The mysterious case of the Disappearing Computer

Opening scene: the PC, gateway to the information world. Sitting on a table with a desk light hunched over it, anchored to its location, suggesting work, adept at many different functions. Dominating the room with its large screen and keyboard; and dominated by an interface that assumes that what users want, and do best, is click, double click, drag and drop. The computer as we know it.

The larger setting: a rapidly expanding user population no longer made up mostly of professionals, but increasingly embracing “ordinary” people of different age groups, occupations and capabilities. A population that is getting more and more accustomed to mobility and mobile devices and, if it is to use technology comfortably, needs systems that are intuitive, transparent and human-centred.

The opportunity for action: a steep upward curve in the sophistication and capacity of mobile devices (forecast to be on the ascent for some time to come), growing bandwidth, new types of interfaces, and new supporting technologies in areas such as language and speech.

And the dénouement: a completely different kind of environment, no longer squatted upon by the single PC but consisting of a variety of more specialised information artefacts that are integrated into, or unobtrusively merge with, everyday objects. These artefacts are modular and aware, and able to interact with each other, either in close proximity or at a distance. The technology is still there, but has disappeared into the background.

What remains unwritten: the plot. What happens? What will make the computer disappear, what will make you not need to use it, what will transform it? What new kinds of environments (and functionality and behaviour) will emerge? And how can we make sure that people’s experience of such environments is coherent and engaging, that they enrich everyday life and result in a world that is more alive, more deeply interconnected?

These are the leading questions. You are invited to contribute to the actual script. It will need to combine the forces of imagination, research and hard technology. The call is out now.

We open this issue with an extended feature on the Disappearing Computer (based on an interview with Simon Bensasson and Jakob Wejchert), followed by the call.

Launching a new initiative involves many activities, from consultation, brainstorming and the charting of territory to gradual articulation of the vision and the mechanism.

Links to the Web sites of all the i3 Projects: AMUSEMENT, CAMPIELLO, COMRIS, CO-NEXUS, eRENA, eSCAPE, HIPS, LIME, MAYPOLE, MLOUNGE, PERSONA, POPULATE and PRESENCE, 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/
for implementing it. Lots of people are involved in the Disappearing Computer initiative, but of these, Simon Bensasson and Jakub Węchert, both already familiar to the i3 community, are central. i3magazine put these questions to Simon:

How does the Disappearing Computer differ from concepts like the Invisible Computer, or Ubiquitous Computing?

The Disappearing Computer initiative does not provide a specific model. If you say ‘Ubiquitous Computing’, there is an implicit model behind it: one that stipulates that computing is everywhere, and you can access it from wherever you are. Similarly the notion of the ‘Invisible Computer’ (based on Don Norman’s book) presupposes something that has changed its form. There is obviously an element of these in the Disappearing Computer, but there is no dogma behind it, there are no preconceptions. The Disappearing Computer is, in a sense, an invisible concept! We’re not saying: “This is how it should be”, but “You tell us how it should be...” We are open to ideas, any ideas.

What does it mean, that in the new vision “the centre of gravity is on the side of the user?” Aren’t the PC, and the Windows interface, meant to be user-friendly?

The current notion of user-friendliness was created by taking a complex issue, such as design languages or the application interfaces, at a low level and saying “How do I translate this into ‘click, double-click, drag, drop?’” The idea is that you don’t have to see what is going on, it’s a black box, and that’s fine because you don’t have to care about this. But sometimes I do need to care. And if I look at current operating systems I have no idea what has been done, and I have no control over what is being done. There’s a lack of trust in the user in the name of user-friendliness.

We need systems that start from the user, that are so transparent that the user can understand them and is in control of what he or she is doing. What does that mean? It’s not enough for the new system to be attractive (nice colour, nice shape, fits the hand well...) or even simple. Some of the simplest things make the mind boggle. Take those Japanese telecontrol machines for air conditioning. They have only three or four buttons, they’re so symbolic and elegant, but I never understand how to use those things. I have no idea how they work, the viewing symbols mean absolutely nothing to me, I have no control.

People complain about video recorders, and it’s true that these tend to be complex. But if they’re complex I will read the manual, and then I will understand the machine. Systems like the air conditioning control ones are devastatingly simple, but obscure. Simple doesn’t mean transparent. And the same is true for the PC: if the interface is not intuitive it won’t be suitable for a lot of users for whom any involvement with the device is frustrating. What are examples of the kinds of artefacts that would illustrate the concept of the Disappearing Computer?

I haven’t got a clue. This is really a question we are asking the proposers. If I were to be asked for my “ultimate” vision, in the holy grail sense, that would be a bit like Pinocchio’s friend Jiminy Cricket, small and unobtrusive, who would talk to me, answer my questions, and convey my commands to other doers in the environment. It would also have a Babel fish incorporated into it that could translate everything for me from whatever language. So in that sense

What disappears with the PC is that if you want to access the world of information you don’t have to go and sit behind a machine that’s sitting there to do it. And I use the word ‘information’ in a generic sense too, of course. There is a world of information, and people really are an inherent part of that world. We have information inside us, information’s out there, there’s information that you give, or take, or process, that’s local, global, information in the sense of interacting with other people — information-theory kind of information as opposed to information-technology kind of information.” (Simon Bensasson)

questions, and convey my commands to other doers in the environment. It would also have a Babel fish incorporated into it that could translate everything for me from whatever language. So in that sense
it would be a single device. This is a bit of a fairy tale though.

The idea of having ten devices is attractive in some cases, unattractive in others. How many telecontrol devices do you have at home? I have five, I think, and I still have to get up and switch the volume by hand if I switched the television on and not the hifi. Ideally my Jiminey Cricket would understand that I want my control all from one place, and take my word for it.

You can’t come up with a proposal for a device that replaces everything. But what matters is how you design your device. For example, a device that operates in a restricted domain may have enough genericity in it for that to be extended, or may be inherently modular.

The computer that we want to make disappear is eminently a general-purpose machine, and that is the beauty of it. This is not something we can afford to lose.

The idea of an artefact being modular and being able to interact and evolve is central to the concept of the Disappearing Computer. But some might argue that even with a small degree of complexity it will become hard to predict what this evolution will yield, and that it could lead to artefacts that are out of control (which may be exciting but also quite dangerous). What is your reaction to this concern?

Dangerous modular and interacting artefacts? Indeed this may be the case, but I think it would be wrong to shy away from the research because this might be the case. Let us see what we come up with, if it is dangerous; and if so, what means of control there are. Sometimes simple solutions at a low level may safeguard against great trouble — take Asimov’s first law of robotics. If, on the other hand, you are referring to the danger of complexity alone (i.e. the system collapsing under its own complexity), then I would agree with you and say that this is why we need basic research, including in the area of complexity.

The kind of technology that seems to be targeted could potentially be used for pervasive surveillance, could be developed into applications that can identify what people (and not just terrorists) are doing. Is this a concern, and would there be a safeguard so that this technology would not be appropriated as an elaborate surveillance mechanism?

What could it introduce which is not already there now? Are we really surveillance-free? Maybe future architects should ensure that each home has its “private” space — one in which you can tell your most dreaded secrets to a partner. I would argue that you would need that anyway. Indeed, the research we fund might address some of these issues with more concern than Mr Gates or others would.

The other thing is the focus on artefacts — this really makes things tangible. I don’t think people realise how different things will become when IT capabilities infuse the everyday physical world; some things will become much more ‘real’ and no longer just virtual processes on a screen.” (Jakub Węchert)
“It’s not Ithaca that matters, but the trip to Ithaca” (and getting somewhere)

Vision and mechanism behind the Disappearing Computer initiative

The intention for all EC initiatives is that the whole should be more than the sum of the parts. But the Commission does not dictate research by means of a super-project or a kind of master plan, with bits then parcelled out to individual consortia to carry out: components or projects are to emerge bottom-up. To allow for this without sacrificing coherence, a focused vision is needed for the initiative as a whole; and this vision should not be too broad (because then its coverage might be too sparse) or too specific (because then it might exclude important opportunities).

Simon Bensasson explains:

“The vision is important because to make things emerge you need to have a focal point, something that concentrates the mind somehow, on the effort. It doesn’t matter whose it is, and at the end of the day we might arrive at something completely different; but without an initial vision you won’t get anywhere, it will be a blunderbuss.

We cannot expect any one proposal to implement a vision. But if the vision is clear, and the target is clear, not in terms of products but in terms of the general direction, then we should get proposals towards that vision, with individual components coming out.”

So the vision is there to provide a focus for the development of components. But the ultimate aim behind an initiative like the Disappearing Computer is to work towards a system; and this is not something that projects can achieve individually. So for the Disappearing Computer a new mechanism is being introduced, which will encourage the creation of new collaborative projects if the possibility arises naturally:

“i3’s approach so far has been to encourage synergy and collaboration between projects in a more background way, through big events and workshops. This has created a lot of sparks of cross-working, but nothing more than that. For the Disappearing Computer, we want to take this model a step further.” (Jakub Wejchert)

If the reviewers identify an opportunity for engineering a higher-level construct that would become possible through combining the skills or results of individual teams, then we’ll try to arrive at an outline specification for a new project, a system of interconnected devices.” (Simon Bensasson)

“We’ll do this through a process of recommendation and negotiation: the mechanism will be a dynamic and iterative one. The review board may make recommendations that the projects may want to improve on, for instance – or conceivably turn down. Remember we do not specify a super-project aiming at a pre-conceived system. But if a system were to emerge from constituent parts, we want to be able to support that.” (Jakub Wejchert)
“We’re reserving a certain amount of money to support this new mechanism. But we’re only going to use that if a genuine opportunity arises to create a truly new entity or dimension, which is at a higher level and involves the participants from different projects. So it is not going to be used to extend the projects, it’s not top-up money.” (Simon Bensasson)

“And this kind of mechanism could well force the issue of standards more strongly, without enforcing them – standards with a small ‘s’, that enable communication and collaboration.” (Jakub Wejchert)

So the new mechanism is intended as a carrot rather than a stick, as an opportunity for projects to work together more than currently happens. Simon Bensasson feels there is room for that:

“(...) and I think that a lot of people in the i3 community would agree, and will see such new forms of integration and cross-working not just as something centrally imposed, but as emerging from a real desire to do something new. We want to provide the right triggers to make that happen. But it’s an experiment, we’ll have to wait and see.”

