

Collaborative Virtual Environments Based on Real Work Spaces

Luis A. Guerrero, César A. Collazos¹, José A. Pino, Sergio F. Ochoa, Felipe Aguilera

Department of Computer Science, Universidad de Chile
Blanco Encalada 2120, Casilla 2777, Santiago, Chile
{luguerre, ccollazo, jpino, sochoa, faguiler}@dcc.uchile.cl

Abstract

Collaborative Virtual Environments (CVEs) have been proposed for various purposes but mainly for leisure. Context providing CVEs may be useful for information sharing and communication tasks. An example organizational unit is selected to experiment the development of a CVE for a real working environment. We start with the actual physical environment of our Computer Science Department and we design a CVE to provide new collaboration features to the people working in it. The approach has many advantages. First, people are familiar with the basic physical environment. Second, some activities requiring physical presence can be done with virtual presence, enabling more convenient ways to work for employees. Third, new opportunities for collaborative work appear as it is easy to do them with the proposed CVE. In this paper we present the approach and the design of the proposed CVE.

1 Introduction

There is little knowledge about how Collaborative Virtual Environments (CVEs) are being designed, what issues need to be addressed, and little guidance about how visualization of the virtual environments based on standard architecture relates to people's performance of certain tasks. Our design approach is a strategy for mapping a virtual environment to a physical space or structure, including a set of guidelines for the interaction space. We propose six elements that make up the interaction space. Of particular concern here are issues pertaining to the gathering of requirements supporting computer-mediated interaction across distributed sites. What kind of interactions are we going to design for? How is coordination of activities supported? How do we engender a sense of co-presence among participants immersed "within" some virtual space?

The background space of a CVE may be based on an existing real world domain. Alternatively, it can be based on various spatial metaphors, such as a city or countryside metaphor (Benyon & Hook, 1997). The general and basic issue of design is how to structure and design a "good" CVE space, including appropriate metaphors for interaction and visualization. This design can have a significant influence on collaboration. Many experiences have shown that some of the virtual worlds to be visualized should not be created only from models generated in the minds of artists or architects, but may rather be derived from or augmented by models extracted from real objects (McMillan & Bishop, 1995). Our goal is to provide a smooth transition from real to virtual work and back by integrating real objects into CVEs.

¹ On leave from FIET, Universidad del Cauca-Colombia.

We propose the visualization of a virtual environment based on a real environment as a way to bridge the gap between real and virtual worlds (Davenport & Bradley, 1997). We wish to consider the development of virtual environments that reflect the real world that are appropriate for certain kinds of scenarios. In this paper we present the virtual environment we developed, some conclusions and further work.

2 The Virtual Environment

As a case of virtual environment based on a real environment, we study the user interface for the intranet at the Department of Computer Sciences of our university. The department wants an appropriate Web page for the use of professors, secretaries, other clerical employees and research assistants. Moreover, there are research groups who want to share information, joint work and applications and would like to make all that easily accessible.

