …

There are many challenges involved in making site plans, the digital terrain model, 3D models of proposed buildings, etc. available on site. These include providing suitable devices for display and interaction, relating digital materials to physical position, and minimising the need for bandwidth to home. Ideally, as illustrated in figure 15, one would be able to precisely superimpose the digital material onto the physical world - using, for example, an accurate model, GPS, and an electronic compass - and thus be able to combine the two. Such a device could be placed on top of a paper document

Figure 16

such as a map and display a corresponding 'invisible digital layer' of documents related to various positions on the map. As we can see from figure 16 (a landscape architect climbing a ladder with a set of paper plans in his mouth), this is not a trivial task.

… and bringing the site to the material

There is a clear need to bring digital material on bear on site, but there is an equal need for the opposite: the site needs to be represented on and through various materials (surveys, drawings, pictures, etc.), both in order to 'bring the site back to the office' and to create the materials on which to concretise the visions for change. On site, this involves among other things the ability to take pictures with precise indication of location and direction, sketching on top of site plans, taking notes to capture impressions, and potentially much more (sound, smell, etc.) We are currently working on prototypes of such devices (figure 17) supporting capturing pictures together with their GPS coordinates and orientation and placing them correctly within a 3D model, sketching on top of digital drawings, relating position to other relevant material etc. As can be seen from figure 17, there is still room for improvement.

Figure 17

Conclusion

The systems and prototypes we have described are targeted at specific solutions to troubles and closed-off possibilities that we discovered through analysing the work practice of professionals in aesthetic design. But they are also directed at a broader agenda which has been variously described as 'ubiquitous computing', 'pervasive computing', the 'invisible' (Norman 1999) or 'disappearing' computer. These terms signal the ambition that appropriate support from information and communication technologies should be available everywhere, that it should be closely integrated into activities, tools and materials, and that it should be convenient and unobtrusive. These are all relative qualities, so of course the ambition is an ever-receding ideal.

In part, this agenda means 'exploding' representation and interaction out of the straitjacket of the VDU, keyboard, mouse and windows, and bridging or dissolving the digital-physical divide. But we think that the agenda is also closely bound up with the character and social organisation of the activities that are to be supported. It involves making materials 'ready-to-hand', which means being able to relate as much

as possible to the materials themselves and as little as possible to the intervening technology. It involves making materials intelligible, which means providing them with an environment that also affords the generation of a relevant context. And it involves making them communicable and accountable, so that they can be shared, and so that they can be intelligible 'in public' as well as 'in private.'

Individual mobile appliances that can augment a nomadic style of work should make it possible to capture aspects of a specific context (e.g. location information) and to tie work materials flexibly into rich and complex mobile and stationary information environments. These qualities will allow professionals to transcend the boundaries of the office, anchor their work in the specifics of different places and contexts, yet not loose their connection to the information, work and people that stay behind. Above, we have summarized our steps towards this through the metaphors of 'augmenting the environment', 'augmenting the object', and 'augmenting the person.'

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