Summer issue: Skunkworks, cafés, troubadours and the rest of it

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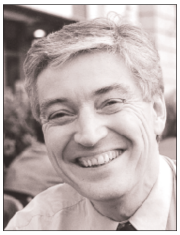

Take a vision factory, a couple of Viennese cafés, a row of roving troubadours, ample slush funds for skunkworks, secluded ateliers, unimaginable future probes, a rallying of national actors, activists and whoever else bothers about people, design and technology, the whole lot stretching from Brussels to Basel to Las Vegas, and what do you get? The plan for the i3 community's future, which was sent to the Commission recently.

The plans stretch far ahead, four years actually, and include a substantial amount of radical exploration of future technologies and design in the context of people, communities and societies. We want to continue to empower ordinary citizens' everyday lives with information technology. We want to go beyond interaction to wherever that may lead, using the vision factory and other means to help find futures and the ways leading to them. And we want to simplify life with information technology, compared to what it is at present.

As the community grows, we will need more self-organisation, distributedness and autonomy for new initiatives. We need as much discussion as we can possibly get, within the community and with parties outside. In this process, i3magazine is set to become ever more central for community discussion. Ateliers will enable us to do things together for longer periods of time. Troubadours will link together sites and organisations, passing important news around, as well as tools, techniques, skills and so on. Summer schools will bridge to the next generation. Future probes will explore new ideas. Sites may host facilities for all, research resources, evaluation expertise, benchmarking — think about it. Retaining base in Europe, we will internationalise collaboration and impact, for instance by taking i3 from Comdex Europe to Comdex Vegas.

And the name, well, it's not really about intelligent information interfaces any more, not all of it, is it? It's not just about interaction but also about what lies beyond. So it's rather, maybe, living with the system, interrelating with people and technologies, or something like that. It's multi-, multi-user, multi-disciplinary, multi-cultural. It's controversial, important, scary, fascinating, for better or worse a matter for everyone, even politicians. Maybe it is something, some new expression which still has the three i letters in it. Who can solve that one?

Links to the Web sites of the i3 CI projects can be found on:
http://www.i3net.org/i3projects/links.html
Information about the ESE projects can be found on:
http://www.i3net.org/schools/

Feature

Prêt-à-porter computing

Context-sensitive, multi-modal user interfaces for wearable computing

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The world is becoming mobile. A decade ago, mobile telephones were big and bulky, and few people had one; today, they are commonplace. In the same way, laptop computers and personal digital assistants (PDAs) such as the Palm Pilot or Psion 5 are becoming popular. Recent years have seen several groups of researchers around the world working on the evolution of these devices into "wearable" computers, which can be attached to the user's clothing and used while truly mobile. The driving force behind this evolution is not simply to allow the user to carry the computer conveniently; the intention is to provide systems that can augment the user's capabilities and act as portals to information as and when required, yet intrude as little as possible into the user's everyday activities.

But current user interfaces are based on a desktop metaphor that does not transfer well to computers intended for mobile, and especially wearable, use. In what follows, Adrian Clark and Neill Newman describe a wearable user interface framework called "*Sulawesi*" which has been designed to provide a more natural user interface for wearable computers. They also highlight two applications that exploit its capabilities.

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What is a wearable computer?

Today's wearable computers typically follow the "*tin lizzie*" approach popularized by Steve Mann while at MIT: they use stacks of *PC/104* cards, about 100mm square, intended for industrial control systems. These have the advantages of being reasonably inexpensive, small and easy to work with, as well as allowing conventional PC peripherals to be used. On the other hand, they use *Intel 486* or *Pentium* family processors, which are really too power-hungry for mobile systems. (Strong ARM-based wearables would be much better, but there appear to be no equivalent development systems.) These wearables are normally attached to a belt and worn around the waist. Power is typically provided by camcorder batteries, also attached to the belt.

As they are intended to be used on the move, wearables cannot use conventional keyboards or mice, and so alternative input devices are needed. The most popular of the existing replacements is *HandyKey's Twiddler*, which features a chord keyboard (in which several buttons are pressed and released together to generate a single character). Not surprisingly, raw typing speeds are nowhere near what can be achieved on a conventional keyboard. The latest version of the Twiddler also features the *Trackpoint* device found on some laptops.

An alternative output device is, of course, also needed. Many researchers use head-mounted displays originally developed for virtual reality use. However, more compact, less obtrusive alternatives are starting to appear: the most exciting of these are being developed by *MicroOptical*.

The wearable modelled by second author Neill Newman in figure 1 is of this type. In addition to the computer itself, the hardware in the belt-mounted unit features video capture and a receiver for the global positioning system (GPS). The input device is a Twiddler and the output a set of "I-glasses", a low-cost head-mounted display. Not visible in the picture is a motion sensor, carried in the wearer's trouser pocket.

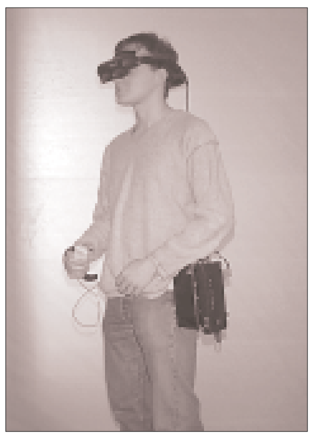

Figure 1: Neill Newman modelling a wearable with Twiddler and I-glasses.

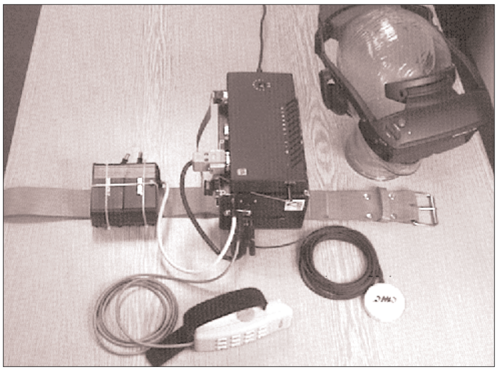

Figure 2: Close-up view of the whole system.

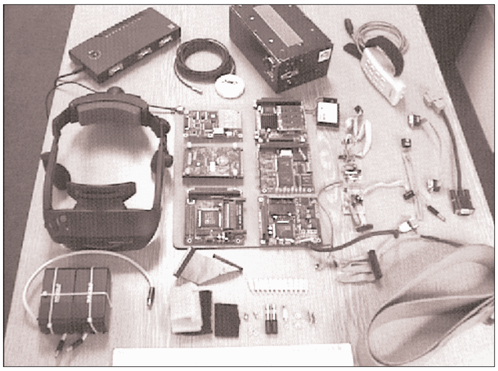

Figure 3: boards and peripherals from which the system is constructed.

Figure 2 is a close-up view of the complete system, while figure 3 shows the various boards and peripherals from which it is constructed. (There are construction instructions on our web pages for brave souls who would like to build their own wearable; see the resources section.) We run the freely available *Linux* operating system, as it gives us the flexibility we need to produce the novel user interfaces described below. That software, *Sulawesi*, is written in the *Java* programming language.

User interfaces for wearables: Sulawesi

The graphical user interfaces (GUIs) found on practically all computers these days are based around a desktop metaphor, with windows representing (paper) documents, icons representing directories, and so on. Interaction with GUIs involves pointing (with mouse, pen, and so on), and entering information involves typing. As we have seen, devices that provide this functionality are not ideal for truly mobile use, so the user interface for a wearable computer needs to be able to interact with the user in other ways, such as speech.

However, the way in which a user might wish to interact with the computer will depend on the situation: for example, while sitting on a train one might be happy to use visual output but while walking, one would prefer spoken output. This means that the user interface must be "multi-modal", that is, able to use several different modes of input and output. Moreover, it should be able to change modes depending on what the user is doing; it should be "context-sensitive". A simple example of this is for the computer to monitor the signal from a microphone to see whether the user is speaking, and only to speak to him or her when no-one is speaking -- a polite user interface!

In an effort to meet these needs, we have designed and built a user interface framework which is flexible enough to encompass a wide range of interaction techniques, can be adapted through well-defined programming interfaces, and can be tailored for a specific purpose. This framework, known as *Sulawesi*, comprises three distinct parts, illustrated in figure 4:

- an input stage, on the left side of the figure, which gathers raw data from the various sensors attached to the wearable;
- a core stage, the middle region in the figure, which contains a natural language processing module and service agents (applications) to process information gathered from the input stage and to produce, where possible, a mode-neutral output;
- an output stage, to the right of the figure, which decides how to "render" the results from the service agents.

The agents in the system can monitor the input and output streams of data and autonomously retrieve information depending on how the system perceives the user's environment.

> *"The graphical user interfaces (GUIs) found on practically all computers these days are based around a desktop metaphor. Interaction with GUIs involves pointing (with mouse, pen, and so on), and entering information involves typing. Devices that provide this functionality are not ideal for truly mobile use, so the user interface for a wearable computer needs to be able to interact with the user in other ways, such as speech."*

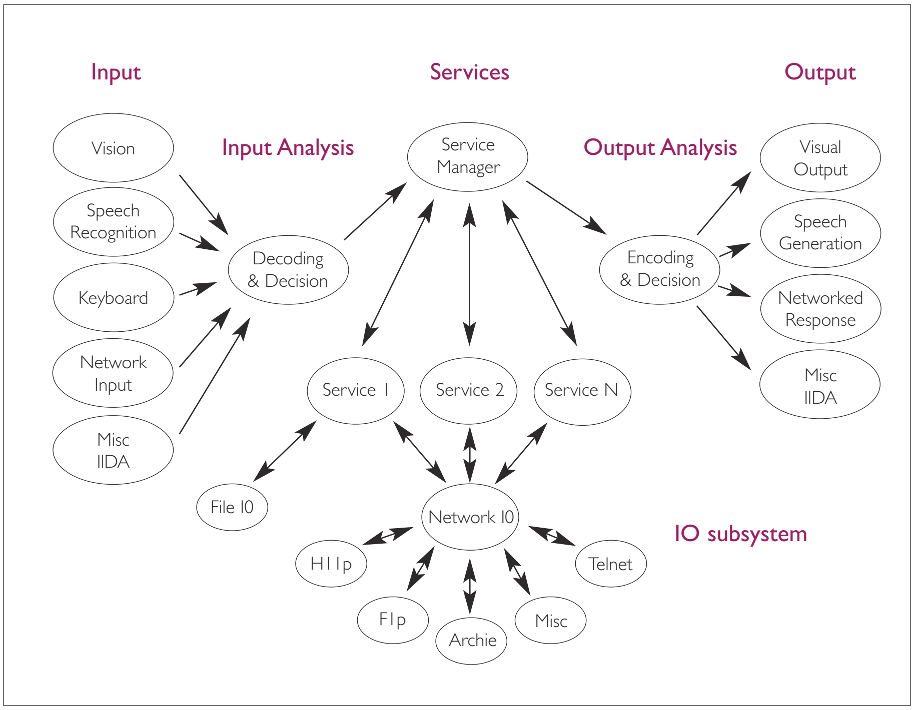

Figure 4: The different parts of the Sulawesi system.

At the heart of *Sulawesi* lies a very simple but effective natural language parser which converts a sentence (either typed or spoken, the latter using *IBM's ViaVoice* recognition engine) into a command stream. This speech module can communicate spoken words, sentences, or even just the knowledge that somebody is talking, to the system core. Two pieces of information are currently extracted from a sentence: the service to invoke, and how the output should be rendered. The list of services is constructed dynamically by *Sulawesi* during its initialization, while the verbs controlling the renderers are stored in a look-up table, which makes for easy customization.

This semi-natural language processing is perhaps best explained by a simple example. The two phrases

Could you show me what the time is?

Please tell me the time

both result in the user being informed of the time, as the word "time" is recognized as being the name of one of the services available in *Sulawesi*. The first example uses "show", which causes *Sulawesi* to render the output visually, while the second uses "tell", which implies audible output. The important point about this approach is that the machine infers meaning from a relatively natural sentence, rather than the user having to adapt to the machine and remember complex commands or manipulate a user interface.

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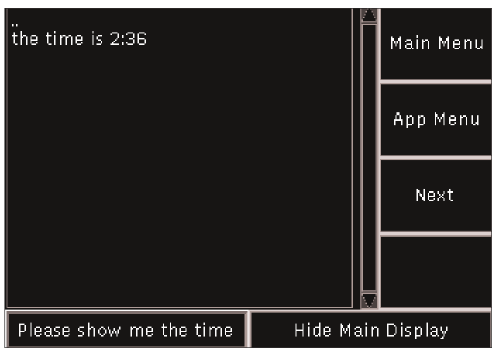

Figure 5: GUI for visual output.

With visual output, we have found that a simple GUI is worthwhile (figure 5). This has been designed for low graphical resolution and colour depth (only 320x240 grey-scale pixels). A high-contrast GUI is essential here, as head-mounted displays are transparent, superimposing their output on the wearer's view of the real world. The main graphical widgets have been placed well away from the centre of the field of view. A text entry box is at the bottom left of the user interface, and a row of menu-selection buttons are on its right-hand side (for a right-eye view; the buttons can be switched to the other side for a left-eyed user). The buttons provide some form of visual feedback by flashing black-on-white for a brief period when pressed. The main panel is used by applications for their displays. A mechanism is provided within the *Sulawesi* framework to allow multiple applications to be "stacked," with only one being visible at any one time. The buttons provide the mechanism to flip between applications, a scheme that was developed to keep the field of view as uncluttered as possible. When the desired application is in focus, the actions of the buttons may be overridden by it to allow some simple forms of user interaction. The last button ("Show"/"Hide") gives the user the ability to turn off the main panel, thus freeing up most of the field of view.

The information abstraction layer

As we shall see, some applications that exploit *Sulawesi* make use of the wearable's location. This currently uses GPS outside and infra-red beacons within our building. These applications are not concerned about the source of the positioning information, only about where they are. Hence, we provide a layer, called the "information abstraction layer" (IAL), which converts the information produced by these location sensors into meaningful locations. For GPS, this might map a particular latitude and longitude into "Home", and a particular signal from an infra-red beacon might be mapped onto "Adrian's office". As usual, these mappings are stored in look-up tables for easy customization. (Applications can still access the raw data if they need to, of course.) There are other IALs too, presenting information from its microphone, motion sensors, and so on.

The IAL approach also provides a mechanism for *Sulawesi* itself to control its responses. For example, the wearable's movement sensor tells *Sulawesi* when the user is sitting, standing or walking. A simple use of this is to blank the GUI when the user stands up and walks. However, more sophisticated behaviours are possible. For example, if the user asks *Sulawesi* to show him or her the time, this would normally cause visual output. However, if the wearer then stands up, *Sulawesi* will normally override the requested rendition and render the information audibly. Information from several sensors may be involved in this decision-making: if the user is sitting but the GPS unit determines that he or she is moving (and is hence presumably travelling in a vehicle), audible output is again used. The rules that govern the switching of rendering are also configurable.

Applications built using Sulawesi

The "news agent" demonstrates *Sulawesi*'s sentence processing and automatic output re-direction mechanisms. The service receives a command of the form

Would you tell me the sports news please.

The information is retrieved from the relevant source using information stored in a configuration file (we use the BBC's news web-site) and sent to the output manager. It examines all the available information from the input sensors to determine whether this would be satisfactory and, if it is, presents the information audibly.

Spatial reminders

With the ability to sense position, it is natural to provide a *Sulawesi* application that produces reminders depending on where a user is. This spatial reminder service makes use of a location IAL which decides transparently what signal source (GPS or infra-red beacon) should be translated. A user enters a reminder (either by typing, speaking, or using any other available input device) with phrases such as

When I leave work, remind me to do some shopping.

and

When I arrive at the shops, remind me to get some bread and milk.

Here, "work" and "the shops" are locations that have been stored in *Sulawesi*. As the user leaves the location "work", the corresponding reminder is triggered; and as he or she arrives at "the shops", the shopping list of bread and milk is output -- the particular mode of output being selected by the system depending on what the user is doing.