“We want people to be open-minded and open to working with others. It costs nothing for a researcher to say: ‘Okay, I could do it like this, like that, like that... Why don’t I choose to do it like this because he’s doing it like this, and this way we’re going to be able to talk to each other.’” (Jakub Wejchert)

“Adaptability may be one way of overcoming problems of bad design. If things can adapt and evolve according to the way people will use them, then their use is not so limited by the way someone has designed them. Functionality and use are actually concepts that can emerge with time, rather than being completely pre-determined from the beginning. I think this sets some real challenges for designing in this context. You no longer design with a completely fixed use or functionality in mind, but rather set the parameters within which new things can emerge.” (Jakub Wejchert)
The network has to roll up its sleeves...

i3 and the Disappearing Computer

There are obvious similarities between i3 and the Disappearing Computer: they share a similar vision (with an emphasis on ordinary people and on technology that enriches rather than impoverishes people’s experiences), and they target similar kinds of applications. As i3net coordinator Niels Ole Bernsen has already stated in his editorial to the previous issue of i3magazine, i3net will definitely support the Disappearing Computer initiative. But does that mean that the Disappearing Computer will be a new i3 research programme (in the way ESE was)?

It is a possibility, but not a foregone conclusion. Simon Bensasson emphasises that for the Disappearing Computer to be adopted as an i3 research programme, it won’t be sufficient that current projects reconfigure into “more of the same” teams and proposals: the i3 community will need to extend itself to the more technological community. And even then, there are a number of possible scenarios, depending on the kinds of proposals that are received:

“The first possibility is that proposals are entirely centred on the i3 community, and something new and worthwhile comes from the i3 community that extends i3 towards technology. In such a case there is no question about it. The second is that the proposals are entirely centred outside the i3 community, on the pure technologists, in which case there is obviously not going to be a place for i3net in coordinating it, although we may encourage some links. The third possibility is that there is a mixture, a sound meeting of the two. And in that case I would argue that there is no point in creating a new network, but there would be a point in enhancing the network with the new community.”

Bensasson sees a lot of potential for the Disappearing Computer; and a lot in i3 that could be of value. But what is it materialising into? A lot of people in i3 have knowledge of what is being planned and have taken part in brainstorming sessions. But have they already been active, addressing the issue, charting territory, seeing what might be worth doing, finding the right people and the right sort of engineering?

“As a civil service, we can afford to wait and see, there’s nothing else we can do. But the network can’t afford the ‘wait-and-see’ attitude, it has to roll up its sleeves.”

“If I were to give a message to the i3 community, then it would be: ‘Don’t look at this as more of the same. Look at it as an extension of the i3 activity towards technology, harder technology, an extension that builds on i3 work but forges partnerships with technologists, engineers.’”

(Simon Bensasson)
The call for proposals

vision of the future
A vision of the future is one in which our everyday world of objects and places become ‘infused’ and ‘augmented’ with information processing. In this vision computing, information processing, and computers disappear into the background, and take on the role more similar to that of electricity today - an invisible, pervasive medium distributed on our real world. In contrast, what will appear to people are new artefacts and augmented places that support and enhance activities in natural, simple and intuitive ways.

mission statement
The ‘disappearing computer’ will explore how everyday life can be supported and enhanced through the use of interacting artefacts. It will investigate how to create artefacts, how to design the functionality they support, and how artefacts can work together to form people-friendly environments. Research will focus on three inter-linked objectives.

create artefacts
This objective focuses on developing new methods and techniques for integrating information technology into everyday objects. It includes development of new software and hardware architectures, communication methods with other artefacts, as well as techniques for embedding processing into materials and objects.

new functionality
This objective considers how artefacts can be modular, aware and be able to work together. It considers how the functionality of artefacts can be adaptable, and how new functionality can ‘emerge’ from collections of interacting artefacts, or by their re-combination by people.

people’s experience
Collections of artefacts will together produce whole environments that are distributed in real locations and open to many people to use. This considers how people will participate in these, and how to ensure that experience is coherent, natural and appropriately engaging.

the disappearing computer
The disappearing computer is a new initiative launched by Future and Emerging Technologies, of the European Commission’s IST Programme. The call for proposals aims to attract: technologists (communication, devices, embedded systems), designers, architects, social scientists and anybody else who feels that they can contribute, from companies, research institutes and universities alike.

submitting a proposal
The deadline for receipt of proposals is tentatively May 10th 2000.

pre-proposals
On a voluntary bases, proposers are welcome to submit pre-proposals, for which feedback will be given. The description of the ideas should be no longer than one page of text. Pre-proposals are receivable at any time up to 31st March 2000.

www.i3net.org
www.cordis.lu/ist/fetdc.htm
URL: istfet@cec.eu.int
For a long time Juha Hemánus didn’t like spending too much time with computers: “I didn’t know what to do with them. It all remained too fragmentary, I never experienced anything. I remember thinking, during my time at the gymnasium, that I would never want to have anything to do with computers. I was educated in an era that believed in big stories, authentic life stories.”

Juha Humánus is one of Finland’s leading directors. He has staged more than 30 theatre, film, opera and music productions, both within and outside Finland (his web site lists his key areas of interest as romanticism, stylization and modernization). In 1999, he directed Otonkoski’s Via Crucis (an outdoor Passion Play, Helsinki), Langgaard’s Antichrist (Tiroler Landestheater, Innsbruck), and Debussy-d’Annunizio’s Le Martyre de St. Sébastien (Swedish Radio Symphony Orchestra, Stockholm).

In 1999, Juha also started working for Nokia. It’s a piece of news that is bound to arouse curiosity even in a community like i3, which is no stranger to the idea of marrying art and technology. What do a theatre director and a big telecommunications company have to offer each other? What is the common ground between the theatre and a company that produces cellular phones and networks (but not software)? How does a person firmly rooted in the theatre enter into a dialogue with engineers? And what brought Juha Humánus round to wanting to work with computers?

“IT took me 15 years to accept that I have to, and I want to,” Juha says when we meet at AC ‘99, in the whitewashed belly of the Santa Maria della Scala Museum in Siena. “But we are now near an era where people will get rid of their personal workstations, desktops, laptops, where chips can be implanted anywhere and carried along, where you don’t even have to know that you’re playing or interacting with computers. In the foreseeable future we can anticipate a shift from the usage (and the domination) of software and devices to an environment of ubiquitous computing, where we don’t see or ‘use’ the devices anymore because the chips are so intelligent and affective that they communicate with us invisibly. And that comes close to the old notion of theatre... We may be approaching a situation where it is possible to have high-quality aesthetic experiences through computing.

Theatre has always been imitation of life: what happens on stage is a recreation of our imaginative processes, of things that we would like to have, or do, in life, but that are impossible, or happened in a mythical past, or elsewhere. Theatre allows us to experience these somewhere — on stage. I would like to have experiences with computers that resemble my experiences in the theatre. That is my big issue, my big challenge with computers.

Computing ‘beyond the desktop’ is nothing new, of course, people have been acknowledging for some time now the need to strengthen and enhance the pleasure-creating aspect of computing, and the importance of usability. But the kind of usability that is usually meant, particularly in industry, is still based on the traditional notion of the computer as a servant, a neutral machine. And this is something quite contrary to what theatre is based on: theatre is based on conflict. I am in interested in creating human-computer interaction that goes beyond the traditional notion of usability, and is brave enough to create conflict. Not for the sake of conflict, but for the sake of nuanced experiences.

Of course getting things done in a comfortable way matters, computers should be easy to use; I, too, would like to use computers without being aware
that I’m using them. But people are not just looking for ease, at least not in my view: they also need challenge, creativity. Can we think about computers and usability not just in terms of minimising risks, maximising ease, eliminating conflict, but also in terms of multiplying pleasure, creating experiences? Such an approach to usability wouldn’t mean destroying the work that has already been done, but rather taking it into a new sphere. If you think of computing like this, it should in principle be possible to augment people’s lives in ways that allow us to create processes that resemble dramatological processes.

And if you think of computing like this, it’s easier to imagine how a theatre person could play a role in developing new kinds of computing: we can stage situations, create scenes, and by doing so contribute to interesting hardware and software features. We can try to distribute metaphorical thinking, give practical shape to imaginative and challenging hardware and value-filled and emotionally satisfying software.

At Nokia the biggest connection with my work as a director is that I create scenarios, stories. Stories along the lines of: we could have this kind of character, this kind of situation, this kind of context — what kinds of machines would we need in order to accomplish these kinds of experiences? To accomplish an experience with a machine you have to adapt the idea of a possible context of experience, and you need to do this already at the point where you manufacture the machine as a whole.

