Transition to 3D social networking

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***Abstract*—In this paper we analyse the theoretical underpinnings underlying collaboration in virtual environments and propose a 3D Virtual World (VW) approach to the construction and facilitation of communities of practice within the context of social innovation. Although connected networks can emerge from 'flat' 2D Social Networks, while face-to-face meetings have been proven successful to undertake innovative entrepreneurial ventures, the 3D VW approach possesses affordances that can be exploited to augment the experience. We propose a model for a 3D Virtual World, as part of the Euro SouthHub project, that facilitates the social innovation experience through collaboration and the setting up of communities of practice, using the Virtual Environment to move towards producing solutions for a better physical world.**

I. Introduction

"Games are the most elevated form of investigation."

Albert Einstein.

Connected networks can emerge from 'flat' 2D Social Networks, while face-to-face meetings have been proven successful to undertake innovative entrepreneurial ventures, the 3D VW approach possesses affordances that can be exploited to augment the experience. The Euro-South Hub project[1] (ESH) is intended to facilitate the social innovation experience through collaboration and the setting up of communities of practice, using the Virtual Environment to move towards producing solutions for a better physical world. The context of our work is within the Euro-South Hub project, which, having inherited visions and scope from the global Hub[2], aims to promote innovation and social enterprise in the Mediterranean area. ESB has both physical and virtual aspects that will be created in Sicily and Malta respectively. Physical, real-life aspects involve people meeting face-to-face in actual buildings acting as "hubs". Such physical hubs will be created and run in Siracusa, with a satellite in Lampedusa,both in Sicily. The Virtual Hub, around which our work focuses, will be developed for Malta.

Currently popular social networks, including *Facebook*, *LinkedIn* and *GoogleBuzz* are two-dimensional (2D). They are 2D because the "world" they offer is in terms of a series of "flat" pages. Pages for personal profiles, for events, for status and other updates, are all 2D when compared to a three-dimensional (3D) Virtual Environment (VE).

Such VEs are offered by online games, usually referred to as MMORPGs[3], including SecondLife[4] and IMVU[5]. Membership in a 2D social network yields several benefits to its users: they can interact, communicate and collaborate synchronously or asynchronously, with fine-grained control over the exposure of their personal details. We believe that the collaboration aspects enabled by 2D social networks can be achieved within 3D social networks. In addition we identify several potential benefits that the immersive 3D experience should warrant in the context of the Virtual Hub.

In Section II we review related and similar work conducted in this direction; we analyse how contemporary 3D Virtual Environments have approached these aspects of collaboration and innovation so far. In Section III we justify the 3D Virtual World approach to complement and build on a 2D social networking application, for the Virtual Hub. Section IV proposes a VE design in terms of four quadrants that facilitates the establishment of communities of practice. Section V concludes our work.

II. Related Work

This section starts by treating Virtual Worlds (VWs) as a form of Intelligent Environment. Social networks that build up over time are one main component of the intelligent environments enabled by VWs; this section then analyzes how such social networks occur in VWs. Finally this section goes through several examples which are conceptually similar to the Virtual Hub, mainly in terms of collaboration for innovation.

A. Intelligent Environments

We consider concepts from the area of Intelligent Environments (*Int.Envs.*) applicable to our scenario. Indeed Steventon and Wright define *Int.Envs.* as "spaces in which computation is seamlessly used to enhance ordinary activity". Work in this area has therefore focused in workflow automation to improve mundane tasks [2]. Chatfield et al. maintain that *trust* is an essential element in *Int.Env.* design and is determined by the appropriate management of information flow across physical, temporal and *social* borders [3].

[1]Project funded by the European Regional Development Fund for the period 2011-2013.

[2]http://the-hub.net/

[3]Massively multiplayer online role-playing games

[4]http://secondlife.com/

[5]http://www.imvu.com/

Social concerns are of primary importance to Droege, who argues that the critical question about *Int.Envs.* is not whether to build intelligent environments, but how to use these environments as instruments for distributed problem-solving [4]. Aarts and de Ruyter state that technology is no longer the obstructive element in the development of *Int.Envs.* Rather, they identify *mediated social interaction* as one of the key challenges unaddressed by research so far [5]. Further work has tried to address this interaction from a social intelligence perspective [6, 7].

Several Virtual Environments (VEs) have implicitly tackled social interaction issues and ended up with varying forms of social networking.

B. Virtual Social Networking

This section goes through how social relationships occur within VEs. Then it analyses computing efforts to capitalize on such social networks.

