Negotiation of Spatial Configurations in Collaborative Virtual Environments

Filipe Santos, Benjamim Fonseca, Paulo Martins, Leonel Morgado

Negotiation of Spatial Configurations in Collaborative Virtual Environments

Filipe Santos[*,1], **Benjamim Fonseca**[2], **Paulo Martins**[2] and **Leonel Morgado**[2]

[1] Escola Superior de Educação de Leiria, Rua Dr. João Soares, Apartado 4045, 2411-901 Leiria, Portugal
[2] Universidade de Trás-os-Montes e Alto Douro, Apartado 1013, 5001-801 Vila Real, Portugal

In the last decades a new culture of childhood has been emerging that redefines the relations between children and their social environment. Instead of seeing children as passive actors in the society where they live, children are regarded as social actors capable of supplying their own personal and active contribution to social life. This approach includes involving children in the planning of physical spaces as well as in social and cultural interventions in their society.
One particular field of study is that of children's involvement in the planning of their classrooms and playgrounds. Since this is a collaborative and creative task, teachers must develop strategies for mediating conflicts between different opinions and tastes: not an easy task.
This paper proposes that the use of collaborative virtual environments as a tool for classroom and playground design may help children recognize and solve conflicts through negotiation, in search of a consensual solution. We see these environments as tools that can help each child see the perspective of others through the better sharing of knowledge and opinions and therefore offer a more engaging learning experience through social interaction among peers.

Keywords Collaborative Virtual Environments; Context; Learning; Negotiation; Spatial Configurations

1. Introduction

Many human activities use some kind of collaboration between participants to reach a goal. This collaboration may be pursued for various reasons: there are activities that cannot be done any other way; some are more effective when done amongst several individuals with similar or complementary skills; and also, there are human activities that are themselves a social negotiation or require one to take place; these are necessarily done as a community.

Collaborative activities face well-known problems of space and time (difficulties in joining specialists that are geographically apart and synchronizing an agenda), which require some efforts (strategies) to overcome. But there are other problems that to be overcome require more demanding and complex strategies, studied in such areas as sociology (*e.g.*: how to manage and solve group conflicts), psychology (*e.g.*: relationship between emotions and logic) and even philosophy (*e.g.*, the discussion on whether context is an object perpetually rebuilt and negotiated.

The work presented here focuses on a specific problem within this general scope: the negotiation of infrastructures in a tri-dimensional space by the community of people who will use it. Several areas of human activity where this negotiation may take place include:

- Children's participation in the design of playgrounds and classrooms;
- Reconstruction of destroyed historic buildings by cooperation between historians, archaeologists, and people with living memory of the buildings;
- Infrastructure design through the participation of populations living where the infrastructure will be implemented.

This paper presents a contribution to the study of new potentials and scope of 3D multi-user virtual environments in the negotiation process of tri-dimensional spaces. Among the several areas mentioned in the last paragraph, our research aims to analyse (as a specific case study) the organization and reformulation of playgrounds by primary school children who use them for their activities.

[*] Corresponding author: e-mail: fsantos@esel.ipleiria.pt, Phone: +351 934591213

2. Children and their environment

Recent decades have seen a redefinition of what is to be a child and what is the role of children in society. Until recently, childhood culture disseminated by pedagogy and psychology theories saw children as a moment in the development of a human being, in need of special care and attention. Children were seen, therefore, as passive social players. [1,2].

New lines of study and cultural viewpoints suggest that children should be seen as human beings that do have the capability to construct meanings of the world that surrounds them, and that develop an autonomy allowing them to make decisions and give personal contributions to society as a whole. In this line of thought, a child is an active player within his/her environment [2].

One way to make children active players in society is including them in the decision processes of infrastructure implementations in the spaces where they live or spend most of their time, such as schools and playgrounds. Through the personal meanings that children build interacting with the world and others, they can make personal appropriations of the design process of their spaces through the manifestation of opinions and, together with the other stakeholders of those spaces, negotiate a solution.

The fact that these spaces and infrastructures are shared by a community requires this participation to be done within a group: it is therefore a collaborative task. And, contrary to certain tasks that have a single solution to a problem – such as a mathematical equation, for example – this one is a creative task. This in turn leads to conflicts due to the various personal tastes and different meanings and viewpoints that each participant has developed about the world. One of the teacher's tasks in these situations is mediating the process, helping children reach a consensus.

3. MMOGs as development environments

Currently we are studying the possibilities offered by Massively Multiplayer Online Games (MMOGs) as online 3D virtual environments that provide a solid technical base for exploring the kind of demands that these problems bring together. MMOGs have been used successfully in many human activities beyond entertainment, such as education and business (*e.g.*, [3]), and are quite popular among "computer skilled" communities. It is our expectation that one of these platforms can be built upon to bridge the aforementioned issues surrounding collaborative 3D modelling and prototyping, at a satisfactory level.

