3D Visualizations for Supporting Social Awareness in Learning Communities

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Abstract - **Establishing and nurturing vibrant learning communities is seen as a highly complex process. An important concept in this context is that of social awareness. In this paper, we discuss supporting social awareness by 3D visualization of social networks, activities and resources. We compare social awareness support provided by virtual environments of Active Worlds and Second Life, outlining directions for future work.**

Keywords-3D visualizations; social awareness; 3D virtual worlds; learning communities

I. INTRODUCTION

The goal of this research is exploring the possibilities of 3D visualizations for supporting social awareness in learning communities. Communities are fluid and emergent [1], as opposed to well-defined groups. It might therefore be difficult for community members to get an overview of the existing social structures, activities and available resources in a learning community. This is a problem because awareness of, e.g., experience distribution and social ties creates occasions for knowledge sharing, facilitating search for cooperation partners. On the opposite, lack of this awareness creates continuous breakdowns in the flow of knowledge and, as a consequence, impacts negatively on learning. We use the term social awareness to indicate awareness of the social situation in a group or community in a shared environment, which can be physical, virtual or both. This awareness includes knowledge on learners' resources, activities and social connections. We distinguish between short-term and long-term, synchronous and asynchronous social awareness [2].

There are various mechanisms for promoting social awareness in everyday life, like chance encounters, message boards, verbal and non-verbal cues [3]. These techniques are not always sufficient due to a number of reasons, such as physical distances between the students, social fears and inhibitions and available spaces that are not optimal for meeting, working and information sharing. Various groupware tools have been used to promote awareness, overcoming the limitations of everyday modalities of interactions, including Twitter, Facebook, Skype and other [4]. Still, these tools mainly focus on supporting already established groups and networks rather than fluid communities [5].

3D virtual worlds have promising potential for supporting social awareness in learning communities. There are a number of reasons for that. First, 3D visualization is a powerful tool for supporting understanding of complex concepts, including social aspects, and is widely used in educational context [2, 6]. Second, 3D virtual worlds provide a constructivist and flexible learning environment where learners can collaboratively construct their understanding by exploring, building and sharing their experiences with peers and forming the environment according to the current needs of the learning community. Third, 3D virtual worlds provide a social arena where students, teachers and other stakeholders can meet and interact overcoming distances and different time zones, allowing supporting social awareness in a synchronous manner [7].

On the longer term, virtual spaces become a container of artifacts used by the users for their daily social and educational activities, and traces left by community members as a result of their participation. The places that serve as triggers and repositories of community memory in real life cannot serve as a permanent reference for community members since such places cannot be accessed any time and because the memories they keep have to be replaced regularly due to the limited amount of available space. The use of virtual places, on the other hand, allows such places with traces to be saved before they are cleaned up or removed, in this way supporting long-term/asynchronous social awareness [8, 9].

In this paper, we will discuss how to 3D visualizations can be used to support social awareness. The discussion will be illustrated by 2 case studies performed by the author in the virtual environments of Active Worlds [10] and Second Life [11]. By comparing social awareness support provided by these 2 environments, as well as alternative approaches, we outline directions for future work.

II. SUPPORTING SOCIAL AWARENESS WITH 3D VISUALIZATION IN ACTIVE WORLDS AND SECOND LIFE

Example 1 (Active Worlds). In order to support social awareness, we have created a virtual world called Viras in the virtual world of Active Worlds [10]. Viras is based on the metaphor of 'Archipelago': a virtual world consisting of sea and islands and groups of islands (Fig. 1). We have arrived at this metaphor after analyzing various spatial metaphors used in educational virtual worlds, trying to combine different features in one system in order to achieve sufficient flexibility [2, 8]. One of the goals behind this metaphor was to re-create the way in which communities and groups naturally are created and developed. Islands represent groups

and individuals, their constellations into archipelagos are communities, and the links, bridges and roads serve as connections between them. Also, we wanted to create a landscape with a high degree of overview, especially from the 'bird's-eye view', of the existing structures by clear distinction of borders and units of community building against the 'sea' background, thus promoting awareness of the community development. In addition to visualizing the social structures, the resources and activities of the community members are visualized in the virtual places where these activities take place (Fig. 2)

