Journal of Virtual Studies

Knowledge Emergence in Virtual Spaces

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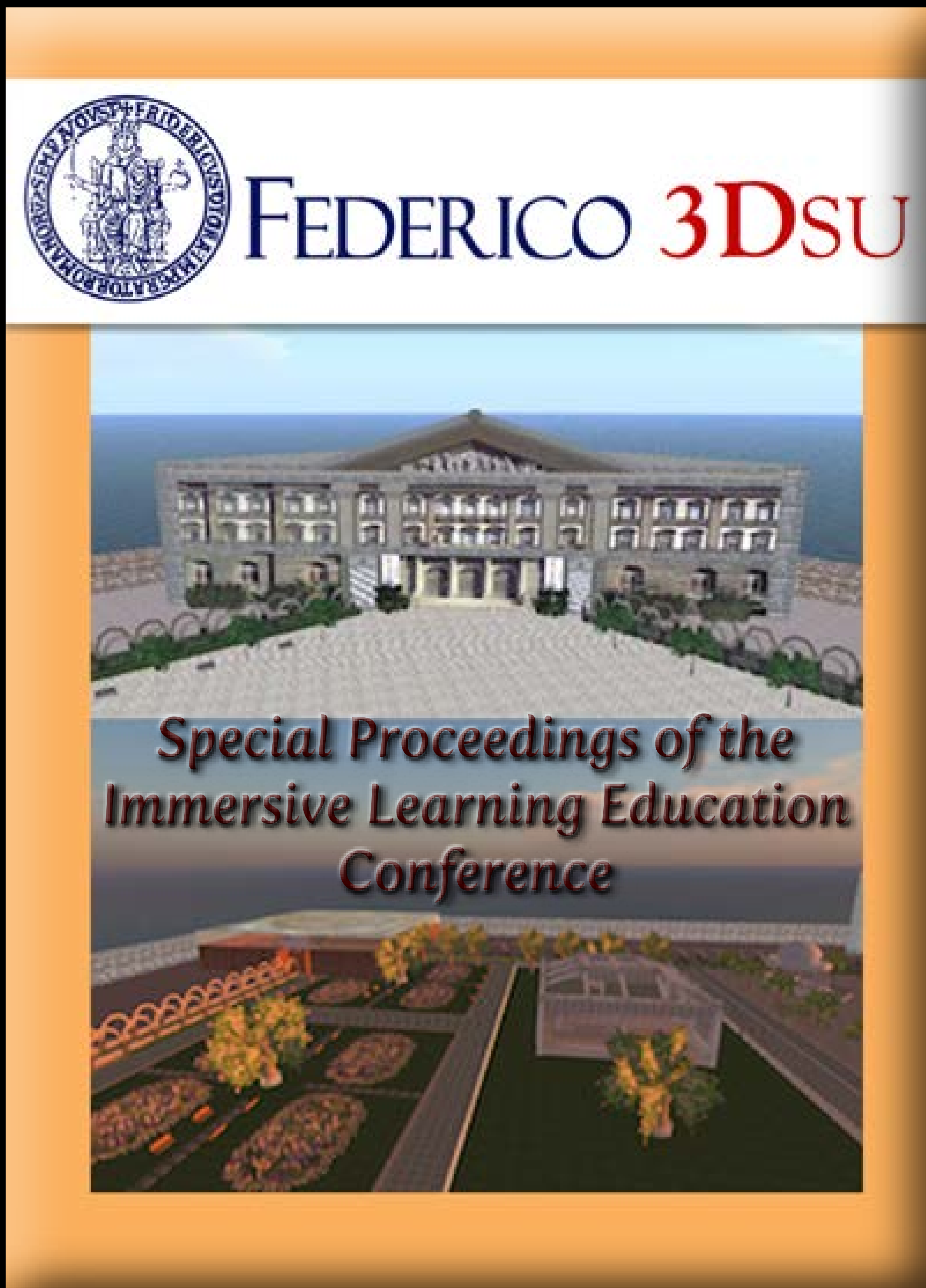

RUCC 2018 The Future Present

The Annual Rockcliffe University Consortium Conference (RUCC) takes traditional conferencing methods and converts them into experiential ones. Attendees can expect a dynamic mixture of sessions, excursions, and critical discussion, all around the topic of innovative technology and its application to education, and how the two can impact our students' preparedness for the digital world and a continually disrupted job market. RUCC participants attending the conference will expect to:

- Differentiate between new technologies in education and how they will impact their own students' future learning and career training, regardless of age;
- Discriminate between the different types of digital literacy skills necessary for students at all ages to become critical and creative thinkers that nurture future innovation; and
- Transform how knowledge is transferred to students so that they embrace rather than fear innovation, and which challenges both the instructor and the learner.

This is the Future Present.

Call for proposals is open until April 13, 2018.
Registration is open until August 31, 2018.

Rockcliffe professional members will get free access to a special hands on pre-conference program.

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JoVS Editorial Information

About the Journal
The Journal of Virtual Studies is peer reviewed and open access. It is sponsored by the Rockcliffe University Consortium, and its main aim is to feature work that examine knowledge emergence in virtual spaces, whether they be web 2.0 or 3D applications. We encourage teachers, academics, practitioners, and others engaged in the use of any virtual space for education, research, or training, to submit proposals to the journal.

Focus and Scope
The mission of the Journal of Virtual Studies is to publish theoretical and practical concepts for the application of knowledge within virtual spaces. All methods, including, but not limited to, qualitative, quantitative, field testing, laboratory, meta-analytics, grounded theory, and combinations thereof are welcome. JoVS is interdisciplinary and international in scope. Preference is given to submissions that test, extend, or build either theoretical or practical frameworks dealing with knowledge emergence and virtual sciences outside traditional practice.

Sections

- Perspectives
- Applied Research
- Practical Application
- Cultural Narratives
- In Review

Subscription
JoVS is free and open access. In order to receive publication notices, please register at the website: http://ejournal.urockcliffe.com/index.php/jovs/index.

Author Guidelines
JoVS accepts submissions year round, with publication occurring at the next publication edition for those who get accepted after a blind peer review process.

The submission process is fully online, so that authors must first register in the website.

Papers should be written in APA style, following all formatting as indicated by this style manual. Currently, there are no page limitations to submissions, as long as they fit one of our sections, are well-written, and have full APA style and citation usage.

Submissions should include an abstract (150-200 words) and a separate title page with author(s) information and affiliation.

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Editor's Edifice

Change is that which cannot be stopped.

This special issue of the proceedings for the University Immersive Learning conference endeavors to highlight the works of Italian educators and researchers, who have embraced the changing landscape of education.

Federico 3DSU is the 3D university virtual environment for the University of Naples Federico II, and they organized this conference to highlight varied works in immersive education. Rocklcliffe University Consortium proudly publishes the proceedings in this special edition of the *Journal of Virtual Studies*.

Immersion in three dimensions is experiential and meaningful, utilizing a user-created virtual environment. The work featured in these proceedings utilizes Second Life and OpenSimulator virtual worlds.

Projects featured here explore learning, identity, immersion, and culture. The settings include virtual schools and museums, and they both leverage the creative potential that sparks innovation.

This special issue includes the conference program, in Italian, as well as papers and abstracts from many of the presenters of the event.

The possibilities expressed in these works only show that we've barely begun to tap the potential of learning. Perhaps they will serve as a catalyst for others to go into the exciting unknown to explore what more can be accomplished when we break down the walls of a traditional setting.

Dr. Leticia De Leon
JoVS Managing Editor

University Immersive Education
Napoli 24 Ottobre 2017

9.00 Saluti Arturo De Vivo w Prorettore Università di Napoli Federico II

9.30 Università & Scienze Umane Digitali
AULA MAGNA PARTENOPE
Coordina Fabrizio Lomonaco w Università di Napoli Federico II
Presenta
Rossana Valenti w Dizionario multimediale di Retorica e Mappa letteraria della Campania
Bianca De Divitiis Antonio Milone w HistAntArtSI (ERC n°263549)
Maria Chiara Scappaticcio w Per i testi latini

9.30 Università & Tecnologie Digitali
AULA A PARTENOPE
Coordina Alessandro Ciasullo w Università di Napoli Federico II
Presenta
Fabio De Paolis w IOS Developer Academy Pietro Nunziante w IOS Developer Academy Gruppi w IOS Developer Academy

su papiro: PLATINUM (ERC-StG 2014 n°636983)
Antonella Ambrosio w CO:OP Community
as Opportunity (Creative EU 2014-2020) e Monasterium
Isabella Valente w Tolkart e GoToArt Gianluca Del Mastro w Chartes e THV INSERIRE

11.00 Coffee Break
11.30 Università & Didattica Digitale
Coordina
Annalisa Boniello w Dir. Scol. (RM) Università di Camerino
Presenta
Simonetta Anelli (CR) w Monica Boccoli (CR) w Annamaria Madaio (SA) w Maria Messere (BA) w Michela Occhioni (LE)
14.00 Saluti