Creating scenarios, stories, that’s my contribution as a philosopher, an aesthetician. But of course I will also do more concrete projects at Nokia, develop prototypes, with possibly very new hardware and software. I hope to be able to come back to this kind of conference in a year or two and present how these “big ideas” have been turned into exact projects. But it’s too early to talk about that now.

Working at Nokia doesn’t mean I’ve left the theatre behind, I had three productions in a row this spring; and combining that more traditional stage work with creating a vision for industry has been hard at times. But I like the idea that the two feed each other. Every conference I go to I am astonished at what is possible already. And at the same time I am struck by what a pity it is that the dominating modes in computing and HCI in the commercial sphere are still so traditional and conventional, so stiff. So much more could be done. Most big software and hardware companies want to maximise their benefit-creating values, not their creative values; but if we can feed them with new ideas, little by little this will add up.

So as computing becomes ubiquitous, as we move towards an augmented reality which makes it possible to produce emotions through specific features in wireless devices, theatre people could apply their dramatic expertise to this new situation. This is the way things are going, and I’d like to be part of how it all develops. Not all artists would agree with this kind of attitude: there are many who think that one shouldn’t have anything to do with industry, with computers, that they are the enemy. Artists tend to be a bit in their own ghetto, at least in my culture. But for me it seems better to be there when the big possibilities arise, when you can influence where things are going — better than staying outside and saying afterwards: “But why didn’t you do this, why didn’t you do that?” And Nokia is a real opportunity in this respect, it is something that is quite unique in Finland today, it’s by far the most dynamic branch of industry in our country.
Important differences remain, of course. The theatre is so much based on moral thinking, moral values—and that's one of the big difficulties for my work in this industry. The kind of development I foresee has its dangers as well: if we don't know where the chips are we don't know who has control over them, who has been able to code them… There is no tradition at all in the computer industry of such a moral dimension. I know you can't really base every practical everyday decision at work on such moral choices, I know that technology moves forward propelled by its own force, I know that really big innovations are born from sheer innovative thinking, not from moral attitudes. But I still tend to think and talk about these things morally, and I do think this matters. At the same time I don't want to become some kind of god, someone who decides what's right or wrong.

So I believe experiences are important, and I don't want to force people to spend time with their computer if it remains essentially empty. Big long-lasting quality experiences with computers do not exist yet. There is good work, but it still remains fragmentary. Or it doesn't work. Or the computer keeps crashing… But we’re already catching glimpses of something that could be huge, of high-quality environments that people really want to stay in for hours. Environments that they come back from as richer people, because they really value the experience.

Juha Hemánus gave a presentation at the i3 Annual Conference ’99, as part of the workshop “Towards a new generation of interfaces.” He talked about a topic that may at first glance seem far removed from HCI: the Aristotelian notion of catharsis. Traditionally catharsis, “a pleasurable release of emotion”, follows the process of identification with (one or several) characters and action on stage (and so takes place in the imagination, not on stage). Catharsis is an enriching, innerly satisfying experience.

Human beings are naturally thirsty for experiences, and a sense of drama may well be essential in coping with post-modern, urban life. Could catharsis, as the result of a particular kind of process, be achieved through interaction with computers? Current HCI may be strong on entertainment, but sheer entertaining pleasure isn’t enough. Catharsis can only follow a process that takes time, feeds the imagination, and allows for identification.

To achieve these things, the whole notion of a machine as a kind of neutral object needs to be rethought. Unlikely? Until recently, perhaps. But with the advent of new information appliances, affective wearables, and devices that are communicative, sensitive and flexible, dramatised interaction with computers is moving into the realm of real possibility. Some existing computer games (such as *Quest for Glory* and *Tetris*) already have cathartic potential. The challenge now lies in “combining mobile communication with the Internet, with necessary new features in the terminals. Thereby one can create new communication links, combinations and structures, whenever and wherever. The rest is up to people themselves.”

Juha Hemánus home page: www.kopiosto.fi/tekijat/hemanus_juha_2153.htm
CornellaNet was born out of the need to find a concrete solution to the growing weakness of the “associative movement”. The basic challenge lies in tracing new possibilities for citizens’ dialogue and participation, and a new commitment to the creation of a local space, free and cooperative in spirit and devoid of economic, social or cultural discrimination, that works towards the integration of the different people and organisations that make up society. These include parents’ associations, small merchants, cultural entities, sports clubs, civic centres, small and medium-sized companies, pensioners’ associations, schools, libraries…: all are being summoned to CornellaNet’s virtual forum for social innovation.

Two thirds of Cornella’s population are involved in such organisations, but most of them are also in crisis in terms of their activities or administration, and this may threaten their continuity. New demands in the workplace, the growing precariousness of employment, and the permanent competition of television and the standardised “culture” it offers cast doubt on the long-term viability of these social entities and spaces.

Something had to be done, and this led to the meeting of a group of people who all shared many years of experience in associative activism as well as using the Internet on a regular basis. This resulted in the birth of CornellaNet, which provides imaginative answers by taking advantage of the immense opportunities new technologies offer in social terms. CornellaNet’s most important values reside in the social and cultural diversity of the people involved: teachers, digital journalists, workers, architects, administrators, lawyers, merchants, students, graphic designers, philologists…; Catalans, Andalusians, Castilians, Galicians…— all of them are active members of civic entities and all of them are looking for new interaction and communication opportunities offered by Information Technology.

In short, economic and cultural progress, cultural identity and social cohesion are all at stake. A new concept and a new understanding of citizenship need to emerge, which will determine society’s future. And that’s why CornellaNet is important.

CornellaNet web page: www.cornella.net

CornellaNet will be in charge of the secretariat of Global 2000. For more information: www.bcnet.upc.es/global2000, or contact vbadenes@cornella.net.

1 The “associative movement” is a non-profit making movement of different citizen’s associations (sports, cultural, ecological etc…)
Creating community at work
A US perspective on on-line collaborative environments

A colleague of mine once remarked in the context of a workshop that people tend to undervalue ambiguity. It’s a resource, he said, but most researchers view it as negative, something to design out of our systems, our interactions, and our lives. Although I no longer recall exactly why he said this, the idea of ‘ambiguity as a resource’ has stuck with me. Over time, it has quietly insinuated itself into my thinking and our work on designing ‘socially translucent’ online collaborative environments. After all, social interaction makes great and subtle use of ambiguity. But when it comes to designing digital systems, particularly those intended for people at work, designers aren’t thinking about ambiguity, or even social interactions. Instead they focus on work: the tasks it comprises, and the objects and functions that might support those tasks.

Entering the new millennium, we are immersed in a panoply of work systems: email with attachments, net meetings, shared calendars, authoring tools, team spaces, etc. We have improving prospects for supporting remote and mobile work. But as software designers, still we do not articulate social goals for work systems. We don’t say: “Let’s make it possible not only to see who is there, but also what others are doing and how they’re reacting.” Or: “This system needs to transmit personality, support peer pressure and the formation of social conventions.” What is the business case for transmitting personality? We don’t propose to design messaging systems to support ambiguous communications, nor to provide software agents capable of lying.

But perhaps we should. In the real world, we routinely rely on social cues. We monitor people’s behavior and reactions. We use ambiguity and subtlety in our communications and behavior for innumerable social ends: to protect feelings, to further agendas, to establish our identities and community ties. A speaker feels emboldened to expand on what she is saying when people are listening with rapt attention, or hastens to draw things to a close or shift gears if people are fidgeting, or trickling out the back of the room. We may pass on seeing the movie if the line wraps around the block. We get more excited about the game when we’re in the presence of fellow euphoric fans. The music seems to sound better and mean more when we’re at the concert than when we’re driving to work listening to the CD.

These examples are unsurprising, reflecting exquisitely tuned social behaviors that have evolved through millennia. What should surprise us is the extent to which fundamental social resources are absent from the digital systems we increasingly inhabit. In the digital world, you might say, we are socially blind. We rarely know who or how many are present, to what or who they are paying attention, or how others react to us. We rely on clumsy mechanisms to express ourselves, to act and react as social creatures.

This is bad enough, but we may have further to go. Being social creatures, even in digital space, may not be enough. Howard Rheingold prefaces his seminal book, The Virtual Community, with this quote from M. Scott Peck:

“We human beings have often been referred to as social animals. But we are not yet community creatures. We are impelled to relate with each other for our survival. But we do not yet relate with the inclusivity, realism, self-awareness, vulnerability, commitment, openness, freedom, equality, and love of genuine community. It is clearly no longer enough to be simply social animals, babbling together at cocktail parties and brawling with each other in business and over boundaries. It is our task – our essential, central, crucial task – to transform ourselves from mere social creatures into community creatures. It is the only way that human evolution will be able to proceed.”

A “social proxy.” An abstract visual representation of people (colored dots) and their activity (spatial location of the dots) relative to a conversation (the circle). The proxy animates as users move around in the environment.
Community may be necessary for human evolution or our everyday lives, but is it really necessary at work? It is. First, as more work is carried out in digital space, we cannot afford to ignore the complex social and motivational factors that remain at the core of our ability to cooperate in purposeful activity. Second, the sheer amount of time that people are spending at work suggests that sociality will be necessary just to keep us sane. We are working harder and longer than ever. Can we really spend all that time in sterile, task-oriented environments? It’s no wonder that “Instant Messaging” is proliferating in corporate and other settings. In the absence of designed ways to communicate in an informal and lightweight manner, workers are embracing methods better known for getting a date on Saturday night than constructing business deals.