The future

We believe that the wearable computer as we know it today will have a transitory existence: it will soon evolve into something different, such as a next-generation mobile phone or a super-PDA. However, the physical constraints and modes of use of these devices mean that conventional, desktop user interfaces are inappropriate. We believe that multi-modal interfaces are the best solution, and that adapting the interface through knowledge of the user's context gives further improvements in usability. *Sulawesi* has given us a framework to explore some of the issues in this kind of interface — but there are many others that need to be addressed before they reach maturity.

Adrian Clark is a Reader in the Department of Electronic Systems Engineering at the University of Essex. He became involved in wearable computing partly through the wish to produce a virtual reality tour guide for archaeological sites, and partly through an interest in mobile information access.

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Neilll Newman is a PhD student in the Department of Electronic Systems Engineering at the University of Essex, where Sulawesi and the ideas behind it form the main part of his doctoral research.

Resources

Wearable computing in general:
http://wearables.essex.ac.uk/

Sulawesi:
http://wearables.essex.ac.uk/sulawesi/

You are welcome to download Sulawesi and try it out.

The VASE lab:
http://vase.essex.ac.uk/

MIT wearable computing page:
http://wearables.www.media.mit.edu/projects/wearables/

HandyKey's Twiddler:
http://www.handykey.com/

MicroOptical Corp:
http://www.microopticalcorp.com/

On the Hippie trail

Contextualising the digital nomad

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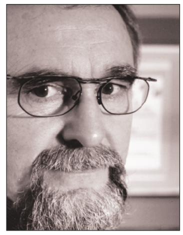

People are using more and more digital information resources, and can often access those with arbitrary devices — from PCs to mobile phones — wherever they are. In this sense, information systems are becoming "ubiquitous" and "nomadic", and are evolving towards ever-active, synchronised processes contextualised to an individual's current situation.

Nomadic information systems adapt interaction and information to the individual user and his or her context. But what does that mean? Which aspects of context need to be taken into account, and which advantages do nomadic systems offer to the people who use them? Marcus Specht and Reinhard Opperman outline the minimal parameters of a "context of use" for nomadic systems, and describe a concrete example of such a system, developed to support visitors to art exhibitions and fairs: Hippie.

Context of use

To adapt interaction and information to an individual user and his or her current context, several models of the context and the person's characteristics are necessary. To describe the *context of use (CoU)* of an information system, we need to define the parameters of context that we want to consider for adaptation. Several approaches have defined context models and described different aspects of context that can be taken into account. For example, Schilit, Adams et al. (1994) include *where you are*, *who you are*, and *what resources are nearby*. Dey and Abowd (1999) discuss the *computing environment*, the *user environment*, and the *physical environment*, and distinguish between *primary* and *secondary* context types.

In our view, at least the following four parameters need to be taken into account to adapt a current CoU:

Location: An object or entity can have a physical location but also an electronic one (described by a URI or URL). Location-based services can be based on a *mapping* between the physical presence of an object and a corresponding electronic artefact. For example, the *Hippie* system (described below) retrieves the internet address connected with an artwork in the exhibition space when a user comes close to the artwork.

Identity: The identity of a person gives access to a lot of second-level-type contextual information. Some context-aware applications rely on a highly sophisticated user model which infers information about the user's interests, preferences, abilities and knowledge, and keeps detailed activity logs of physical movements and electronic artefact manipulations.

Time: Time is an important dimension for describing context. Beside the specification of time, most context-aware applications use categorical scales (e.g. *working hours* vs. *weekend*, *free* vs. *busy* hours).

Environment: The environment of a context describes the objects and the physical location of the current situation. In several projects, approaches for modelling the objects, and for building an ontology and taxonomies of their interrelations, are used to select information and present it to a user.

The nomadic exhibition guide *Hippie*, developed at GMD, relies on these parameters.

Hippie

Hippie was developed for an exhibition environment, and provides information about two domains: an *art exhibition* and a *fair*. The museum visitor can access the *Hippie* system either through the internet or with mobile location-sensitive devices in the exhibition space. The nomadic user is supported both during the preparation for a visit, the actual visit, and the evaluation of a visit.

Figure 1: A visitor using the Hippie system in front of an artwork in Castle Birlinghoven.

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During the preparation of a visit *Hippie* supports the visitor by:

- giving access to individualised information, with annotation and communication possibilities;
- making the visitor aware of events and activities in physical and electronic space. Infrared sensors that are connected to significant points in the physical space (exhibits, transits), and electronic sensors connected to the corresponding internet pages, make visitors aware of each other;
- adapting information to the interests, knowledge and preferences of visitors; and
- supporting non-experts in the graphical understanding of exhibits.

During the visit, *Hippie* supports the visitor with:

- headphone-supplied audio presentation;
- a high-precision localisation system for selecting and presenting location-aware information: and
- intuitive interaction facilities, like physical information points and information selection by physical movements.

During the evaluation of a visit, *Hippie* supports the visitor by:

- detailed reporting of a past visit;
- recommending facilities for extending current knowledge;
- offering tools for contacting visitors in other CoUs for discussion (see Gross and Specht 2001).

Evaluation

The *Hippie* prototype was implemented for an art exhibition in the castle of *Birlinghoven*, the headquarters of *GMD* in Sankt Augustin. Evaluation experiments were conducted with 60 visitors using three comparative guidance media. The results showed that the prototype was effective in helping visitors find out more about the art domain. But it turned out that to satisfy novices, computer handling needs to be improved. This is due partly to the fact that the hardware device is still too heavy and too difficult to use while roaming.

One focal area of interest for the evaluation was the adaptive user-support by the system. Assessing adaptive features of a system is a difficult task. Methods of adaptation evaluate the user history and can be more valid as more data about a user can be collected. But in experiments, access to user data is typically limited, and so is the time for evaluation. In the current study sessions varied in length between 0.5 and 1.5 hours, with a mean of 69 minutes. To present adaptive tour proposals for the visitor during the time period of the experiment, the system cannot analyse more than around 30 - 45 minutes' visiting recordings.

One main criticism voiced in expert workshops, and one of the main outcomes of the user evaluations, concerned the complicated interaction with small laptop computers, table PCs, or even wearable computers like the *Xybernaut*™ *MAIV*. In response to this we are trying to develop a completely new kind of interface in the *LISTEN* project. In *LISTEN*, the user wears a lightweight headphone that displays 3D audio information; the user's movements in space are tracked with an accuracy of 10 cm and 5 degrees. The high quality of audio material used in LISTEN, and the 3D audio rendering, will allow for intuitive interaction between the visitor and their physical environment.

Marcus Specht joined GMD-FIT as a researcher in 1998 after receiving his Diploma in Psychology in 1995 and a doctoral degree from the University of Trier in 1998. He has rich experience in intelligent tutoring systems and the integration of ITS and Web-based tutoring, gained from his involvement in projects in the field of adaptive hypermedia and ITS (ELM-ART, InterBook, AST). He has worked on user modelling and personalisation in several European and national projects in the field of wearable computing and nomadic systems (HIPS, DeepMap, LISTEN). His main research interests are adaptive learning and training systems, knowledge management, ubiquitous and wearable computing, and intelligent interfaces.

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Reinhard Oppermann received his PhD in Psychology in 1975 and has worked at GMD since 1979; he is also Honorary Professor for Computational Visualistics at the University of Koblenz His main research and teaching interests in research and teaching are in the areas of user-centred system development methodology, user interface evaluation, user modelling, and learning and nomadic information systems.

Home page:
http://fit.gmd.de/~oppermann

For more on
Hippie:
http://hippie.gmd.de/

LISTEN:
http://listen.gmd.de

Nomadic information systems at FIT:
http://fit.gmd.de/topics/icon/?aspect=nomadic-systems

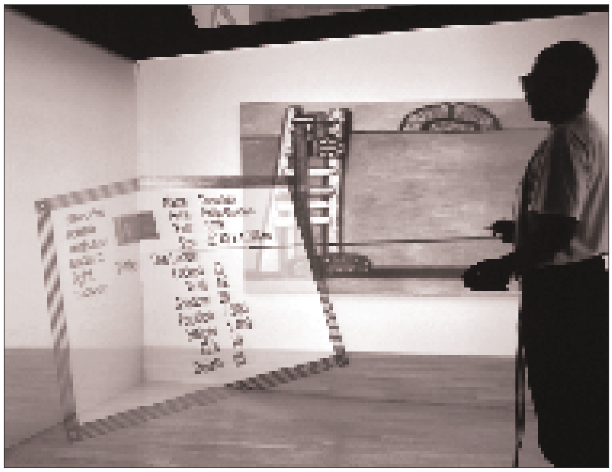

Figure 2: A content author configuring a sound source in the CAVE for a LISTEN environment.

We also realised during the development of *Hippie* that support for the content providers of such highly interactive multi-media-enriched physical spaces is crucial. Therefore another focus of the *LISTEN* project is the development of an authoring environment for immersive audio-augmented environments. An example can be seen in figure 2, where a curator configures a sound source in a virtual-reality-based authoring tool. The tool will enable authors to create highly-interactive audio soundscapes and experience a simulation of the environment immediately.

To conclude, nomadic information systems need to support users in a variety of different settings and contexts. The *Hippie* project takes into account the user's position in physical space and his or her user profile to select contextualised information for the nomadic user. We are extending the application with location, identity, time and environment parameters to give a richer model of the user's current context; and we are also investigating new interaction facilities for nomadic and especially mobile users. We see usability and getting the right information at the right time as two key points for future developments in nomadic computing and mobile applications.

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Feature

Vital Signs

Usable abstractions at home and at work

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As more and more of the things in our homes contain microprocessors, they increasingly offer abstract functionality. What does "abstract" mean in this context? Put simply, abstractions are things that we can't see or touch. But when a computerised appliance contains a user interface, the user is expected to interact with abstractions – by means of what he or she sees and touches in the interface. To this end, the interface includes representations of abstraction, or signs. Users see and manipulate those signs in a systematic way. If they become sufficiently familiar with the conventions, they may even think of the sign as the object, forgetting that they are only manipulating signs – abstractions themselves can never be touchable.

Two research issues arise from this. The first addresses the status of abstract behaviour: how can the user interface of an appliance (let's say a MiniDisc player) include things we can't touch? Briefly, this can occur either because the user is asking the appliance to do something in the future (like recording a radio programme – as it is in the future, we can't interact with it now), which we call an *abstraction over time*; or alternatively because the user is referring to a number of entities (like a playlist of music to be played at a party) which we call an *abstraction* over a class of entities. The second research issue addresses a universal type of human artefact: what are the general characteristics of systems of signs we can interact with? We call these *notational systems*. They include a notation (a visible representation of the abstractions) and an environment for manipulating that notation.

The characteristics of notational systems are more often found in our offices than at home – at least for the present! Every office worker is expected to interpret, manipulate or create specialised abstract notations related to their work: timetables, flow diagrams, decision trees, work rosters and many more. If we use computers in our work, almost every type of software application includes notations that allow us to create and manipulate complex and powerful abstractions. The spreadsheet notation, for example, is almost as powerful as a general-purpose programming language – which is probably the most challenging abstraction-handling notation that any human ever has to deal with. But it's not just professional programmers or spreadsheet users that face challenges in computer abstraction. Someone working with a word processor might regularly create abstractions over a class (e.g. defining a search-and-replace operation, or a paragraph style) or abstractions over time (e.g. a repeating keyboard macro).

Vital Signs

The *Vital Signs* project at the Cambridge University Computer Laboratory addresses the needs of people using these kinds of systems – not professional programmers (though they too might benefit from usability improvements), but home owners and office workers who must deal with notational systems to help them define abstract functionality in their environment. The starting point of the project has been to address two common misconceptions that occur in usability research: misconceptions about the role of metaphor in direct manipulation, and misconceptions about the needs and abilities of non-technical users.

First, metaphor. Since David Canfield Smith's work in the 1970's it has been assumed that metaphor in user interfaces (the desktop, for example), is primarily beneficial because it replaces abstraction (which is difficult for users) with depictions of physical objects that behave in a way structurally related to the metaphor. Three years of research in Cambridge has demonstrated that although it is very beneficial for users to be able to directly manipulate signs representing computer abstractions, there is no benefit beyond a simple mnemonic one from signs that resemble physical objects. Most users are able to recognise and process abstractions, and strained physical metaphors can even make their job harder. The *Vital Signs* logo shows an abstract figure "kicking the bucket" – actually the bucket is the original wastebasket from the Macintosh desktop, and symbolises the occasionally strained physical metaphors of current generation interfaces.

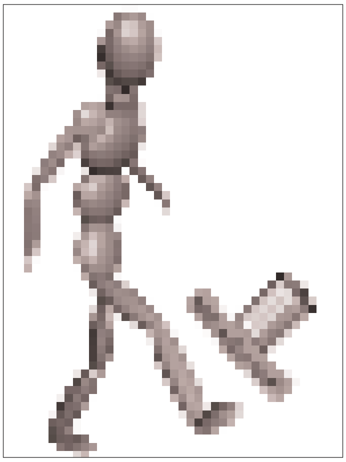

Figure 1: Vital Signs: abstraction versus metaphor

The second observation is related to this situation. Professional computer users (especially programmers) are very experienced at creating and manipulating abstractions. Is it asking too much for regular office workers (let alone homeowners) to attempt such challenging intellectual activities? A study carried out as part of the *Vital Signs* project addressed this question directly. We surveyed the office contents of secretarial workers who were not confident computer users, and compared them to the offices of computer science researchers. We found that the secretarial workers were always creating and maintaining abstractions: folders, drawers, cabinets, file boxes and binders. Computer scientists also use such abstractions – the two groups were perfectly comparable. But in the computer environment, computer scientists were likely to create at least one computer abstraction (directories, folders, macros and style) for every paper abstraction in their office. Office workers were incredibly reluctant to invest effort in computer abstractions. It's not that office workers are unable to deal with abstract notations – it's just that computers don't serve their needs as well as paper does.

We have modelled this phenomenon by adapting a well-known model of the psychology of investment decisions (by Kahneman and Tversky). Our system users are not investing money (as in Kahneman and Tversky's work), but they are investing their time and attention in creating abstractions. This is true whether the abstraction is a series of labels in a filing cabinet drawer, a word processor macro, a programmed recording time in a MiniDisc player, or a complex software application. In each case the abstraction developer invests some attention in programming work that could otherwise be spent on achieving the job itself. Furthermore, the abstraction route is risky. It may not work, it may work partially (a "bug"), or it may turn out to be inappropriate for what is actually needed when the time comes to execute it. This risk of failure is just like the risk of gambling losses in the situations investigated by Kahneman and Tversky. We have created a cognitive simulation of this phenomenon in which a simulated agent makes investment decisions about a simple abstraction – whether or not to invoke a search and replace dialog in a word processor.

The results of these studies are now informing the second phase of the *Vital Signs* project. The name *Vital Signs* refers to the recognition that our user interface elements are abstract signs, not metaphors. But it is still essential to retain the advantages of direct manipulation by making those signs "vital". They should respond immediately to user manipulation, and their effects in the abstract task domain should be directly communicated to the user. In the second phase of *Vital Signs*, we are implementing two experimental notations for generating abstractions: one for the office environment, and the other for the home environment.

