IMMERSIVE EDUCATION IN VIRTUAL SPACE

Klaus Bredl, University of Augsburg, Augsburg, bredl@phil.uni-augsburg.de
Amrei Groß, University of Augsburg, Augsburg, amrei.gross@phil.uni-augsburg.de

Abstract

This paper follows an inductive design approach. It starts with the introduction of selected socio-technological phenomena concerning virtual worlds and tries to bring them to the field of education. A strong combination, looking at the growth in use of virtual three-dimensional game spaces and the possibilities these spaces offer for the educational field. Today, the phenomena of virtual space, representation as a virtual self and social presence have a strong influence on learning and teaching in immersive virtual environments. Together, these three phenomena lead to immersive experience and enable explorative learning. Further, the dimensions of virtual space, representation, and presence will be associated with selected virtual learning and teaching projects of the Digital Media division, created by students and for students at the University of Augsburg. Three immersive learning environments – one for each of the dimensions named - are presented to show the relevance of this upcoming technology for the construction of knowledge.

Keywords

Immersive virtual environment, explorative learning, games, 3D projects

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1. Introduction

In the past decades, the world of everyday media use has changed fundamentally. Virtual worlds are of increasing importance and more and more become part of our lives. The idea of interacting in three-dimensional virtual online spaces has spread rapidly; worlds like *Second Life* – started in 2004 – and more recently *Minecraft* thrive. In 2014, *Minecraft* was the second most common search term on You Tube (Cowan, 2015); in September of the same year, Microsoft bought the startup for 2.5 billion dollars (Zeit Online, 2014). However, virtual worlds are not only common in the context of digital online games, but in the field of professional education and even advanced training as well.

2. Virtual space

The first dimension is the shared virtual space, defined by its three-dimensionality and its respective objects. During use the learner becomes part of this space, and interprets it and his/her own role within his/her surroundings based on his/her experiences and expectations. Depending on how a space is equipped and designed, it may alter a user's interpretation of his/her virtual surroundings.

But what is a 'virtual space' and how can it influence the fields of learning and teaching? First of all, the term 'virtual' is defined as «facilitated by networked computers» (Bell, 2008, p. 3f; Sköld, 2012). 'Space' is the three-dimensional environment where learning objects are placed and where an interaction of a user with these objects and even with other users is possible. 'Virtual spaces' are cultural environments enriched by semiotic symbols for educational purposes and are to be distinguished from virtual environments or platforms for the support of learning processes like Moodle or StudIP, which are conventionally provided with less possibilities of interactivity and mostly uni-modal which means mainly text-centred.

Taking these facts into consideration, the aspect of learning in and with virtual worlds is determined by the combination of questions about space, technology and education. According to the knowledge-oriented constructivist world-view, multidimensional virtual environments appear to be especially appropriate for education, because they allow their users to explore and create spaces of their own, to research various sources and different representations of knowledge and to even solve problems using given tools.

Hintenberger and Kühne (2009) indicated that virtuality and reality are not necessarily opposites. They were able to show that the acceptance of new phenomena is, in fact, linked to how long they have been a part of our

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everyday lives. Looking at the socio-cultural constructivist view on virtual spaces, we have to take into account as well that all objects and all possible interactions are designed following conscious and unconscious decision making (Taylor, 2003). There is also the question of realism and the role of exact display in virtual spaces. Here, accuracy sometimes has to take a back seat and learning tasks may need to be adapted in order to benefit from a virtual world's strengths. The educational design approach should favour peer communication, interaction and participation.