Gaetano Manfredi w Rettore Università di Napoli Federico II
Edoardo Massimilla w Direttore DSU Università di Napoli Federico II
14.30 Introduzione ai lavori
Flavia Santoianni w Federico 3DSU Università di Napoli Federico II
Simon Pietro Romano w IOS Developer Academy Università di Napoli Federico II

Responsabile scientifico Flavia Santoianni Coordinatore scientifico Alessandro Ciasullo Segreteria organizzativa Elisabetta Griffo

15.30 Università & Innovazione Didattica Coordina Maurizio Sibilio w Università di Salerno Presenta Pier Cesare Rivoltella w Università Cattolica di Milano Kevin Feenan w Rockcliffe University CA – USA Renata Viganò w Università Cattolica di Milano

Pier Giuseppe Rossi w Università di Macerata
Pier Paolo Limone w Università di Foggia
Fabrizio Lomonaco w Università di Napoli Federico II

15.30 Università & Ambienti Educativi Coordina Rosario Diana w CNR ISPF di Napoli Presenta
Achille Notti w Università di Salerno
Corrado Petrucco Daniele Agostini w Università di Padova
Laura Fedeli w Università di Macerata
17.00 Coffee Break
Andrea Benassi w INDIRE Firenze
Annalisa Boniello w Università di Camerino
Alessandro Ciasullo w Università di Napoli Federico II

18.30 Chiusura dei lavori

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Andrea Benassi Researcher of New Technologies for Didactics and Virtual Worlds – INDIRE

Applied Research

FEDERICO 3DSU. ADAPTIVE EDUCATIONAL CRITERIA FOR A MULTI-USER VIRTUAL LEARNING ENVIRONMENT

Flavia Santoianni
Alessandro Ciasullo
Fabio De Paolis
Pietro Nunziante
Simon Pietro Romano

In different kinds of adaptive systems, adaptation effects could be different. Brusilovsky, 2003

No single instructional strategy is best for all students. Magoulas, Papanikolaou, Grigoriadou, 2003

ABSTRACT

This paper introduces one of the first Italian prototypes of a 3D University Multi-User Virtual Learning Environment, Federico 3DSU, which simulates the Department of Humanities of the University of Naples Federico II, its Digital Humanities research areas, and the highly developing digital world of the Apple Developer Academy of the Athenaeum. Its instructional design is an entanglement of situated, socio-constructivist, and adaptive approaches to learning. The interest towards the intertwining of learning and adaptation processes is at first discussed in the more general area of learning environments design and then it is deepened in the Adaptive Learning Environments Model, as revised by Bio Educational Sciences approach. According to these issues, Federico 3DSU adaptive design criteria are analyzed from multiple perspectives and its architecture is outlined, with a particular focus on reproducing the Apple Developer Academy, a partnership between the University of Napoli Federico II and Apple, as an innovative virtual environment for learning.

Federico 3DSU is a MUVE (Multi-User Virtual Environment) for Education designed to implement Digital Humanities research and to introduce University and School teachers and students into the digital world of the Department of Humanities of the University of Naples Federico II and into the highly developing digital world of the Apple Developer Academy of the Athenaeum, a partnership between the University of Napoli Federico II and Apple. Federico 3DSU is indeed one of the first Italian prototypes of a 3D University VLE (Virtual Learning Environment), which has been realized on an Opensim platform through Singularity viewer.

3D Virtual Learning Environments are frontier educational methodologies, which can be characterized by a situated (Tyre, von Hippel, 1997), socio-constructivist (Wiley, 2003; Duffy, Kirkley, 2004; Santoianni, 2008) and adaptive (Wang, 1984; Santoianni, 2007, 2010a) approach to learning. Key aspects of novelty of Virtual Learning Environments – compared to other non-spatial but still effective educational methodologies – may be mainly seen in their potential to enhance motivation to learn through their simulated game-like experience

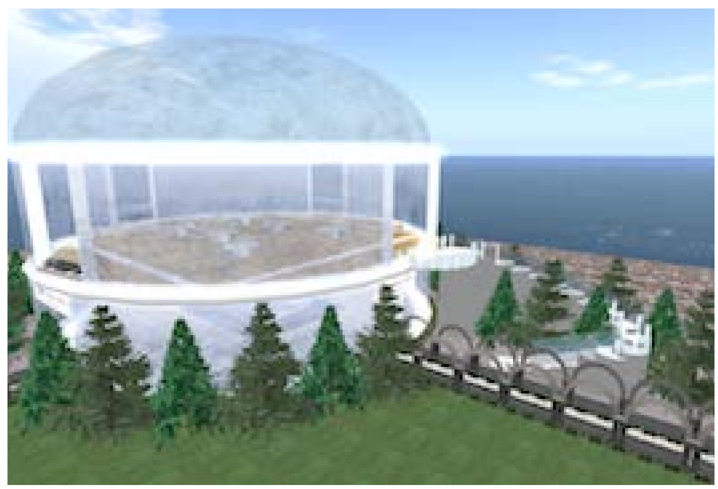
and in their intrinsic support to a growing sense of empowerment, control and interactivity perceived by users (Nonis, 2005).

Moreover, in 3D Virtual Learning Environments students learn in situated contexts, which allow them to have experiences unavailable within the classroom (Yair, Mintz, Litvak, 2001) through simulated what-if scenarios. 3D VLEs support visual learners, whose spatial skills are otherwise usually neglected by traditional educational models (Santoianni, 2010b, 2016). The new worthwhile challenge (Newcombe, Frick, 2010) of spatial education is today considered an educational frontier (Montello, Grossner, Janelle, 2014). The actual multidisciplinary spatial turn (Warf, Arias, 2008) sustains indeed the more and more high spatial performances (Bodenhamer, Corrigan, Harris, 2010) requested by technology and digital education.

3D Virtual Learning Environments may indeed require – and, on the other hand, 3D VLEs may develop,

according to each environment demand – users' spatial skills as spatial visualization and perception in relation to user's body, and mental rotation of shapes (Toptaş, Çelik, Karaca, 2012). Visual presentations may also enhance abstract concepts learning (Sedivy, 2015) and concepts comprehension, reasoning, and organization (Santoianni, 2014, 2016).

The possible link between spatial education and 3D Virtual Learning Environments design should be interpreted through pedagogically oriented criteria, just because pedagogy is never to be considered neutral towards technology (Frauenfelder, Santoianni, 2006) – even if technological resources are often seen as neutral in their aims (Lewin, Lundie, 2016). Such pedagogical criteria may be oriented by cognitive flexibility as a soft skill highly involved in new technologies development – i.e. the open-mindedness needed to accept technological



continuous and increasing change, which allows users to cope with unfamiliar situations (Barak, Levenberg, 2016).

Cognitive flexibility is a key-learning competency that regulates users' adaptability to learning environments and lets them become ready to change in learning situations. The issue of intertwining learning and adaptability is a significant challenge in both educational and technological fields, and may support ground implications for 3D Virtual Learning Environments design.

Anyway, the interest towards the entanglement of learning and adaptation processes has invested the educational/technological research also as concerns the more general area of learning environments design. To be considered adaptive, a learning environment should indeed be developed according to specific criteria – as to monitor users' activities according to domain-specific models, to infer users' preferences, and consequentially to facilitate learning.

As an example, Adaptive Interaction may support users' relation to the system without modifying any learning content, while Adaptive Course Delivery may tailor a course to learner (Brusilovsky, 2001). The adaptive techniques of Content Discovery and Assembly lie in the assembly and discovery of learning content from distributed repositories through adaptation-oriented models, and Adaptive Collaboration Support encourages adaptive learning by social interaction, communication, and collaboration (Paramythis, Loidl-Reisinger, 2004).

Adaptive educational interfaces research is mainly based on intelligent tutoring systems and adaptive educational hypermedia, whose core concept is the idea that a software may be adaptively customized to users to be more effective and user-friendly. Intelligent tutoring systems focus more on customized problem solving support, while adaptive educational hypermedia are more related to facilitate learners through educational materials (Wolf, 2002).

Adaptive hypermedia systems may be considered alternative to "one-size-fits-all" hypermedia (Brusilovsky, 2004), and are closely related to individual user models. Individual differences, student needs, and learning preferences are indeed at the core of adaptation in hypermedia systems.

Adaptive web systems allow users to rely on adaptive content selection through a search-based access to information, in which the system prioritizes the most relevant items according to user's interests; on adaptive navigation support, through a browsing-based access to information, in which the system guides the user to the most relevant items, hence increasing the speed of navigation; and adaptive presentation, through a web page presentation of user related information to improve content understanding. Mobile adaptive hypermedia increase then their usability through adaptation technologies related to users' contexts (Brusilovsky, 2003).

Adaptive web-based learning systems may combine tutor-centered style of traditional intelligent tutoring systems with the more flexible student-centered approach of hypermedia systems, in which adaptation implies modifying the educational context to accommodate individual differences.