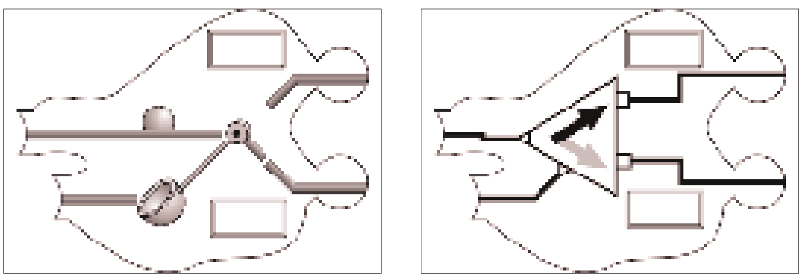

Figure 2: Experimental evaluation of visual metaphor

See What You Need

Our office project is entitled *See What You Need (SWYN)*. It is intended to supplement word processors with the powerful kinds of abstraction provided in (for example) Microsoft Word's *Visual Basic*. Rather than taking *Visual Basic* as a functional objective, we consider the *Perl* language, which is often used by computer professionals for small-scale or casual programming tasks. Perl is even less suited than Visual Basic for use by non-programmers, so we are completely replacing the notation with one that shows users only the abstractions that they need. These are expressed in transparent overlays superimposed on the word processor window, so that abstract structures can be seen and manipulated at the same time as the data that they will affect. These abstract notations have been experimentally verified in usability trials with non-programmers before implementation started. We believe that this is an essential precaution in this kind of research, but one that is unfortunately all too rare. Within the context of *Vital Signs*, SWYN demonstrates the combined advantages of reducing the cost of abstraction investment (through programming by example techniques) and simultaneously reducing the risk of abstraction failure (through direct simulation of effects in the work domain).

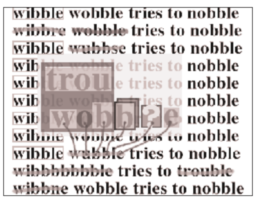

Figure 3: SWYN notation for regular expressions

Media Cubes

Our home-environment project takes place in the context of the Computer Laboratory *AutoHAN* programme for automated home area networking. We have developed a hardware implementation of the ATM networking protocol that was installed in a test house several years ago. Since then we have been working on distributed computing architectures and user interface technology for interacting with networked devices in the home context. Usability has been a relatively unsuccessful aspect of past home-networking research around the world, despite a great deal of investment in home networking and control technologies. Our approach is to adapt the familiar remote control, both simplifying its interface and extending its capabilities. We have created a range of remote controls which each have only a single button, and a single conceptual function. These "*Media Cubes*" can be dynamically associated with any appliance in the house, however. If a cube with the "play/pause" function is associated with a CD player, pressing the button will play and pause the CD player. Moreover, the cube can be associated with any appliance in order to provide the same remote control function.

Figure 4: Media Cubes concept

So far these are direct manipulation functions: cubes can be directly associated with appliances by placing them against an appliance. The associated appliance behaviour can be defined directly using the appliance's own controls. But the abstraction power of the cubes lies in the fact that they communicate with each other (through induction loops in their faces). More complex combinations of behaviour can be defined by placing sets of cubes together and recording their configurations. The physical cubes then become a notational system of their own – not a pencil and paper notation, or even a notation on a direct manipulation GUI screen, but tangible signs that can be touched, grasped and moved in *literal* direct manipulation of abstract definitions.

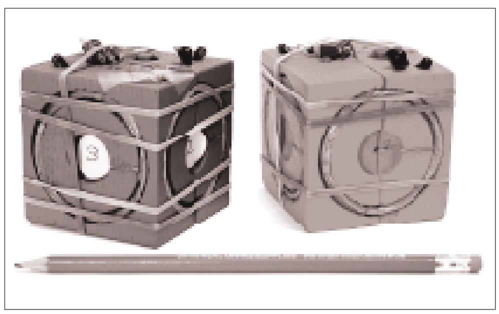

Figure 5: Media Cubes operational prototype

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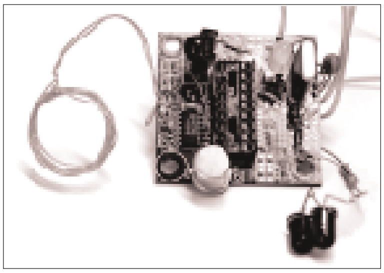

Figure 6: Media Cubes internal hardware

The *Vital Signs* project is funded by the UK *Engineering and Physical Sciences Research Council* under EPSRC grant GR/M16924 "New paradigms for visual interaction." The goal of the project has been to radically re-think the nature of abstract interaction, providing abstract facilities that directly address the needs of users. This is not restricted to the rather limited notion of "End-User Programming", which appears to emphasise the corporate objective of enabling unqualified programmers to undertake software development projects. Instead, *Vital Signs* concentrates on the abstract characteristics of typical domestic and office tasks. Many of these are informally described as "programming" – we say that we program our VCRs, and the timers on our boiler controls. But neither professional programmers nor computer science researchers are in the habit of accepting such activities as resembling their own far more complex occupations. *Vital Signs* addresses these most basic types of programming, demonstrating that it is possible to work from a coherent cognitive perspective and theoretical critique to the development of practical design tools and prototypes. Further work continues to take this agenda seriously, as we undertake studies of central heating programmers and mobile communications devices.

Alan Blackwell is a lecturer in the Cambridge Computer Laboratory, with qualifications in professional engineering and experimental psychology. He had 12 years experience of designing industrial systems and software products before returning to academic research in 1995. In 2000/2001 he is teaching design-related courses in the Computer Laboratory and Architecture Faculty. He is a Research Fellow of Darwin College, and co-founder of Crucible, an institute created to encourage interdisciplinary collaboration of technologists with researchers in the Arts, Humanities and Social Sciences.

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AutoHAN project page:

http://www.cl.cam.ac.uk/Research/SRG/netos/han/AutoHAN/

Crucible homepage:

http://www.crucible.cl.cam.ac.uk/

References and related publications:

http://www.cl.cam.ac.uk/~afb21/publications/

Workshop

Toy stories

A design experiment

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The i3 project KidsLab recently took part in an unusual two-week-long workshop, in collaboration with another EC project, Sheltered Workshops. The Sheltered Workshops consortium, which focuses on the development of toy prototypes for disabled children, conducts design workshops throughout Europe. Its first Nordic workshop, which was held in Halmstad, Sweden, took the shape of a complex design experiment aimed at developing new prototypes for severely disabled children.

Severely disabled children are a user group "in need" for two reasons: industry tends to be relatively uninterested in this group because it is too small a market; and play material developed for these children tends to be geared towards therapeutic benefit, rather than simple enjoyment of the activities involved. The ambitious commitment of the workshop organisers was to relate and address both these issues. The approach was unusual too: instead of the usual think-tank for creating new ideas in corporate settings, the workshop involved a complete immersion on the part of the participants into the world of the users, as well as cross-fertilisation between different disciplines and cultures. The result was the creation of a unique design space.

KidsLab helped provide a knowledge basis for the workshop's participants, and took part in prototype analysis and testing. The whole experience was a wonderful opportunity for the KidsLab team to turn ideas about child-centred interdisciplinary design methods and prototype testing into reality. Lieselotte van Leeuwen describes the fruits of an intensive two weeks of learning, from the perspective of KidsLab.

i3 magazine

The workshop

Aim: The goal of the workshop was to develop new prototypes of toys for severely disabled children, and to test them in order to meet industrial standards for mass production. There were 20 participants — industrial designers, engineers, architects, teachers, therapists, and students, from places as diverse as India, Cambodia, the U.S., Mexico, Italy, the U.K., Rumania, Hungary, Germany, Denmark, and Sweden.

Set-up: Workshop participants shared a house and workspace for the duration of the two weeks, and were given facilities to work with all kinds of material. They were welcome at any time at the local day-care centre for children with severe mental, perceptual and motor disabilities, and could choose to work either individually or in groups. Staff at the *Nordic Center for Research on Toys and Educational Media (NCFL)*, which organised the workshop, was available full-time to provide information or solve technical problems.

Philosophy: The toy and play philosophy supported at the workshop was that toy design should centre on enjoyment rather than on therapy goals. Lots of toys which have been especially developed for disabled children don't address the quality of play as intrinsically-motivated joyful action; in other words, the fun is missing. Both motoric and cognitive goals are more easily achieved through self-motivated play than through tasks unrelated to the children's desires and needs. The continuous access to the day-care centre made it possible to develop toys for individual children, rather than for "disability profiles".

The programme: The two weeks started with a scientific symposium, which offered participants different perspectives on toy design for disabled children. Disabled people, designers, scientists and representatives from industry all gave their views on how special needs of children can be met. This included a presentation by KidsLab, which had as its task to prepare workshop participants for behavioural observation at the day-care centre for severely disabled children. Under the title "*Behavioural observation with the eyes of a designer*", we tried to focus the attention of observers on the relationship between disabled children, their material and their social environment in terms of action *possibilities* — not impossibilities. The symposium was followed by two days of observation in the day-care centre.

The evolving ideas were then discussed in guided interdisciplinary groups, in order to filter out the most promising design directions with the help of physiotherapists, teachers, designers and engineers. The group had 11 days to discuss and make prototypes in iterative loops which included the children, teachers and parents from the day-care centre. The resulting exhibition showed 34 prototypes of diverse design.

Asked about the pay-off of such a design method, the participating designers reported that they experienced it as very inspiring and horizon-broadening. Teachers and therapists said they had discovered new ways of looking at material and supporting joyful learning.

Prototype evaluation

Reference group. A reference group of 12 experts, including therapists, teachers, nurses, designers, play experts and physiotherapists, selected six prototypes for further product development.

Expert evaluation. A designer and an expert in children's interaction from KidsLab analysed these six prototypes and proposed changes for improvement. Design criteria included aesthetic, material and production needs. Play criteria addressed the variety of affordances of a toy, in terms of age and skill, and in terms of possibilities for focusing attention for longer periods and integrating the toy into other contexts.

One of the disabled children exploring a prototype which allows him to train the strength and co-ordination of his arms while his attention is focused on playing a story with the animals.

Design iteration

First re-design: After the evaluation, the proposals for change were discussed with the original designers. On the basis of this a work plan was drawn up to re-design three of the prototypes, in a process of close cooperation between the original designers, NCFL and KidsLab. The new prototypes had to be suitable for supervised testing in day-care centres for disabled as well as non- disabled children.

Testing. Under the lead of KidsLab different versions of the three final prototypes were tested by a team of designers and social scientists in three day-care centres with disabled as well as non-disabled children between two and 15 years of age. The prototypes were given to the staff of the day-care centres one week before the actual sessions, to give them the opportunity to form their personal opinion and expectations for use. Those were documented in an interview before the start of the test sessions.

The actual test sessions were performed by teachers and therapists familiar to the children. The teachers introduced each new toy, and after a period of guided play the children could play freely in small groups or by themselves. The KidsLab team, consisting of a sociologist, two experts in play & learning and a designer, took part as observers with video and photo cameras. We were included in the daily routine of the day-care centres, so the children could get used to us.

Afterwards we repeated the interview with the teachers/therapists to find out if their views and ideas had changed after actual use of the toys with the children. We asked them about their ideas for changes and for how the toys could be used, and whether they would like to use them. Then the prototypes were left with the day-care centres for a further two weeks, to get information about what happens when children get used to the new toys: are they forgotten, or used in other ways?

Contacting industry

The prototypes, together with the test reports, are currently being offered to industry for product development. We hope that this final step will be successful, so that an extraordinary experience of immersed designing will enrich the world of special needs and other children, with new toys that are fun to play with.

What we learned about test methods

- Live interviews are far more informative than the results of questionnaires.

  A live semi-structured interview allows for informed discussion of expected and unexpected aspects of a prototype, and therefore provides far richer and more meaningful information to the design team.

- 'Before' AND 'after' interviews can reveal important differences between first impressions and opinions based on experience.

  The difference between the two gives information about the discrepancy between expectations about a toy (teachers/parents as buyers) and what it offers in the reality of children's play. Design and instructions should try to minimise this discrepancy.

- Behavioural observation of prototype use is the richest and most valid method of information gathering.

  Results of observations are often very different from, if not in conflict with, those of interviews. We don't see this as a failure of the procedure, but as a consequence of the diversity of viewpoints — the difference between 'doing' and 'thinking about doing', by others or even the same person. Both 'thinking about' and 'doing' influence how a prototype is received and used. However, behavioural observation provides far more and richer material, it is concrete, and can be carried out at different levels of granularity and from different professional viewpoints. Video observations can be re-done and compared in more objective technical terms.

- Analysing observations from the different professional backgrounds results in detailed advice about potential user groups, possible contexts of use and changes in various design aspects.

  For instance, a designer may observe what happens to the *object* as a function of play, whereas a social scientist may focus on what happens to a *child* as function of play. Their terms of description are different: *physical* versus *behavioural-dynamic*.

  The mutual relationship between both views makes it possible to extract meaningful information for design at a concrete and practical level. For example, a designer often observes not only what is wrong (e.g. with a certain shape) but in doing so will also "see" the solution to the problem. However, a social scientist observing the same episode might not recognise the shape as the cause of the problem, but will describe 'what's going wrong' (e.g. in terms of a child's frustration). Both observations are important. Since a certain level of frustration constitutes a challenge it may motivate learning; and the design solution may not lie in eliminating the problem, but in making the problem salient to the child, thereby giving her the key to a solution. Together, the two perspectives prevent the risk of replacing one mistake with another one, since eliminating the problem might have led to boredom. In other words, interdisciplinary observation can lead to efficient design improvements, with minimal iterations and frustrations for the design team.

- Since video analysis is extremely time-consuming, it is useful for observers to write down observations *in situ*, thus allowing for pre-selection of video episodes.

  Photos (in addition to video material) can be an extremely useful medium for pinpointing important moments. The time between the session and its analysis should be as short as possible.

One of the children manipulating a 3D puzzle piece in a testing session. The toy should help him develop two-handed manipulation of objects in relation to each other.

A girl assembling a multifunctional game- and drawing toy in a free-play session.

Conclusions: changing the way we think

As already pointed out earlier, designing for disabled children may not be of great interest to industry, since the potential market is far too small for profitable mass production. We do believe, however, that there is a solution to this problem, and that this should be taken into account from the start: when talking to industrial partners, a shift in thinking from 'disability' to 'ability' might help.

Instead of describing the suitability of a toy for children with certain *disabilities*, we should describe the minimal *abilities* that are necessary, and the challenges for development that a toy offers. Such an approach broadens the audience for a toy tremendously, for instance by including children at comparable cognitive and/or motoric stages of development, such as children in hospitals who are temporally immobile. Design which supports high-quality play for disabled children will always support high-quality play for children without disabilities as well.

Such an approach has consequences for the design process. After developing a toy prototype for a disabled child, the minimal abilities needed to use the toy should be described. As a result of this description, other user groups can be identified and taken into account for further development and testing. What we end up with is a toy for a certain age group, with special features that allow for the integration of children with mental and/or physical disabilities.

For KidsLab the sheltered workshop conducted in Sweden was a unique opportunity to work and learn about toy development, in an experimental context and immersed in the world of the user. It is a concept we would wish to follow up on!

Lieselotte van Leeuwen, co-ordinator of KidsLab, is an experimental psychologist. Focus of her research has been the influence of environmental design on the development of perception and action. She is part of the Nordic Center of Research on Toys and Educational Media and works as consultant for several design projects in industry and academia.

http://www.idc.ul.ie/KidsLab

Sheltered Workshops is an EC project that forms part of the "Innovations" initiative. For more information see

http://www.hh.se/ide/ncfl/workshop99.html .

The Nordic Center of Research on Toys and Educational Media (NCFL), located at the University of Halmstad, Sweden, conducts a wide range of projects with and for industry with the aim to put children at the centre of product development and reach efficient co-operation between industry and academia.

http://www.hh.se/dep/ncflweb/index.html

Feature

The difference that doesn't make a difference

Physical Computing

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People at ITP (the Interactive Telecommunications Program at New York University Tisch School of the Arts[1]) believe that computational media will make possible exciting new artistic forms. There may not seem to be much evidence to back up that belief: In the arts computers are used to create work more efficiently in traditional linear or static forms; and doubters say that you will always break the spell on an audience's imagination when you ask them to interact.

