Surveillance-based Mechanisms in MUVEs (Multi-User Virtual Environments) used for Monitoring, Data Gathering and Evaluation of Knowledge Transfer in VirtuReality

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ABSTRACT

Multi-user virtual environments (MUVEs) generate a large amount of data but most of them are not accessible even to users who triggered them. What's more, most data-sets are not even stored for further use; they have only temporary character and very short "half-time of decay" limited f.e. to one-second-long screen display. Such a huge loss of data makes evaluation of knowledge transfer in MUVEs almost impossible. There is a need to both improve monitoring capabilities of MUVEs to be able to make completion assessment and use MUVEs that enable simulation (re)experience using complete data-sets gathered from environment itself. Future research in the field of simulation methodology is suggested.

Keywords:
Evaluation, Knowledge Transfer, Assessment, Monitoring, Multi-user Virtual Environment, Games

FOREWORD

This paper focuses exclusively on very special case when activities in multi-user virtual environments (MUVEs) are going to be monitored and evaluated. Following chapters are not intended to challenge issues like whether online games should or should not become a part of learning process or how to manage activities in MUVE. Suggestions and conclusions described below are based on observations and evidence gather inside the MUVEs with respect to the aim of the paper as a whole – to pinpoint future needs and future research topics in the field of evidence-based research and knowledge transfer evaluation in MUVEs.

1. ABOUT MUVE

In general (following the original meaning by Morningstar & Farmer [M]) term "MUVE" (multi-user virtual environment) refers to digital-based environment of any (visual) kind that enables communication and interaction among multiple users. MUVE as a category covers both two-dimensional (2D), world-wide-web-based platforms like chats, discussion forums and even learning management systems, and three-dimensional (3D) virtual world and online games of different kinds and types (defined f.e. by Robbins-Bell [RB2008] and [RB2009]). Both 2D and 3D MUVEs are examined in this paper.

Inside the MUVE users – represented by unique avatar and/or profile – are able to use predefined set of tools to trigger actions, for example insert a text, click a button, move a mouse etc. These actions influence the environment as a whole by affecting some other objects and/or subjects, in some cases enforce feedback and afterwards – very often – simply disappear without being logged, saved or stored. This means that we are likely not able to log every triggered action. As an example: during the process of chatting – means writing a text into the web-form and afterwards publishing such a message at the chat-board in a real time – typing single character is not logged anymore, only the result (sent and published message) is stored as a change of content of publically visible chat-board.

But there is no methodological barrier to use data gathered directly from digital-based environment for reconstruction and simulation of processes in a MUVE during specific period of time. The only question is to what extent we are able to take into consideration the "structural" lack of evidence described above – or how to challenge and falsified findings that arise from data-set we acquired. Following chapters are focused on describing issues that needs to be taken into account during monitoring (and afterwards evaluation) within MUVEs.

The main reason why researchers should focus more on monitoring of MUVEs is simple – ICT and particularly MUVEs are becoming an integral part of our everyday lives. Below mentioned MUVEs like f.e. virtual learning environments and wikis are broadly incorporated into learning process at least at the universities via so called "e-learning" and "blended learning" concepts. Game-based learning and game-elements in combination with ICT (mainly computers and notebooks) are very often used to make learning process much more effective, memorable and – last but not least – fun for students and children from very early age.

But simply using an ICT tools and services like wikis and (serious) games in not enough; there is a need to master methodology, to be able to actively work with feedback, interact with students/users and evaluate knowledge transfer. Without these "meta-activities" learning process can be enriched and more various but cannot prove usefulness of integration of these elements into learning process. Following chapters therefore address also aspect of MUVE as a frame for knowledge transfer and collecting evidence to support evaluation process.

2. VIRTUAL LEARNING ENVIRONMENTS AND WIKIS

Virtual learning environments (VLEs) – also called learning management systems (LMSs) – are online available software platforms designed to support teaching and learning. The core features are administration of students and groups of students, files and teaching materials management, collecting and comparing student grades, communication, feedback

assessment, collaboration and peer-assessment and – last but not least – tracking of activities of users.