1) Creation and Formation: In [8] Sherlock examines the activity of grouping in WoW[6], currently a very popular MMORPG. In WoW players form groups to solve quests: social interaction makes the game more enjoyable whilst building social capital[7]. Such social capital is exercised in the completion of game objectives. The game design in WoW [8]:

> "encourages cooperative play by making some quests difficult for solo players [...] reward structure is thus part of social play; quest rewards are more attainable and can be accumulated faster if you choose to cooperate with others in the same situation"

Another MMORPG, EverQuest[8], was examined by Jakobsson and Taylor to analyse group formation. They find that players often amalgamate a group of characters with "different but complementary" skills to reach game objectives, as solving quests [9]. These confirm that the VWs at the basis of these MMORPGs are rich in social collaboration and networking.

In [8] Sherlock also treats games as sites of textual production, where *players* (not game developers or paid copywriters) have transformed themselves into online writing communities. They discuss game strategies and howto's across blogs and fora dedicated specifically to these topics. Such communities are in fact another form of social network emanating from VWs.

In [10] Petridis et al. analyse the social buildup in order to tackle shared community problems within a number of Alternate Reality Games[9] [11]. They also provide a timeline of ARGs. Importantly, they state that "web-enabled and real-time access to the clues, puzzles and available solutions is a necessary prerequisite for a collectively solved ARG".

We next tackle computing artefacts that attempt to model and thrive on the social structure within VWs.

[6]World of Warcraft, http://eu.battle.net/wow/en/

[7]Within social scieneces, *social capital* usually refers to connections within and between social networks, and is meant to achieve collective results.

[8]EverQuest, http://www.everquest.com/

[9]Alternate Reality Games (ARGs) in this paper refers to *Alternate Reality Games*, and not to *Augmented Reality Games*

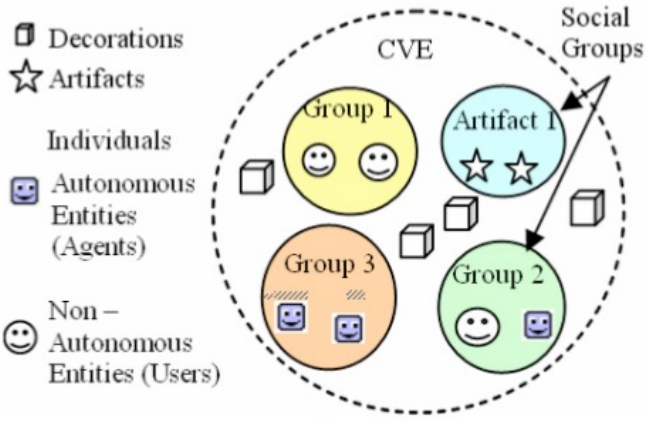

Fig. 1. CVE conceptual model [12]

2) Computing Efforts: Méndez et al. hold collaboration central to the interaction between entities populating the VW. Therefore, rather than modelling the aesthetics of the VW, they model a VW in terms of three main elements: *individuals*, *artefacts* and *decorations* [12]. Group membership is determined by the individuals' abilities and the way in which they interact with other components of the VW (individuals or artifacts). Hence, as reproduced in Figure 1, the VW is populated by sets of individuals pertaining to different social groups and by sets of artifacts that provide some type of service. Each group restricts the way its elements interact with other group elements. In order to totally define the collaboration relationships supported within the VW, a graph-based high level notation to specify the interactions among the entities is proposed, as reproduced in Figure 2.

The result of this modelling is embodied within a Java-based framework Méndez et al. propose in order to reduce the effort in implementing Collaborative Virtual Environments (CVEs). So the construction of VWs can be facilitated. But how to thrive on the user-generated content created by the communities in VWs?

By crawling and indexing online Web content Web crawlers are the enabling technology for Web search engines. Similarly, Eno et al. propose an *agent crawler* that collects user-generated content in Second Life[10] and related VWs [13]. Such *agent crawler* emulates normal user behaviour in order to interact with objects and access crawlable data. For instance, the crawler might move or "touch" VW objects (including users) to access note cards, chats, and associated links and URLs. They demonstrate that such autonomous agent crawlers enhance the ability to identify the dynamic networks of relationships within VEs.

The next section examines several VWs and ARGs enacted to exploit collaboration and innovation.

C. Collaboration examples

We encountered several academic efforts that attempt to capture the concepts and challenges involved in creating VWs

[10]Note that in Second Life all content is practically user-generated.