But those taking part in the *Physical Computing* classes at ITP have found some interesting glimmers of new possibilities by taking the opposite approach, demanding much more of more parts of the user. Dan O'Sullivan talks about the theoretical background for Physical Computing, and about how it is implemented in the ITP curriculum.

Computers for the rest of you

Your body makes contact with the world using hundreds of muscles and millions of nerve endings; and the internal connections within your imagination are even more numerous. Your mind distills all this activity down to a very meagre executive summary called "consciousness". The fact that our bodies are capable of instantly finding the most pertinent bits out of this flood of sensation and imagination is impressive, especially in dangerous situations.

In the more enjoyable activities in our lives, such as sports, sex and art, the trick is not to worry so much about the 'summary' but to deal directly with the full flows into and out of your body and mind. In the simple act of walking you are not conscious of the millions of decisions involved in having your feet correctly meet the terrain, but you would say that it is you making those decisions.[2]

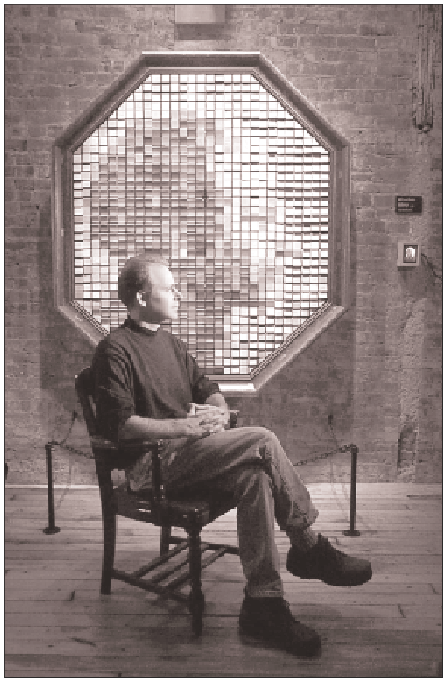
Despite the fact that we are capable of processing much more, we spend most of our time conscious only of our consciousness. Indeed we come to equate 'consciousness' with the whole of our self. If we are making computers in our own likeness, as I believe we are, it is not surprising that they primarily cater to that tiny part of our experience that reaches consciousness. Your body is bored with just that. Maybe it is time we started making computers for the rest of you.

Computers are seen as information processors, and the Internet as being for information transfer. 'Information' by some definitions is analogous to 'consciousness', *difference that makes a difference*.[3] Many people in the arts cannot get too excited about the web because they also want the *difference that doesn't make a difference*. They want to include some of what was cast off in distilling the information, allowing the user to do more processing to complete the picture. You would think computers would be well-suited to this. Containing context along with the content is a unique capability of the non-linear media of computers because they can store more associations than 'forward' and 'backwards'. Ultimately the non-linearity of computer media will better capture and portray our raw subjective experience.

It is tempting to blame current computer hardware for limiting how rich an experience we can convey. Although computer networks and processors have developed fantastically in the past decade, the bandwidth between the person and the machine remains along the same old pipelines of the keyboard and mouse, monitor and speakers. New calls for "broadband" refer to bandwidth between machines and not to the bandwidth coming back from the person into the computer. This results not from shortcomings of the technology but from an impoverished view of people. We should not be looking at the computer but at the person. Imagine what a limited being the computer sees when it looks back at you: an eyeball and two ears for input, and fingers (probably the most consciously controlled part of our body) for output.[4] Something that looks more like a *Tralfamadorean*[5] than a person.

For starters it would be nice to reverse things so your eyes are used for input into the computer and your fingers are used for sensing output. Your eye movements are not very consciously controlled and thus people pay close attention to them. People are just as interested and more trusting in what you give off, your non-conscious actions, than what you give out[6]: it is the difference between trying to say something and trying to express yourself. Most communication over the Internet filters what you give off, leaving only what you give out. This controlled communication might seem attractive for business but will not go far in building trust, or letting expression flow once trust is built.

Better yet, let's get away from the head and the hands and look at the neck and big muscles in the arms, legs and seat. Research into convergence shows that people lean forward at computers and backwards when watching TV. Well, people can assume many more positions than that. In fact sometimes they are not sitting at all. Sometimes they leave the house and sometimes they dance.



Danny Rozin pictured in front of the wooden mirror, which he created. The wooden mirror has hundreds of wooden chips, attached to motors. The wooden chips act as pixels to give a video image of whatever is in front of the mirror.

Physical Computing at ITP

Being within New York University's Tisch School of the Arts, ITP attracts students who sense the potential of non-linear media, for expression instead of information. We are a graduate programme, so our students usually have a background outside of computers, for instance in architecture, filmmaking, or sword-swallowing. In their first semester students learn to program computers and to create digital media, but they are often frustrated that most examples in the new media are a step back from traditional media in their expressive potential (for the student or their audience).

At ITP I started an area of study that I called *Physical Computing*. In these classes students are asked to go back to a wider view of what people do with themselves than is currently in evidence on the World Wide Web. Students are also asked to stretch their conception of the place and shape of a computer beyond the grey box in an office. The results are projects that range from room-sized installations to clothing to musical instruments.

We have shown several hundred projects at our bi-annual shows and have in the process collected and developed many techniques for artists interested in Physical Computing.[7] For instance, Danny Rozin, a former student and now director of research at ITP, has created many installations — such as "The Wooden Mirror" and "The Easel", shown all over the world.[8]

As a by-product, Danny has developed an *XTRA for Director* called "Track Them Colors"[9] that allows students to plug a video camera into the computer and do some simple machine vision and video manipulation very easily. The first thing many students need for their projects is the position and movement of the user's body — their whole body, not just their fingers. Bill Buxton, of *Alias/Wavefront*, rightly points out that the toilets in some modern airports are smarter than your computer in this respect; but Danny's software is rectifying the situation. With millions of pixels per second, video blows by the limits of your consciousness and begins to challenge the capabilities of your full body. This XTRA opens the richness of video up as an input in addition to the usual output. Each year the projects get better, because thanks to alumni like Danny students have a technical and conceptual leg-up.

The introductory course for Physical Computing is pretty wide open. It covers some skills without too much methodology or theory, and then gets out of the way of the students' pent-up vision. We work with micro-controllers, which are just very tiny and cheap

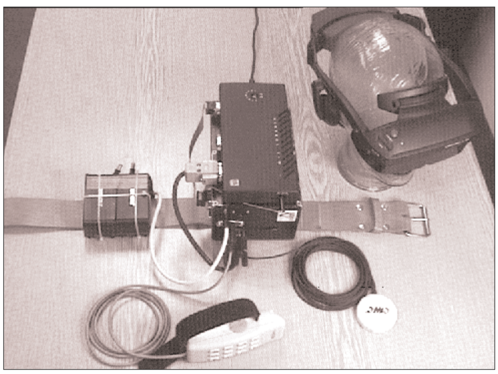
"We come to equate 'consciousness' with the whole of our self. If we are making computers in our own likeness, as I believe we are, it is not surprising that they primarily cater to that tiny part of our experience that reaches consciousness. Your body is bored with just that. Maybe it is time we started making computers for the rest of you."

computers. The skills presented are at a medium to low level. The students have to build their own circuits, but they can program the micro-controller in *Basic* instead of *assembler*. The class looks for interesting transducers like photocells, motors and thermistors for converting between electronic signals and the many types of energies like light, pressure and heat that your body can create or sense.

Physical Computing fits in well with the other departments at the Tisch School of the Arts, like film and theatre, if for no other reason than the fact that that the job market is not easy. Physical Computing has many pedagogical advantages that benefit students who will go on to more purely software pursuits in the web industry. With these tiny micro-controllers students deal with bits instead of bytes, which allows them a look down at the "metal" of computers, something which they don't get in higher level languages like *lingo* which are widely used at ITP. For the less technically adventurous, computer programming can suddenly become clear when it has tangible components like wires, buttons and motors.[10]

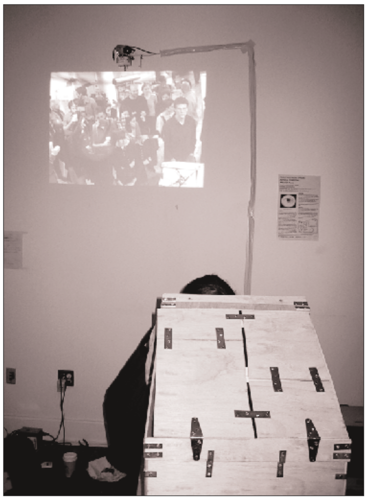
The class has a simple structure and limited assignments, but students work harder in this class than in any others. One motivator is that the work usually has some physical manifestation where they can see people using it, unlike the distant and anonymous use of their web projects. The open-endedness of the class encourages a playfulness that can bring out the zeal of the eccentric. I think the main reason for the obsession shown in this class is that it taps into the belief that the computer revolution has just begun. It reminds students that computers will not always be as limited as they are now. The potential of computational media in the arts is well served by a big step back in perspective when looking at both the machines and the people that use them.

Some examples of ITP project work.



Preetidrawers. The drawers are motorised and show you very little at first, but as you look for longer and more closely they become animated and reveal more of their contents. Project by Preeti Shah.

A system for navigation through virtual spaces. Air blows towards the person using the system from the direction of the other person in the space. The sound of the other person's heartbeat is also directional. Project by Bill Meyer.



Eyetracking. The person looking into the peephole in the box is watching a video of people standing in front of the wall, and has his or her eye movement tracked. Only the areas of the video that the person looks at are updated on the wall. People standing in front of the box can try to attract the viewer's eye and thus direct the forming collage. Project by James Powderly and Michelle Kempner.

There are now many classes that follow up on the introductory class. "Designing Experience", taught by Masamichi Udagawa, and "Public Places", taught by Gideon D'Archangelo, provide more methodological backbone, the former coming from industrial design, the latter from museum design. "Expressing with Technology", taught by Danny Rozin, is more for the fine arts crowd. "Physical Computing 2", taught by Tom Igoe, offers more professional project management skills and deeper technical insights. Other classes, like "Sonic Design", taught by Ben Rubin, and "Virtual Reality", taught by Jean-Marc Gautier, take on a whole new flavour when you have been infected with the possibilities of Physical Computing.

Step back

The great success of the World Wide Web has somewhat cemented our vision of what computers can do as processors of information. As we try to push that conception to suit the more expressive parts of our lives, we are hampered by a very consciousness-centred view of ourselves. We should make computers notice and service the parts of our experience that never reach consciousness. This calls for some practical training in the areas of digital and analogue input and output from the computer. At ITP we try to do this in our Physical Computing curriculum.

References

1 The Interactive Telecommunications Program (ITP) is a two-year Masters programme at New York University's Tisch School of the Arts. For more information see http://itp.nyu.edu/

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Physical Computing web page:
http://fargo.itp.tsoa.nyu.edu/~dano/physical/physical.html

eSCAPADE

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One of the things that distinguishes i3 work from other kinds of "advanced IT" is that it is built on collaboration between people from traditionally widely divergent disciplines: designers, computer scientists, ethnographers and technologists work closely with psychologists, teachers, artists, … And for some i3 projects it is the contribution made by artists, in particular, that makes their results especially striking. *eSCAPE* is one such project. Annika Blunck talks about the challenges and rewards of the collaborative process.

The world of media art is a phenomenon of the information society as well as the art world. There is usually a close relationship between a newly-developed medium and its artistic application, and the system-specific representation of the medium is mostly the 'task' of the arts. In our work at *ZKM (Zentrum für Kunst and Medientechnologie)* we attempt to both visualise and specify the ways in which a medium transforms reality; in other words, we are dealing with intuition and imagination on the one hand, and formalisation and 'calculability' on the other.

The process of involving artists was central to the *eSCAPE* project, and triggered discussions regarding 'shareability' of the experimentation, copyrights, access and knowledge, in all the disciplines involved: computer science, electronics, social science, art and design. What would happen after a creative impetus was given to teams generating new software and interfaces? Could the artists keep and re-use the tools wrought by this process? One reason why the artists involved in the project were not immediately willing to share their knowledge with a totally new set of collaborators was that as long as it is their own, they are the guardian of its quality; but once it is given to somebody else, it is 'out of control'. Starting collaborative work within an unknown structure that might develop in a largely unforeseeable way seemed dangerous — and challenging.

Pursuing the *eSCAPE* vision required a shift in our thinking about research, towards using and developing theories, practices and techniques that are interdisciplinary. After a demanding process of trial and error, a common language was established and honed, which allowed the artists to communicate freely and enabled the engineers to recognise what was being communicated, and translate it optimally in technical terms. Indeed, the understanding in some cases was fluent to the point where the software and hardware developers were able to anticipate requirements and suggest tools most apt to convey particular lines of creative thinking. This building up of a dialogue and mutual confidence by no means happened automatically, but the overall working process of seeking and finding solutions to conceptual and technical issues turned into an inestimably valuable common culture – and a precious resource for new work.

The development of information environments linking the physical and the digital required technical expertise in both software and in hardware. Experts in virtual reality, information systems and interface design had to work together in order to realise the underlying technologies. The successful realisation of a seamless, integrated distributed 3D environment demanded the development and application of techniques for grounding this new technology in the lived experience of everyday life. Social science was needed to specify the role of information technology in current social practice, and to provide an understanding of how people interact with this technology. Art and design were required to understand people's needs and desires, and to help design technologies that were useful, stimulating and engaging.

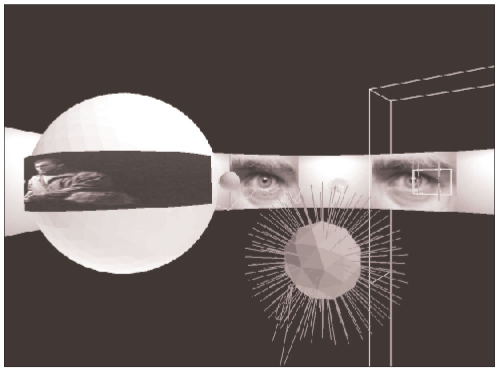
One flagrant misunderstanding which arose between *eSCAPE*'s 'technical' and 'artistic' communities, and which was resolved only after fierce discussions, concerned the nature of the artist's potential contribution to technological development. The developers of the innovative computer tools initially considered the role of the artists as essentially 'decorative' — they would join in and make the austere technologies enticing and exciting. Instead, the intuitive approach of the artists'

"The developers of the innovative computer tools initially considered the role of the artists as essentially 'decorative' — they would join in and make the austere technologies enticing and exciting."

The last few years have seen a rapid growth in the development of computer systems that use shared spaces to support interaction. This has been fuelled by the increasingly ubiquitous techniques that allow new presentations of digital information. This initial shift to shared networked environments has been recognised in the Inhabited Information Spaces schema of the i3 initiative. Within this scheme, the eSCAPE project has developed electronic landscapes that provide interconnections between virtual environments. Two main forms of electronic landscapes have emerged within eSCAPE and have been used by different communities of users.

An *abstract* electronic landscape is one where the structure of the space and the layout of bodies in the space are dependent on the content of the data. Abstract electronic landscapes help users make sense of on-line information by providing a landscape that reflects the structure of information. *Physical* electronic landscapes capitalise on the familiarities of our everyday physical environment, such as roads and buildings. They exploit the everyday nature of our real world to build environments that can be explored and used by citizens for 'real world' purposes.

These electronic landscapes represent the convergence of artistic, social and technical work, and allow users to explore on-line information and virtual worlds in a new way. The landscapes are dynamically constructed and are based on both the content and structure of the information and the effects of user activities. Designed by artists and built using the *Deva* virtual reality system, *Placeworld* represents *eSCAPE*'s first large scale physical electronic landscape. It is a place where places meet, and a technological, aesthetic and conceptual framework for supporting creativity and social interaction via the Internet.