In such an environment where teachers can set each step of learning process and afterwards have an access to students log of actual activities VLEs often cause the "creepy treehouse" effect, means lack of confidence in a controlled environment [S]. Data from logs are therefore incomplete and limited to actions that meet requirements of the course, f.e. logging into the VLE and uploading homework in time or simply "view" of particular page with no additional information about page scrolling or time spent reading (see example below, Table 1).

Table 1 – Example of automatically logged data from LMS "Moodle"; underlined parts of log are active links to web page user visited or web page that contains additional information or summary.

Time	IP Address	Full name	Action	Additional information
2010 04 10 22:29	85.X.X.X	Jakub Štogr	forum view forum	Discussion forum #1
2010 04 10 22:29	85.X.X.X	Jakub Štogr	resource update	Online conference info
2010 04 10 22:29	85.X.X.X	Jakub Štogr	resource view	Online conference info
2010 04 10 22:27	85.X.X.X	Jakub Štogr	resource view	Online conference info
2010 04 10 22:27	85.X.X.X	Jakub Štogr	course view	SEL

A **wiki** is a website that allows the quick creation and collaborative editing of web pages. The most well known example of wiki is Wikipedia.org. The basic principle of wiki content creation is free access to any web page of wiki for anyone. Due to the fact that even anonymous visitor can add, correct or delete part of the web page, every single change of content is logged and history of changes is publically available. Therefore information about history of web pages is complete but log of single user is scattered among these discrete changes (see example below, Table 2).

Table 2 – Simplified example of automatically logged data from wiki Wikipedia.org (web page called History for term "wiki"); underlined parts of log are active links to web page that contains older version of term description, information about user profile etc.

Time	User	Size	Explanation of change
00:43, 25 April 2010	Tisane	(26,365 bytes)	(→Searching)
13:08, 24 April 2010	HaeB	(25,924 bytes)	(→User communities:…)
13:03, 24 April 2010	HaeB	(26,333 bytes)	(→Research communities:…)
01:10, 24 April 2010	Tisane	(27,143 bytes)	(→User communities)

As it was already mentioned above both VLE and wiki are examples of 2D web-based and quite simple environments. There are limited possibilities how to interact with the environment, limited number of active links and/or interactive elements in general. But default data-logs of these environments are insufficient and not able to provide complete "map" of activities of users.

It's possible to oppose and argue that there are more sophisticated systems that can provide detailed overview about behavior and triggered activities, f.e. proprietary LMSs or monitoring systems in the field of advertisement. That's true. But still – generally speaking – monitoring module is not a high priority feature.

3. GAMES VS. MUVES "AS SUCH"

In 2008 American Psychological Association published a study [A] where we can read that: "*certain types of video games can have beneficial effects, improving gamers' dexterity as well as their ability to problem-solve*".

Just a few month later report done by Pew Research Center [P] concludes that „*all American teens play computer, console, or cell phone games and … gaming experience is rich and varied, with a significant amount of social interaction…*". In more details 97% of 12- to 17-year-old respondents play games, 31% of them every day. And in February 2010 game designer and game researcher Jane McGonigal stated that "*we spend three billion hours a week playing online games*" [MC].

The problem is that even if there is evidence that games are not only evil, teens are often heavy players and time spent gamming worldwide is quite significant, there are hardly any methods and tools used to assess and evaluate processes inside them.

In a previous chapter there are just two examples of simple environments and problems we can face when we try to use build-in functionalities for monitoring. The question is what kind of problems appear when we start to investigate games in a same way. In a fact, games are much more complex, mostly 3D, gamers can interact with each other and create temporary or stable groups, cooperate and sometime even trigger kind of "script" (or pre-programmed set of actions) that manipulates avatar automatically.

Picture 1 – Screenshot from 3D MMORPG (massively-multiplayer online role-playing game) called "The Lord of the Rings Online" (September 2009)

In a most cases evaluation is done only based on questionnaires or other indirect methods of gathering data about (and from) participants. Virtual environments – means games itself – are not data-mined and in-game surveillance tools are rarely used for monitoring.