In our work at the IBM T.J. Watson Research Center, we are designing “socially translucent” systems that support groups working within online communities. We are interested in making people and their behavior more prominent, enabling the creation, exercise, and mutual observation of social behavior. We are intrigued by the notion of how to foster trust and, yes, community, in work teams, whether collocated or geographically distributed. We are focused on supporting long-running, contextual interactions rather than short-term, task-focused activities. To do this, we combine support for conversation with visual representations of people, their activities vis-à-vis the conversation space, and of the conversation itself to provide a community-oriented environment for carrying out work. We are explicitly interested in blending work and social talk, synchronous and asynchronous interactions, and private and public discourse. We are hoping to provide a digital substrate upon which knowledge communities can grow, where “discoursebases,” rather than databases, can provide a medium for people to develop, share, and reuse experiences and knowledge, and watch others do the same.4

Admittedly, creating communities for work is a biased view of what’s hot in online community research. There is much more going on.5 But from where I sit, on a beautiful Sunday afternoon, looking out over my back yard, there’s nothing more important to the quality of digital worklife in the new millennium, and hey, maybe even to human evolution.

Social proxy schematic. Part (a) shows the layout of the social proxy: dots 1, 2 and 3, inside the circle, are part of the current conversation; dot 4 is in another conversation. Part (b) shows how dots move: in this proxy they move abruptly to the center when they are active, and slowly drift to the periphery with inactivity.

Thus, a tight cluster of dots represents an active conversation; dots scattered around the periphery indicate that participants are around but not actively engaged.

References
1 Will Hill at the Conceptual Frameworks for Domain-Specific Design Environments workshop hosted by the University of Colorado, 1992.

Wendy A. Kellogg is Manager of Social Computing at the IBM T.J. Watson Research Center in Yorktown Heights, New York.
Children and narrative: the physical approach

Great men play with dolls

Toys, play and narrative are the starting point of the Narrative Toys research project based at the Interactive Institute in Malmö. The aim of the project is to develop innovative toy concepts that support collaborative narrative, and at first glance working with virtual environments may seem like an obvious focus for this kind of research.

But the Narrative Toys project is resolved to stay “physical”, and steer clear of virtual environments or computer games. One reason for this choice has to do with memory and visualisation: physical placeholders help organise mental or fictional spaces because we associate memories with objects and retrieve them through objects. Physical space is also important because it provides a transition between telling and enacting, between shaping a story and entering into it. And finally, a physical playspace offers an open space for the reformulation of narratives, as different story worlds meet and get mixed up in play.

Replica Play

We tend to associate narrative with activities and media such as storytelling, comics, film, perhaps computer games... Children’s play and toys are less often considered as a space and medium for narrative and stories.

Yet playing with toys has a strong connection with narrative. Symbolic play is “an early developing narrative form”, writes Greta Fein, who has studied children’s play and narrative extensively. Replica play — playing with small models of real-life or fantasy objects or characters — is particularly close to storytelling, since “in constructing replica play texts the child assumes the role of an outside narrator: The child participates in two ways: as an actor giving voice to story events and as a stage manager-director providing justifications and explanations for these events.” (Fein 1995, p. 155)

The link between narrative and toys (or visual representations of story elements) is particularly evident in children's play but not restricted to it. The French novelist Honoré de Balzac used cardboard boxes and dolls as visualisation tools and memory aids to keep track of the characters in his densely populated novel. Officers in “war rooms” used to enact battles with miniature soldiers, and later tanks, to develop their strategic thinking and planning skills.

Sandplay therapy

Toys enable the building of model worlds, and building model worlds is an activity close to narration: physical replicas add to the construction of a story by representing, in a very immediate way, relationships that are not easily expressed in spoken language, like spatial relations or simultaneity. Viewed as such, toys become communicative tools.

This perspective on toys is also found in sandplay therapy, a variety of psychotherapy developed in the ’30s by Margaret Lowenfeld. Lowenfeld started using sandtrays and toys in working with children in order to facilitate communication between child and therapist: the theory behind sandplay therapy is that if children are given a “vocabulary” of materials through which they can “talk”, they will express their ideas and feelings about the world in spontaneous play, working out and trying to come to terms with their experiences.

The Video Sandbox

In the Narrative Toys project we have recently developed a prototype that has a lot in common with sandplay therapy: the Video Sandbox. The Video Sandbox consists of a sandbox with loudspeakers hidden at the sides and a video projector attached to the ceiling above, in a fairly dark room. A very simple kind of software projects into the sandpit an interactive puzzle consisting of images which can be dragged around. These images are not on the other side of a glass screen but present in the physical play space.

When we let a group of four-to-five year old children play in the Video Sandbox they do not understand at first the relationship between the images and the sand — they try to “mix” sand of different colours. But they quickly learn to handle the dissociation between projection and sand, and start collaborating to build shapes out of sand and projected images.

The fact that the images are part of the physical space opens up a whole new dimension of play: the children go back and forth between telling and acting, between shaping the place and entering into it. As the Sandbox changes the children are busy “telling” the changes, creating meaning out of the accidental combinations that have occurred. The Video Sandbox showed the importance of a playspace that invites
both to telling and enactment, and that invites children to create and modify the environment. Our next step will be to continue to explore how children can modify the play space further by adding sounds to objects, and how the system evolves as it is being extended.

Should the alligator be kept out?

Does the character of toy figures have an effect on the kind of play they generate? Greta Fein describes a study where a group of four-year-old children were given two different sets of toys and asked to tell stories about them. The first was a “canonical” family set, the second a “disruptive” set (one family member was replaced by an alligator). The study showed that the disruptive set yielded more interesting stories. The introduction of a conflicting element — the alligator — spawned creative elaborations and resulted in more elaborate narrative structures.

So the meaning of toy figures affects story content and structure. Not only do children prefer telling disturbing stories, but the disturbing stories are longer, structurally richer and more emotionally engaging than the more “commonplace” ones. Fein’s conclusion is that “narrative thought is organised around vivid, unexpected or disturbing events; departures from the commonplace and orderly” . (Fein 1995, p. 160) So no interesting narrative without disturbing content! Which means that “politically correct” toys are not necessarily the ones that yield most creative results.

And what about “brand toys”, toys that are directly connected to specific media stories? Adults often think, or fear, that such toys limit children’s play and self-expression. The implicit assumption is that they toys will somehow remain “fixed” in a separate universe, and that fantasy play must be completely original. But what happens in children’s playrooms is that toys get mixed up (often in a big pile) and incorporated into different kinds of context. Moreover “story digestion” is an important aspect of play. Children need to replay, deconstruct and appropriate the stories they pick up, and brand toys can support this process.

In other words, “… children use the media as raw material in their play culture, and this gives it new dimensions, media and situations. Play culture and its spaces are in turn the crucial conditions for children’s reformulation of the cultural products.” (Mouritsen 1996) This is the way toys are used in sandplay therapy. Sandplay practitioners recommend a “well-rounded world selection”, which includes representations of family members, cartoon characters, houses and trees — as well as Star Wars figures, and My Little Pony…

Through playing, telling, enacting, children engage in the process of creating meaning out of a cultural heritage of stories — and end up making them their own.

References


The Video Sandbox — an “augmented” sandbox with interactive image projections and sound effects.

Narrative Toys web page: www.interactiveinstitute.se/narrativity/narrativetoys

For more on the Transpersonal Sandplay Therapy Center: www.sandplay.net
Children and narrative: the virtual approach

Invoking the muse

Children gather around a candelabra. Their attention is focused on a storyteller who holds a "magic mirror": — a golden picture frame with a holographic foil in the centre. The storyteller recounts how she was given this mirror when she was a little girl, by an old woman in the forest. The mirror, she says, can conjure up whatever the creative authors, and the story is created “in the moment.” Often these forms of storytelling take advantage of the atmosphere, with story elements being influenced by set and setting.

Collaborative storytelling tools

KidStory is developing two storytelling platforms, KidPad and the Klump. Both of these are designed to support “shoulder-to-shoulder” collaboration by supplying users with multiple input devices (such as mice). KidPad is based on a drawing metaphor, working in 2D with powerful zooming capability. The Klump is based on a 3D animated virtual modeling object. The two tools are different yet complementary in nature. They offer different media and interaction for creating stories.

KidPad

While there are many storytelling applications for children, few of these move beyond the concept of the “interactive book,” where narrative content is fixed. What would an application look like that empowers children to be authors? One way would be to present children with a blank canvas, good tools, and methods for defining narrative structure. This is what we have done with the KidPad application. The children start out with a blank canvas; the tools at their disposal include crayons, eraser, and a set of magic wands to spatially connect storytelling scenes. If there is plenty of time, the children typically go through a number of iterations before arriving at something that is new, personal and unique. When time is tight, the story tends to be more restricted to houses, schools, adult suggestions and so on. For a child with ideas, KidPad is a well-suited tool.

The Klump

The Klump is an abstract object that can be shaped, stroked, played with and altered, and that emits colored patterns and sounds in the process. It is based on the Blob, which was developed in the eSCAPE project. When people interact with the Blob they often endow it with properties and tell stories about it. We decided to use it as the starting point for our 3D storytelling tool for two reasons.

KidPad
First, we wanted to move away from the obvious 3D agents and objects; and second, we wanted to try and extend the evocative elements of the Blob for storytelling. What we have done is take the Blob’s physical model and extend it to work with multiple-user input devices. The result is the Klump which, apart from its intrinsic properties, can also function as an idea generator for collaborative partners.