In adaptive systems design, the locus of control can lie with the system or with the learner – in adaptable or customizable systems (Wolf, 2002). A key point is then the balancement between *adaptivity* – that is when a system adapts itself managing learners' data in a system controlled way – and *adaptability* – that is when a system supports end-user modifiability, so providing adaptive control to learners (Magoulas, Papanikolaou, Grigoriadou, 2003). The last adaptive modality refers to the so called *structural coupling* (Riegler 2002), a relationship in which the individual, and not only the environment, can set her/his own conditions and request context to modify itself.

Adaptive learning environments have been influenced by many different regulating models (Paramythis, Loidl-Reisinger, 2004). In the domain model, a representation of adaptive courses, which outlines the possible relationships between courses parts, is organized. In the learner model, users' models are tailored for the learning domain. Individual user models are always interdependent with user's interaction/learning history, a key node for any educational design (Santoianni, 2000, 2006). Individual users model is intertwined with group model, which identifies similar groups of learners. More in general, the adaptation model defines – also implicitly – what can be adapted, and when and how it is to be adapted.

The original Adaptive Learning Environments Model (ALEM) (Wang, 1984) was designed to innovate educational programs in order to facilitate learning for students of various cognitive, cultural, and socioeconomic backgrounds. At the core of this approach were the following adaptive ideas:

- learning is a dynamic process and learners evolve in different ways;
- education should be adaptive: changing, tailored, and specific;
- learners need at least basic academic skills, self-efficacy, and cognitive responsibility;

- education may use both actual teaching models, standards-based curriculum, and direct assessment system.

These ideas have been recently reformulated by bioeducational approach (Frauenfelder, Santoianni, Ciasullo, 2017; Santoianni, 2006), whose adaptive premises are:

- learning is a personal situated, embodied, and dynamic process;
- each learner has an evolving personal history of learning;
- learning evolution develops cognitive structural modularity;
- learning processes are both explicit and implicit;
- learning mind is an entanglement of cognitive, emotional, and perceptual dimensions;
- education is influenced by evolutionary compatibility processes between learners;
- education should be adaptive: changing, tailored, and customized;
- learners need at least core knowledge, basic skills, cognitive identity awareness, and related openness to change;
- education may use both experimental teaching models, core curriculum, and evolutionary idiosyncratic assessment;
- education copes with educability criteria and boundaries.

The main design concept of 3D Virtual Learning Environment Federico 3DSU is rooted on the previous bioeducational adaptive premises in order to structure it as an Adaptive Learning Environment. Adaptive Learning Environments are indeed learner centered, and evolve according to learners' development, dynamically modifying and continuously regulating their educational offer (Howard, Remenyi, San Juan, 2006).

According to these hypotheses, 3D Virtual Learning Environment Federico 3DSU roots its adaptive design on personalized learning, and users are free to explore the various educational opportunities offered by the environment. However, environment's design – even if it allows autonomous learning experience – is regulated by recurring logical organizers used as implicit constraints in order to guide users while living a 3D experience. These logical organizers are related to the Elementary Logic Theory (Santoianni, 2011, 2014b), whose instructional design foresees three classes of spatial organization of concepts – union, separation, and correlation – each in turn in subdivided

in two sub-classes: integration and sequentiality (union), individuation and comparison (separation), inference and correlation (correlation). The both free and constrained structure of 3D Virtual Learning Environment Federico 3DSU enhances cognitive

flexibility (Barak, Levenberg, 2016) through personal patterns of interaction among the multiple possibilities of relations between concepts.

Moreover, as an Adaptive Learning Environment, 3D Virtual Learning Environment Federico 3DSU conveys just core knowledge and basic academic skills, while it sustains users' self-efficacy through a discovery learning process regulated by users' personal experiences, catching information from past, present, and future of humanities just walking in the Athenaeum pathways. Then, 3D Virtual Learning Environment Federico 3DSU respects a multimodal view of learning – a key concept in education (Santoianni, 2010b; Ciasullo, 2016) – through audiovisual and kinaesthetic experiences regulating the learning approaches (Leite, Svinicki, Shi, 2010). Lastly, 3D Virtual Learning Environment Federico 3DSU is designed to be modified and customized by users through the chance of moving 3D objects to modify the learning environment in a structural coupling way (Riegler 2002).

3D Virtual Learning Environment Federico 3DSU involves learning cognitive, emotional, and perceptual dimensions giving the illusion of immersion, which – with interaction and user involvement – characterizes any virtual reality. Even if it can be accessed from a simple workstation, it may be considered immersive, because it may give the sense to be surrounded by the presence of objects (Nonis, 2005) and it leads lack of awareness of time and a gap with the real world (Jennett, Cox, Cairns, Dhoparee, Epps, Tijs, Walton, 2008).

To complete, as an Italian prototype of a 3D Virtual Learning Environment, Federico 3DSU simulates−being a case study of the new frontier of Digital Humanities – the University of Naples Federico II Department of Humanities courtyard and its four corners (A, B, C, D). Its instructional design is consequentially structured in four main areas: the *Welcome Area*, to give students information about University Federico II enrollment and structural resources, the *Teaching and Learning Area*, to allow teachers gain educational competencies and to let students explore cognitive functioning, the *Digital Humanities Area*, that is an archive of Digital Humanities resources, and the *Campus Area*, where students may find all available open access digital resources.

Recently, Federico 3DSU has been enriched with a further area representing the Apple Developer Academy, a partnership between the University of Napoli Federico II and Apple. The objective of such an integration was indeed twofold, since the Academy does represent an unprecedented example of an effort to experiment with innovative pedagogical models by also leveraging disruptive space design techniques.

Training at the Academy is aimed at developing apps for the world's most innovative and vibrant app ecosystem. The program focuses on software development, startup creation and app design with an emphasis on creativity and collaboration, with the aim to help students develop the skills needed to succeed in their professional (and social) lives. The Academy attracts students from all over the world and with a wide range of backgrounds. Training is designed to support not only those with coding or computer science experience, but also young people interested in areas such as design and business. Academy classes are all based on a novel technique known as Challenge Based Learning (CBL), a multidisciplinary approach to teaching and learning that encourages students to leverage the technology they use in their daily lives to solve real-world problems (Nichols, Cator, Torres, 2016). CBL is collaborative and hands-on, asking students to work with other students, their teachers, and experts in their communities and around the world to develop deeper knowledge of the subjects they are studying, accept and solve challenges, take action, share their experience, and enter into a global discussion about important issues.

Besides providing all students with so-called "soft skills" (emotional intelligence, adaptability, ability to collaborate and negotiate, situational awareness, ability to communicate, etc.), the Academy leverages CBL to teach topics falling in the coding, design and business fields.

In order to achieve the above-mentioned objectives, the Academy is physically designed as a single, integrated collaborative space, filled in with round tables for allowing students to work in groups, as well as huge monitors for projecting keynotes and video clips, displaying one's own laptop monitor while coding, sketching Graphical User Interfaces (GUIs) and taking notes directly on the protecting glass screens. Collaboration is the key concept at the Academy. There are no frontal lessons, no ordinary ways of structuring classes. Spaces are student-centric: every single corner of the Academy premises has been carefully thought as a potential facilitator of students' interaction and creativity. The role of the "teacher", in such spaces, is completely overturned. The Academy works at a fast pace and requires everyone to be highly self-motivated. The teaching team is comprised of individuals from diverse backgrounds with industry experience, and/or academic experience, who need to be critical and flexible thinkers. They work in team to create new, fully integrated, cross-curricular learning experiences for the students and must be prepared about exploring new teaching styles and pedagogy. They are expected to learn alongside their students, as well as to work with an extended team to build a strong collection of the best teaching practices and material.

Federico 3DSU has succeeded in reproducing the Academy look and feel in the form of an innovative virtual environment for learning.

Designing Virtual Environments for Learning is indeed a specific field of design applied to pedagogy. Learning space and learning are always interrelated phenomena whose interactions depend on the outcome of educational and pedagogical projects. Students involved in building virtual learning-oriented virtual spaces are involved in defining visual assets, design concepts, and virtual learning spaces for learning.

The basic instrumentation to operate in a three-dimensional space implies the activation of a sensitivity capable of spelling in spelling space, in the juxtaposition of preformed elements useful in defining the functions of the living space and in understanding a universal coordinate system. Another aspect no less important is the ability to build paths and options with the support of guidance systems in order to construct conceptual and temporal maps of the discovery and learning pathway. Spatiality and pathway have always been the two main factors of any orientation process for a student who does not just want to stop at the informational placement of the knowledge blocks he or she has.

Three-dimensional modeling techniques, Virtual Reality simulation and Augmented Reality represent an integrated system for arriving at a novel concept of habitable space, where digital introduces a new dimension matching virtual and physical media, hence allowing for the realization of virtual environments that look more and more accessible and manipulable.