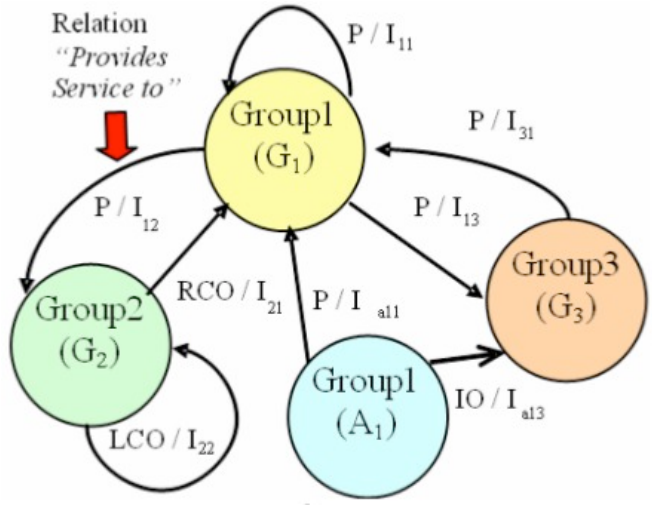

Fig. 2. Collaboration graph [12]: directed graph defining the collaboration relationships in a CVE

for collaboration in different contexts. *+Spaces* [14] concerns the development of VW tools for *e-government applications*. *iWorlds* [15] involves research from *Int. Env.* perspective on how to incorporate online game aspects from VWs into *mixed reality simulation*. Tuite et al. in [16] analyzed the unique challenges of developing *PhotoCity*[11], which they consider as a hybrid between ARGs and *Games with a Purpose* [17]. We go in detail about two other ARGs, *iSeed* and *WorldWithoutOil*, which thrive on social collaboration to innovate from an *environmental* and *econonomical* perspective respectively.

1) iSeed: The concept behind the *iSeed* ARG (part of the UK-based "Living Stories Project") is to generate an interactive community wherein players share information and learn from each other, in accordance with social learning principles. It is the first ARG in the UK that addresses environment issues: social networking sites are combined with Second Life to create a platform which allows social networking to contribute content within a VW. Real-world behaviour is encouraged via virtual rewards. Petridis et al. fully evaluate *iSeed* from a social collaboration angle in [10].

2) WorldWithoutOil: The ARG *World Without Oil*[12] (WWO) started in 2007 as "a collaborative simulation of a global oil shortage" with the tagline "Play it - before you live it.". In WWO players set out to manage a simulated global oil shortage; they joined the game as individuals but coalesced over time into a powerful online collaborative network as they investigated the oil crisis, sharing lessons learned [18]. They leveraged their collective intellect to forecast imaginary shifts in fuel prices and availability. Such forecasts triggered debates about the implications of resulting shortages on day-to-day life and global industries. Finally, they devised clear steps to mitigate these effects, producing strategies for managing this realistic challenge.

[11]http://photocitygame.com
[12]http://www.worldwithoutoil.org

As a result some players changed their actions in *real* life, not just their *alternate* one. For instance, adoption of oil-independent means of commuting to work. The factor that players got to communicate personal endeavours as part of the game, and received positive feedback about it, enabled this to be hugely successful. Renowned game producer/director Tony Walsh[13] hailed WWO as an ARG "with a conscience [...] a raging success contributing to positive social change".

III. Motivation

Having reviewed current efforts to approach collaboration and innovation in *Int. Envs.* we go back to our main question: why adopt a 3D approach to the Virtual Hub?

A. Redefined Social Interaction

Social interaction possibilities offered by 2D social networks are limited by being embedded within HTML and stateless HTTP, even though they attempt to make the experience as responsive as possible through a combination of DOM[14] manipulation, JavaScript and Ajax[15]. But that is as far as Web applications can go.

On the other hand, Virtual Worlds (VWs) offer rich, three-dimensional environments for social interaction and, as in the case of the examples given in Section I, are experiencing significant commercial success. Within VWs interaction with other avatars mimics real-life interaction as the avatar can perform a variety of activities such as do the "thumbs up" gesture, crouch, wear a funny hat, or run away. . . with VWs we can completely rethink the online social interaction possibilities in traditional web applications. In addition VWs may be part of people's real-life for periods ranging from days to years. We intend to tap these opportunities for evolving ways of online interaction in the Virtual Hub, specifically in terms of *collaboration* and *innovation*.

B. Multiplayer collaboration

It is a well-known fact that groups perform better in problem-solving and idea generation than individuals in terms of time taken, the number of problems solved, and the number of solutions generated [19]. Past research confirms that groups with better collaboration perform better in problem solving and creativity [20, 21].

The impact of *virtual teamwork* on real-world collaboration has been studied, from a psychological angle, by Qiu et al. in [22]. They confirm that virtual teamwork positively affects collaborative problem-solving and creativity in the real world. In addition they discovered that simple teamwork in VEs can facilitate face-to-face collaboration shortly after the game play.