Our work in the schools has begun to show that the Klump is indeed an engaging artefact which encourages children to improvise collaboratively. For instance:

“Water ... shall we swim? I see bananas... and ice cream... with chocolate and pear-flavored sprinkles.” (Two Swedish schoolchildren bouncing off ideas in their interaction with the Klump)

This example shows the children agreeing with each other and building on each other’s suggestions. We would like to support this and encourage children to take it further; and as a start we have developed the Storysphere, a tool which makes it possible to save shaved Klump story elements that incorporate shape, colour and sound.

The Klump, while being a tool, is also toy-like and encourages play. Toys, by their designed nature, engage and stimulate the imagination, and can be used as tools (and vice versa). Over-emphasizing the distinction between toys and tools could result in excluding the exploration of possibly rewarding paths.

The project has benefited from both approaches. There are some experiments with KidPad that include animated abstract objects to start idea formation, and in the Klump we have added some of the special tool manipulation ideas from KidPad.

Creativity and borders

Is it possible to build a framework for the creative process without over-restricting the possible outcomes? The goals of the storytelling tools will partially determine what level and what type of framework are desirable. For instance, if the goal is storytelling-fluency or problem-solving, it may be necessary to steer the child towards particular results. But when the goal is to encourage creative self-expression, the particular building blocks that a tool is stocked with may require careful consideration. If the tool is stocked with fish, octopuses, and coral, the stories are more likely to be about sea life; indeed, the old woman, the magic mirror and the candelabra described above appeared in many children’s stories before the children found other sources of inspiration.

So we need to be aware of the limits we impose through the tools. At the same time some limits are necessary, even in creative improvisation where skill, experience, and an understanding of the basic rules of the art are needed before borders can be explored. The tension created by the borders can, over time, become a source of inspiration and exploration.

Computers can augment storytelling practice in schools by offering control of “new media:” computer-generated sound, video, graphics, and interaction offer channels for storytelling that provide new forms of expression. But it is not hard to conceive of computer applications that limit creativity and impair self-esteem. As we continue our work into the second year of KidsStory, in which we are developing tangible storytelling interfaces, we remain aware of the inherent power of the tool, and the incidental power of the designer.
Virtually (or more than) real?

Virtual Reality and Augmented Reality

Virtual Reality (VR) has become an important technology in the day-to-day development process. One of its uses is in “digital mock-ups”, enabling a reduction in the number of prototypes needed in a product development, with a corresponding saving on times and costs. A far less well-known technology is described in the term “Augmented Reality”. As an extension of Virtual Reality, this technology integrates virtual information into a real environment. José L. Encarnação and Stefan Müller present an overview of both technologies, and the potential for their future development.

Virtual Reality

The nature of VR is best summed up in one word; immersion. Immersion describes the feeling of being part of a virtual world and of diving into data worlds. VR systems are immersive systems, which require us to start thinking in completely new ways about how we interact with our computers and our data. The user is able to participate in artificial 3D worlds with his or her own hands and body, and in turn, these worlds make new demands on our methods of simulating and representing them.

Today, data helmets and gloves play only a minor role in practical applications, but in the future, immersive projection technologies (IPT) are expected to become increasingly common.

The most important new development is a screen where a large image is projected stereographically; viewers wear special glasses and experience the image with a 3D depth effect. Another projection technology is the CAVE. This is a cube consisting of large screens (see Figure 1) which allow the user to immerse himself/herself in a virtual reality with their entire body, and to perceive the represented environment on its actual scale.

A third example of IPT systems are desktop projection systems (e.g., Workbench™, and Baron-table™). These “virtual tables” are especially suitable for virtual models where a desk metaphor is more appropriate (e.g., smaller items or pieces of work).

An important basic technology for all VR output devices (data helmets, IPTs, etc.) is tracking -determining the position and orientation of certain parts of the viewer’s body (e.g., of their head or hand).

VR Applications

The particular advantage of VR is its ability to show objects in a 1:1 representation. In the areas of development, planning, and training, and with hands-on examinations, the resulting spatial impression is an important extension of conventional technologies. Furthermore, VR offers interaction possibilities that are close to reality and thus intuitive.

Application areas include:

• Architecture, interior design, and town planning

• Digital mock-up (e.g., ergonomic examinations and cockpit layout, installation and assembly simulation);

• Training simulators (e.g., in medicine).

For fuller details, please see www.igd.fhg.de/www/igd-arl/Augmented Reality

Augmented Reality (AR) stands for the advancement of visualisation and VR technologies. Its main purpose is to fade in information to the viewer’s (or Figure 1. Five-sided CAVE at the Fraunhofer IGD. Two users fitting a doorlock into a car door (courtesy of TAN and BMW.)
camera’s) actual field of vision and to superimpose and augment it with the real images (see Fig. 2).

In principle AR technology consists of several components:

Output devices: The typical output devices are semi-transparent glasses or headsets. Computer-generated images are displayed, and the viewer also perceives reality through the transparent projection areas (see Figure 3). Another large application field is augmented video where pre-recorded footage is augmented.

Computer technology: Many AR applications need wearable computers. These computer units are so small that they can also be worn on the body, for instance by attaching them to the belt.

Additionally, stationary devices can also be used in some areas. For example, they can be integrated into mobile output units or firmly installed in the room (e.g., an operating theatre).

Tracking and registration: In order to allow precise augmentation between a 3D model and real images, the viewer’s position and the orientation of their line of sight have to be exactly determined. Initial solutions are offered by special components such as GPS (Global Positioning System), and electromagnetic, ultrasonic, inertial or optic sensors.

Interaction: AR technologies add a new dimension to human-machine interfaces and involve new interaction paradigms, because reality itself is involved. By means of a (tracked) pointer, the viewer can point at a real object and immediately have necessary information displayed.

Telecommunication: With regard to mobile users, the integration of telecommunication features into AR devices is a consideration, with the possibility of updating information from anywhere and at any time, and of providing it in augmentation with the real object (wearable LANs).

AR Applications

Development is at a very early stage world-wide. So far, only a few applications have been realised. The most well-known example is AR support in the paperless laying-out of cables at BOEING. The cables for aircraft assembly are produced on a cabling board, and the corresponding assembly information is presented through the user’s semi-transparent glasses. Further applications focus on service support in the area of colour copiers and printers.

Recently in Germany, an exciting new project named ARVIKA, backed by a consortium of 20 partners, has begun developing the software needed to implement AR at every level of the product development process (construction, production, service and maintenance). For further information, please see www.arvika.de.
School of the Future, take 3
Which end is up?

In the past two issues of i3magazine, an ESE project coordinator (Ulrich Hoppe) and an influential architect and designer (Michele Zini) sketched their visions of the school of the future. This time, a view from the inside: Leon Cych is a primary school teacher who currently works as a support teacher, teaching 4-to-12 year olds “depending on where I am at any one time.” He also runs the

As a jobbing teacher I sometimes have this nightmare about schools of the future and technological innovation. It consists of one very distinct dystopian scenario: the increasing “a place for everything and everything in its place” of the XML world view that seems, to me, to lead to a universe of highly efficient web-based lexicons/ indexes of multinational company car parts. I sometimes doubt that the grass roots education community will agree on, or come to “terms” with, this world and that this may well, by default, lead to contracting out control of information to an extent previously unthought of.

I imagine that the school of the future will still be beset, as it is now, with funding and other difficulties in relation to technology. I foresee the technological hardware becoming extremely cheap, efficient and recyclable; but I also anticipate that the medium by which these devices are run, and the information engine that powers them, will become increasingly proprietary, arcane and expensive to access — unless children, teachers and others take control of it and use it for their own purposes, rather than being led by it.

Paranoid? Perhaps.

Fortunately young children are not that easily taken in, and as a teacher that is where I would like to think I come in.

The one thing I enjoy about working with young children is the fact that they are inherently curious and equal parts — subversive. Recently children in the Playground project at our school were given a classic Pong game to deconstruct and re-invent for their own purposes. One of the first things they did was to make the functions of the game act on elements completely outside the conventional framework associated with the “Pongness of Pong”, producing unusual and unexpected outcomes. Someone hadn’t read them the script so they rewrote it! This is something sadly lacking in the mathematics curriculum in this country at present (barring the solving problems strand of the “Daily Mathematics Hour” which is its one saving grace). The Playground project is a shining example of how young children are taking control of decision-making in new and “engaging” scenarios. Learning = Play, Play = Learning — just the way it should be. I personally can’t wait to see what happens when it meets the web — I have a strong suspicion it won’t only be children who will be the biggest game players…

On the plus side I should imagine the school of the future will be less text-based, or to be more specific, less reliant on outmoded and inefficient ways of representing “language”. Text will still be there, but there will be more and different flavours of “communication” and control — if children are given the opportunity to empower themselves. And that is, always has been and will be the teacher’s role. The teacher’s role will definitely not be that of a technician; more that of a broker between worlds. Technology will give children more “thinking space”, and the teachers will still be there to ask the same pertinent questions they always have to trigger those thoughts.

As a teacher I would imagine that the ILS (Integrated Learning System) model of “learning” will be totally discredited in the next 10 or 15 years, except for low-level skills acquisition. Drill-and-kill computer programs will be consigned to the dustbin of historical curiosities.