MMOGs, which are also sometimes called *Virtual Worlds*, are games that can support many users simultaneously (hundreds or thousands) and typically are played through the Internet inside a persistent 3D world. Some of the most popular [4] are Lineage II [5], EverQuest II [6] and World of Warcraft [7].

Our attention focuses on a particular variety of these environments, one sometimes called Massively Multiplayer Online Social Games (MMOSGs). These are environments where socialization and the building of the actual virtual world itself are emphasized, by opposition to other games where well-defined goals are to be met. MMOSGs include games such as Second Life [8], Active Worlds [9], There [10] and Entropia Universe [11].

The versatility allowed by MMOSGs makes them a good platform for several other domains of activity besides socializing activities, such as entertainment, education and business. As an example, we show in Fig.1, Fig. 2 and Fig. 3 some applications already developed by the users of the popular MMOSG Second Life (the most popular MMOSG, if measured by number of subscribers [4]):

Fig. 1 Singer Suzanne Vega, represented by an avatar, gives a live concert to a Second Life audience. [12]

Fig. 2 The Global Outreach Morocco project brought students with backgrounds in technology, business, and hospitality together to study economic development in Morocco through the growth of the travel and tourism industry. Students used Second Life as an education tool to develop specific locations, such as this Hassan II mosque [13].

a) b)

Fig. 3 a) Virtual visiting of the Washington Monument [14]; b) Reuter's virtual news bureau [3]

One interesting aspect of several of these worlds is that they give their users tools that allow them to change the virtual world itself: editing tools (see Fig. 4). Virtual Worlds can, this way, be built from the ground up and developed by its users (players). It is even possible for users have property rights over virtual objects they create, as is the case of Second Life.

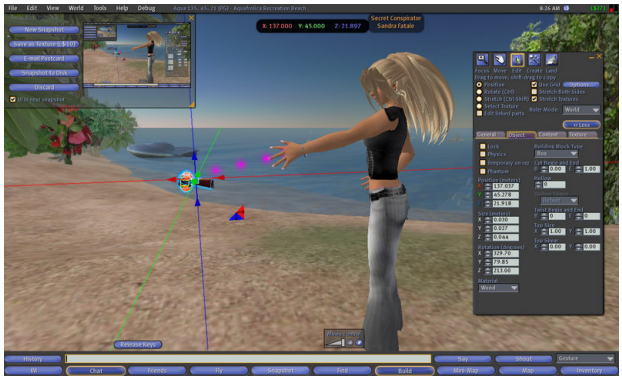

Fig. 4 A Second Life user edits an object [15].

It is also interesting that several of these worlds offer powerful scripting tools that allow players to program the several objects they have created in the virtual world (its properties and events). Sometimes these languages allow the communication of the Virtual World with the exterior, connecting these worlds to other software applications. In brief, we find these worlds powerful programming platforms for developing software solutions where collaboration and spatial configurations play a central role.

4. Research focus and design approach

Negotiation is a task that implies the mastering of several skills, such as knowing how to present arguments, discuss, listen, and respect different points of view. Therefore a contribution that 3D multi-user collaborative environments can offer to the negotiation of spatial configurations of objects and infrastructures in 3D spaces is allowing the comparison between several spatial configurations as they arise throughout the discussion.

Under this perspective, the negotiation of a tri-dimensional configuration in a 3D environment in our mentioned application case (playgrounds and classrooms) may start from an initial configuration – proposed by the teacher or one of the students – to which other students propose changes, giving birth to new configurations. The negotiation is done during this process, and ends, preferably when there is a consensual agreement on a given configuration.

Our research aims to identify the requirements and functionalities for information systems that may hold, query, and analyse the historic evolution of the several 3D configurations proposed by the participants, and then implement the prototype of such a system and study its impact in the negotiation processes and on the process towards reaching a consensus. This "history of configurations" tool intends to give each user a way for performing visual comparisons of two recorded spatial configurations. We believe that a tool of this kind, where the user manipulates and compares in a novel way several spatial configurations may provide a significant contribution to the process of negotiation.

Our requirements research will only focus on the aspects of 3D spatial configuration negotiation itself, not on the aspects that may or may not contribute to final consensus. At this level, we will only look into the possible impacts that the prototype will contribute to this process. This is because each specific situation uses person-driven methods to reach a solution: in a peer team, consensus may be desirable but if this is not the case, the final configuration may be reached by a voting process; in teamwork, it may come from the direct choice of one of the participants (typically, the team leader); also, consensus may be automatically achieved in favour of the last configuration reached upon a deadline, and also through any other process the a group may decide to use. Such activities are beyond the scope of our research.