Masaki Fujihata: Nuzzle Afar (1998)

Jeffrey Shaw: The Distributed Legible City (1998)

Knowbotic Research: IO_dencies Sao Paulo (1999) proposals turned out to be an efficient and effective way to promote discussions of a wide range of design and development issues, and allowed different participants to develop their own views about the issues involved. Furthermore, because details of implementation and functionality remained more often than not unresolved, the proposals remained open to imaginary extensions, developments and modifications.

The 'artistic involvement' developed in phases. The first step in order to outline a concept for an interactive art piece was to reflect upon what needed to be taken into consideration with respect to the installation's content as defined by the artist. More or less simultaneously, an integrated information architecture was laid out, and dedicated tools were defined. The resulting interactive installations transformed the *eSCAPE* project's objective of three-dimensional information visualisation into three-dimensional meaningful spaces with would be valuable to the audience and could be accessed intuitively.

So *eSCAPE* has been an ongoing experiment that has built upon imaginative extension and explored the limits and boundaries of the possible. In addition, the artistic investigations have been numerous enough to be treated as a separate domain of expertise ready to inform future technologies.

Today we are facing the end of the dominance of the traditional PC. Computing is already embedded in more places than just our desktop computers. More and more, the digital will permeate physical space in a seamless manner. In the near future, we will expect computing to be everywhere. But despite these developments, information technologies are still often too complex and too hard to use, too demanding of attention and too isolating from other people and activities. In *eSCAPE*, the physical and the digital have become integrated and interdependent spheres of activities. As a next step, in order to really help humans, a computing device should become more aware of its user and its own environment, and become more part of the physical, human world. And media art might again be encouraged to push the boundaries of these new technologies.

Anikka Blunck works as a research associate at the ZKM Institute for Visual Media. She has developed a number of different projects for international exhibitions centring on media art. At the ZKM she contributes to and supports collaboration between commissioned media artists and hard- and software developers. Her publications and research deal with the evaluation of interactive installation in relation to Information Technology.

For more information on eSCAPE:

http://www. escape.lancs.ac.uk

http:// www.placeworld.org

on ZKM:

http://www.zkm.de

User studies

Placeworld (a physical electronic landscape)

Feature

A den of ubiquity

Context-aware computing

Ubiquitous computing, disappearing computers, pervasive computing…: regardless of how you refer to it, it's coming. The idea that we will seamlessly interact with computational services running on our mobile devices and embedded in our environments is no longer the stuff of science fiction. We do not have seamless interaction quite yet, but researchers are working towards the goal of having access to information and services anywhere and at anytime, via the use of more natural interaction techniques than a mouse and keyboard. Anind Dey expands on the role of context-awareness in all this, and its relationship to 'ubiquitous computing'.

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Context-awareness and ubiquitous computing

Ubiquitous computing has a number of important themes, all of which are interrelated. *Capture and access* refers to the capture of a presentation, meeting or one's life in general. *Natural interfaces* refers to the use of speech and gestures as an input technique. *Scalable interfaces* refers to the ability of interfaces to scale, to support a large number of users over a large period of time, in a large number of locations and on a wide variety of devices.

The theme I focus on in my research is that of context-awareness. *Context-awareness* is the ability of a computing service to collect information or context about a user, and then use that context to provide some services or functionality in support of the user and her task. *Context* is defined as any information relevant to an interaction between users, their devices and their environments. This can include *physical context* (such as the user's identity and location), *social context* (such as the relationship between users and between users and devices), and *virtual context* (such as meeting information kept in an electronic calendar or e-mail message (Schilit et al., 1994; Pascoe, 1998)). Context can also be broken down into information that is explicitly provided by users and information that is implicitly sensed by a computational system. The field of context-aware computing has tended to focus on the latter, because of the greater contrast with traditional interactive computing.

The most well known context-aware application is the *Olivetti Active Badge* system (Want *et al.*, 1992). This system kept track of the location of the building occupants, so when an incoming phone call arrived, it could automatically be routed to the phone the intended recipient was nearest to. This application used physical context, including location and identity. Most context-aware applications only use physical context, and then only location. (With newer mobile phones knowing their own location, the field of location-aware services is blossoming.)

There are four important aspects of context: *location*, *identity*, *time* and *activity*. They correspond to the *where*, *who*, *when* and *what* of a situation. All four of these context types should be used to determine what situation a user is in and what action is appropriate to take on behalf of the user.

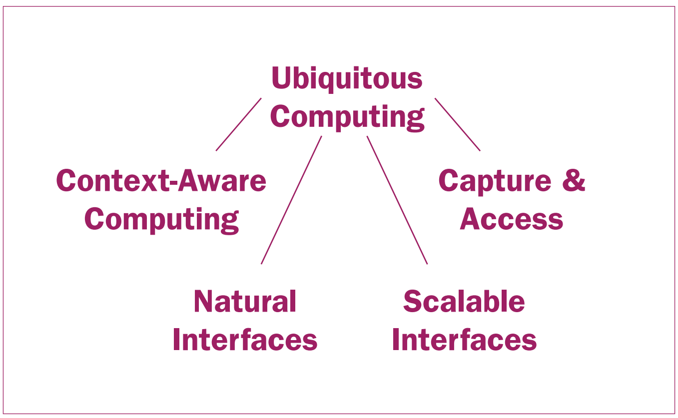

Figure 1: Themes in ubiquitous computing.

There are three broad types of actions that can be taken upon recognising a given situation:

- present the collected and summarised context back to the user for the user to act on explicitly;
- perform a set of services automatically for the user; and
- tag captured information, like a presentation or a videoconference, with the context to facilitate easier retrieval of the information at a later time. This is commonly known as *context-based retrieval* (Lamming and Flynn, 1994).

The most commonly used action is to simply present the context back to the user. One of the challenges of context-awareness is to explore the use of a variety of context types and the ways in which it can be used.

But for what purpose? Why is context interesting or relevant? Context holds the potential for performing more appropriate services for the user. Applications that use context know more about the user than those that do not use context. This increased knowledge can have the effect of making an application seem smarter. The application can be more dynamic and keep up with the changing situation of the user. Particularly for users interacting with their environments or small hand-held devices, the ability to provide input is often lacking. Implicit sensing of context provides an additional channel of input between users and their devices and environments.

"Context holds the potential for performing more appropriate services for the user. Applications that use context know more about the user than those that do not use context. This increased knowledge can have the effect of making an application seem smarter. The application can be more dynamic and keep up with the changing situation of the user."

Examples of context-awareness

There are three common types of context-aware applications that we see in use today: tour guides, travel assistants and personalisation systems. The context-aware tour guide is the most common type of context-aware application (Abowd *et al.*, 1997, Davies, 1998). When you visit a museum these days, very often you are given a handheld device that can display audio or multimedia information about the exhibits you are viewing. The device is aware of its location (and therefore the visitor's location) using some type of positioning system, and uses this context to index into its repository of exhibit knowledge. If the device has access to additional knowledge about the user (e.g. the amount of time the user has to spend, personal interests or preferences) it can potentially use this context as well to provide more focused or more appropriate information.

You can now buy or rent cars with interactive computers inside. *Daimler-Benz*, *Cadillac* and *Hertz* all provide cars with travel assistants. These assistants aid the driver in arriving at a chosen destination. With an installed global positioning system (GPS) unit and compass, the assistant knows where the car is and in which direction it is headed. The user indicates where she wants to go and the car provides driving directions, prompting the user before each important turn. If a turn is missed, the assistant recalculates a new path and helps the driver stay on course. Newer systems can take advantage of more dynamic information such as construction and current traffic patterns.

On the World Wide Web today, there are many services that try to personalise information for visitors. Sites like *My Yahoo!* allow visitors to enter a profile to indicate their interests. When visitors return to this site, it shows them information that is relevant to them based on their interests. More advanced systems take the knowledge of aggregate visitors with similar interests to suggest popular news articles or items to buy. These are three common but simple uses of context.

Challenges in context-aware computing

There are plenty of challenges to address in order to build more compelling and more sophisticated applications. Just as in ubiquitous computing, devices and environments need to be instrumented to support the collection of context, and be built to support interaction with each other. But there are issues more fundamental to context-aware computing, for instance:

- Determining what is context. What context should be collected in a given situation and how does that change from situation to situation?
- Determining what users really want to do. Given that we can determine what situation a user is in, how do we determine what it is that they are trying to do and what we can do to support them?
- Determining where context-awareness can be applied. Are there specific domains that are particularly appropriate to apply context-awareness to? Are there domains where it is not appropriate at all?
- Dealing with issues related to the collection and use of context, including privacy and inaccurate context. When we collect information implicitly from the environment and use it, we are impacting a user's perception of privacy. How do we give users the ability to control access to their private information? What happens when the context we are implicitly sensing is inaccurate?
- Giving end-users control over how their context is used and over the services performed on their behalf. In each context-aware application a trade-off is being made between the amount of control given to the user and the amount of control kept by the application. How do we allow end-users to gain control over their context-aware applications so that they can indicate what actions they want to occur in various situations?

Researchers at the *University of Lancaster* (Davies et al., 1998), *University of Karlsruhe* (Schmidt *et al.*, 1998), and *University of Kent* (Pascoe, 1998) have been working on exactly these issues. These challenges have led me to build the *Context Toolkit*, a software infrastructure that deals with many of these issues, to allow others to more easily build more sophisticated context-aware applications and explore these issues and, more generally, the theme of context-aware computing (Dey, Salber and Abowd, 2001).

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For more information on the Context Toolkit:

http://www.cc.gatech.edu/fce/contexttoolkit.

New series

Journeys across i3

Part one

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"…for although these lands may have been inferred and written about, it has all been speculative up to now, without confirmation by sight, without full understanding – so much so that most of those who heard about them listened and adjudged them more likely to be legendary than anything else."

Christopher Columbus

This is the first part of a series of reflections on research at the frontiers of designing information technology for people. These reflections are mainly drawn from my experiences in setting up and running "intelligent information interfaces" – or i3 for short – a grouping of research projects that has been looking at new paradigms of interaction between people and technology.

"What has been really significant about i3, and why?": this is a question that I will try to address in this series of articles. Each article will describe some observations – or what I call "insights" – that stem from the i3 projects and activities. These, I think, have a general significance beyond the outcomes of the projects themselves. This naturally leads to a broader discussion that is taken up in the final section, "views to the future".

My impressions have come from the many interactions I have had with i3 researchers over the years: the numerous workshops and conferences, the arguments over coffee, the lively discussions whilst waiting at the check-in desks at airports, or even the quick perusal of a deliverable in the comforts of my office. These articles are, then, my personal conclusions — of what I have thought to be significant. Indeed, whilst writing, I found that trying to be completely objective about a programme that one has set up is impossible — and perhaps even pointless! Rather, I decided: let these be my personal reflections on research on the interaction between people and technology, as well as my own critique of how these relate to a broader context. Clearly, this is just one view out of potentially very many, and hopefully it will start similar reflections and critiques by others.

I have tried to direct these articles towards the general reader, who may not have in-depth knowledge of developments in interaction design. As a consequence, some might find certain observations obvious, or perhaps even naïve. However, I think it is useful to try and find some general "truths" across a range of research activities, even at the risk of making some gross generalisations. For many people and researchers not at the forefront of designing interactive systems, some of these generalisations can be relevant (or perhaps even a revelation!) and thus could apply to their own work in an interesting way.

To start, let me briefly sketch some of the reasons for, and history of, setting up this research programme.

The roots of i3

At the Chicago world fair in 1933, the official motto was:

"Science Finds - Industry Applies - Man Conforms."

To many of us today this seems quite shocking — yet this kind of thinking has been the driving force of much development in the last century. In particular, starting from the 'mind-set' of the *ENIAC*, one of the colossal computers of the 1940s, much IT progress has been driven from the point of view of the machine, and can be caricatured as simply making boxes smaller and smaller and faster and faster. Surprisingly, little thinking has been taking place "outside the box".

In contrast, more recently, and as a reaction to a number of factors (information overload and the dangers of alienating large portions of the population only being the tip of the iceberg) human-centred approaches to developing technology have started to come to the surface. It is along these lines that in 1995, we at the *Future and Emerging Technologies* unit launched a research initiative on "intelligent information interfaces" (i3). The thrusting force of this initiative was to investigate "new paradigms for interacting with information".

More specifically:

"The aim of i3 is to research and develop new human-centred interfaces for interacting with information, aimed at the broad population".

To help define a research agenda for this broad topic, we first had a competition for specific ideas of how this could be done. "*Connected Community*" and "*Inhabited Information Spaces*" were selected as two visionary themes on which we based a subsequent call for research projects.

Following this, a related initiative on "*Experimental School Environments*" *(ESE)* was launched in 1997:

> *"The aim of i3-ese is to research new kinds of IT-based tools designed to enable new approaches to learning, focussing on the age range of 4 to 8".*

Much of this research took a fresh look at how people interact with each other using IT as an active medium, rather than as a box sitting on the desk and feeding you information. In particular, it moved away from the machine-centric view of virtual reality, and instead tried to see how everyday people and real locations could become the basis for communication and exchange.

All of this necessarily involved a multi-disciplinary effort, spanning a range of universities, research centres and companies across Europe, and involved a mix of people from many walks of life – artists, designers, computer scientists, games companies, technology companies, experimental schools, teachers and children, people in communities, and so on. At the same time, all these different outlooks were united by a common vision: exploring new relationships between people and technology.

Insights along the way

The first journey in this series of articles deals with process. It identifies two insights: "*The way in which you discover things about people affects the responses you get*", and "*Involving people in the research process can lead to more meaningful technology*". These naturally lead to a broader discussion on the methods we might use to reduce the apparent gap between people and technology.

Insights covered in subsequent articles will illustrate ways in which we can begin to change information design from something purely abstract (as it currently exists on the PC or the internet), into something that becomes inter-linked with various contexts: location, place, group, community and culture. This gives us a starting point from which to map out an understanding of ways of designing environments, in which technology becomes less and less explicitly present; and it also provides a basis for a discussion on "embedding" values in technology. What I argue is that, in the future, the approaches to design information and knowledge exchange in places and settings will be quite different from the present one of just delivering screen-based services through a large number of PCs. The role of *context* will become paramount — and it turns out that this is where Europe has some real advantages.

> *"We know that when we ask people something, the way in which we do it can change the response — even our tone of voice or body posture can be a determining factor. How does this simple observation of human behaviour map onto the more general questions of how to do "user analysis"?"*

Although each insight is illustrated with an example from a specific project, it could easily apply to the work of a number of others. So an insight should be seen as having been applied — implicitly or explicitly — by a number of researchers, and thus applying to more than just the example given. Nor is the list of insights exhaustive. I am sure that you could find other insights from other points of view, such as research management or specific technical advancements. But I thought it more interesting to concentrate on insights pertaining to the original mission of i3: *the search for new paradigms of interaction.*

(1) The way in which you discover things about people affects the responses you get

Consider the above statement at a personal level and it seems almost self-evident: we know that when we ask people something, the way in which we do it can change the response — even our tone of voice or body posture can be a determining factor. How does this simple observation of human behaviour map onto the more general questions of how to do "user analysis"? How should we go about trying to understand what is important to people, and the kinds of things they would like to use technology for?

A criticism of many IT products is that they are too complicated to use. A caricature of the way people arrive at such bad design is: "Get some user requirements on paper in a couple of days; go off and build a system for a couple of years; add a few features; then evaluate in a couple of days"! Clearly, human-computer interaction has gone beyond this and changed many of these attitudes. However, many still rely on questionnaires, where shallow responses from the masses help make rapid decisions. Often these questionnaires embody prejudice, not only in the questions that are asked, but in the very fact that the paradigm of "question and answer" is used.

An example of an activity pack, containing, maps, stickers, post cards, disposable camera…

In contrast to the traditional methods of asking people what they *think* about a product or prototype, an alternative way is to probe them for inspiration – to involve them, and give them a creative role in "proposing solutions", rather than "answering questions". This is exactly what Bill Gaver and Tony Dunne (Royal College of Art, London) and Elena Pacenti (Domus Academy, Milan) tried to put into practice in the *PRESENCE* project, by developing a number of so-called "cultural probes".