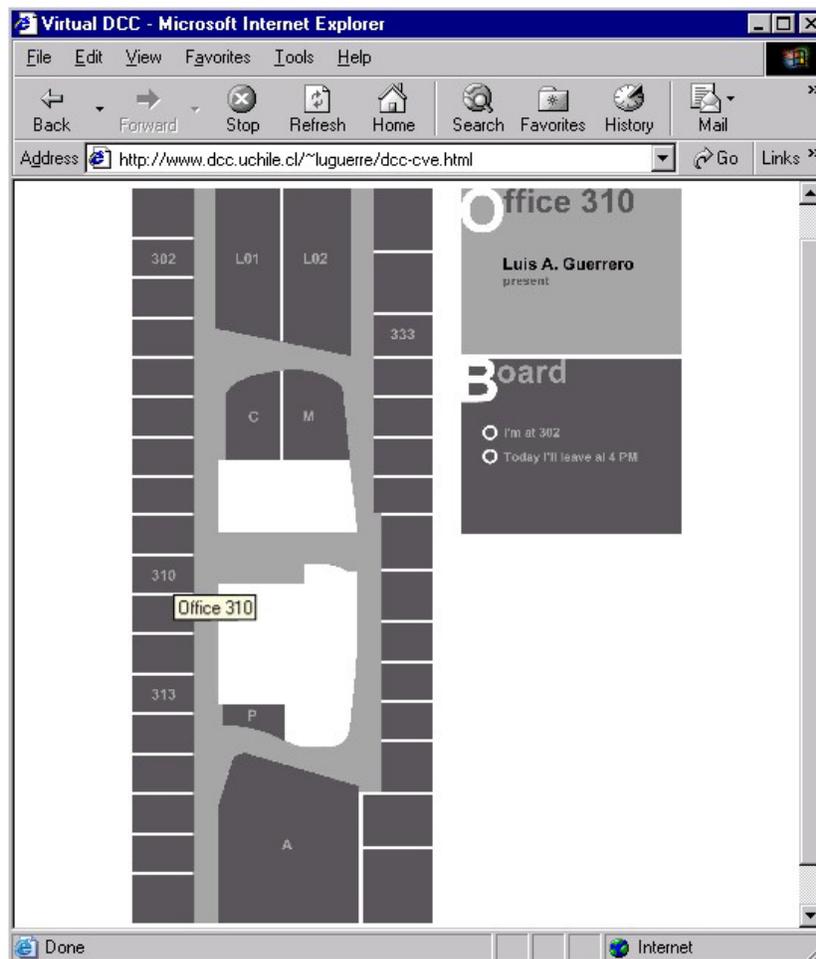


Figure 1: User interface for the CVE of our Computer Science Department

In order to make use of existing user knowledge, we want the elements of the interface and the operations performed on them have real world counterparts wherever possible. However, it is clear that this design goal could not be followed rigidly; otherwise some limitations of the real world would be re-created in the virtual environment, such as the limitation that physical objects can only exist in one place at a time. Inspired by the DIVA Virtual Office Environment (Sohlenkamp & Chwelos, 1994), we propose six elements that make up the interaction space: *environment*, *people*, *spaces*, *tools*, *roles* and *privileges*. The virtual environment is based on the real spaces. Figure 1 shows an improved version of the real physical environment. Please notice that anyone familiar with the floor will easily find the spaces. Each space in the virtual environment may be defined as a collaboration space. The spaces which are currently defined as virtual collaboration spaces are labeled, such as A (Auditorium), L1 and L2 (laboratories), and so on.

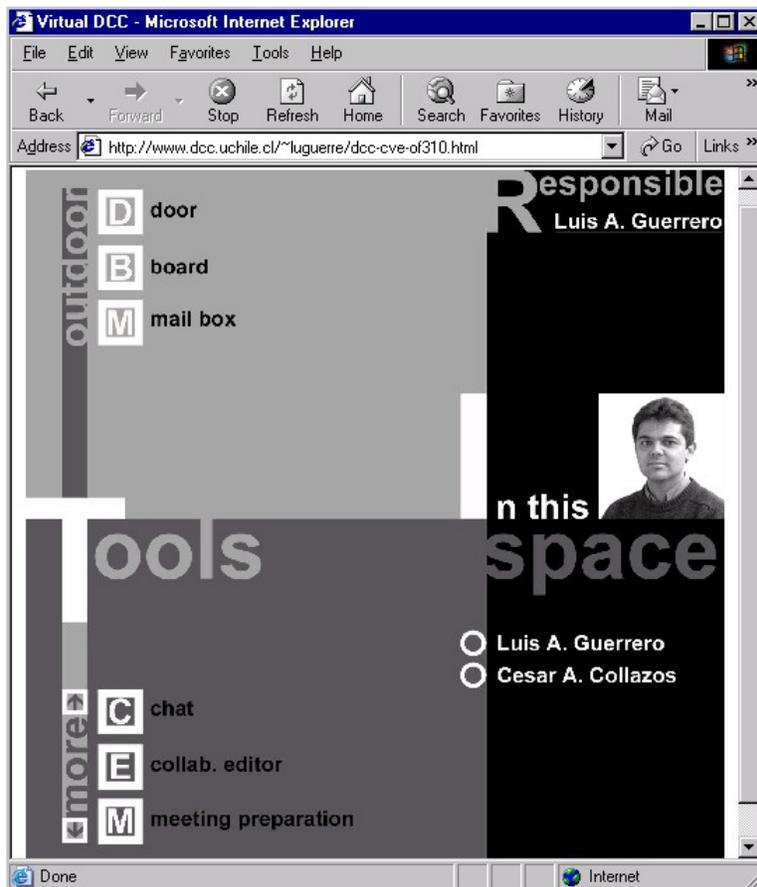


Figure 2: User interface for a collaborative space (Office No. 310)

Within a space, there are three sections (graphically, upper, middle and lower part of the screen, as shown in figure 2). The upper part is open to any person having access to the intranet. It contains basic data about the responsible person for this space. Clicking on the responsible person's picture leads to his personal Web page. It also contains a mailbox to leave messages to the responsible person. Finally, it has a "door" to leave the space. The middle part of the space window contains a restricted section. It lists the people present in the space (this presence may be physical or virtual).

It also lists a set of tools relevant to the type of cooperation between the responsible person and the one entering the space. Finally the lower part includes two buttons, “back” that permits to go back to the previous level, and “home”, that permits to go back to the initial environment (not shown on Figure 2).

3 Virtual Environment Architecture

The previous section illustrates a case in which a basic architectural blueprint is the starting point for a user interface allowing simple access to a complex computer-based system of collaboration features and privacy restrictions. The familiarity of the users with the real architecture eases the access to virtual services which increase the opportunities for collaboration: people do not need to physically go to a certain space to be able to interact and work together with some other people.