3. Representation of the (virtual) self

The second dimension is the existence of a representative. The interaction through personal representatives so-called avatars within virtual spaces is something many users are used to from the field of online and offline gaming (e.g. Sims, World of Warcraft etc.). The crucial factor here is how well the configuration of an agent allows identity building, enhanced personality traits and – subsequently – how strong the user identifies with his/her virtual self. There are four levels of identification with a digital representative which, with increasing complexity and configurability, provide a corresponding amplification of immersive experience: the 'player', the 'avatar', the 'character', and the 'persona'. In relation to representation, this division can also be seen as the primary means of differentiating representation (cf. Bartle, 2003). Players are real-world people who are sitting at a computer connected to some virtual world. An Avatar is a player's representative in a virtual world. It is controlled by a human user, basically a puppet. As Bartle states: «It does as it's told, it reports what happens to it, and it acts as a general conduit for the player and the world to interact. […] It's a mere convenience, a tool» (Bartle, no year). The avatar as the user's representative provides a certain range for configuration especially through the significantly higher level of customizability – the user can change its appearance, clothing, gender, and size, thereby creating a higher level of identification with his/her artificial self. A 'character' is defined by the fact that the user communicates through an avatar in the 'I'-perspective and is a player's representation in a world; «an extension of yourself, a personality that you don when entering the world» (Bartle, no year). From this point of view, the situation is more of an inner psychological 'upgrading' of an avatar and less a question of technical implementation. The highest form of identification, and thus also of immersive experience, is the 'persona'. At this point the virtual representative is part of the user's identity: «Any separate distinction of characters has gone - the player is the character. You're not role-playing a being, you are that being; you're not assuming an identity, you are that identity» (Bartle, no year). This situation just as well

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appears to be more of a phenomenon of cognition on the level of the user's relationship to his/her virtual representative, even though there might be a high level of technical individualization in the customization of this virtual 'me' (Bredl and Herz, 2010).

Avatar, character and persona always embody certain psychic representations and identity traits which become manifest during interaction in the virtual world and which possibly also preoccupy their owners in real life. As with an imaginary companion, a virtual representative is potentially able to compensate for real-life relationship deficits such as asking for help in a socially competent way. Thus, education always takes place in an intersubjective, defined space regardless of whether virtual or real.

Through the ongoing development of virtual worlds such as the numerous online computer games, Massively Multiplayer Online Role-Playing Games (MMORPGs) and Multi-User Virtual Environments (MUVEs), it is evident that the creation of an imaginary companion in the form of an avatar is of growing importance. As with fantasy literature, MMORPGs can provide escapism and, indeed, support the formation of representational skills like individualizing one's own avatar on appearance e.g. with clothing and special gestures. The development of representational skills and the potential to stage role-playing imply the creation of a 'space of possibilities' and the establishment of a genuine link between the inner and outer reality.

Physicality is provided via the avatar — the personal representative — which often results in the learners' impression of actually being there in the virtual space. Although the user is able to choose from a range of predefined physical gestures for his/her avatar, one should not draw a comparison between virtual world interaction and a real physical meeting as, in contrast to real life, all gestures must be made consciously. Any evaluation should therefore always be made in relation to other e-learning settings.

In addition, the possibility of using the audio channel (voice chat) enables the integration of speech into the educational process.

4. Social presence

Immersion in virtual worlds can often be understood as 'I-participation' or 'inclusiveness' (cf. Pietschmann, 2009, p. 68). Pietschmann presents the following definition: «Immersion is a psychological condition characterized by the extent of the user's impression of being part of an environment that continuously offers stimuli and experiences» (2009, p. 44).

Closely connected to the experience of immersion is the sense of

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presence within a virtual environment (Heers, 2005). For a better understanding of this state of being, it is helpful to look at the shades of the phenomenon presence made by Heeter (1992).

Heeter describes three grades of presence in virtual worlds: Environmental presence associated with the interactional possibilities offered by the virtual world, personal presence describing the 'sense of being there' in the virtual world, and, finally, social presence, which is related to the existence of other people in a virtual environment. Social presence, in particular, describes the phenomenon of perceiving the virtual environment as a social context or an educational setting in which one's own representation encounters the representation of a teachers and one's own attitude is geared toward meeting a 'real' human (Bredl and Herz, 2010).

Immersion and presence also occur through the various methods of navigation in the three-dimensional world where it is possible for an avatar to fly and teleport. Sophisticated users in Second Life or Open Sim are easily able to even create three-dimensional objects of their own and bring them to life with scripts that enable further opportunities for interaction.

Interesting for educational process could just as well be the significant tendency towards a greater readiness for self-revelation which can be identified amongst users within virtual worlds (Weisband and Kiesler, 1996; Joinson, 2001). This can occur through the physical isolation experienced during work or play at the computer coupled with the absence of social and contextual clues during communication. The resulting lower identifiability has a positive impact on openness and readiness to communicate. In any case, a hypothesis emerges when looking at online communication: because of the idealization processes and selective self-portrayal, reciprocal communication happens more socially and intimately than it would in face-to-face situations (Walther, 1996). The reason for this, besides self-idealization, is the idealization of the counterpart caused by filling knowledge gaps with positive and idealized content. The causes of this, according to Walther (1996), are the predominantly positive projections which emerge from the selective self-portrayal on the Web.