In a sense the approach was more akin to modern psychotherapy than the fact-finding of traditional forms. The formula of "questionnaire" was transformed into the concept of "activity pack", with maps, diaries, stickers, cameras and "tell us your day" postcards. The cultural probes were tried out with three communities: one in Oslo, one in *Bijlmermeer* (or Bijlmer), a suburb of Amsterdam, and one on *Peccioli*, a small village in Tuscany. As an approach, it came more from design than from cognitive science. It resulted in a deeper reflection on people in their community and thus gave deeper insights into the design of technology for that community.

One example of the lessons learnt from using cultural probes in the Bijlmer community is quite striking: that despite the Bijlmer being an underprivileged suburb, its local inhabitants were quite proud of it. In fact, they disliked outsiders' scathing impressions of poverty and unemployment. This gave the project designers a great impetus to define the tools in a way that could specifically encourage this notion of "community pride", and led to ideas about the relationship between "interactive benches" and a reflection of community "feel".

Specifically, the project partners developed a number of "slogan benches" – real benches made of wood placed in public places in the community. On the back-rest of these benches was a set of changeable slogans that were composed by a group of community members. The operation of the system as a whole was quite subtle. The slogans could be changed by turning a knob, and a radio link to a base station kept all the currently displayed slogans in check. A neural-network classifier selected images according to the choices of slogans on the park benches, and these were displayed on large screens in other parts of the community. The overall effect was that, in a subtle way, the community could define how it felt about itself. These subtleties could not have easily been arrived at without the fresh approach to discovering some of the deeper issues of what the community wanted.

A potential criticism of the cultural probes is that, even though they moved far beyond the typical questionnaire, the very design of the activity packs may channel certain – even subconscious – ideas of the designer. Clearly, it is impossible (and perhaps

Some of the benches placed in the Bijlmer community.

Examining the benches.

Benches become the focus of local talk – whilst a girl takes a look at a slogan.

undesirable) to be completely neutral – but it is possible to go further than asking people to fill in forms. Whatever the criticism of this method, it is likely that in the future, work on how you can get people involved in defining technological solutions will prove increasingly important. As the division between technology and people increases, more methods have to be put into place that can dynamically inter-relate people's needs and aspirations with technological invention. In summary: it's not just *what* you do, but *how* you do it, that can make the difference.

Designing a low-tech prototype of the "storytelling machine" at Rågsvedsskolan in Stockholm

(2) Involving people in the research process can lead to more meaningful technology

You can extend the previous insight by saying: not only do you need to change the way in which you probe people to gain an understanding about them, but this should become part of an active and participatory process, extending over the lifetime of a research project.

The idea that people – and in particular children – can and should be co-inventors of technologies, is one of the precepts of the project *KIDSTORY*. Headed by a team of researchers (including: Yngve Sundblad (KTH, Sweden); Kristian Simsarian (SICS, Sweden); Steve Benford (University of Nottingham) and Allison Druin (KTH and the University of Maryland)) the project illustrates how children can provide valuable insights into the design of new technology.

With a particular emphasis on group storytelling, the project developed a range of tangible tools within mixed-media environments. These included, for example, a "storytelling machine", a "media sandbox" and "a magic carpet". In the development of all of these, a range of people contributed to the design process, including children, teachers and parents, as well as interaction designers and technologists. For example, in the creation of the "storytelling machine", children were involved right from the start in inventing low-tech prototypes; these gradually grew in complexity through a number of sessions.

Children's comments, as well as researchers' observations of children's behaviour, were fed directly into the design decision-making, as part of a rapid iterative process. Here are some examples of the kinds of guiding ideas that children had. Some of these involved fairly minor changes in development:

> *"The objects are magic wands. Press the picture and the object will do the thing."*

> *"If you show something that uses electric[ity]…the place will get hot."*

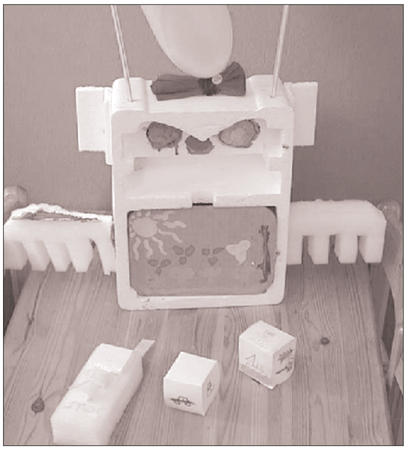
while others involved major changes:

> *"I want [images of] children in the middle of the carpet…You stand on them and they speak to you."*

> *"Instead of looking at something on the computer screen you could look at it on a cinema screen."*

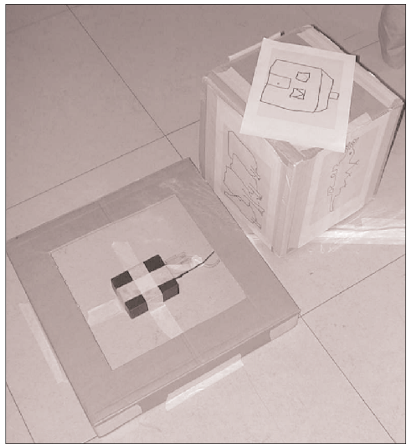
which resulted in fairly substantial design changes. (Particularly the last idea prompted live cinema projection as part of the magic carpet setting.)

All these are examples of children actually influencing the final prototype, sometimes quite significantly. Clearly, co-design with children is still (literally) in its infancy and a lot of work still needs to be done, particularly on the methodological aspects.



A low-tech prototype with storytelling dice invented by eight-year-old Fatima at Rågsvedsskolan.

Further design of storytelling dice invented by Fatima.



Technical realisation of the storytelling dice.

One objective is to gain a deeper understanding of how different methods affect the outcomes of the co-design sessions. The other is to try and close the gap between children's answers to design questions and actual design requirements. Lieselotte Van Leeuwen (University of Halmstad) and Liam Bannon (University of Limerick), who have been involved in the *KIDSLAB* workshops, suggest that there are two basic ways to close the gap. One is to improve co-design methods so that children can provide the design team with directly usable information. The second way is to translate children's answers from whatever format used (verbal, drawings, objects…) into the language of design. Both ways need to be explored and analysed.

A valid criticism of this work is that with time the co-designers, who are initially naïve, start becoming technologically wise, and thus may start providing solutions that are technologically sophisticated, but intuitively less helpful. It is clear that co-designing technology with people – in particular with children – still needs more research. However, it holds the promise of being better able to come up with solutions that are more user-friendly and match people's aspirations. Apart from this, a notable feature of the research (and true to the spirit of anthropology and ethnography) is the open approach. It is the researchers and designers who go to the children in their *real everyday* school settings, rather than children coming to the *researchers' laboratories* – and this is an eye-opening experience for everybody.

Views to the future

In many ways both insights are saying similar things. The difference is that the first emphasises the development of technology with people *before* the process starts; the second says that *after* it starts, people should be involved in an iterative manner throughout. I believe that these two insights have a more general bearing than just providing a prescription for the design of interactive tools. In this section I place the insights in the context of the more general issue of the rift between people and technology. In fact, I think that the insights can help reduce this gap in a practical way.

There is a growing debate today on reducing the gap between people and technology. This rift has been largely spurred on by a rapid advancement and expansion of technology; together with the justified fear that we are creating a technocratic society (i.e. one controlled by scientists, engineers and, most recently, machines!). Clearly, technology has brought great progress; but at the same time people have become disillusioned with "progress for its own sake". As everybody today is witnessing, progress is being made, but often to the detriment of other factors: the environment, people's well-being, the pace of life, to name but a few. In addition, issues of values and ethics are also being brought to the forefront. One recent example of this is the Eric Drexler – Bill Joy debate on the virtues and dangers of nanotechnologies. I don't think there is any one formula for bridging this rift; but neither will the issues go away until they are properly addressed.

"Clearly, technology has brought great progress; but at the same time people have become disillusioned with "progress for its own sake". As everybody today is witnessing, progress is being made, but often to the detriment of other factors: the environment, people's well-being, the pace of life."

Efforts to reduce the gap at the policy and legislative level typically involve large public advisory groups, mandated to provide general guidelines, often of an ethical nature. These can give valuable advice on how to avoid disasters, but do not tell us much about how they make technology "better". Others claim that public understanding of science and technology will help reduce the gap. This also has some drawbacks, since one can easily argue that the opposite is necessary – i.e. that technologists need to better understand people!

The problem is that we are still living under the precept of "*Science Finds - Industry Applies - Man Conforms*". By contrast, simply trying to invert this equation into "*Man Finds – Industry Applies – Science Conforms*" is not a very imaginative solution either, as driving things only by people's needs is limiting: often people cannot appreciate possibilities until the possibilities are presented to them. I think that it is the iterative mixing of these frames that brings the most interesting possibilities.

Enabling everyday people to become active participants in technological development offers a valuable alternative, or rather addition, to the various approaches described above: it brings researchers and ordinary people closer together at the "grass roots" level. In this iterative approach both become co-creators of technology, so that technology becomes created *with* people rather than for them. It offers technology-minded people the opportunity to think beyond the laboratory, towards the everyday world; and it offers people without a technical background (or even technophobes) the opportunity to *act* in a positive way to influence development.

i3, and in particular the work described in insights (1) and (2), provides some tangible examples of what already has been achieved in this respect. I think that some of these experiences are relevant to broader areas of technological development, beyond solely interaction design. Here are four propositions, stemming from i3, that could apply to broader areas and could in their own way help to reduce the people – technology rift .

Firstly, one should eliminate the idea that people are simply "users". The success of many of the i3 projects lay in the fact that they did treat people as people – not as consumers, customers, and not even "cognitive engines". Instead, people were *people*: either living in communities or learning in their everyday school settings. Furthermore, i3 used everyday people, from communities, or children from schools, to evaluate the results of the projects. A careful appraisal of *who really is the person that research is being aimed at* can make a difference.

Secondly, many more areas could try to include people in research and development. Let us take one area at random, say *nanotechnology*; it could be interesting to include everyday people in just a few of the projects undertaken. If researchers could see this as an opportunity rather than a requirement, then this could lead to new ideas – even if nanotechnology is far from being directly used by everyday people.

Thirdly, there is an issue (that perhaps was not touched on so much by the i3 projects) of how to move from the *co-creation* of technology to include *co-ownership*. Everybody needs to have the feeling that "this has been done because of me", and this sense of ownership should last beyond the time of a research project. Investigating forms of "collective ownership" of the outcomes is a way of ensuring that co-creation results in a lasting process.

Finally, there is the importance of openness. This involves getting all potential participants involved *right from the start* of the research process, and breaking down the barriers of "us" and "them". These are key elements for *any* interdisciplinary

"Finally, there is the importance of openness. This involves getting all potential participants involved right from the start of the research process, and breaking down the barriers of "us" and "them". These are key elements for any interdisciplinary activity, whether it includes everyday people or not."

activity, whether it includes everyday people or not. You must encourage a spirit of curiosity and openness to the points of view of others, so as to move towards something new. Scientist and mathematician Jacob Bronowski had a good way of putting this :

> *"The essence of science: ask an impertinent question, and you are on the way to a pertinent answer."*

Walter Gropius, architect – who at the *Bauhaus* intertwined craft, art and industrial process into what is today's discipline of industrial design – said:

> *"As long as it's an open process, it's alive. When it's closed, it's dead. The Bauhaus is a ferment which is still there and still growing."*

It is with this kind of open process (and as has been exemplified by many i3 projects) that we can move towards solutions pertinent to reducing the people-technology divide.

To conclude: it seems like we are coming to the point where technology offers a quasi-infinite set of possibilities. So what do we do? Carry on regardless in all directions? Stop research that could be potentially helpful in some unforeseen way? How can we channel possibilities towards those things that are of interest to people and humanity at large? I have tried to argue that action not only has to be taken at legislative levels and the level of public awareness, but also directly at the research level itself. In this respect, the co-creation of technology perhaps offers some of the "ferment" necessary for arriving at answers pertinent to people, at this hazy dawn of the 21st century.

Subsequent articles

In subsequent articles I will illustrate other i3 insights, such as "*Information that is location-sensitive inter-weaves the digital with the physical*", or how "*Theatre and Architecture can guide the design of information in physical space*". These will underline the difference between the design of information in the "abstract" and the design of information in "context" — a bit like the difference between reading about how to learn to ride a bicycle, and actually learning to ride a real bicycle…

Carrying on from the "views to the future" section of this article, I will argue that, even if we manage to reduce the gap between people and technology, we will still not resolve the problems of "knowing where we are going". New processes and openness are only part of the picture. We will still need vision and direction – people with new skills, such as information architects, and other forms of ferment, such as magic…

The opinions expressed in this article are those of the author and do not necessarily reflect the position of the European Commission.

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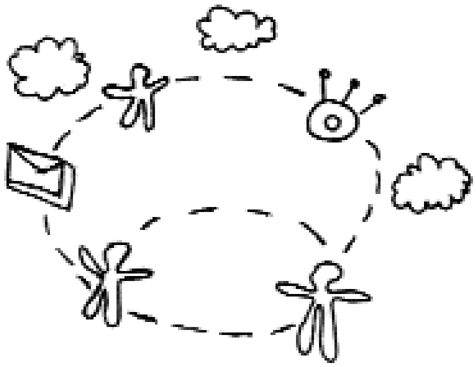
Jakub Wejchert studied natural science at Trinity College Dublin, specialising in physics, and holds a doctorate from the same institution. He worked at IBM research (USA), on computer graphics and interface design. and is currently with the Future and Emerging Technologies unit at the European Commission, where he has been responsible for setting up and running a number of research programmes, including i3.

Further information on the various i3 projects can be found on www.i3net.org

The mysterious case of the disappearing computer begins to unravel

The Disappearing Computer initiative explores how everyday life can be supported and enhanced through the use of collections of interacting artefacts. Together, these artefacts will form new people-friendly environments in which the computer-as-we-know-it has no role. The aim is to arrive at new concepts and techniques out of which future applications can be developed.



Specifically, the DC initiative focuses on three inter-linked objectives:

- to develop new tools and methods for embedding computation into everyday objects to create artefacts.
- to research how new functionality and new use can emerge from collections of interacting artefacts.
- to ensure that people's experience of these environments is both coherent and engaging in space and time.

DC projects

2WEAR	A Runtime for Adaptive and Extensible Wireless Wearables
ACCORD	Administering Connected Co-Operative Residential Domains
AMBIENT AGORAS	Dynamic Information Clouds in a Hybrid World
E-GADGETS	Extrovert Gadgets
FEEL	Non-intrusive services to support focussed, efficient and enjoyable local activities
FICOM	Fiber Computing
GLOSS	Global smart spaces
GROCER	Grocery Store Commerce Electronic Resource
INTERLIVING	Designing Interactive, Intergenerational Interfaces for Living Together
MIME	Multiple Intimate Media Environments
ORESTEIA	Modular Hybrid Artefacts with Adaptive Functionality
PAPER ++	
SMART-ITS	Interconnected Embedded Technology for Smart Artefacts with Collective Awareness
SHAPE	Situating Hybrid Assemblies in Public Environments
SOB	The Sounding Object
WORKSPACE	Distributed Work support through component based SPAtial Computing Environments

All DC projects started on January 1, 2001.

News

"We need to be able to live with technology, and have technologies that live with us."

The IST FET (Future and Emerging Technologies) programme recently organised a Strategic Planning Workshop (Brussels, 26-27 April 2001).The aim was to provide input for the preparation of the 6th framework programme (FP6, 2002-2006).