The question is why. Five years ago, in 2005, Sande Chen and David Michael published an article "Proof of learning: assessment in serious games" [C] where they defined three main types of assessment used in serious games:

- *Completion Assessment - Did the player complete the lesson or pass the test?*
- *In-Process Assessment - How did the player choose his or her actions? Did he or she change their mind? If so, at what point? And so on.*
- *Teacher Evaluation - Based on observations of the student, does the teacher think the student now knows/understands the material?*

They also explain that "*Teacher evaluation is a combination of both completion assessment and in-process assessment. … Teacher evaluation can also include observation of the student in action.*" [C]

Even if Chen and Michael focused mainly on serious games and game developers' point of view above mentioned definitions are far more complex. Completion aspect is almost the same as in a case of VLE or wiki. System needs to be able to set and afterwards monitor completion of goals – in games called f.e. "quests". But there are basically two possible ways how to give a teacher (or "evaluator") possibility to "be in the process":

- Real-time experience – Become a member of group, play together with students and even lead them.
- Simulated (re)experience – Be able to fully reconstruct the whole environment and replay every single activity. Become an "invisible observer" during process of replaying.[1]

In a second above mentioned case logged data-sets are not used only for completion assessment. Even if these data-sets still provide information about activities gathered from environment, they become much more important. They are memory-records, kind of video-tapes than can be repeatedly played using appropriate tool (software and hardware combination). Therefore logged data cannot be limited to human-readable screen outputs as we can see at Table 3 below.

Table 3 – Example of human-readable data logged automatically from chat window of MMORPG called "The Lord of the Rings Online".

You accept the offer to join a Fellowship.
The loot rule has changed to Round Robin with Roll/Pass.
The loot quality has changed to Uncommon.
Gilgalthir has acquired [Khazâd-iron Ingot].
You have joined the chat room for your Fellowship, Fellowship chat is now available.
You have joined a Fellowship.
[To Fellowship] hi
[Fellowship] Gilgalthir: welcome
Gilgalthir has acquired [3 Khazâd-iron Ingots].
Edheldin slaps Jiversallmighty on the cheek.
Nonesuch waves to Banion.

Due to the fact that at least online games use "client-server" architecture and fully digitalized real-time exchange of data via Internet network to synchronize gamers all around the world, these kinds of "instructional" data-sets exists.

The problem is that we do not have an access to them, we have no right to save and archive them and – last but not least – we are not able to replicate them back into the virtual world.

And there is another issue – most MUVEs do not provide special access to data logs of other users; means teachers have the same access as other users have. What's more, quite often every user/gamer can choose what kind of personal data s/he is going to make public and share. For others such a user is therefore represented only via activities of avatar. Assess and afterwards evaluate a knowledge transfer in MUVEs where we have no role of supervisor is therefore very complicated and sometimes almost impossible. Gathering only publicly available data in 3D MUVEs is generally speaking not enough and there is a need to combine all available sources of data (f.e. data-logs from more users with audio and video records) to be able to make any conclusions.

[1] Actually, these "reply functions" are already incorporated into some – mostly racing – games. Gamers can replay their race, evaluate it and learn from the mistakes.

Nevertheless, opened and fully scalable MUVEs exist. One example is SecondLife.com. As an owner of piece of land inside the Second Life you have a right to create and script interactive object of any kind, even with the ability to trigger HTTP request and receive such a request from the Internet which is useful for storing and retrieving data from databases. Objects that monitor avatars (f.e. storing visited places, names of avatars you met and activities in general) are quite common and are often worn attached to the "HUD" (head-up display) as you can see at the Picture 2 in a right bottom corner of the screen. You can also manipulate an avatar using pre-programmed scripts or use so called "bots", fully automated avatars that can look like other regular users. In such an environment idea of simulated (re)experience can be put into life.

Picture 2 – Screenshot from MUVE called "Second Life" (January 2010)

CONLUSIONS

Monitoring activities and gathering data from MUVEs is challenging task. Even simple environments like VLEs and wikis do not properly store all available data about behavior of users and/or changes of content. In a most cases analyzing these data-sets can provide enough information for completion assessment (means answer to the question whether user completed the task, pass the test etc.) but cannot be used for modeling simulated (re)experience. The most promising are MUVEs where we have full access to both data-sets and tools that can be used for "re-playing" past activities.

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