McGonigal goes further, and foresees a future where ARGs will "eventually become a significant platform for real-world business" rather than just a "niche entertainment genre" [18]. The rationale behind her prediction lies in the following:

[13]http://www.secretlair.com
[14]Document Object Model
[15]Asynchronous JavaScript and XML

- Through ARGs people acquire hard-to-master skills that make collaboration more productive and satisfying. One of the cornerstones of ARGs is to clearly communicate who did what and the value of such contributions (usually through scores and points). Within this competitive and feedback-rich environment, it is obvious who the best collaborators for a given task are.
- Business management literature deems *innovation* essential to any competitive business entity, as it is the primary contributor to the economic value of the firm [23, 24]. ARGs trigger innovation by enabling the players to propose risky solutions to current realities, yet remain safe from real-world consequences. This is enabled by the relative ease to prototype and test experimental solutions.

Hence McGonigal argues that "custom-designed ARGs will enable companies to build powerful collaboration networks, discover solutions to specific business problems, forecast opportunities, and innovate more reliably and quickly" [18]. McGonigal goes further to propose massively multiplayer science (MMS). The rationale behind MMS is the following [25]:

> "Scientists often solve problems by forming networks, working together in teams to test different strategies and compare results. The process is highly social, extremely challenging, and purposely iterative - you preform the same experiment again and again, just like in a game. And at the end of the day, when all results are in, you know who the winner is."

C. No Physical Barriers

The elimination of physical barriers is not new when comparing 3D to 2D social networking. However physical barriers will be removed in our case because the "Virtual Hub" seeks to implement a replica of a physical environment. In this sense there will be no issues, for instance, of users not making it to the "Virtual Hub" simply because it's too far away.

Our project involves the design and implementation of a Virtual Hub in Malta to complement the physical Hubs in Ortigia and Lampedusa. We therefore seek to apply ARG concepts to the VW that will be implemented for the Virtual Hub. We intend to maximize the opportunities presented by a collaborative game setting, where players conduct the innovation process collaboratively and in game-like situations. Section IV details the solution's design.

IV. Proposed Solution

In this proposed solution we want to capitalize on the affordances[16] of VWs resultant from continuously developing technologies [26]. In our virtual Hub context, we wish to address the question of how the design of the VW itself facilitates the establishment of communities of practice. In Sections II and III we have seen how some of the breakthrough initiatives in ARGs as well as established MMORPGs enforce such communities of practice through the game design and motivation.

This section describes the way forward we are proposing for the Malta Virtual Hub. The Virtual Hub, as part of the ESH, will enable its entrepreneurial members to easily and effectively communicate and collaborate, thereby building a vibrant virtual society whose collective work could potentially enhance their contributions at the leading edge of social innovation. We wish to adapt some of the elements present in successful 3D worlds to be able to understand better how these spaces can not only help organizational learning and practice but can also serve to manage the inherent knowledge present within the established communities.

A. Methodology

The methodology proposed for this solution uses direct observation of the physical Hub in order to complement the experiences created in the "real" spaces. We have visited one successful Hub[17], interviewing Managers, Hosts and members to understand the visions and the practicalities involved in keeping the Hub alive, dynamically connecting its members together through its various activities.

Since the Virtual Hub is primarily targeted for the Maltese social entrepreneur community, with the possibility of opening it to Italy and beyond, an initial meeting focused on listening to a representative group from the community to understand some of the possible requirements and focus on how the technology affordances can be exploited to accommodate and cater for the needs. Since the project is still in its initial phases, a prototyping methodology will be made use of, where each stage of the projected prototype is evaluated with an identified user group. Improvements to the system are expected to follow as a result of this evaluation. Since the projected number of users is not expected to be considerably high, a flexible design approach [27] to the study is expected using a realist perspective which focuses more around the theory upon which the reality is reflected. Within this approach, user evaluation studies are expected to arise from ethnographic investigations occurring within the VW proposed. In this case, participant interactions are observed over a period of time, data collected and analysed and recommendations proposed.

B. Quadrants

Our proposed solution is the creation of a VW having a number of distinct affordances, categorized into four main quadrants within the 3D world. The target outcome is that this virtual world will not only provide the necessary space where people can meet and interact but also support collaboration processes as the knowledge inherent in conversations is harvested and collated. The quadrants build up and expand upon several archetypes[18] as defined by Kapp and O'Driscoll [28]

[16] In this context by *affordance* we imply the quality of the environment which allows and enables an individual to perform an action.