The workshop consisted of a plenary session and four parallel sessions.The third panel, on *Society and people*, was of particular relevance to i3 and included many i3 members. It was chaired by Gillian Crampton-Smith (Ivrea Interaction Institute), with Tom Rodden (University of Nottingham) as rapporteur. The panel consisted of Aharon Aviram (Ben Gurion University), Liam Bannon (University of Limerick), Niels Ole Bernsen (Odense University), Augusto Chioccariello (CNR), Bill Gaver (RCA), Hans Gellersen (University of Karlsruhe), Ulrich Hoppe (University of Duisburg) Irene Mac William (Philips), Norbert Streitz (GMD), Walter Van de Velde (Starlab), Gudrun Klinker (Technical University Munich), Hans Schaffers (Telematics Institute) and Lennart Fahlen (SICS).

This group was given the task of outlining the major research challenges to be addressed by a future FET like activities within the coming FP6. It was briefed to consider adventurous high-risk research that offered potentially high benefits. The group focused on research with a minimum of a ten-year time scale to exploitation.

A major topic of initial discussion was the need to think carefully about the overall organisation of any future basic research activities. As technologies have matured and become increasingly pervasive, it has become clear that the traditional boundaries of research need to be reconsidered. The group stressed the need to engage with researchers from other backgrounds, in order to provide new disciplinary perspectives and specific skills and expertise, as well as real innovation. It was felt that some *integrating mechanisms*, in the form of common projects or scenarios that allowed these different disciplinary perspectives to be combined, were essential.

The group also emphasised the importance of encouraging a *social*, *cultural* and *ethical dimension* to different research activities in practice. Another broad focus for all of the research was support for *everyday life*, rather than for specific activities (e.g office work).

The overall driver in future research needs to be a recognition of the importance of technology in altering the way in which we all live, and the need to think carefully about the relation between society and technology as part of any research programme:

This discussion on the broad principles of a research programme was followed by a consideration of some of the basic research topics that a programme might address. These included:

Reflecting dreams and desires

"We need to help people find the space to dream, and allow people to think about what their dreams are, and how visions and dreams relate to their actions."

Future forms of interaction

"If objects in the world are getting more and more complex then we need to add simplicity. We need models that allow people to understand and design the new experience they are exposed to".

Complex combinations of technology

" We need to handle scale and diversity … from the smallest sensor to the largest physical space and beyond to future cities … How do people use this space, and how do people and technology cohabit this space?"

Multidisciplinary working

"We need deeper understandings of experience … sensorial models of experience …computation views of experience…techniques to promote new experiences. We need to address these together."

For a full report on this panel session (including a more detailed description of the topics discussed by the group, and the set of recommendations made by the group), and for more on the workshop in general, see

http://www.cordis.lu/ist/fet6fp-6.htm

Two i3 books in the pipeline

Two books on i3 research programmes are currently being prepared.

The first one, which focuses on i3 projects in the *Connected Community* research programme, is well underway. Patrick Purcell (Imperial College) is editor-in-chief, and Niels Ole Bernsen, Mimo Caenepeel, Federico Casalegno, Thomas Rist and Jakub Wejchert are on the editorial board. The second i3 book will present research results in the *Inhabited Information Spaces* programme. Its editor is Dave Snowdon (of Xerox Research Centre Europe); Steve Benford, Elizabeth Churchill, Emmanuel Frecon and Alan Munro are on the editorial board.

A call has recently gone out for proposals for a third i3 book, on *Experimental School Environments*.

Troubadours, ateliers, jamborees

If you thought that troubadours belonged to the middle ages, that ateliers were the exclusive realm of artists, and that jamborees were noisy and unrestrained revels or sprees, you may be surprised to hear that they are all part of the new EC initiative DC (the Disappearing Computer) and the recently submitted proposal for the next phase of i3.

Jakub Wejchert describes the concepts as follows:

Troubadour grants

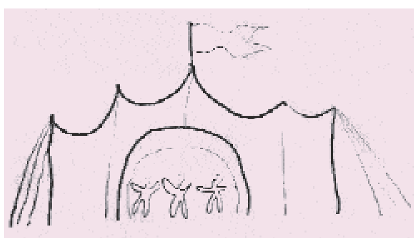
"Borrowing from the idea of the travelling musician of the middle ages, a troubadour would be a 'travelling researcher' who presents their ideas to others, gains from the feedback of others, or makes theirs skills available to others, both within and outside the initiative. A troubadour could visit a range of project sites and other locations over a period of months. In particular, the aim of a troubadour would be to see how their work could be related to that of others in the initiative, so as to lay the foundation for possible future 'piecing together' of work."

Research ateliers

"Collaborative research at a distance does not 'just happen' — it needs a range of activities to help bring people closer together. Traditionally, project meetings and workshops have played a main role in this respect. However, research at a distance could be futther enhanced by allowing people to work together in one location on specific tasks for short periods of time. 'Research ateliers' would be designed to allow researchers to come together for periods of time (a week or a month) to work on a specific topic. In such ateliers, people from a range of projects could construct and experiment with technologies together, thus laying the foundation for integrating components into more coherent systems."

Jamborees

"The annual jamboree will be designed to act as the focal point for the initiative. It will bring all projects together in one large collective event, so as to demonstrate results and to facilitate discussion and exchange. It will focus on activities that help the formation of a community of researchers, and in particular, on activity that are not available at traditional conferences. The annual jamboree will also be open to the public and will provide open access events to encourage this."



CARESS follow-up project CARE HERE gets IST funding

A follow-up project, to CARESS, called CARE HERE (Creating Aesthetically Resonant Environments for the Handicapped, Elderly and Rehabilitation), has just been accepted for funding. It will receive 1.9M Euro, and have partners in Genoa, Bristol, Landskrona and Aarhus and Lund.

For more information please contact Stefan Hasselblad (stefen.hasselblad@mila.landskrona.se).

i3 in the media

i3 continues to expand its media presence.

If you would like to hear what Niels Ole Bernsen, Jakub Wejchert, Tony Brooks, Stefan Hasselblad and others had to say about themes like *i3*, *IT research*, *the Disappearing Computer*, *Personics* and *future office spaces* (in Danish and English), have a look at *i3 in the media* on the i3 website: http://www.i3net.org/ser_pub/media/ (go for the radio clips recorded by National Danish Radio at the i3 Spring Days in Porto).

netzspannung.org: an Internet media laboratory

From September 2001, the Internet platform netzspannung.org will be available as an online Internet media laboratory for the media art & design/science & technology community.

netzspannung.org is a platform for media staging, artistic production, and inter-media research. It has been designed as a "Distributed Community Context Architecture" and geared explicitly to the information, communication, production and cooperation sectors.

netzspannung.org is intended for producers of digital culture who wish to use and shape the platform for their projects. An Internet "tool box" is available for exchanging information and for production of online projects. In addition to expanding the functionality of this system, members can integrate their own computers and so build up a distributed network of experimental media spaces.

For more information check:
http://www.netzspannung.org

i3 community takes the plunge at Orbit/Comdex in September

i3 magazine

27 projects have been selected to exhibit at the i3 Research Village at Orbit/Comdex this year.

All i3 members are warmly invited to join them at the i3 Research Village and take part in this year's *i3 Annual Event*, which will be held in parallel with Orbit/Comdex 2001 (25 – 28 September). Special i3 events include a reception, a one-day conference, and this year's AGM (Annual General meeting); in addition to this, i3 members will have free access to the Orbit/Comdex exhibition at large, and to the e-business congress.

There will be ample room to unwind as well: the centre of gravity of i3 social activities during Orbit/Comdex 2001 will be *Zurzach*, a small, picturesque medieval spa town appr 60 km west of Basel, where i3 has reserved a number of hotels clustered around the superb local thermal spa. There will be a regular shuttle service between Zurzach and Orbit/Comdex 2001.

Deadline for registration is for i3 at Orbit/Comdex Europe 2001 is 10 September 2001. Hotel bookings need to be made as soon as possible, as spaces are limited. For all information:

http://www.I3net.org/ac2001/orbitcomdex/

Another date for your diary: the first i3 summer school (1 – 10 September 2001).

And another opportunity for i3 people to converge, discuss and learn, in yet another beautiful place.

At the *i3 Summer School* (Ivrea, 1 – 10 September 2001) the focus will be on introducing young researchers to work in the i3 tradition, with a special emphasis on *Interaction Design*. The theme of the school, which is taking place at Ivrea's new *Interaction Design Institute* ("majestically situated on the edge of the Aosta Alps"), is *Designing for communities*. Directed by Gillian Crampton-Smith and Giorgio De Michelis, the school will offer a thought-provoking mix of talks and hands-on work in ateliers. For more information:

http://www.i3summerschool.org/

i3 embarks on collaboration with StepStone

Looking for a job? Or do you have a job vacancy? All i3 members are invited to put their job vacancies on the StepStone web site during September, at no cost, as part of a special collaborative arrangement between i3 and StepStone. Job-seekers within the community are encouraged to keep a close eye on the StepStone web site during that month.

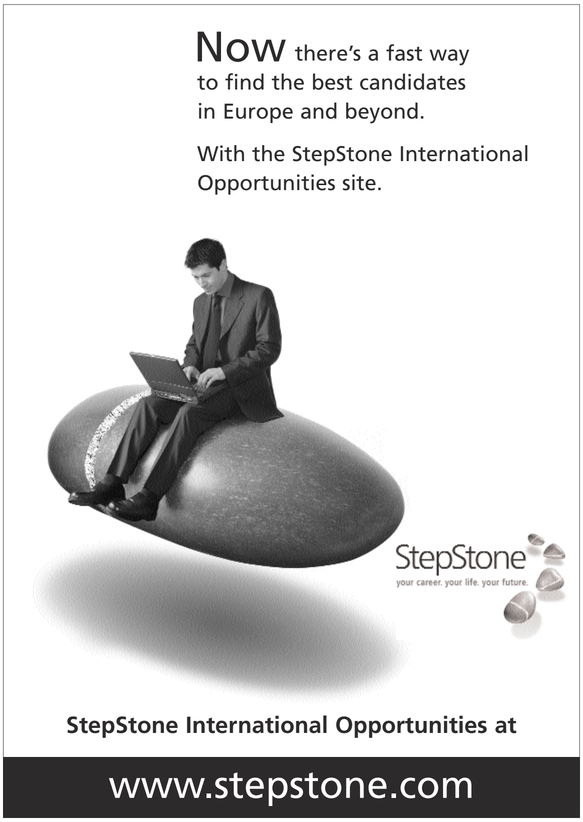
StepStone was launched in 1996 to meet employers' demands for a better recruiting solution. Today, it has over 931,799 registered subscribers, over 581,811 CVs in its database, and over 1 million user sessions a week - 13,617,155 in total for the first quarter of 2001.

StepStone matches qualified candidates with relevant career opportunities. For job seekers, the goal is to provide quality career opportunities, training and educational courses, and editorial content and tips that will help people secure the right job. For employers, the vision is to be a long-term recruiting and HR solutions partner, both locally and across Europe, offering the highest level of customer service, building long-term relationships and delivering measurable results. This is reflected in a strong commitment to the European marketplace.

Stepstone also offers an International Opportunities site that has a truly global reach, featuring jobs from around the world.

Check http://www.stepstone.com.

For inquiries please contact
gerhard.protschka@stepstone.ch



Tony Brooks Soundscapes concept becomes subject of i3 TWI-AYSI probe

In January 2001, Tony Brooks (Denmark) and Stefan Hasselblad (Sweden) started a preliminary investigation into the complementary role that interactive lights and visual media might play, and into ways of achieving aesthetic resonance with colours and shape manipulation, to stimulate a stronger perceptive multisensory cell response to that achieved with just sound (as in the i3 CARESS project).

The first phase of the investigation took place in Stefan's special school in Landskrona, Sweden, where the two researchers worked with seven special-needs children. Phase two of the probe involved collaboration with four disabled boys from an institute in Aarhus, Denmark.

The probe findings on the use of the new generation of sensor system interface, which were supplied by PERSONICS, substantiated the theory, concept and methodology of Tony Brooks' Soundscapes work on new technology in the field of special needs (see feature in i3mag10).

Tony Brooks writes:

"In future, other aspects of our sensorium could be uncovered that further alter and expand our methods of perception and change our approach to the creative process. I am convinced that the human visual system and psyche bear far more potential than we presently realise."

For more information:
http://www.personics.net
http://www.i3net.org/about/futureprobes/twi-aysi.html
http://media.nis.sdu.dk/video/twi-aysi.html (TWI-AYSI probe video)

Opinion Column

Political devices

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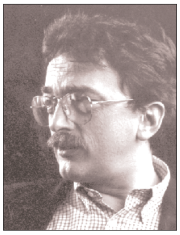


In February, a *Gartner Group Inc*. report by Nick Jones appeared, titled "*The Social Impact of the Connected Society*". I quote from it because it is distributed freely by the company through its 'Insight' electronic newsletter, and because it proposes a scenario that merits discussion by people engaged in designing and developing new interaction systems for the Information Society.

The report assumes that, with a probability ranging from 70% for 2005 to 90% for 2010, the following conditions will hold:

- Individuals will carry or wear many devices that have some form of computing capability, both single-function and multi-function. Device sizes will vary from the relatively large (e.g. those embedded in clothes) to the very small (e.g. subcutaneous implants for biological monitoring and identification purposes).
- Device functionality will increase substantially, with many devices performing multiple tasks.
- Every nontrivial computing device will have at least one form of built-in wireless technology.
- Device prices will continue to fall.
- Display technology will have become both cheaper and more flexible. Flexibility will allow displays to be folded, rolled up and incorporated in clothing and/or in sunglasses.
- Any wireless device will be locatable by the systems in its vicinity.

While I think some of these assumptions are highly questionable, I will not discuss them one by one, because the overall scenario set out by the Gartner Group report is plausible.

The report then goes on to evaluate the different directions which Western industrial societies can take on the basis of the above assumptions. One of the issues it discusses is *privacy*: are we moving towards a society where privacy is vanishing, or will we defend ourselves against Big Brother? The report's answer runs as follows:

> *"By 2007, privacy legislation will not substantially inhibit enterprises from delivering mobile products and services, as long as those enterprises obtain explicit customer permission for the use of information (0.7 probability).*
>
> *Through 2007, the delivery of mobile products and services will be substantially impeded by privacy legislation, which will be more extreme in the European Union (EU) than in the United States (0.3 probability)."*

This forecast seems reasonable: it is well-known that Europe is concerned about privacy, but one can also imagine that ICT industry will try, even in Europe, to force public regulations in order to ensure the development of mobile products and services.

But if we look at this more carefully, we discover that the scenario proposed by the Gartner Group report contains some hidden assumptions. Let me try to illustrate them.

Why is mobile technology development strictly linked to a threat to the privacy of citizens? We can imagine that in a global mobile network, we can have both nodes that are locatable and accessible by others and nodes that are not. Subcutaneous implants for identification purposes, as well as personal identification through mobile devices, can be avoided and forbidden without affecting the development of mobile technology. The fundamental question here is not technological but political: are we moving towards a global society where *efficiency* is the dominant value and *diversity* is considered an obstacle (as the Gartner Group seems to presuppose), or are there different options open to the Western industrial societies, including ones that could could revitalise local communities and put social values first?

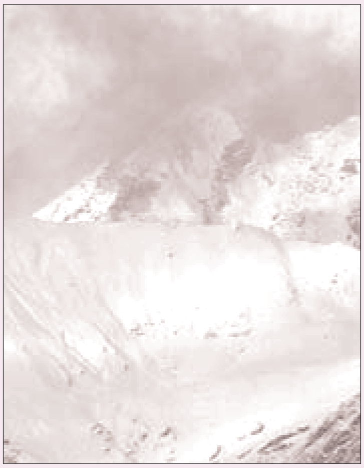
But when we consider this a second question arises: are the options I have just referred to intrinsically luddite, is it possible that they will only block the development of mobile technology? My answer is to this is *no*. And all the projects we have developed, and are developing, in i3 (and, I hope, in the Disappearing Computer), confirm this: the main problem is not at the level of regulation, but at the level of research directions.