5. Cases: Working with immersion in learning and teaching – 3D projects by students for students

Seminars about education and communication in 3D have, under various titles, been part of the bachelor degree course 'Media and Communication' at Augsburg since 2009.

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The seminars in virtual worlds are offered to all bachelor students of Media and Communication. There are not any requirements except basic knowledge of digital media. As a result, most of the participants have never worked with virtual worlds before. The course is based on the following structure: starting with an introduction to virtual worlds and their benefits for learning and teaching, the students are soon asked to create and customize an avatar of their own. Although collaboration and content creation took place within the virtual world of Open Simulator, the courses continue to use Second Life in order to get started and have the students acquire basic building and scripting skills. This procedure has proven itself well, since there are many helpful examples and the students are easily able to adapt to the rather similar world of Open Simulator afterwards.

During the first six weeks of semester, the students are taught how to build, script and create content in Second Life and Open Simulator at university. Supported by tutors, they create their own Second Life and Open Simulator avatars, explore both worlds, form groups and collect ideas for the creation of their very own immersive learning environment. As soon as every group has found a project-scenario in form of a virtual learning environment to work on, most seminar meetings take place within the virtual world. Mandatory presentations during week eight and eleven allow the students to show their progress and ask questions. At this time, assistance is provided by the lecturer and tutors. The seminars end with a final presentation and an online test run of all the learning environments created.

Afterwards, every project group has to submit a written report about their project, its underlying thoughts and ideas and the process of creation with a summative evaluation with potential learners as well as a Machinima video documentation. The 3D project itself, and both the written and the video documentation are part of the assessment.

Case concerning the role of virtual space: Claude Monet is considered one of the co-founders and most important representatives of impressionism. His paintings, showing lily pounds and flowering green pastures, are well known all over the world. Monet's beloved garden Giverny, his primary source of inspiration, blossoms again year after year and keeps his legacy alive to date. To this day, it is visited by half a million people every single year. In Open Simulator, users now can explore Monet's Garden with all of its amazing plants and animals close up. The visitor is allowed to enter Claude Monet's holiest, to linger at the lakeside of his famous lily pound, to cross the Japanese bridges and to admire the splendor of thousands upon thousands of colorful blossoms. And, just like that, he gets to know Monet himself: Exploring the giant, living and immersive masterpiece of virtual Giverny, the visitor is asked to assist the master with the completion of his very last painting. He is giving a task,

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thereby made part of the virtual space he entered. Doing so, the freshman painter's aid is introduced to Monet's life and art while answering questions and claiming objects. Within the rich environment of Giverny, the user immerses quickly. At the end of the journey, he has received Monet's hat, his paintbrush, his glasses and various water lilies – the 'ingredients' to the master's last painting.

In this case, the virtual exploration of the inspiring space of the garden of Giverny allows the user to not only take the perspective of the artist but to become the artist himself.

Case concerning the role of the representation of the (virtual) self: Decades after *Star Trek's* first run, the Spacecamp Helibasa in Open Simulator allows everyone to be an astronaut. Ready for takeoff? Then join the astronauts-in-training at Helibasa, learning all about the creation of the universe, asteroids, meteorites, comets and the Milky Way! During training, the user is introduced to the planets of our solar system, the history of the exploration of space and its heroes.

S/he experiences zero gravity, looks around a collection of space ships and is finally awarded his/her very own space suit. If s/he is able to pass a hall full of quiz questions, the user reaches the launch pad and becomes part of a space mission to explore the planets of our solar system. In outer space, the user can visit the sun, the moon and various planets, including a secret alien hideout, learning a lot about what makes them special underway.

A visit to real cosmic space is something to be eluded most people. The virtual world however overrides the borders of space. Spacecamp Helibasa allows the user to reach the 'final frontier' – and makes the dream of a moon walk to come true for everyone. 'Being there' in person, the exploration of space turns from abstract science to something personal: an immersive adventure.

The possibility of taking the role of an astronaut in training and during missions to the planets and moons of our universe shows the importance of the factor representation: to explore an environment as a defined virtual self in a certain context, supplemented with a fitting frame story and tasks, creates personal aims and goals the user seeks to accomplish.