Example 2 (Second Life). The second example is a Virtual Research Arena being constructed at the Virtual Campus of Norwegian university of Science and Technology in Second Life [11], presenting a number of research projects performed at our university as well as student projects (Fig. 3). The virtual research arena serves as a meeting point for the communities of students, researchers and general public, sustaining awareness of research activities in these communities. It has been used as a venue for a number of community events, such as a science fair, international seminars and project presentations (Fig. 4). While developing the Virtual Research Arena, we have explored innovative ways of capturing, storing and mediating community knowledge through 3D creative visualizations and role-plays. The 3D constructions capturing the knowledge and experiences acquired by different generations of students and researchers will be stored in a virtual 'project gallery' constituting the community repository [9].

This repository and the community meeting areas contain a number of boundary objects that have been collaboratively created in order to facilitate the exchange of ideas between communities of students, researchers and practitioners. These boundary objects contribute to establishing a common ground, shared understanding and vocabulary among community members by to a significant degree taking advantage of visual symbols, interactive elements and aesthetics elements [9].

In Table 1, we provide an overview and compare social awareness mechanisms in Active Worlds and Second Life (based on the presented 2 studies), along the dimensions of *learner, place, artifacts*, following a characterization framework developed earlier by the author [2].

Figure 1. 3D visualization of social structure of a learning community as 'Archipelago'

Figure 2. A virtual place with visualizations and traces of students' discussions and activities.
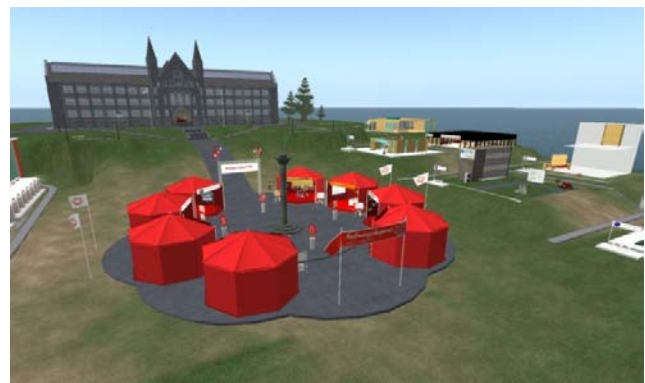

Figure 3. Virtual Research Arena as 3D visualization of a learning community's activities and research projects

Figure 4. Examples of 3D visualizations of community's activities: Virtual Science Fair, exhibition booths presenting research projects and seminars

III. DISCUSSION

The overview of social awareness mechanisms in Table 1 shows that Second Life in general provides equivalent or better support. For both virtual environments, usefulness for long-term social awareness support depends on the extent of usage and applies to active users only. Short-term awareness can only be supported with a relatively large amount of users online, and to a limited degree. This discussion raises a number of issues in connection with the suitability of 3D