If this is right, a new — serious — problem arises: the public perceives Europe as trying to impede the development of mobile services and products. The European Union appears to have no role in the development of mobile technology, where the lead is totally in American hands. This means either that Europe is not aware of the fact that our projects are developing an original research direction that could offer a valid alternative to the Big Brother menace; or that it is not capable of selling them to the public. What can we do, what should the European Commission do, to overcome this *impasse*?

Announcement

Designing for communities

i3 summer school
Ivrea, 1 – 10 September 2001



For more information about the summer school:
http:// www.i3summerschool.org

Interaction Design Institute, Ivrea:
http://www.interaction-ivrea.it

For further enquiries, please email:
i3summerschool@i3net.org

Focus

The focus of the i3 summer school is on Interaction Design, a dynamic emerging research field full of new concepts and ideas — many of which inspired by i3 work.

Purpose

The summer school aims to involve graduate students and researchers from a wide range of backgrounds (both academic and industrial) in the new ways of thinking and the new research issues fuelled by Interaction Design.

Location

The summer school will take place at the recently established *Interaction Design Institute* in Ivrea (Italy) — a new kind of institute that, under the directorship of Gillian Crampton-Smith, combines research, design and business. Ivrea is situated at the edge of the Aosta Alps, within easy travelling distance from Turin and Milan.

Programme and faculty

The summer school programme will be a stimulating mix of presentations by keynote speakers and creative groupwork in ateliers.

Lecturers will include John Bowers (KTH, Stockolm), Gillian Crampton Smith (Interaction Design Institute, Ivrea), Giorgio De Michelis (University of Milano, Bicocca), Wendy McKay (Inria, Paris), Thomas Rist (DFKI, Saarbrücken) and Tom Rodden (University of Nottingham).

Among the atelier leaders will be Alan Munro (University of Strathclyde), Elena Pacenti (Domus Academy), Peter Rist (DFKI, Saarbrücken) and Dave Snowdon (Xerox Research Centre Europe, Grenoble).

Cost

The summer school fee of *500 Euro* includes registration, lunches, coffee breaks and summer school dinner. PhD students will have their fees covered by grants. Inexpensive lodging options (less than 20 Euro per person per night) have been arranged.

Spring Days report

i3 Spring Days 2001: version 3.0

Svend Kiilerich
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This year's Spring Days dinner took place on board of a boat sailing up and down the same beautiful section of the Douro river — over and over again. The Spring Days workshops, on the other hand, did not tread water: they moved in — sometimes tantalising — new directions.

After Sitges (version 1.0 - 1999) and Athens (version 2.0 - 2000) the venue for the i3 Spring Days 2001 was Porto. As in previous versions it was the workshops that made up the core of this year's event and gave computer scientists and technologists, as well as ethnographers, psychologists, teachers, artists, designers …. PEOPLE …., a chance to meet and discuss. Ten workshops took place under this year's motto, *(Inter)facing tomorrow*, under headings such as Using IT in Education, Inhabited (Information) Spaces, Innovative IT Systems for Education and The Disappearing Computer, and most of these attracted many more participants than expected. This suggests that the "open doors" concept works well to support networking across projects.

As always, heartfelt thanks to Thomas Rist, *sine quo non*, and to local organisers Secundino Correia and Pedro Pinto, for all the hard work!

Cutting-edge technology and sybaritic pleasures

i3 at Orbit/Comdex Europe 2001
25 – 28 September 2001

The response to i3's call for proposal for the i3 Research Village at Orbit/Comdex Europe 2001 has been overwhelming, and 27 projects have been selected to display research results at the village. The main format will be hands-on, the main emphasis on engaging Comdex visitors and capturing their imagination.

Village neighbourhoods

Community: Connecting People

Computers often tend to isolate rather than connect people. The results presented in the Community neighbourhood show that this need not be the case, and that technology can actually bring people together instead of fixing them in isolation in front of a screen.

Exhibits: *KidsLab, Campiello, Magic Lounge, Verbal non-verbal communication*

Learning: storytelling

Stories play an essential role in understanding the world, especially for young children who have not yet made the transition to reading and writing. The four projects in this neighbourhood focus on the impact and potential of stories, and demonstrate how new technology opens up new avenues for storytelling.

Exhibits: *KidStory, Pogo, Puppet, Today's Stories*

Play

Play is a vital part of childhood, and children love computer play. The projects on display in this neighbourhood acknowledge this but go beyond the limitations of current technology to explore new dimensions.

Exhibits: *Playground, éTui, Ventilar*

Assistive Technologies

People with mental or physical disabilities stand to gain a lot from appropriate new interfaces. Developing such interfaces is important not only because of their human and social impact, but also because they often push the boundaries of the science and the technology involved.

Exhibits: *CARESS, Personics, Teleface, Unicorn*

Common areas

The Piazza

This will, above all, be a relaxed social space for 'hanging out' and discussing things over a drink. But there will be more to sample.

Exhibits: *Electronic Graffiti, EyesCube, Cyber café,*

The High Street

As in a typical high street, this is where you find services and information.

Exhibits: *Cyberella, StepStone, Hips*

The Administrative Centre

The Administrative Centre will place i3 research in context.

Exhibits: the EU *FET* programme, the *i3 Summer School*, *ELSNET, i3labTV, The Disappearing Computer.*

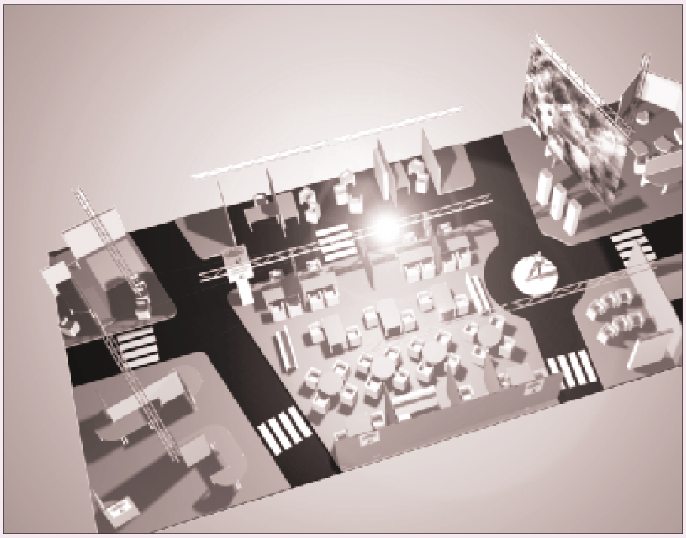
i3 conference at Orbit/Comdex Europe 2001

You don't need to be involved in the i3 Research Village to come to i3 at Orbit/Comdex! Coming to Basel offers you the opportunity to touch base with the i3 community, and take part in a number of other i3-related events and activities. One of those is a special *i3 e-conference*, taking place on 28 September, with Stephen Heppell from Ultralab and Derrick De Kerckhove from the McLuhan Institute as keynote speakers. The invited talks will be followed by a panel discussion on *People and Machines: who is driving whom?*

Zurzach

Zurzach is the ideal retreat away from the hustle-bustle and pressures of Orbit/Comdex, and during the week of Orbit /Comdex 2001 it will become the centre of our social activities, and the best place to meet up with other i3 members in a relaxed setting.

Zurzach is a small, picturesque medieval spa town situated approximately 60 km west of Basel, in a valley surrounded by mountains. The town boasts excellent restaurants and a superb Health Spa. All the hotels are clustered around 'The Spa', which includes thermal baths, the latest exercise facilities, swimming pools and all the beauty treatments and pampering a jaded i3 member could hope for. All included in the price of your room! A special direct coach-shuttle for i3 members will run to Orbit/Comdex at least twice a day; there is also a public train connection to Basel.



Floorplan for the i3 Research Village at Orbit/Comdex, designed by Philips.

More information

On i3 at Orbit /Comdex (general info, registration, hotel bookings):

http://www.I3net.org/ac2001/orbitcomdex/

On Zurzach:

http://www.badzurzach.ch/

Programme

25 – 28 September	Orbit/Comdex 2001 exhibition
25 September (am)	Connecting Leaders (organised by Messe Basel)
25 September (pm)	General assembly and i3 reception
26 September	i3 social dinner
27 September	i3 reception and dinner (organised by Messe Basel)
28 September (am)	*Futurizing, The New Road Ahead*. Conference organised by Messe Basel
28 September (pm)	Closing reception
28 September (pm)	*People and Machines: who's driving whom?* i3 conference

Important dates

July 6, 2001	Deadline for hotel bookings at Zurzach
September 10, 2001	Deadline for registration

Book Review

Soft play of the future

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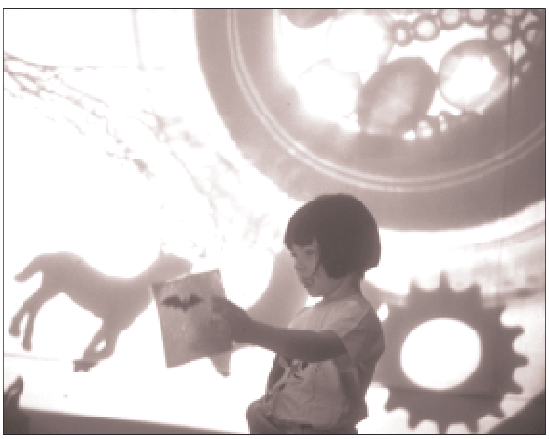
Giulio Ceppi, Michele Zini: (eds): Children, spaces, relations. Metaproject for an environment for young children. Reggio Children,1998

More than a book, this is a journey. For me, it was the chance to re-visit on paper what I had discovered in person a year ago, with astonishment and joy: the *Reggio Emilia* infant-toddler schools. For those who have not been there, this book will be a surprise, made of infinite drawers that one may open or not, find full or empty, evocative or silent. It is an intelligent exercise in the rediscovery of the plurality of language for expression, an attempt to restitute a meaning to elements that, although physically present, have mentally disappeared from school: space, lights, materials, colors... Traditionally absent in most current research, which often confuses innovation with a massive introduction of information and communication technologies and totally neglects the space dimension, those physical qualities find here the attention they deserve.

The book stems from the collaboration between the *Reggio Emilia Municipality*, *Domus Academy* and the Italian *Ministry of Education*. Edited by Giulio Ceppi and Michele Zini, it explores the "physical characteristics and soft qualities of the environment" for young children, through the lenses of an interdisciplinary group consisting of architects, designers, teachers and the "pedagogistas" of the *Reggio Emilia* schools.

"Children, spaces, relations" is divided into three main sections: the first identifying keywords and metaphors expressing the desirable characteristics of the environment; the second focusing on design tools; and the third presenting essays and contributions on the pedagogical and architecture/design issues. "Overall softness", "relation", "osmosis", "multisensoriality", "epigenesis", "community", "constructiveness", "narration", "rich normality" for Part 1; "relational forms", "light", "color", "materials", "smell", "sound", "microclimate" for Part 2. These are the "thematic drawers". But the beauty of the book is that it does not require a linear and sequential reading, but can be navigated at random, stimulated by a headline, a name, or one of the numerous images. It is an open invitation to construct your own understanding of the issue. No wonder!



So do not expect a treaty on architecture, or the n^{th} version of the guidelines for the "school of *the* future". This book does not offer a recipe for a reproducible experience, but the account of an experience which is extraordinary and unique not only from the point of view of its architectural and educational paradigms, but also from the social, political and cultural perspective. Certainly, the words and images will create a resonance; but they will need to be interpreted and inhabited by your own specific context to trigger a new extraordinary and unique experience.

What is really striking when visiting the schools or browsing through this book, is that we won't find the classic chaotic school space saturated with colors and objects, to which adults' imagination attributes the magic quality of stimulating children. Not at all. The environment in the *Reggio Emilia* schools is rich in perceptions but not overdone. Here objects find their ecological space and stand in a network of connections of meanings with the other objects and with the people inhabiting the school, adults and children. Objects are engaged in a dialogue with the school and the school is engaged in a dialogue with the city.

The environment is evolving, but preserves layers of memory, echoing the children's experience inside and outside the school as individuals and as members of a community. As Carla Rinaldi points out, *"a living organism never remains the same, and a school for young children is never the same from one day to the next, so we must be able to ensure a continuity of identity within change, a memory of the past and a memory of the future".*

A column in this magazine is not enough to account for the richness of this book. I can only recommend it for reading and periodical, regular flicking through.

To order a copy of the book, please contact reggiochildren@rch.municipio.re.it

Future events

Links to all events on this list are available at http://ravsted.nis.sdu.dk/conferences/

INTERACT2001 - Eigth IFIP TC.13 Conference on human-computer interaction
9-13 July, 2001
Tokyo, Japan

UM2001 Workshop on User Modelling for Context-Aware Applications
13-17 July, 2001
Sonthofen, Germany

IV2001, 5th International conference on information visualisation
25-27 July, 2001
SOAS, University of London, London, UK

CogSci2001
1-4 August. 2001
Edinburgh, Scotland

IJCAI-01: Seventeenth International Joint Conference on Artificial Intelligence
4-10 August, 2001
Seattle, Washington, USA

HCI International 2001, 9th International Conference on Human-Computer Interaction
5-10 August, 2001
New Orleans, Louisiana, USA

International Conference on Advanced Learning Technologies (ICALT 2001)
6-8 August, 2001
Madison, Wisconsin, USA

The Fourth International Conference on Cognitive Technology: CT'2001, Instruments of Mind
6-9 August, 2001
University of Warwick, UK

Hypertext 2001 - The Twelfth ACM Conference on Hypertext and Hypermedia
14-18 August, 2001
University of Aarhus, Århus, Denmark

IFIP World Computer Congress 2002
25-30 August, 2002
Montreal, Canada

Designing for communities, i3 Summer School on Interaction Design
1-10 September, 2001
Ivrea, Italy

Eurospeech2001 - Scandinavia
3-7 September, 2001
Aalborg, Denmark

ICHIM 2001, Cultural Heritage and Technologies in the Third Millennium
3-7 September, 2001
Milan, Italy

EUROGRAPHICS 2001, Challenges in Computer Graphics for the 21st Century
4-7 September, 2001
Manchester, UK

Euromicro Conference - Multimedia and telecommunications
4-6 September, 2001
Warsaw, Poland

CRIWG"2001: Seventh international workshop on groupware
6-8 September 2001
Darmstadt, Germany

Fifth International Workshop CIA-2001 on Cooperative information agents
6-8 September, 2001
Modena, Italy

Appel a communication, Interaction without frontiers
10-14 September, 2001
Lille, France

COSIGN 2001 - Computational semiotics in games and new media
10-12 September, 2001
Amsterdam, The Netherlands

IHM-HCI 2001, Interaction without frontiers
10-14 September 2001
Lille, France

IVA2001 - Third International Workshop on Intelligent Virtual Agents
11-12 September, 2001
Madrid, Spain

(COSIGN 2001) Computational semiotics on games and new media
12-14 September, 2001
Amsterdam, The Netherlands

ECSCW 2001: The 7th European Conference on Computer Supported Cooperative Work
16-20 September, 2001
Bonn, Germany

8th IFAC/IFIP/IFORS/IEA Symposium on Analysis, Design, and Evaluation of Human-Machine Systems (HMS)
18-20 September, 2001
Kassel, Germany

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GMD: German National Research Center for Information Technology (Darmstadt)
GMD - Forschungszentrum Informationstechnik GmbH
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Ravensburger Interactive Media GmbH
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NL
ACS-Interactive Media Research & Projects
Compuleer
Doors of Perception
Halmstad University
IPO - Instituut voor Perceptie Onderzoek
LOST BOYS Content and Usability
Meru Research
Netherlands Design Institute
Philips International
Philips Design
Technische Universiteit Eindhoven

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SINTEF Telecom and Informatics
Telenor R&D

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