A more open-ended model of learning could emerge, where the teacher will step in at appropriate moments. I imagine the best learning would still be in highly relevant contexts initiated by enthusiastic and highly motivated individuals. Not much difference there then!
Media Lab Europe in Ireland

Giorgio De Michelis kicks of his new opinion column on i3-related issues in a European context

Early December last year the Republic of Ireland and the Massachusetts Institute of Technology (MIT) announced a long-term collaboration to establish Media Lab Europe, an independent, university-level research and education centre designed “to invent the future” and to replicate the innovative and entrepreneurial environment of the world-renowned MIT Media Lab. Total costs of running Media Lab Europe for the first 10 years are forecast to be approximately Euro 165 million. The Irish government will provide Euro 35 million as seed capital and a suitable downtown Dublin location; the remainder will be raised from research contracts, sponsorships and private contributions. The Irish government’s contribution includes Euro 10 million to MIT for the MIT Media Lab’s assistance. Media Lab Europe will be governed initially by a board of directors designated by the Irish government and MIT. Mr. Negroponte will serve as acting executive director and first chairman of the board of Media Lab Europe. The independent Media Lab Europe is initially expected to develop a cooperative program for conferring joint degrees with several Irish universities, but it is envisioned that over time it will develop and implement its own master of science and doctoral degree programmes.

The i3 community could be irritated and frustrated by this news. A European government is formally recognising the prominence of American research in our field and is investing a large amount of money in order to get support from an American institution in our domain of research. As far as I know there are no other European research centres receiving, for “Inventing the Future”, the amount of resources that the Irish government grants to Media Lab Europe. The initiative has not got a European perspective and creates a privileged link between Ireland and the US. And finally, through its Irish branch Media Lab will be allowed to compete for European funds for its research. Competition in the research field will no longer be the same in Europe.

But in order to give a positive answer to the above question, the i3 community must take one step further in the direction of giving a strategic orientation and an adequate level of continuity to its research activities. I think that there are two main areas where something new must be invented.

First, within the i3 community, research groups should work on developing joint long-term research and education programmes, creating at the network level a research centre with the dimensions of the Media Lab. The European Commission and European companies should also be solicited to provide the financial means to support high-quality research networks. i3net has already tried to create something of this type (e.g. the Business Partner initiative), but the creation of Media Lab Europe forces a reconsideration of its timing and structure.

Second, i3 should make an effort to characterise the European inspiration of its research programme. On the one hand, it should focus on the need for European industry to pay attention to its specificity; and on the other, it should develop a European design-oriented style of innovation in accordance with the design-driven industry of fashion, furniture, electronic appliances, etc. If we are not capable of outlining an European way of “Inventing the Future”, then the supremacy of Media Lab cannot be discussed.

The above points do not exhaust the issues raised by the establishment of Media Lab Europe: I have proposed them only in order to open up a discussion. I hope that the reactions of the i3 community will contribute to defining an effective strategy for building, on i3, a European way of developing Information and Communication Technology.
Conference report

The tie-free community


One of the first things that would strike any visitor at IST ’99 was the proliferation of ties and gray suits. Which also means, of course, the proliferation of men. There was one corner, however, just next to the cybercafé, which had a distinctive note, if not for the presence of women, then at least for the absence of ties and gray suits.

This apparently insignificant detail, which would normally be more of an issue for a fashion magazine report or a newspaper column on the Presidents’ wives social dinner, says a lot about a certain way to stand on the European research scene.

On a stage largely dominated by the myth of standardisation, a concept borrowed from the technological arena and brought into the socio-economic agenda with a simple twist of the tongue, the i3 community was proclaiming its difference, standing gloriously tie-free.

This is not the biased impression of a groupie such as I can be. Several people approached me, almost to whisper in my ear in a sign of complicity: “You know, this is the most amazing corner of the exhibition.” “What you do is absolutely great.” “You can really feel that here something is happening.” “This is the only corner where the word ‘research’ still means something.” Etcetera. Twinkling eyes, smiling faces, renewed faith… Beyond the undoubtedly brave act of taking part in a collective ritual refusing to a-critically embrace an established code of practice, the i3 community had some other weapons on its side. It stood as a community where human beings still appear to be tri-dimensional and not flattened into the five-letter formula of ‘users’. A community that dares to question itself and gives some chance to imagination and intuition. A community where questions are open, and not a rhetorical exercise to support pre-formatted answers.

In the attempt to develop multi-disciplinary research in a complex, multi-cultural reality such as Europe, there is a real risk of falling into a confusion of levels of discourse and taking dangerous (unproductive) short cuts. Concepts which make sense in a specific discipline may get transferred into another with devastating or ludicrous effects; language terminology with an established semantics in a certain culture is imported into languages where it simply clashes with the deepest and truest cultural patterns…

I believe the appreciation that i3 received lay essentially there: in the acknowledgement of its courage to take the winding road with a curious eye and some confidence that the ‘equipment’ it brings with itself will help delineate a path which will make sense in the future.

An echo from the session “Children shaping the future” at IST ’99

On November 22nd, the Ballroom of the Conference Centre in Helsinki hosted a passionate debate about children and how their voices can bring freshness and new meaning, to help us shape a ‘better IT world’, a better future.

The panel, introduced by Simon Bensasson and moderated by Walter Van de Velde (of COMRIS, Today’s Stories and KidsLab), consisted of three women: Alison Druin, from the University of Maryland and part-time visiting professor at KTH, Stockholm (involved in the Kidstory project); Anna Home, Director of the Children’s Film and Television Foundation and previously based at BBC Children’s Television, where she organised two world summits for children, with the aim to influence TV production of children’s programmes; and Justine Cassell from MIT Media Lab, director of the ‘Junior Summit’, which gathered children from around the world to offer them a platform from which to influence the new digital culture. The fourth speaker, the Italian Carlina Rinaldi from the Reggio Emilia Schools, never made it to Helsinki, due to a snow storm that paralysed the airport in… Bologna!

The room was packed: the theme of children seems to attract people with a genuine interest in the fundamental questions lying behind this big IT business… — or this “Information Society” that, whatever it will be, is certainly going to happen (in spite of its misleading name and the uncertain geographical and social boundaries).
As the panel moderator put it, the real question behind this process of construction of a new society is a matter of politics: what kind of world do we aim at? And who sets the agenda? Only from there can we formulate our research questions. And children can help us bring back some freshness in the process, and maybe help us take more meaningful steps to shape our future…

Yes, but how can we listen to children’s voices? How can they contribute to the shaping of new IT tools and uses? How can this be done in way that is meaningful to both children and the adults involved? How far do we, the adults, mediate? And where do we draw the line of responsibility?

The perspectives presented certainly reflected very determined stances: all speakers insisted on the very central role that children ought to have in determining what the future of IT and media must be. It is a role that emphasises their full dignity as human beings.

Allison Druin\(^1\) stressed the importance of involving children as ‘partners’ in the design process — as opposed to the other possible roles of ‘users’, ‘testers’, or ‘informants’. “What gets children excited?” – she asked. “to be social”, “to be expressive”, “to be connected (part of a community)”, “to be in control”. And here lies the trade-off between adults and children… But the ground remains a bit perilous, because this approach does not exclude per se the risks of (mutual) manipulation, as someone from the audience remarked.

Anna Home presented her experience with the children’s World Summit on media, which attempted to have the children express their views freely and to influence the design of children’s television programmes. At the Summit, the children were given a camera to document the experience, and the result shown by Ms. Home at the session was very humorous and moving. One thing the children were saying echoed in an astounding way what many of us were secretly thinking about this very official IST ’99 conference: “It looks like a military parade” an adolescent repeatedly said provocingly about the summit. “We should listen to children”, who are “bursting to say things” and who have “the insight that often we lack”, Ms. Home concluded passionately.

Justine Cassell recollected her experience as director of the Junior Summit, which gathered children from all over the world to discuss themes related to the advent of the digital era. The video bore witness to the complex negotiations between the children and the adults, and the final ‘takeover’ of the children in the conduction of the Summit, with the adults shifting from the role of ‘leaders’ to the role of ‘optional consultants’. What was really striking (and to me at least puzzling), was that the children seemed to reproduce all the adults’ institutions to manage the task… For Ms. Cassell, the progressive destitution of the adults from their original position did not result in a loss of the adults’ role and their power (as repository of knowledge). On the contrary, children, once they were left free to manage their summit, very willingly turned to the adults to receive advice…

The three presentations put so much emphasis on the need to give children power, that the legitimate question arose from the audience whether, being charmed by all this children’s playfulness, we are giving up OUR responsibility to educate altogether?

It is really too bad that Carlina Rinaldi could not make it to Helsinki. Her perspective could certainly provided a synthesis between the need to give children a voice and that of not giving up our role of responsibility as adults…

The debate is open. Hopefully it will not remain a rhetorical exercise to be played out once a year in official European arenas…

\(^1\) Alison Druin’s recent book ‘The Design of Children’s Technology’ was reviewed in 13magazine 05
Conference report

The truth is in the Limerick

KidsLab & CARESS workshop on action-related sound, Limerick, 15—16, December 1999

There was a young lady of Wight
Who traveled much faster than light,
She departed one day,
In a relative way,
And arrived on the previous night.

On the airplane on her way to Limerick, Lieselotte van Leeuwen found the above limerick, not knowing yet that the workshop she was going to would have quite something in common with that lady of Wight. The reason why might be of interest to those in i3 who have experienced the challenges of long-distance interdisciplinary communication.

The starting point for the workshop was work done by Phil Ellis, Lisa Percy and Stefan Hasselblad using sound-beam technology. This technology enabled severely handicapped children to control complex sound structures through the body movements they were capable of. In this process, and driven only by their intrinsic motivation, children gained more control over their movements and, more importantly, sound became the means by which they started to purposefully interact with their environment.

The ability to consciously cause changes in the environment is the basis for the development of self-awareness and intentionality. As a user-controlled medium of expression this technology has high potential as an early-learning tool for all children. However, the current use of the sound beam restricts it to a small spatial area and doesn’t allow fine-tuned mappings between sound and specific movements. In order to facilitate unrestricted movement, including locomotion, the CARESS team decided to explore and apply sensor-technology further.