Case concerning social presence: One of the first projects brought to life was the Magic Forest, a research adventure rich in detail and full of extraordinary ideas, designed to be an introduction to the methods of empirical social research all students of Social Science have to take. Fully implemented in Second Life, the Magic Forest takes the student on a fantastic and immersive journey into the world of the tasty Gingerbread House, the Big Bad Wolf, Sleeping Beauty's thorn-covered castle and the Enchanted Garden. Upon his/her entrance to the Magic Forest, the student is welcomed as a member of the renowned Magic Wood Research Institute. Starting in the labyrinthine Enchanted Garden, s/he has to

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answer questions and complete practical exercises such as evaluating statistical data in SPSS or conducting an expert interview with the Big Bad Wolf in- as well as outworld in order to proceed to the next level. Along the way, the student becomes acquainted with various methods of empirical social research; s/he follows breadcrumbs to yet other magical locations, learns about the research progress and about data evaluation and finally gets to interview the Big Bad Wolf about what happened to Little Red Riding Hood and her grandmother.

Implementation of the Magic Forest into the curriculum of the *Introduction to the Methods of Empirical Social Research* should therefore work. During the use of the virtual environment, real-world tasks were given. The students learned the basics of statistics during a visit at the Gingerbread House, for instance, and were afterwards asked to evaluate questionnaires using the SPSS analysis software in the real world, thereby getting the password needed to advance in the Magic Forest.

Through the implementation of peer-based tasks, the learners had to interact with each other, which increased the interactivity of the world and, since the users cooperated and interacted with each other, allowed for a feeling of social presence – the sense of actually being 'there'.

Because of the use of an open virtual world, the implementation of computer-controlled non-personal characters (NPCs) and the need to cooperate on- and offline in order to succeed, social presence was guaranteed.

Technological requirements

Except for the Magic Forest (Second Life), the outlined projects were created in Open Simulator, an open-source multi-user 3D application server platform for hosting virtual worlds (See opensimulator.org for more information). Out of the box, Open Simulator can be used to create virtual environments similar to Second Life that can be accessed through a variety of clients including the regular SL viewers, and on multiple protocols. It supports online, multi-user environments as small as one simulator and as large as thousands of simulators, 3D virtual spaces of variable size, inworld scripting using different languages such as LSL/OSSL, C# and VB.NET, and real-time physics simulation as well as inworld 3D creation.

Since 2011, Open Simulator is used for the projects of the Digital Media division at the University of Augsburg. At this time, a previous commitment to the world of Second Life, using space on European University Island, had just come to an end due to high land leases and the small number of prims (A primitive or prim is a single-part shape, used for building objects in OpenSimulator and Second Life) available; forcing the team to find new ways to continue its 3D program. With its business

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Partner 3D Grid (http://3dgrid.de/), the Second Learning Grid was founded, a very own Open Simulator world with various regions and an unlimited amount of prims. All regions have text and voice chat available and feature a Hypergrid portal to allow for visits to and from other grids, thereby increasing the factor of social presence.

6. Conclusion

The possibility of the dimensions of virtual space, representation and social presence leading to immersion seems to be of strong interest for virtual learning and teaching. The three cases shown above gave an insight into what immersive environments are able to achieve and how they are able to enhance a user's learning experience: Virtual spaces offer users and teachers the opportunity to construct and bring to life knowledge in an explorative way.

They enable users to see Giverny through the painter Monet's eyes, to feel the experience of a spacewalk and to become part of an immersive adventure in the Magic Forest.

Beside the projects mentioned, there are around forty other worlds created by students and for students that show the pragmatic possibilities of using immersive 3D technology in the educational field. The way students were able to create complex worlds without having had respective knowledge or experience before, strengthens the assumption that educators just as well are able to adapt to the technology easily and as a result to create new forms of virtual learning environments for explorative learning. The next step ahead is the cooperation with educational and social institutions to design and evaluate new 3D-scenarios in real processes of learning and social work.

Further, the development of head-mounted displays for the mass market adds a new dimension to virtual (VR) and augmented reality (AR), allowing the use for an increased immersive experience of digital media. These new possibilities have also to be taken into consideration for the educational field. They need to become a focus of future research concerning learning and teaching.

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