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VIRTUAL WORLDS IN EDUCATION: OPEN RESEARCH TRAJECTORIES

Laura Fedeli

ABSTRACT

The article describes open research trajectories tied to the author's main lines of research focused on the virtual world Second Life. The lines are all framed around the concept of embodiment, but are structured in three different paths since they had different objectives: the disclosure of embodiment, the empathetic dimension of virtual interactions and, finally the implications of embodiment on a methodological point of view when running a research in virtual worlds.

Introduction

Even though Virtual Worlds are not a recent technology (the first 3D Virtual Worlds, *Ultima Online* and *EverQuest,* were created in 1997 and 1999), it is in the the last decade that Multi-User Virtual Environments (MUVE like *Second Life*), Massive(ly) Multiplayer Online Role-Playing Game (MMORPG like *World of Warcraft*), and other kind of 3D socially-oriented environments (open access or proprietary), have reached their focus as object of interest in the educational context.

The present contribution will deal with the description of the research lines that University of XXX (Italy) has been developing in the last eight years in the field of virtual worlds when used for educational and research purposes.

Specifically three trajectories were drawn and developed by the author within the department of Education, Cultural Heritage and Tourism:

- The concept of embodiment;
- The emphatetic phenomena;
- The research methodology implications.

What does *embodiment* mean in virtual worlds?

Virtual worlds are often labelled as "immersive" environments where users feel a strong engagement in the practice of their activities. The investigation run by the author in the last years (AUTHOR, 2009, 2013, 2014, 2016, 2017) aimed at framing in a precise theroretical approach the statements about sense of presence and immersion reported in the wide international literature when addressing advantages and potentialities of virtual worlds in education.

Presence and immersion are connected to the concept of "body" and this aspect was, thus, identified as the focus of the research in the following intertwined aspects connected to the embodiment of the avatar and its life in the virtual environment: identity, action/perception, and social interaction.

Cognitive sciences (Gallese & Lakoff 2005; Merleau-

Ponty, 2009/1945; Varela, 1990) assigned to the "body" values for knowledge and comprehension that have an impact on Pedagogy and the methodological approaches developed in the didactical practice.

Qualitative studies developed within a phenomenological approach and an exploratory case-study approach aimed at collecting data about evidence of embodiment in Second Life as perceived by different samples of teachers and educators who were used to develop didactical activities in the above mentioned virtual world (AUTHOR, 2009, 2013, 2016; AUTHOR, 2011).

As a result of the studies it can be stated that the user avatar's body affects at different levels the perception of presence, immersion and interaction in the virtual world and becomes one of the main affordances of Second Life. A 3D personalized avatar acquires for the user, the connotations and functions of a physical "body" being the way in which not only he/she can identify himself/herself and gain reputation in the community, but the avatar can also rely on sensory motor and kinaesthetic skills which enable the user to develop a life cycle and social interactions.

The qualitative data gathered in-world with different techniques (interviews, focus groups) within the framework of the embodiment supported the hypothesis that the actions experienced in the virtual world are to be intended as a social construction always reflecting the educational context in which they occur (formal, informal) and the affordances of the specific environment (e.g. building and scripting features in Second Life).

The research line on embodiment is open to new direction if we consider that the identity issue can have a different impact in different virtual worlds and with different target users (age can be a discriminating factor). As an example we can refer to the open sims created for specific purposes (e.g. to support face-to-face classes) and with a niche of population in terms of number of avatars and kind (e.g. Primary School students). In those cases identity and reputation built by the avatar may have different roles and relevance.

Does empathy occur in Virtual Worlds?

The embodiment in social virtual worlds offers the chance of a rich interaction among avatars by allowing the expression of the user's feelings through postures, gestures and facial expressions. Communication is not just written or oral text, is embodied.

The rich augmented communication is an affordance of the environment that covers the gap traditionally attached to distance learning, that is, the lack of empathy among participants. Addressing the concept of empathy means crossing its evolution both at semantic level since the word convey different meanings, both at disciplinary level since the concept is present in several theoretical paradigms (e.g. Psychology, Philosophy, Neurophysiology).

The connection between empathy and Education has been object of relevant interest and research studies since the nature itself of education is empathetic (Bellingreri, 2013), but the development of an empathetic dimension in the virtual interaction is still an open fertile field of investigation.

Recent studies in the field of virtual/augmented reality or in the field of artificial intelligence aimed at investigating the nature of empathetic occurrences and neural reactions when the human subject is involved in virtual reality scenarios (Fusaro, Tieri, & Aglioti, 2016); another emerging field is the one that is focussed on the prototyping of empathetic artificial agents as coaches during the learning process (van der Zwaan, Dignum, & Jonker, 2014).

In the context of virtual worlds the author conducted a research (2014) within a Master course in *instructional technology* run online through a Learning Management System (LMS) and with the support of Second Life to develop one single module. The data collected through students' narratives and reflection papers published in the LMS and the participant observation technique during the activities run in Second Life (mainly field trips) and in-world focus groups highlighted the presence of empathetic behaviours.

Specifically the embodiment and the graphical/functional characteristics of the environment's interface like the POV tool (Point of View) fostered the change of viewpoint and this affordance was reported as a positive feature to support team building and mutual comprehension. POV was, in fact, used to change the visual of the avatar for the management of the space and the interaction (position/distance of the avatars from each other). The "empathetic embodiment" (as referred to by Gee, 2003) was detected by a linguistic analysis by identifying the presence of indicators such as personal and spatial deixis that characterized the verbal interaction during the virtual experience and that are meant as empathetic traits (Lyons,1977).

Additional research paths could be directed in the study of how and if the use of virtual worlds interactions can affect the students' empathetic attitude in face-to-face teaching/learning process. In a perspective of blended solutions (face-to-face + online) in education, the use of social virtual environments characterized by the embodiment of the users could represent an interesting field of research in terms of dimensions of empathy (type, level, space, time).

What are the implications of developing a research in/about virtual worlds?

The international literature shows a rich range of studies dealing with projects and experimentations affecting all school grades (from pre-school to graduate and post-graduate courses) with a variety of aims, from the professional development (e.g. teacher training) to the testing of new strategies to approach disciplines across different school-based curricula (Gregory, *et al*., 2016).

There exists a variety of investigations on virtual worlds designed using quantitative methods, such as social network analysis (Stafford *et al.,* 2012), and qualitative methods like the ethnographic (Boellstorff, 2008; Nardi, 2009; Pearce, 2009) and phenomenological approach (AUTHOR, 2013; 2016) along with the use of case studies (AUTHOR, 2011; Nettleton, & Lennex, 2013).

This paragraph will delve *into the qualitative research* applied to Virtual Worlds starting from the inputs offered by recent published studies (Boellstorff, 2008; AUTHOR, 2013; Nardi, 2009; Pearce, 2009) with the aim of unravelling and briefly discuss methodological implications related to the specificity of the environments as a technological infrastructure and as a social/cultural context. Aspects related to ethical aspects tied to the avatars' identity, procedures for gathering data and the potential barriers encountered by researcher to approach the sample and collect the data need to be addressed when using virtual worlds.

Social virtual worlds, that is, environments that rely on community-based culture (and sub-culture), require the researchers, who is going to perform his/her study activity, to access the "world" as an experienced user (AUTHOR, 2014) who is fully aware of:

- The affordances of the specific world (in terms of graphical/functional features)
- The avatar life-cycle in the specific world (the range of available personalization and communication action);
- The "rules" of the group/community object of the study.

All those characteristics make the world meaningful for its residents and, for this reasons, the researcher needs to expose him/herself as a reliable subject interacting in a lived cultural/social context. Just in this case he/she will be able to: 1) identify gatekeeper who will support him/her in the selection of the sample; 2) obtain an informed consent by the sample; 3) interact with the participants in the sample during their daily/regular activity in the virtual world (educational activities or professional ones); 4) collect data in forms of observations, interviews and/or focus-groups, 5) select the most appropriate tools to record data.

The methodological aspects just highlighted are all connected with identity and "reliability" of both the researcher and the sample in the virtual world. Reliability means that each actor (the ones who perform the study and the ones who are involved as participants in the study) is expected to play his/her role with a commitment that can follow protocols which can be different from the ones adopted in the face-to-face interactions, but which definitely need to respect the ethical procedures (e.g the anonymity of participants) (Boellstorff , *et al*. 2012)

The future lines of research analysis can examine the literature to identify in what ways qualitative studies have been addressing methodological issues in virtual worlds and if a multi-situated ethnography, as a research approach, can help overcoming, for example, difficulties related to ethical issues.