When designing the user interface for a CVE, it may become clear that certain physical spaces should move to other locations because they are functionally disconnected. In a certain way, this is similar to the re-engineering that results from trying to automate processes in an organization: when designing the workflow, it becomes obvious that certain processes should be modified before automating them.

The case study is useful to illustrate a type of environments we may call Collaborative Virtual/Real Environments (CV/RE). We may characterize such environments as a pair of a real environment and a virtual environment based on the real one. Each environment benefits from the existence of the other. The virtual part of a CV/RE may be modeled as follows, assuming the characteristics we have described for the Computer Science Department case. The environment has a set of tools (and their relevant data files) associated to it. The environment provides a map of the site and organizes people and information by providing data and user awareness. The spaces provide places for people interaction and where tools can be used. Figure 3 shows a tree structure in which the nodes are the spaces. The nodes and their links define a navigation model. For instance, from the environment it is possible to go to the Auditorium (node A); from there, it is possible to go to any of the conference rooms inside it (nodes C1, C2, C3). Note that people who have no rights to enter to the Auditorium will not even know that there are three conference rooms inside it. This is a parallel to the real situation.

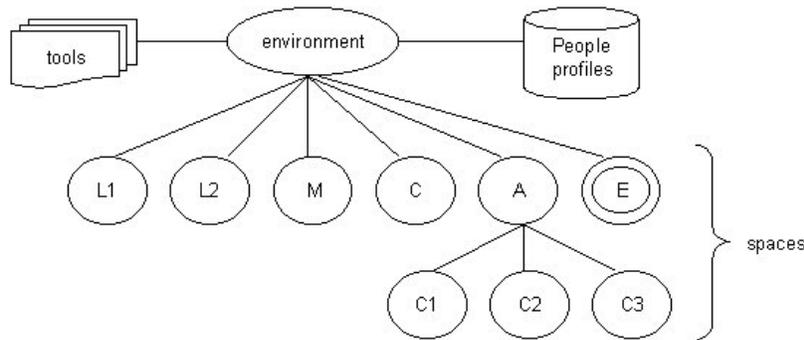


Figure 3: Virtual part of the CV/RE architecture

In figure 3, the especially marked node E corresponds to the Entrance to the environment. Its user interface is similar to the other spaces and it is the only place where people are requested to

identify themselves. The system provides this feature, since each time a person navigates in the tree structure, the current node sends a message to the next space with the person's data. Each node has its own list of authorized users to enter it, as well as the available applications for each user. Therefore, when a person moves from a space to another, the new space is configured according to the person's roles and privileges.

4 Conclusions and further work

The proposed design approach could be useful for some communities for which there is a strong relationship between real and virtual environments. In this case, the existence of a CV/RE can reinforce the physical/virtual worlds association, with benefits for both. In the case of the Computer Science Department, e.g., this virtual environment could help to support collaborative and cooperative activities, because the environments offer the means to access appropriate information as well as awareness tools. People can physically visit a colleague because the virtual system indicated he/she is physically present. Alternatively, the hints of physical presence can motivate a person to work together with the colleague in the virtual world (distributed work using the intranet).

The proposed approach includes a set of six elements that could be easily adapted for the design of a CV/RE when the users are people who have a knowledge of the real environment. Setting up the virtual part of a CV/RE is an opportunity to re-think the physical part of the CV/RE: the physical spaces could be re-assigned to reflect the best use of teams who may want to be closely located. Finally, the virtual part of the CV/RE is flexible and dynamic: people will always be changing authorizations and available tools.

Finally, the proposed approach is an attempt to make CVEs usable in the office environment, as contrasted with its usual leisure application. People may find natural to use collaborative tools embedded in this intranet interface. Nevertheless, experimental results are not available yet, since we are just beginning to deploy the CVE. Users' acceptance will then be reported in a forthcoming publication.

Acknowledgements

This work was supported by Fondecyt (Chile) grants No. 1000870 and 1030959; and graduate thesis scholarship No. 49 from Departamento de Postgrado y Postítulos, Universidad de Chile (2002). Our thanks to Felipe Encinas, who helped with the virtual spaces design.

References

- Benyon, D. & Höök, K. (1997). Navigation in information spaces: supporting the individual. Proc. of Interact'97. Howard, S., Hammond, J., Lindgaard, G. (eds). London:Chapman & Hall, 39-46.
- McMillan, L. & Bishop, G. (1995). Plenoptic modeling: an image-based rendering system. Proceedings of Siggraph'95, ACM Press, New York, 39-46.
- Davenport, G. & Bradley, B. (1997). The care and feeding of users. In: Visions and Views, IEEE Multimedia, Jan-March, 8-11.
- Sohlenkamp, M. & Chwelos, G. (1994). Integrating communication, cooperation, and awareness: the DIVA virtual office environment. Proceedings of CSCW'94, ACM Press, Chapel Hill, North Carolina, 331-343.