[17] http://vienna.the-hub.net/public/

[18] In this context an *archetype* refers to activity types the VW is intended to model.

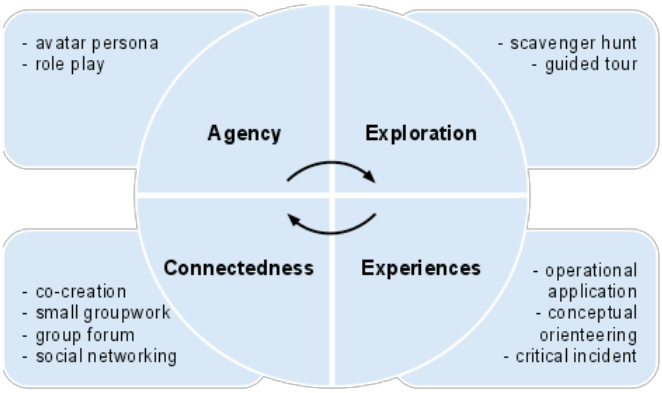

Fig. 3. Archetypes mapped out onto the four 3D learning experiences Macrostructures. Adapted from [28].

including the self representation through avatars, guided tour, the element of co-creation, group work and forum discussions, and critical incident in a game environment.

1) Guided Tour: In this section of the virtual world, the avatars will, with the help of an assistant Host agent, explore the realms of the VW, what they are capable of inside the VW, and how they can link the contents of the VW to the flat 2D Web. The assistant agent will act as the "Host" who most often is present in the physical Hub. Such a Host would typically introduce new people together and will also interact with the members present on location. In our VW, the agent Host will provide a sense of comfort to the member avatars, by gradually introducing them to the 3D world mechanisms.

2) Social Connections: In this quadrant we want to concentrate more on the community aspect, and learning through collaboration. Thus the environment facilitated by the design of this quadrant, aims to foster interactions based on communication. The vital component to the 3D social dimension lies in the strengthening of ties as communities are brought together irrespective of the geographical distributions. To facilitate this, we want to curate all the information and knowledge, which is inherent within most of the public discussions, in a way that such knowledge structures can be reused to spur further investigation.

3) Co-Creation: The archetype of co-creation supports a collaborative effort between 2 or more individuals effectively working together to produce something new. What we want to create in this quadrant is a space where individuals are free to put their ideas to practice. Whereas in the second quadrant, they are free to brainstorm ideas, and discuss these with others, in this third quadrant they can experiment, in a relatively safe and risk free environment. In another context, whereas certain flat 2D prototype designs might be costly, and not offer all the facets which 3D representation and modeling can offer, in a 3D space this challenge is greatly overcome. 3D models in VWs can be quite representative and whilst stimulating the creative process in individuals may not necessarily need specialized skills.

4) Game: In the fourth quadrant we want to bring together aspects of engagement in a game-like environment where members can have the option to get together and solve quests and missions in a bid to overcome a challenge, which is somehow afflicting the world. We have seen a number of ARGs whose target is that of making some kind of 'real' positive impact on the world through the collaboration and connected effort of people across the globe. We want to recreate a situation where people can use and foster their connections to complete quests that not only engage, but also harvest collective knowledge in a specific context. We view this game as an online, social experience – targeting social innovation in specific contexts, using strategy and evaluation as pillars sustaining the game VW.

C. Future Directions

Our future work lies mostly in two directions. The first direction is in the transformation of interactions between avatars [29]. The extent of this transformation can be considered in the way the interactions are happening between the avatars. Current research trends are investigating sensory abilities of avatars. As humans, we have an innate skill to identify body language and gestures and use this information to react and adapt to the situation. In VWs this becomes slightly more difficult to achieve unless some degrees of transformational social interactions is supported by the technology implemented. The second direction of our research work is related to knowledge management, and the schema deployed to be able to collate, harvest, filter and present the information acquired over the 3D social space in context. Although some research exists in the field of organisational learning and 3D VWs [26, 30], more studies are needed on how the communities established within the VWs can contribute to the collective knowledge shared over the 3D space, and how that knowledge can be collated and effectively presented in context.

V. Conclusion

In the context of our work we do not wish to recreate the physical Hub experience which boasts some excellent networking spaces across the globe. 3D spaces are not meant to replicate or replace these experiences [31]. Our work doesn't target the replacement of face-to-face interactions or interactions over the 2D social web. We however believe that these media, can be augmented in value, with 3D world interactions. Technology developments are making 3D world interactions not only easier to access but also less costly and have the ability to offer many more affordances to support information sharing and collaboration whilst collating and harvesting the knowledge disseminated during interactions, contributing to global innovation practices.

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