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TECHLAND: EVOLUTION OF A VIRTUAL WORLD

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ABSTRACT

Techland is an OpenSim based virtual world. It is a group of educational and service islands focused on math and science for middle school students, K6 – K8 degree. It has been owned and managed by the author since 2010 with the aim to engage students and to make learning easier. Students can log their personal avatar, hang out, meet other avatars of the school, collaborate in mathematical and scientific projects, build and code together. The teacher acts as a supervisor and facilitator as well, helping students to express their creativity and knowledge through the "learning by doing" methodology. This work is describing the evolution of Techland from a simple classroom teaching support to collaborative platform for scientific projects, and is showing how, year-by-year, students improve their building and coding skills, moving from the role of simple users to content and objects creators.

Keywords: *Collaborative Learning, Constructivism, Coding, Machinima, Mathland, OpenSim, Techland, Virtual Worlds, Virtualscience, Learning Objects, 3D modeling.*

Introduction

In this paper the author is describing how Techland, an Opensim based virtual world, has been used for educational purposes since 2010. In those years the "Ministero della Pubblica Istruzione", the Governative Italian Educational Department was involved in a general innovation of the educational methodologies based on new digital technologies.

The challenge was to fill the gap between the school and the digital native languages (Prensky, 2001), by finding alternative ways to the frontal lesson.

Teachers were strongly encouraged to try out new teaching approaches, by using the same technology loved by young students and by making them learn the proposed contents in a more effective way.

In 2007, Second Life reached its highest fame so, researchers became more and more interested in exploring the potential of virtual worlds for teaching purposes (Littleton & Bayne, 2008). As years passed by, it was clear that Second life was not expressly designed for education, especially for underage students; but, meanwhile, a new open source multi-platform, multi-user 3D application server, OpenSimulator, (opensimulator.org) was developed

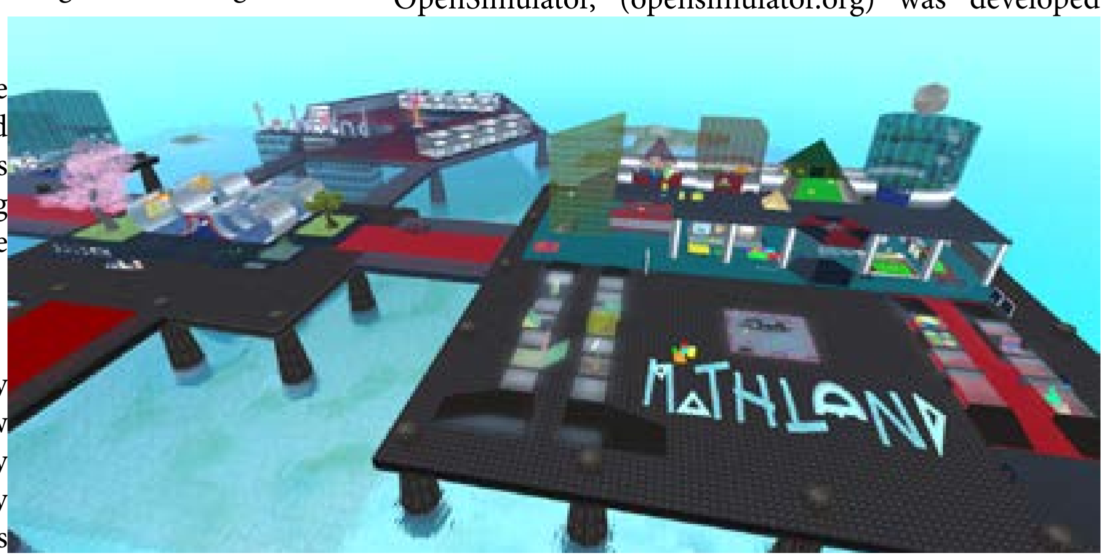

Fig. 1. *Techland: Platform system (Welcome area and Mathland island)*

when Linden Labs, the creators of Second Life, decided to release the code, in order to allow an open construction of virtual worlds. Differently from Second life, it had additional advantages:

- -It could be hosted on a personal server or PC;
- -Different OpenSim worlds can be connected by the Hypergrid protocol, that lets avatars move from a world to another; -Our own islands and student permissions are easier to be administrated;
- -It has a very low cost, compared to Second life.

So, it was the right time for the author to bring immersive education in her daily teacher's job, by applying the skills acquired in Second life.

Background

The pedagogy used at Techland is based on constructivist learning theories having its roots in J. Piaget (Piaget, 1936) and, later, in the socio-constructivism of L. Vygotsy (Vygotsy, 1978).

Dickey (2005) illustrated how 3D virtual worlds can provide "experiential" and "situated" learning. Clark and Maher (2005) emphasized how virtual environments encourages "collaboration and constructivism".

Based on the reviews of publications spanning 20 years, Dalgarno and Lee (2010), identified the main characteristics of virtual learning environments that can facilitate learning, in addition to situated and experiential learning (spatial knowledge, increase motivation and collaboration).

According to the definition of Wilson (1996), an OpenSim virtual world can be considered a constructivist learning platforms. In this kind of VW people/avatars can build, interact and share space, tools, ideas and resource.

Techland configuration

Techland is an Opensim-based virtual world. It consists of a group of educational and service islands dedicated to math, chemistry, biology and earth science, suitable for K6-K8 students. It is hosted on a Linux server (Intel(R) Xeon(R) CPU E3-1225 V2 @ 3.20GHz, 4 cores - 2 TB local disk space, 32 GB real memory), owned and totally managed by the author (aka Michelle Techland) (Fig. 1.) . Techland is configured as a Hypergrid Grid. It means that avatars coming from similar OpenSim-based virtual worlds can "teleport" to Techland using the hypergrid protocol. The URL address of Techland is http://techlandgrid.it:8002.

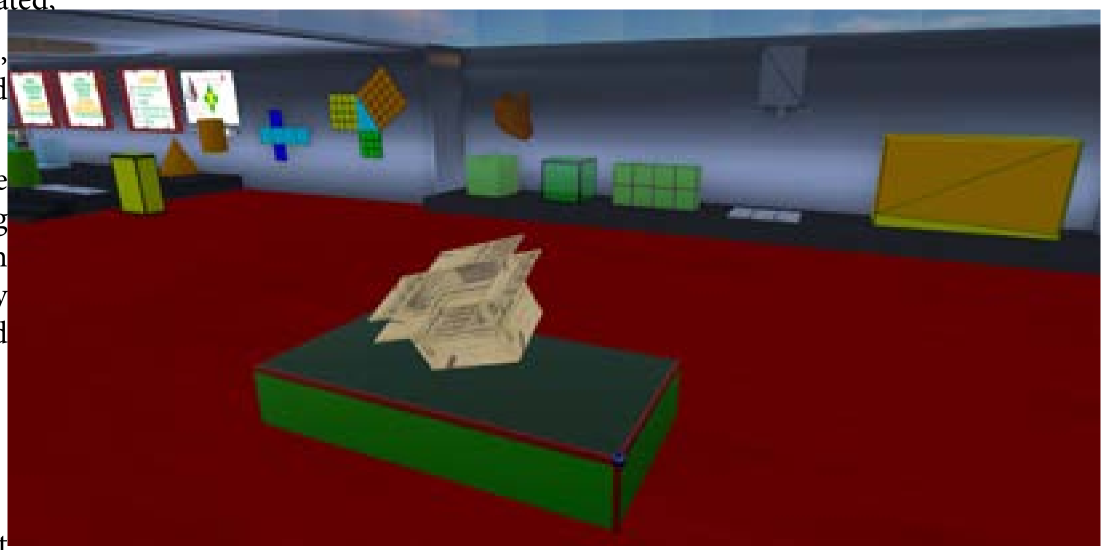

Fig. 2. *3D learning objects*

Avatars can log in Techland using a viewer, an user graphical interface (e.g. Singularity, Firestorm).

Interacting with 3D learning objects

To simplify mathematical and scientific concepts, Techland was initially developed as a giant 3D book, where scripted learning objects act as paragraphs, displaying mathematical and scientific properties and giving information (Fig. 2.).

Learning objects have been set up by the author combining building and coding techniques and they are placed along structured learning pathways in thematic areas (Occhioni, 2013).

During the author's daily activity, virtual world is showed by an interactive whiteboard and the teacher's avatar is a kind of assistant. When clicked, objects change their appearance and position, animating themselves and giving information.

This interaction help students to visualize mathematical and scientific properties in a dynamic way and in real time, as a 3D vision gives a correct perception of space and geometric transformations (Kaufmann, 2011). So, 3D objects are something like metaphors of abstract concepts.

This 'modus operandi' is typical in islands (e.g. Mathland, Statland and Chemland) centered on curricular topics like mathematics, statistical science and chemistry (Occhioni, 2015, 2016).

After a short training time, students/avatars are also free to explore the educational islands from home or from computer lab, developing spatial abilities, experimenting a "first person" or a "third person" view of the objects (Gu, Nakapan, Williams & Gul, 2009). 3D objects make tangible and immersive the representation of abstract concepts (Bell T.J, Fogler H.S,1995).