TABLE 1. COMPARING SOCIAL AWARENESS SUPPORT IN ACTIVE WORLDS AND SECOND LIFE

Active Worlds (Viras/Archipelago)	Second Life (Virtual Campus/Virtual Research Arena)
Learner	
• Virtual environment provides rich possibilities for conveying of awareness information and identity expression through creation of places and artifacts • Virtual environment provides alternative means of communication and conveying of awareness through chat and 3D content brainstorming, 3D movement and manipulation of 3D artifacts and places	
• Limited selection and rotation of avatars makes identification of users and conveying of short-term social awareness difficult. From AW version 4.2, some avatar customization features are provided • Complexity of movement and communication in 3D space limits the use of existing awareness mechanisms • Search for collaboration partners with needed resources is complicated, especially due to the fact that Active Worlds consists of a number of un-connected universes	• Extensive possibilities for avatar (appearance and clothing) modifications, such as in in-built avatar editor and acquiring avatar features on the Linden market makes possibilities for social awareness support more prominent • Second Life features such as advanced camera movement, Skype-like, mini-map and teleportation features facilitate exchange of awareness information, but it is still restricted • Second Life's in-built search possibilities makes search for collaboration partners, i.e., members of different communities, easier. Additional search elements can be implemented by scripting, i.e., 'virtual project gallery' [9]
Place	
• Flexibility of building is beneficial for awareness and allowed fast development of the world • Uncritical use of provided facilities for flexible building may limit creativity and thus awareness expression (especially uncritical buying of pre-made objects in Second Life) • A repertoire of places of different types is beneficial for social awareness, allows a quick creation of an initial set of places and mediation of a range of activities (especially pre-made objects in Second life, commercially available and provided in the virtual campus and virtual research arena [9]) • 3D places can convey awareness of activities and learners by keeping traces and by mediating activities in a way, similar to real-life (though leaving traces is restricted due to rights and property managements) • Place structures are useful for visualizing social structure on the group level	
• Existing flexibility of building is still not fully sufficient for reflecting social structures on the community level with the increased size of the world • The additional complexity associated with leaving traces explicitly and still limited repertoire of places makes other tools more appropriate in a number of tasks • The appearance (Archipelago) can serve as a distraction for learning activities	• In-built map features provide a comprehensive overview of community development. Still, such development and its flexibility is strictly limited by land ownership and building rights issues • Leaving of traces is restricted by rights management mechanisms, but adjustments are possible through programming. Repertoire of places is rather extensive, with a variety of free and for-sale objects in the universe • The appearance of a science fair and campus provides an appropriate atmosphere for learning and research activities, but at the same time serves as an informal socializing place
Artifact	
• 3D artifacts provide rich possibilities for conveying awareness information about learners and their activities, communication and activity mediation in a visual, symbolic and 'real life' way • The effort associated with expressing awareness information in 3D artifacts makes other tools more preferable in some cases	
• The functionality associated with 3D artifacts does not cover the whole range of user needs	• Second Life has extensive functionality for programming and designing artifacts, including integration with external tools such as Sloodle, but the associated complexity makes it rather difficult to use in some cases

virtual worlds in general for social awareness support and learning facilitation, compared to other tools.

For example, support for finding collaboration partners in 3D virtual worlds may for the moment appear less straightforward compared to the more traditional 'yellow pages'/database approach [12] and social media such as Facebook and Twitter. Generally, simpler text-based communityware applications can in some cases be more efficient for exchange of information and 'matchmaking' of community members [13]. At the same time, as shown by our results and in the related literature, 3D virtual worlds can provide possibilities the 'traditional' tools cannot give. This includes 3D visualization of both awareness-related and educational information and an alternative arena for social and learning activities [2, 8, 9]. The facilities provided by the 'traditional' tools, can with some effort be integrated with the virtual worlds, e.g., more effective operations on documents. An example is the Sloodle initiative that focuses on integrating functionalities of Moodle learning management system and Second Life [14]. Therefore, 3D virtual worlds can potentially provide nearly all functionalities necessary for performance of central social and learning tasks. However, these functionalities must be provided in a more user-friendly and effective way than is possible with most existing virtual worlds at the moment.

We believe that appropriate support for social awareness, especially in an educational and research context, could be obtained in the context of virtual research arenas like the one described in Section II, where students and researchers can participate in sharing and collaborative elaboration of scientific content. Such virtual research arenas contribute to increasing awareness of ongoing research projects by visualizing activities and resources available at the corresponding research groups, thus facilitating search for collaboration partners. By presenting research results in a visualized and interactive way, it could be popularized and presented to a wider audience in a more appealing manner. In addition, such virtual research arenas can be accessed by the students, researchers and general public at no cost across distances and different time zones.

IV. CONCLUSIONS AND FUTURE WORK

In this paper, we have focused on 3D visualizations of learning communities and associated resources, activities and social networks, comparing support for social awareness provided by virtual environments of Active Worlds and Second Life. We have also shortly discussed the advantages and disadvantages of 3D visualizations for social awareness support compared to alternative approaches. In order to provide adequate support for social awareness, there is a need to overcome the identified limitations of 3D virtual worlds. To fully exploit the strengths of different technologies, a hybrid solution will probably be optimal. Future work will therefore include developing a comprehensive framework and guidelines for 3D dynamic visualization of social structures and processes in a learning community. Additional issues to consider will include augmenting 3D virtual worlds with other awareness tools (e.g., mobile devices, social media etc.) and combining 3D visualizations for educational and social purposes.

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