Paul Masri and Nishan Canagarajah from Bristol University have done work on optical fiber sensors, which are wireless and very sensitive. The suitability of these sensors as compared to other ones was one of the topics of discussion at the workshop. Suitability is of course closely related to the kind of activity the sensors are used for — yet the task context in which the technology could be used was another issue to be worked on. New action possibilities provided by the technology on the one hand, and learning areas with a need for enhanced methods at the other, set the borders within which user scenarios should be developed.

Workshop participants: the CARESS team, the KidsLab team, specialists from sound design, music technology, performing arts, sensor technology, biomechanics, HCI, education, therapy, child psychology, perception-action, ergonomics and multimedia…

What Kidslab learned about conducting workshops for interdisciplinary remote co-operating teams:

1. An interdisciplinary discussion can only start with all partners in one room. E-mail and bilateral conversations are not suitable.

2. The specific aims of a workshop get re-defined from the very beginning.

3. Conducting interdisciplinary workshops requires a continuous reshaping of the process, in response to the current dynamic and its relation to the workshop goal.

4. Solutions for interdisciplinary questions can only emerge in this kind of workshop after a shared space for imagination is created. It is hard to predict how much time this will take, but the time required will be proportional to the complexity of the task. In other words, it takes the time it takes — tied schedules are counter-productive in this respect.

5. As enough mutual understanding of the different facets of the problem builds up, the discussion naturally switches to integration or product aspects.

6. Chaos is a natural phase in understanding the complexity of a problem from different viewpoints. Chaotic discussions are more productive in small groups of no more than six-eight people guided by a person who can re-direct the discussion if it begins to drift away from the agreed focus.
Sessions should have a clear goal and not take longer than 60 minutes, since it is extremely difficult to understand a problem in the language of another discipline.

7. Having external experts, users and students of the respective disciplines in groups like this one is extremely rewarding, since the mixture forces a group to use concrete and descriptive rather than abstract terms.

8. Workshops are a means of catalysing the learning process of a design team in an extremely short period of time.

9. In order to create practical solutions to interdisciplinary problems, a workshop has to be four to five days long.

10. Scenarios are an expression of a shared design space. Without thinking in shared terms scenarios don’t emerge.

11. It is fun to do.

We came back from Ireland with intense and diverse memories of great ideas, hard work, incredible flexibility and friendliness on behalf of staff and student members at the Interaction Design Center, and music and Guinness. We traveled very fast and we arrived a step before the one we intended to start off with. Limericks contain universal truths.

CARESS (Phil Ellis & Lisa Percy) about their workshop experience:

Seeing first-hand the work of other researchers proved invaluable. The sensor technology that is being developed at the University of Limerick provided an interesting source of comparison with the CARESS interfaces being developed at Bristol, and sparked ideas for possible future research developments.

The focused discussion groups enabled researchers engaged in similar areas to share ideas and begin to unpack some of the theory behind current research contexts. The opportunity to involve students from the interactive design institute was very welcome. The students shared their experience of design and educational work and were often able to phrase questions which project researchers take for granted.

Above all the two days provided all participants with the opportunity to share their experiences with a group of individuals from very varied backgrounds. With attendees engaged in education, electronics and the arts, a wealth of new ideas was open to discussion and exploration. It was only a pity that time ran out before some concrete scenarios could be explored and developed to give people a more tangible grasp of some of the concepts which had been introduced.

It is always good to have the opportunity to spend time in ‘soundboarding’ and ‘brainstorming’ sessions, particularly with stimulating and imaginative colleagues in related disciplines. The experience in Limerick has brought greater focus to current CARESS project work and raised questions and new avenues for investigation for future work.

In the workshop we tried to determine the shared space for design according to four broad fields involved: Sensor technology, Sound design, Mapping between sound and movement, and Learning & Play.

Figure 1 shows how we planned to use a scenario as the shared context within which the 4 areas could be discussed in their interdependency.
Conference report

On-line and on-site on equal terms

Memoria Futura, Sankt Augustin, 11—12 December 1999

Information technology has proven itself to be of value. But what is the relationship between art, culture and technology? How do networks, connectivity and new instruments influence artistic work and artistic processes? How is IT research influenced by collaborative interdisciplinary work with computer scientists, artists and cultural theorists? Artists, researchers and curators gathered at the Memoria Futura symposium in Sankt Augustin, Germany last December to look at these questions. They were joined by a group of invited experts who participated in the discussion via the Internet, as part of an experiment on integrating different media at cultural events for a broad public.

This experiment was made possible by a system of interactive Internet television (i2TV). Live audio and video from the symposium were streamed to Internet participants (who were able to take part in the symposium by means of text), while at the same time the Internet view was projected into the actual space of the symposium. As a result on-line and on-site participants were visible to each other all the time.

The i2TV prototype got positive feedback from both the audience, the symposium speakers and the on-line participants, and aroused great interest among people from diverse backgrounds — science, technology, arts and culture. This confirms that the approach is suitable and relevant for research into new forms of communication for a broad audience. After the event there were several inquiries about and proposals for collaboration on further work of this kind. So the kind of media integration we tried out at Memoria Futura points to new forms of public events.

The experience itself and the comments we got brought up the following issues and directions for further work. The most difficult part is the creation of a meaningful relationship between on-line participation and the on-site situation. The continuous visibility of the on-line discussion on a screen next to the speakers worked well as a visual marker of the presence of on-line participants. The on-line moderator selected the most important questions from the on-line participants and displayed them on the fly in large letters. The questions also appeared in the browser window of the on-line participants, and this was accepted as welcome feedback. But visual feedback for on-line participants is something that needs more attention. The development of a suitable spatial design for integrating on-line and on-site visual feedback is a central issue in this respect.

We found that splitting the on-line debate into a public part visible on the screen at the actual event, and a “chat-only” part visible only on-line, helped to separate out those elements that contributed to the social dynamics of the on-line situation (like saying hello, making jokes and personal remarks, and so on) but were redundant to people not participating on-line.

We also found that it is important for the symposium moderator to get an easy grasp of the on-line discussion and the selections and suggestions made by the on-line moderator, much work remains to be done on simplifying the editorial input device for that purpose.

The challenge is to create a set-up in which on-line and on-site participants are more equal partners in the debate, while retaining the specificity of both situations (online, on-site); and to involve the on-site audience more actively in debate. Further exploration of the formats of mixed-reality performance and mixed-reality stage could help to address these issues.

The i2TV system is a prototype of a virtual platform which supports user visibility, collaborative web browsing, textual communication channels and the integration of Internet participants into events taking place at real physical locations. It builds on top of publicly available MOO-WWW technology of enCore Xpress. See /lingua.utdallas.edu

The i2TV interactive internet broadcast event was part of the i3net eRENA project (www.nada.kth.se/erena/) The system will be developed further as a part of the “virtual community platform” for a Communication, Art & Technology Network – CAT. See imk.gmd.de/mars/cat

Memoria Futura web page: imk.gmd.de/mars/cat/memoria

Bonnie Nardi and Vicki O’Day present a refreshing and sound debate on the acceptance or rejection of technology in today’s society. They argue convincingly for a holistic concept and framework that could support the changing ways in which people build their perceptions of information technology into the 21st century.

Nardi and O’Day’s starting point is that of a local environment or setting. They introduce the term “local habitations”, borrowed from Shakespeare, and from this develop the concept of “information ecologies”. This provides the frame for the main argument throughout the book, and the backdrop against which they suggest reflecting on our inter-relationships with technology.

The metaphor clearly takes its inspiration from the biological sciences. Nardi and O’Day define an “information ecology” as constituted by local systems of people and their practices, technologies and values. Information ecologies are similar to biological ecologies in that they exhibit system dynamics, diversity, complexity and evolution. From a biological perspective this metaphor works at an initial level, but at a later stage it may need to be adapted, as our understanding of both the complexity and the simplicity of biological systems is still developing. Interestingly, Nardi and O’Day also systematically use the cinematographic representation of technology (as in Fritz Lang’s “Metropolis”) as a grounding point. Perhaps a greater diversity of examples could have strengthened their argument.

As is pointed out in the preface, the authors’ philosophy stems from the school of “people-driven technology change”. We believe that we have the leverage necessary to affect technology change by acting in spheres where we have knowledge and authority — our own information ecologies. The authors make it clear that the motivation to write the book grew out of their personal experiences as researchers in Silicon Valley, USA.

Nardi and O’Day weave a story that touches on several issues and areas surrounding technology development. These include the history of technology (where the human is perceived as “object” and brain function is reduced to the information processing model), the ethics and values of technology development, the politicisation of technology, and tips on supporting a “technology with heart” approach. They end by placing the information ecology concept in a global context, using the internet as example. In terms of their original frame this example works, but only to a degree. They suggest that the internet is made up of many “local habitations”. The net is global, but at present the interactivity is very much virtual in nature, and the ecological dynamic potentially very different from the information ecologies that will increasingly bridge the real and the virtual.

If Nardi and O’Day sought to feed the debate, I think they have succeeded. The book is well-written, well-referenced and accessible to both converts and sceptics alike. It may well serve as a touchstone in our future reflections on the issues it raises.

From a personal viewpoint, and in the context of our own “local habitation” in i3net, I would like to pose the question: Is there a need for practitioners working on creating the future to look for sources of inspiration that diversify our perspectives and support our creative aspirations?