From users to producers

In the learning set described above, students were almost passive users, although with a relative degree of interactivity. The next step was making students develop an entire project in-world, by collaborating together. In this case the teacher had the role of facilitating and supporting learning. After a short training on building and terraforming techniques, students were encouraged to express their creativity and knowledge starting from scratching the setting of the construction of an entire island dedicated to a specific topic. The first island totally set up by students was Waterland (Fig. 3.).

Fig. 3. *Waterland. Behind Bioland and Eartland*

Starting from a grass expanse, students set up a project focused on water. The first step was to get information: a) brainstorming and research; b)statistical activities (consumption, resource, water footprint …); c) Scientific activities (chemical and physical properties of water); d) documentation activities (multimedia presentations). The second step was to translate information into 3D objects (tridimensional graphics, molecules, the water waste treatment and the phytoremediation plants, a house displaying domestic consumption of water). Notecards for additional information are often included into the objects. Some stuff used as background were imported from specialized websites. The third step, after the building activities, was the production of short movies about water by using the PC screen capture (machinima techniques). The actor/avatar was "forced" to play gestures, lips movements, facial expression by means of special animations. Movies and other multimedia presentations were collected in a website in Italian language: http://www.virtualscience.it/acqua/index.html

After Waterland project, students carried up other similar projects in a collaborative way.

In 2016, for example, K8 students were involved in the reconstruction of a plastic recycling plant as the final outcome of a project about plastic materials.

In this type of projects students generally divided the island into different zones, including:

- an Info Point where to collect all contents displayed in a special presenter;
- a sandbox where to build and improve objects to be after moved to their definitive place;
- exhibition areas hosting the results of the project;
- a movie set for the students machinima activities;
- a Meeting Area.

Generally, all projects steps were discussed and planned in the classroom or in the computer lab and then carried out at school or at home, sharing objects, ideas and horizontal communication.

Year-by-year students improved their building skills, really contributing to the development of the Techland islands (Occhioni, 2017).

Producing scripting objects

In Second Life and in Opensim-based virtual world it is possible to include scripts in 3D objects and to give them a particular behavior or appearance, by using the Linden Scripting Language (LSL), a text-based programming language. Scripts are made employing a special editor included in the viewer.

When the author and her students started scripting objects with the LSL program, it was clear that it was quite difficult for pupils. They had to pay attention to syntax errors, spending a lot of time to debug and often they were discouraged to go on coding.

In 2014 the "Ministero dell'Istruzione, dell'Università e della Ricerca", the Governative Italian Educational Department, started a three-year national project named "Programma il futuro" whose aim was to make students familiar with the key concept of computer science and with the computational thinking. Our school took part of that project since the beginning so, students became familiar with visual programming languages like Scratch, developed by M.I.T Boston and Bockly, a Google project.

Visual programs were more intuitive, and students easily combined functional/structural block to make scripts. They were more engaged; they avoided syntax errors and were able to run correct sequences of instructions as well. In order to combine coding and virtual worlds, we used the Flash Scratch to Linden Scripting Language (FS2LSL -http://inworks.ucdenver.edu/jkb/fs2lsl/), a visual graphical program developed by John K. Bennett from Colorado University, that translate the visual code into the textual LSL language.

Since then, students started producing 3D learning objects, becoming more and more creative, adding contents and behavior to their products. Coding helped students to think in a sequential manner, to decompose complex problems into simpler sub-problems, to be clear in giving instructions and to share jobs. The combination of coding and building activities has increased the students' engagement with mathematics. 3D objects can be divided in:

- Functional objects (animated objects displaying properties and concepts);
- Assessment objects (to test one's knowledge);
- Content Objects (multimedia presenters or video screen);
- Instructional Objects (saying how to proceed);
- Recalling Objects (linking to external resources).

In 2016 about 80 students from 4 different cohorts were involved in the "Mathland arithmetic" project for about 4 months, developing a new section focused on arithmetic under the supervision of the teacher (http://www.virtualscience.it/arithmetic/index.html) (Fig.4.).

They divided into three groups: Builders, Coders, Content Creators, working together to accomplish all tasks. Generally, the final product of a project is used with other cohort of student to be displayed on an interactive whiteboard or to be expanded in content and creations.

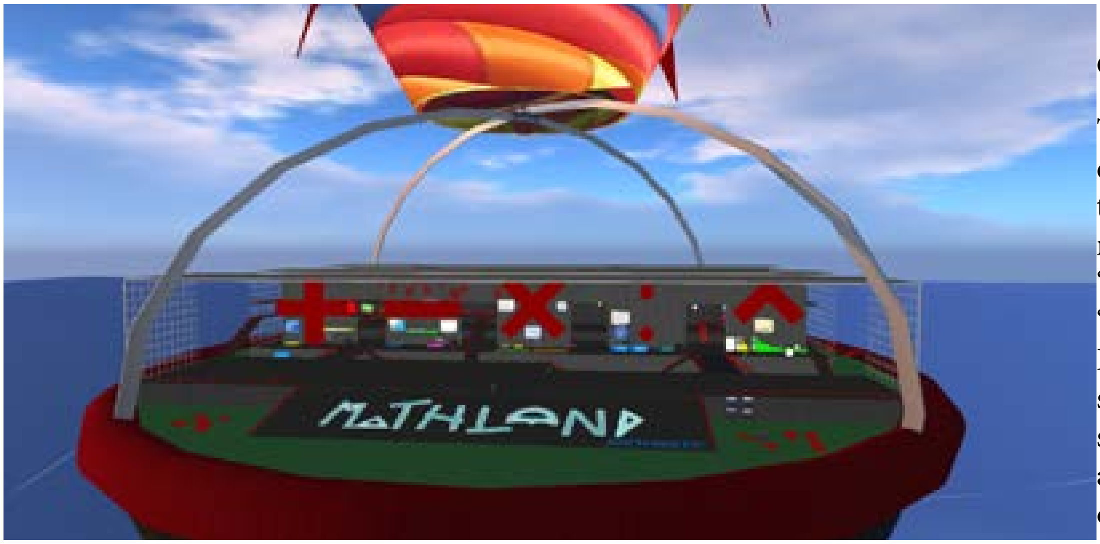

Fig. 4. *Mathland arithmetic*

Conclusions

Techland is a learning environment that allows the use of different teaching methods, in particular "learning by doing" and "cooperative learning". Besides, In Techland, students can use effectively skills learnt in other areas too. Indeed they can combine in-world modeling with desktop modeling, developing creativity and design skills (Thornburg,2014).

Modeling objects

The virtual worlds viewers have recently started supporting the COLLADA files (COLLAborative Design Activity), enabling users to create objects with desktop 3D modeling applications and import them in Second Life or OpenSim. In 2016-2017, a group of about 50 students of our school started an extracurricular project to learn the key concepts of 3D modeling and 3D printing, using a solid modeling CAD software (Autodesk 123D Design). As compared with mesh modeling CAD, such as Blender or Maya, it was easier and more intuitive to be used and very close to the in-world building. So, after sixteen hours of training, they were able to build their objects and then to import them in Techland (Fig. 5.).

That type of objects, commonly called 'mesh', is very detailed, realistic and improves the aesthetics of Techland. Students can also build objects in-world and then export them to be printed in 3D.

By now, 3D modeling is practically one of the most important or necessary 21st century skills. This is the reason why it is quite advantageous having experience of it since the very beginning of compulsory education.

One of Techland's strengths is that it is constantly evolving and expanding: new islands and new content are added from time to time, depending on the needs of the pupils and on the projects they are participating in.

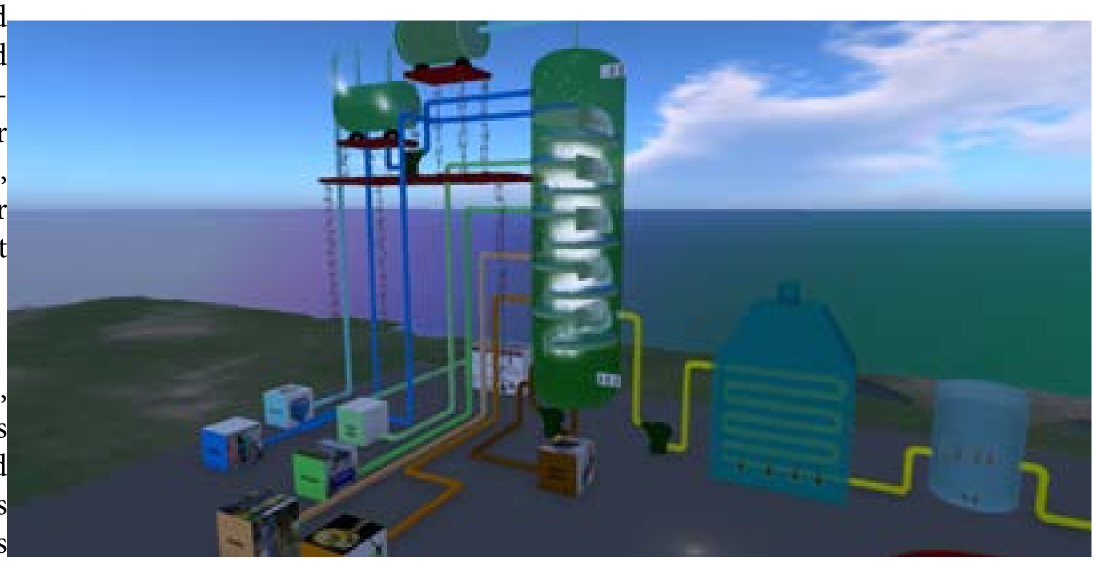

Fig. 5. *Mesh objects. Petroleum distillation plant, Powercity*

Year-by-year Techland has become a collaborative platform where teachers can approach to new methodologies and students are active protagonists of their own knowledge.

