The Interactive Collaborative Environments Laboratory

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ABSTRACT
We overview the Interactive Collaborative Environments laboratory at the Swedish Institute of Computer Science.

Keywords
ICE, SICS, CVE, DIVE, COVEN, eSCAPE, KidStory.

INTRODUCTION
For several years the Interactive Collaborative Environments (ICE) laboratory has researched and experimented with different kinds of techniques to let participants in a collaborative virtual environment (CVE) stay present both in the physical and virtual world. Many interaction techniques have involved different kinds of display techniques combined with social and aesthetic design components. The ICE lab's competence lies in the areas of distributed multi-user infrastructures and novel application prototyping involving advanced information technology, social awareness components and interactive art and design.

RESEARCH THEMES
We aim to consider the whole gamut of human activities, understanding how information systems are a medium of communication between people as much as a tool for individual access to data. Designing the next generation of control and interaction surfaces brings together work in media spaces, tangible devices, augmented and virtual reality, ubiquitous computing and distribution infrastructure technology to explore how a number of heterogeneous devices and interfaces can be used in unison.

The ICE lab is organized into three groups:

- The ***PlaCE*** Group (Platforms for Collaborative Environments) focuses on realizing the infrastructures that are necessary for successful collaborative environments. PlaCE builds upon SICS long experience in the field and through the development of the DIVE tool kit [1].
- The ***ACE*** Group (Applied Collaborative Environments) researches different areas of application for collaborative environments.
- The ***LACE*** Group (Lucid Augmented Collaborative Experience) focuses on developing new ways of experiencing future collaborative environments.

HISTORICAL BACKGROUND
The ICE lab is located within the Swedish Institute of Computer Science (SICS). SICS is a nonprofit foundation sponsored by the Swedish National Board for Technical and Industrial Development (NUTEK) and by an industrial association of major companies including Telia and Ericsson. SICS's main role is to bridge the gap between academic and industrial related research. The lab started life as the Distributed Collaborative Environments (DCE) group and grew out of the MultiG research program in Sweden in the early 1990s. SICS worked alongside KTH and a major result was the first release of DIVE [2]. This early technical work was reinforced when both the ICE lab and KTH participated in the ESPRIT funded COMIC project. This introduced ICE to researchers at Nottingham, Lancaster and Manchester who were to have a major influence on the direction that future work at the lab took. The lab currently contains eleven full time researchers together with a number of guest and associate researchers from many disciplines. This represents a significant growth since the COMIC days, when the lab consisted of four permanent researchers [3]. Two scientific advisors, Tom Rodden and Yngve Sundblad, ensure that the work of the lab is appropriately focussed.

PROJECTS
COVEN
COVEN [4] was a recent European project whose aim was a comprehensive approach to the development of CVE technology. COVEN brought together twelve academic and industrial partners, with expertise in computer supported collaborative work, networked virtual reality systems, computer graphics, human computer interaction and telecommunications infrastructures. The project was driven by a number of applications in different areas, including tourism and business planning. Applications were built around scenarios of prospective uses of virtual environments by general citizens and/or professionals, and served as a requirements base for exploring and evaluating methods, techniques and supporting tools for collaborative

interaction in scalable CVEs. Technical results were integrated into the DIVE platform. Taking advantage of the Internet, a large component of the project was a trial and experimentation activity that lead to a comprehensive understanding of the network requirements of these systems as well as their usability issues and human factors aspects. COVEN ended in December 1999.

eSCAPE

eSCAPE is a long-term research project developing electronic landscapes that provide interconnections between virtual environments. The general problem being addressed is to move beyond the current generation of virtual environments, which have adopted an insular view with each virtual environment being relatively isolated from others with very limited forms of interconnection. The eSCAPE project aims to develop techniques to allow a wide variety of different approaches and spaces to co-exist. This is addressed by exploring the formation of "electronic landscapes" that promote cooperation across and between these environments and provide a more general experience and navigability of the resulting heterogeneous information space. Research work within the project focuses on the production of two thematic places that act as contrasting alternative instantiations of electronic landscapes. In the Virtual Cityscape, a fairly concrete, familiar, metaphor is used to provide interconnection between the shared environments, while the Virtual Planetarium [5] shows a more abstract approach.

KidStory

While educators and parents are turning toward computer technologies to support learning activities for their students and children, few of these new technologies support collaborative learning experiences. KidStory [6], an international, interdisciplinary, and intergenerational research partnership, addresses this by proposing to build systems that support the development of skills which include: creative problem-solving, collaborative learning, expressive design, development of multiple forms of literacy, and exploration initiation. The project believes that new learning experiences need to be developed that are supported with technologies that are as inherently collaborative as a box of crayons or a pile of blocks. KidStory's collaborative storytelling environments build on the idea of an explorative narrative and include real physical objects and spaces together with virtual environments and embodied children as multiple simultaneous users. In KidStory children, educators, and researchers from various disciplines work together in the design and development process.

DIVE

The Distributed Interactive Virtual Environment (DIVE) is an internet-based multi-user VR system where participants navigate in 3D space and see, meet and interact with other users and applications. The DIVE software is a research prototype, freely available for non-commercial use. The first DIVE version appeared in 1991. DIVE supports the development of virtual environments, user interfaces and applications based on shared 3D synthetic environments. DIVE is especially tuned to multi-user applications, where several participants interact over a network.

LAB REFLECTIONS

As the lab has grown from a team of technical researchers to incorporate several disciplines (computer scientists, artists, ethnographers, and psychologists), through local and international EU projects, we have learned to value the different perspectives. Consider the following example concerning DIVE. A number of small bugs in the graphics rendering software to render color and shape were only identified when an artist tried to realize her work within the system. The rendering differences were of no consequence to the programmers working with the system, but the rendering effects were crucial to the artists. Once the rendering was fixed, it was clear to everyone it was a necessary improvement. However, it was clear also that such effects would have continued to pass unnoticed without the artistic intervention. From a greater perspective, having work driven by participatory design and ethnographic fieldwork changes the motivation for the technical team. For example, instead of working in isolation, working with children on a new prototype in KidStory both affects the prototype and, more subtly, the attitude of team members. The child-user enthusiasm is often transferred back to the development team. Thus not only is the shift from technology-driven to a more use-driven approach good for the end-results, but it can also be good for the perspective and motivation of the team members as individuals.

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