As a starting point to the analysis of the processes of spatial negotiation and the registering of its versions (the history) we have drawn our inspiration from a well know collaborative system that already puts in practice the concept of version recording and management, although only of hypertextual documents, not tri-dimensional configurations: wiki platforms [16]

Therefore, the preliminary phase of our work will be the analysis of how well these platforms may be conveniently adapted to store spatial 3D configurations and how its mechanisms for version tracking may be conveniently adapted to implement an identical mechanism for our research

The use of an existing wiki platform as a starting point, adapting it to the proposed problem we intend to investigate, seems to us a promising line of action, given that, as already mentioned, some 3D collaborative environments can easily communicate with external Web applications. By developing an appropriate abstraction layer, we foresee the possibility of putting one of these collaborative environments to use for 3D manipulation, while storing and holding data (the spatial configurations) in a wiki platform, in such a way as to be transparent to the user of the virtual world.

5. Implementation concepts

We foresee that in the course of developing this research we will reach specific difficulties, which will require more detailed studies. One expected case is the definition of what will constitute a single configuration (i.e., a "version"), in a world with various simultaneous players, who may change the configuration of the objects concurrently. In a first approach to this problem we are considering the use of some method so that only one user at a time can change the objects – at any given moment, other users will be simply watching the changes taking place in the spatial configuration. One such method, inspired on an approach to physical programming [17], is placing inside the virtual world a special object (a magic wand, for example) that works as a token, giving its holder the ability to change the spatial configurations of the objects (or at least only those will be recorded). Only the holder of the token may

perform valid changes and it is with its release that it will be assumed that a configuration change is finalized by the user. This will constitute *one* version of the spatial configuration, which will be stored in the wiki platform. The token is then available to be held by other user who may then do his personal contribution to the discussion by making his own configuration.

6. Final remarks

A 3D spatial configuration is a collaborative task that is normally negotiated by the users or future users of the space. Negotiation aims at final solution, that may be achieved (by consensus, imposition or any other method) or not. We believe that a conveniently designed software tool that gives its users a clear method of comparing the different suggested configurations may contribute to an adequate negotiation process.

The scope of such tool doesn't end at any specific field of human activity, although in the present study we are focusing on the case study of children playgrounds and classrooms. We believe that if such a tool proves useful in negotiation within this particular context, a reasonable assumption may be held that approaches similar in scope can contribute to similar problems in other contexts where three-dimensional spatial configuration negotiation is necessary.

References

[1] T. Sarmento and J. Marques, A Participação das Crianças nas Práticas de Relação das Famílias com as Escolas, Interacções **2**, 59-86 (2006).
[2] UNICEF Innocenti Research Centre, Cities with children - Child friendly cities in Italy, Innocenti Innocenti Insight, 6, **24** (2006).
[3] Eric Auchard and Kenneth Li, Reuters opens virtual news bureau in Second Life, Scientific American.com, "http://www.sciam.com/article.cfm?chanID=sa001&articleID=624567140FECC40163FED3C45A959A7C", retrieved October 30th, 2006.
[4] Bruce Sterling Woodcock, An Analysis of MMOG Subscription Growth, MMOGCHART.COM **12.0.29**, November 2004, 1 January 2005, http://www.mmogchart.com, retrieved October 29th, 2006
[5] Lineage II, http://www.lineage2.com, retrieved October 30th, 2006.
[6] EverQuest II, http://everquest2.station.sony.com, retrieved October 30th, 2006.
[7] World of Warcraft, http://www.worldofwarcraft.com, retrieved October 30th, 2006.
[8] Second Life, http://secondlife.com, retrieved October 30th, 2006.
[9] Active Worlds, http://www.activeworlds.com, retrieved October 30th, 2006.
[10] There, http://www.there.com, retrieved October 30th, 2006.
[11] Entropia Universe, http://www.entropiauniverse.com, retrieved October 30th, 2006.
[12] W. James Au, New World Notes: Suzanne Vega And The Second Life Of Live Music, http://nwn.blogs.com/nwn/2006/08/nwntv_the_secon.html, retrieved October 30th, 2006.
[13] C. Bedford, R. Birkedal, J. Erhard, J. Graff, C. Hempel, B. Minde, O. Pitz, K. Pouliot, D. Retamales-Toro, J. York, Second Life As An Educational Environment: A Student Perspective. In Daniel Livingstone and Jeremy Kemp (eds.), Proceedings of the Second Life Education Workshop at the Second Life Community Convention – San Francisco August 20th, 2006, ISBN 1-903978-32-7, pp. 25-26, Paisley, UK: The University of Paisley (2006).
[14] B. Book, Travelling Through Cyberspace: Tourism and Photography in Virtual Worlds (June 2003 version), http://ssrn.com/abstract=538182, retrieved on September 15th, 2006.
[15] Wikipedia - Second Life, http://en.wikipedia.org/wiki/Second_Life, retrieved October 30th, 2006.
[16] A. Ebersbach, M. Glaser R. Heigl, Wiki Web Collaboration, ISBN 3540259953, Berlin, Germany: Springer (2005).
[17] J. Montemayor, A. Druin, A. Farber, S. Simms, W. Churaman, A. D'Amour, Physical programming: designing tools for children to create physical interactive environments. In Proceedings of the SIGCHI conference on Human factors in computing systems: Changing our world, changing ourselves, pp. 299-306, New York, NY, USA: ACM Press (2002).