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MU.VI. A VIRTUAL REALITY EXPERIENCE TO MEET THE APULIAN HISTORICAL CHANGES

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Nicola Baglivi

Pierpaolo Limone

ABSTRACT

This paper describes Mu.Vi – Virtual Museum, a virtual reality project developed by Arte Amica to make museum more usable. Arte Amica is a Southern Italy StartUp aimed at creating new virtual environments to better access the cultural heritage. These digital contexts are structured by using 3D devices, augmented and virtual reality, open data, and low cost technological tools. Therefore, Mu.Vi entails two interactive video projections and two 3D viewers through a traveling exhibit showing some historical changes in Otranto (an Apulian City). Mu.Vi was created referring to the cultural historical concept that people develop through the manipulation of objects in activities and the mediation of tools. Furthermore, learning is situated in cultural contexts and is more effective when meaningful. At the same time, it can be strongly supported by immersive and interactive virtual reality environments.

Theoretical background

The project which will be described in this paper was organized according to the main constructivist and cultural historical concepts. Namely, we used the idea of object oriented activity (Vygotskij, 1978), situatedness (Chen et al., 2007) and authentic learning (Chang et al., 2010) to arrange a virtual experience to teach history. That is, such concepts were the pivotal points to define the structure of Mu.Vi, a virtual museum developed for tourists and residents in Apulia (IT). Cultural historical theories formulated by Vygotskij (1978) remind us that human beings' higher mental functions develop through activities. These are represented by a triangular structure, composed by the subject, her own objective to be manipulated and the tools mediating between the subject herself and the object. As for example, if a three-months-old baby boy (the subject) plays with his own teddy bear (the tool) and during this experience his mum tenderly laughs and says to him "I do love you", maybe he is manipulating the object of creating the relational experience with the mother through the mediation of the bear. At the same time, Vygotskij clues that play is a learning mechanism, so that several authors (Annetta et al., 2009; Cai et al., 2006; Packer, 2006) stress the idea of "edutainment", which is an integration of learning and playing. The focus on the activity as a cultural mediated process supporting the development of people, generated several further perspectives, like the idea of situatedness (Brown, Collins & Duguid, 1989). Indeed, scholars suggest that knowledge is situated and strictly connected with the specific context in which it is developed. In other words, it is the product of both activity and situations people experience. Therefore, learning is highly situated and can be realized just in the actual work setting. The concept of "authentic learning" (Chang et al. 2010; Falloon, 2010) is then strongly integrated with these previous ones, since it refers to the thought that learning experiences are more effective when they are real problem based and meaningful.

What is the relation between these concepts and the virtual reality? According to Bricken (1991), virtual reality is experiential and intuitive, and it allows users to manipulate objects through virtual tools, by potentially supporting the development of new developmental areas. Furthermore, she stresses that, in virtual reality, people can actively inhabit a multi-sensory context. So, this stimulates those multiple intelligences theorized by

Gardner (2006). McLellan (1991) argued that virtual reality learning experiences can be designed to sustain situated learning realistic or virtual processes, within which people can feel a high degree of engagement in the activities (Mineo et al., 2009). Therefore, the project we will describe refers to a virtual reality educational environment through which people could interact with objects (such as ancient castles, towers, and so on), manipulate their own knowledge, experience immersive activities and guide their own situated and authentic learning path by playing[1].

The project

Mu.Vi – Virtual Museum is a project realized during the Italian summer event "Apulia365-summer", by Arte Amica SC. This is a StartUp created by four young Apulian people in 2015 to mainly create new ways to access the cultural heritage. This company makes projects connecting technology with culture by using low cost and easily reachable techs, developing ad hoc web applications, and using opendata. Furthermore, Arte Amica creates augmented and virtual reality apps for iOS, Android and Windows phone. It also makes multimedia objects, 3D reconstructions, educational websites, software for companies working in the cultural field, audiobooks, and digital tools for the presentation and indexing of cultural data. So, in order to propose Mu.Vi, Arte Amica created several multimedia objects to discover the change Otranto city had in 1480 after the so called "Kept in check of Otranto". Especially, Mu.Vi has been created to show how castles and cost towers from the area changed over time. The cultural event was an itinerant exhibit and therefore three stages were created through three different weekends. That is, during each weekend, the visitor could discover one of the three stages of the itinerant virtual museum. The first one was at the Gallone Princes Castle in Tricase (Lecce, Italy); the second one was at the Mounts Castle in Corigliano d'Otranto (Lecce, Italy); the last one was around the defensive city walls in Lecce. In each of the three stages, four emplacements were arranged. Two of them had interactive video projections called "Ramparts" and "The territory evolution"; the other two had 3D viewers and were called "Route through the castles" and "A walk through the cost towers". The

1 According to Unesco and Frontiers (1999), we refer to virtual reality as an immersive and interactive simulation of either reality-based or imaginary images and scenes. In the project we present there are also hybrid reality activities implying the merging of both real and virtual worlds (Lindegren & Jhonso-Glenberg, 2013). However, we generally use the label "Virtual reality" to describe the entire project.

user could independently go ahead in the virtual path when she managed the audio projections. Indeed, through a movement recognition system, the visitor could discover multimedia contents. In other words, according to the theories previously explained, the participation, attention and interaction of the user were guaranteed for a successful and effective experience. The use of several gestures allowed the participant to take or move a virtual object, to leaf through virtual screens, to push a button, etc. Through the 3D viewers, the visitor could watch a virtual reality video about existing but very often closed ramparts in Lecce.

The following image, for example, shows the first video projection for the selection of the experiences.

"The territory evolution" experience describes how ramparts were empowered in the area between the 1400 and the 1500. First, a short foreword introduces the main dynasties that governed the area since the XI century to the 1500: then, the transformation of the ramparts made over the 1480 is depicted. In that year, actually, a Turkish army going toward Brindisi (a Northern Apulian city) diverted to a bay close to Otranto because of the very strong wind. Such a place is still called "The Turkish's bay" and was used by the army as a camp from which they assaulted Otranto. After a few weeks, the natives could not resist anymore and the army entered in the city by destroying part of the defensive walls, killing people, raping women and making children slaves. This event is still nowadays called "The kept in check of Otranto". Visitors can use the digital contents through the text modality, which implies that the user has to do some choices to go ahead in the experience (e.g. to identify a lineage's standard, or the year a reign installed, a reign's effigy, and so on). Beside this interaction through which the visitor has to make a binary choice, she can also move objects to gain several new contents, such as:

- Positioning the castle in the corresponding quarter on the maps in order to discover some related information;
- Moving the Turkish ships heading towards the Otranto's harbour;
- Putting the coast towers on the map to turn on the animations.

Generally, each content has been linked with an action or an image immediately readable, to really involve the user herself and make easy her experience. The activity was with or without music background, whereas sometimes there was a narrator. The music was usually coherent with both contents and historical age they were related to.

In a few words, people had to play through these tools; such an edutainment experience required to constantly pay attention to contents and allowed people to learn them in an effective way.

can watch seven towers, four of which on the Adriatic seaboard and the other three on the Ionic one. The 3D videos have been made in the static modality, that is with a fixed camera with backgrounds coherent with the environment. Each video had an on-screen text pointing out the name of the tower, its construction period and the locality was built on.