Finally, a quote from Nardi and O’Day’s concluding chapter:

“We found in Shakespeare’s poetry a vivid expression of how creative invention becomes real and concrete when it is grounded in local meaning:

And as imagination bodies forth
The forms of things unknown, the poet’s pen
Turns them to shapes, and gives to airy nothing
A local habitation and a name.”
Call for contributions
i3 annual conference 2000

Building tomorrow today
Community, design and technology
13 — 15 September 2000, Jönköping, Sweden

This year’s i3 Annual Conference, “Building Tomorrow Today”, will integrate key concepts and perspectives from innovative computing technologies, the design of interactive and collaborative systems, and research into systems which support communication and collaboration among communities.

The i3 approach to Building Tomorrow Today gives special importance to symbioses of new technologies and innovative design, to social and participatory approaches to systems engineering, and to experiential and action research.

The conference will be structured around the following topics:

• integrating physical and virtual information spaces;
• tangible artefacts and embedded interactive objects;
• ambient interactive computing (e.g. in "intelligent homes" or in environments for leisure and play);
• connected communities (e.g. in neighbourhoods, around schools and the home, within professional communities…); and
• innovative technologies supporting early learning.

Contributions are now invited for the following:

1. Papers (thematic sessions)
Thematic sessions will consist of invited and submitted papers, and will be organised around the above list of conference topics. Sessions will be held in parallel and will include time for open discussion. Discussions at thematic sessions will be reported on later at special plenary panels.

Paper submissions (up to 2400 words) should focus on at least one of the conference topics (please specify which one(s)), and contain a concise description and/or discussion of the main points of the presentation.

2. Interactive performances
Interactive performances are special sessions (of up to one hour) in which a new product or concept is presented in a live performance involving multimedia technology (sound, animation, video…) and interaction with the audience.

Proposals for interactive performances (up to 600 words) should state authors/presenters, content, theme, duration and presentation style of the interactive performance, as well as the type of space and equipment required. Additional material (sound, animation, video) is also welcome and should either be provided as an online readable web presentation under a specified URL, or be sent by mail or courier (in the case of video or sound tapes) to the i3 secretariat, address below.

3. Workshops
Workshops at AC ’2000 should be practically-oriented and offer adequate opportunity for discussion. They should have a clear focus (for example the needs of specific target groups such as children, teachers, the elderly) and be characterised by interaction between designers of a system (prototype) and its (potential) users.

Workshop proposals (up to 1200 words) should specify proposer(s), duration, objectives, content, methodology, and intended target groups.

4. Exhibitions/demonstrations
There will be an exhibition space at the conference centre for demonstrations (prototypes and systems related to the conference topics) and exhibits.

Demonstration and/or exhibition proposals (up to 1200 words) should specify proposers, the prototype/system to be exhibited, how it will be demonstrated, and space and equipment requirements.
**Timetable**

**Paper submissions**
- Notification of acceptance (with instructions for revision) May 5, 2000
- Final submissions due: May 24, 2000

All paper submissions will be reviewed anonymously.

**Interactive performances/Workshops/Demonstrations/Exhibitions**
- Contact between proposers and the Programme Committee: April 2000.
- Notification of acceptance with final instructions: May 5, 2000
- Final submissions due: May 24, 2000

Proposers of interactive performances, workshops and exhibitions/demonstrations will be contacted by the programme committee to discuss the submitted material as well as practical constraints and spatial conditions for, or restrictions on, participation.

**Important general information**
All submissions should be sent as email attachments to submission@i3net.org.

They should give the name(s), affiliation(s), email(s) and website address of all author(s) or proposer(s). Please also specify any special requirements concerning room and equipment, as well as conditions for, or restrictions on, participation (where relevant).

Accepted papers and descriptions of interactive performances, workshops, exhibitions/demos and workshops will be published in the conference proceedings.

For more information please check the conference web site: www.i3net.org/btt

or contact:

**Building Tomorrow Today**

i3net Secretariat,
The Natural Interactive Systems Laboratory, University of Southern Denmark, Science Park 10, DK-5230 Odense M, DENMARK

Tel.: (+45) 6550 3551, Fax.: (+45) 6315 7224, Email: heide@nis.sdu.dk

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"All Roads Lead to Jönköping"

The i3 Annual Conference 2000 will be held at the Elmia Conference and Trade Fair Centre in Jönköping, which offers spacious, modern conference facilities as well as excellent technological equipment. Jönköping is centrally situated in Sweden and lies within comfortable travelling distance of Copenhagen, Oslo and Stockholm. This advantageous position is one of the reasons for its rapid growth as a centre of communication technologies.

Why not the take the opportunity to become better acquainted with Jönköping’s beautiful surroundings and local community during your visit? A post-conference programme will offer delegates a choice of cultural and outdoor activities, on their own or in groups. For more information please check the conference web site: www.i3net.org/btt

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**formatting requirements**
- All submitted text should be in Word or rtf format.
- All submitted images should be in tiff or jpg format, scanned in at high resolution (at least 300 dpi), and submitted as separate files. Please mark in the text where the images should be inserted, with caption where appropriate.

**Conference organisers**
Lars Heide, Conference Manager, Natural Interactive Systems Laboratory, Odense (DK)
Bo Gustafsson, Local Organiser, Jönköping University (SE)

**Programme Committee**
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Marilyn Panayi, University of Southern Denmark (DK)
Thomas Rist, German Research Center for Artificial Intelligence (DFKI)
GmbH, Saarbrücken (D)
Duncan Smith, Crystal Presentations, Birmingham (UK)
Since its take-off in 1997, the i3 community has built a significant and inspiring body of knowledge that continues to grow. The amount and quality of the work, and the momentum of its development, call for more contacts with society at large, and in particular with companies and governmental institutions. A determined effort to achieve this has now been set in motion.

Solid relations between i3 and external partners will be of enormous benefit to both sides. The breadth and depth of research in i3 is such that it can generate focused visions of future avenues for potential partners for its part, i3 only stands to gain from having its work disseminated more widely.

So there is ample scope for a strong partnership between i3 and external partners. But setting up such a programme is a big undertaking. It requires a robust understanding of the needs and priorities of industrial and governmental organisations, a clear-headed insight into the strengths of i3 and its projects, and the drive to convince the right people, in Europe and across the world, of what they stand to gain. More than anything else, it takes hard work.

i3 has engaged the support of Marc Blasband to turn the partnership idea into a working reality. Marc has 40 years of international experience in software, on the edge between research and industry. Moreover, taking into account how people react to technology has been a major focus of his work with speech interfaces in the last four years. So the i3 approach slots in well with his background and interests.

To make the partnership programme work, Marc says, he wants to present a unified vision of what i3 has to offer. At least part of that unity of purpose lies in working closely with users — ordinary people in their everyday lives — and determining how they react to new information interfaces. This, Marc believes, is something the industrial world is looking for.

The i3 partnership programme sails under the motto “Be less surprised by the future”, which is its promise to potential partners. To support this concept Marco Susani has designed a watch that gives “the time tomorrow”. The watch is sent, together with a short letter, to carefully selected people in industry and governmental programmes. This is followed up by further personal contact, to clarify what the i3 partnership programme stands for and what it has to offer.

The i3 partnership programme started preparing the ground for fertile collaboration with industry in November, and is expected to grow its first green shoots in March. So be less surprised by keen industrial interest in your project in the near future.

Contact information:
Marc Blasband
Tel/Fax +31 30 6992343
Email: cplr@worldonline.nl
www.compuleer.nl
Future events

Links to all events on this list are available at http://www.i3net.org/mail/i3news/conferences.html

ACM SAC 2000 - Track on Coordination
March 19-21, 2000
Villa Olmo, Como, Italy

“Smart Graphics” AAAI 2000 Spring Symposium
March 20-22, 2000
Stanford, CA, USA

AAAI Spring Symposium Series 2000
20-23 March, 2000
Stanford University, California, USA

ICCM-2000 Third International Conference on
Cognitive Modelling
March 23-25, 2000
Groningen, The Netherlands

PRESENCE 2000: 3rd International Workshop on Presence
March 27-28, 2000
Delft University of Technology, The Netherlands

CHI 2000 - The Future is Here
April 1-6, 2000
The Hague, The Netherlands

RIAO 2000: Content-Based Multimedia Information Access
April 12-14, 2000
Collège de France, Paris, France

AISB’00 CONVENTION: “Time for AI and Society”
April 17-20, 2000
University of Birmingham, England

CIR-2000: The Challenge of Image Retrieval
May 4-5, 2000
Brighton, United Kingdom
International Working Conference on e-commerce in
transportation, tourism, and recreation 2000
(TRATORE 2k)
May 9-11, 2000

Durban, South Africa

COOP 2000: Fourth International Conference
on the Design of Cooperative Systems
May 23-26, 2000
Sophia Antipolis, France

Fourth International Workshop CIA-2000 on
Cooperative Information Agents
July 7-9, 2000
Boston, USA

Developing reactivity and large mental outlook
in the computer age (CLMO’2000)
August 14-18, 2000
University of Bergen, Norway

Global Challenges of the Information Society:
A Web of Opportunity
August 20-25, 2000
Interlaken, Switzerland

ECAI 2000 and PAIS 2000
August 20-25, 2000
Humboldt University, Berlin, Germany

HCI’2000
September 5-8, 2000
University of Sunderland, UK

scope2: constructing reality
September - October, 2000
Vienna, Austria

Conference Universal Access in HCI
August 5-10, 2001
The Fairmont Hotel, New Orleans, Louisiana, USA

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Instituto de Engenharia de Sistemas e Computadores

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