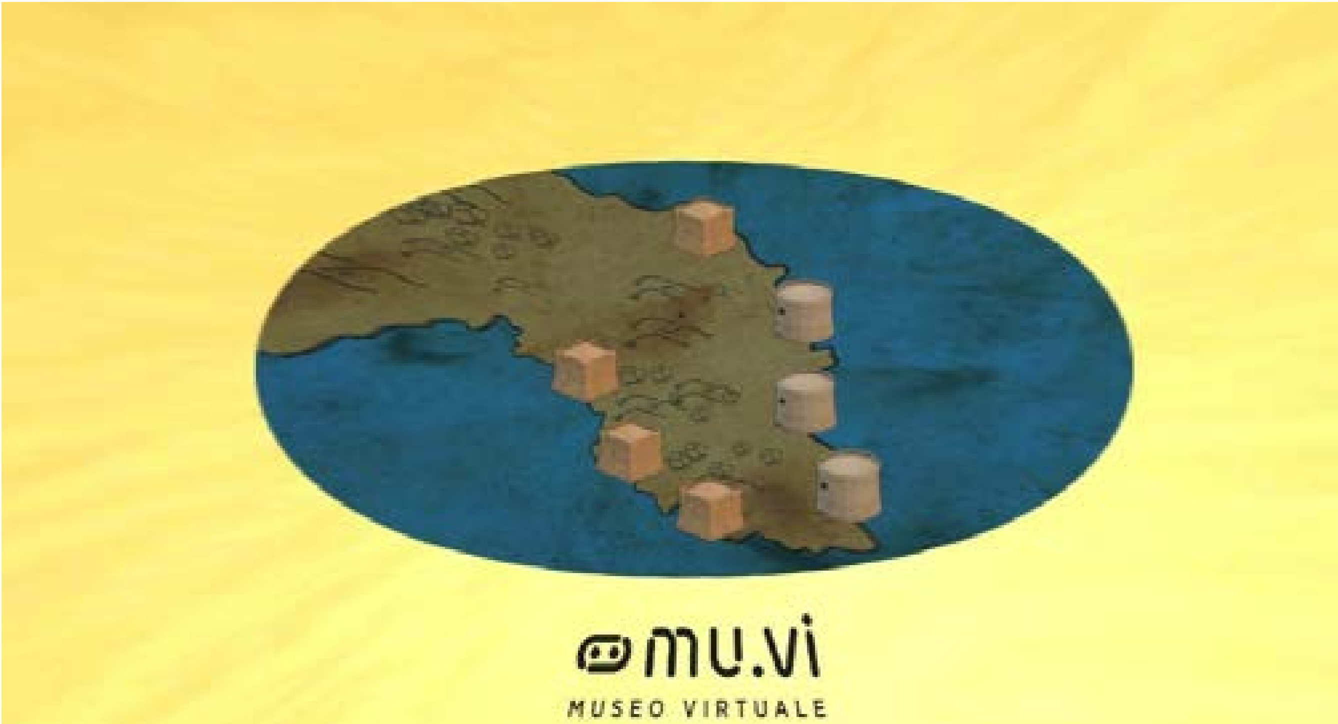
The "Ramparts" experience consists in a from a bird's eye perspective 3D view of the castles. The user can turn on the different steps of the path by doing the right interactive movements or commands. At each step, the virtual model put into the foreground the structural point or the detail it gives the information about. Such an action is due to a sequence of movement, rotation and zoom in or out. So, the system is shaped by 20 animations with just as many learning moments.

As for the "Route for the castles" experience, Mu.Vi graphically represented the Terra d'Otranto (which is the area around Otranto) according to the explored historical age. Once the visitor wears the 3D viewer, she visualizes the map with the models of the main coast towers. The interaction with the system is done without the controller, since the user can make her own choices by selecting the specific commands with a time cursor. Namely, the selection is made if the user aims at the single tower for some seconds. At this point, a virtual reality video about the tower turns on. The user

"A Walk through the castles" experience is about the watching of dynamic virtual reality videos, made inside some ramparts existing in the Lecce's area. Specifically, they are the Gallone Princes Castle in Tricase, the Mounts Castle in Corigliano d'Otranto, The Spinola-Caracciolo Castle in Andrano, the Castle of Acaya and the defensive city walls in Lecce. Once the user wears the viewer, she is inside a virtual sphere where she can see five different screens. Each of these corresponds to a video titled with a specific name and the selection is made by pointing at the title for some seconds. The videos have been realized with a moving camera inside the structure.

Results and conclusions

The audience was enthusiastic and just very few people had vertigo during the watching of the 3D videos. In case of long-lasting sessions, some noticed the fatigue of the



arm used for the interaction. For this reason, during the next experiences a leap motion instead of the Kinect will be used. Whereas, from a psychoeducational point of view, several users proposed to integrate more text or voice information, especially about the ancient buildings people went virtually through. Users really enjoyed the manipulation of the virtual objects and the management of the learning paths.

The project will be replied in other Apulian cities (e.g. Galatina, Aradeo, Gallipoli) and we will improve our understanding of the experience with deeper explorations.

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Abstracts

TOGETHER IN THE ROYAL AND THE VIRTUAL FOR SUSTAINABLE CHEMISTRY: A TRAINING PROJECT FOR TEACHERS OF LOWER SECONDARY SCHOOL

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Chemistry is not always adequately treated in the lower secondary school programs, being sometimes taught by traditional methodologies and generally ineffective in attracting interest and achieving minimum learning goals. In some cases there is a lack of specific skills and means necessary for the development of teaching methods based on laboratory teaching and for the use of innovative and stimulating teaching tools. The result is that, often, students consider chemistry a difficult discipline, far from everyday reality and related to environmental disasters or harmful substances for human health. The teacher training project “Together in the Real and the Virtual for Sustainable Chemistry” [1], funded by Ministero dell’Istruzione, dell’Università e della Ricerca (MIUR) with funds for the dissemination of scientific culture, intended to train Science and Technology teachers of lower secondary school on new contents in the field of Chemistry for Sustainable Development, proposing also the use of new teaching methodologies, such as laboratory teaching and immersive teaching in virtual worlds, which in recent years has had strong development thanks to the recognized didactical potential, being an engaging teaching tool and somewhat familiar to the students of our time, called “digital natives”.

Chemistry is an experimental science and the laboratory experience always generates extreme curiosity and interest in students and contributes decisively to its scientific training by developing the ability to put “thinking” and “doing” closely. In a virtual world,

Figure 1. 3D virtual environment of project, under construction on edMondo, OpenSim grid of Indire.

students can realize their own image of chemistry, a thematic and interactive didactic journey, simulate a reaction, build a molecule or a chemical plant, create an educational game in a congenial environment where they can externalize their creativity, interact with others, and collaborate in building their own end product where they can immers through a personalized avatar without time-limiting restrictions[2]. Realizing experiments in real labs and telling, documenting, building or simulating them in virtual environments, stimulates students not only to develop their own creativity and digital skills, but also to develop skills related to the acquisition, re-elaboration and communication of knowledge and skills of group-working. Virtual worlds also offer a potential for synchronous and asynchronous learning because students can access in their available time, either remotely or alive. Immersive teaching in virtual worlds can thus become a tool to intrigue students and motivate them to study chemistry, a discipline considered arid, dangerous and far from everyday reality.

During the theoretical-practical lessons of the project, teachers were able to realize the potential of immersive teaching, to discover OpenSim-based virtual worlds for science teaching, such as edMondo[3], Unicamhearth Island[4], Techland World[5] and Edu3D[6], to learn the basics of 3D building and scripting and, in some cases, begin in experimenting virtual worlds with their pupils. In edMondo, OpenSim grid of Indire, a 3D virtual environment (figure 1.) realized in collaboration with teachers and students of lower secondary school in whitch the activities carried out during the project have been illustrated, is under construction.

Sitography

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EDUCATION IN VIRTUAL WORLDS: FROM MATHEMATICS TO BUILDING, A RICH AND INTERESTING DISCOVERY PATH.

Maria Messer

ABSTRACT

"The universe is a huge book written in a mathematical language, in which letters are triangles, circles and other geometrical figures", Galileo Galilei quoted. How easy it's to prove it in virtual worlds, where from a prim, an elementary geometric solid, everything springs! From a prim everything origin by means of geometrical transformations, up to become simple and complex, modern constructions, or copies of ancient monuments, perhaps missed in time. Behold, the great virtual book is filled by letter, paragraphs and chapters written after accurate data harvesting, careful remarks, shared opinions in work groups, where students and teachers put together their own different expertises.

In the article will be highlighted the different experiences undertaken by the students of the Second Degree Secondary School of the Istituto Tecnico Economico e Tecnologico Gaetano Salvemini, (located in Molfetta, in Bari Metropolitan Area) since 2012, in EdMondo, the virtual World focused on the Educational programm of the INDIRE (Instituto Nazionale di Documentazione Innovazione e Ricerca Educativa), research institution of the Italian Education Ministry.

Image. *Screenshot in the virtual world EdMONDO: students working on the Lucca's Old TownConstruction*

INSTRUCTIONAL DESIGN FOR A GEOSCIENCE EDUCATIONAL VIRTUAL WORLD

Annalisa Boniello

ABSTRACT

In the international framework, there are different examples and models to build an educational virtual environment . In this research, the model of instructional design to develop and create the virtual environment of the Unicam Earth Island has been done according to the ADDIE model. This model is the most used for 3D educational virtual environment.

Since its creation and up to the moment of the writing of this article, the implementation of Unicam Earth Island has been a work in progress because in every experimentation the users (students and teachers) interact with the environment, adding their contents or objects. The Island has been a community of practice on geoscience education and a laboratory in which there are always new paths or projects in progress.

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