

Storytelling with Storyteller Agents in Second Life[®]

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Abstract— The “Coming Home” project at the University of Southern California’s Institute for Creative Technologies was started in 2009 to research how virtual worlds could facilitate health care activities for returning US military personnel, who frequently suffer from psychological and physical challenges. These challenges include increased stress and loss of self-esteem related to the war events they have experienced. As part of the activities of Coming Home, we implemented an ambitious storytelling activity that reinforces the positive ideals for which a warrior stands, by presenting historical figures from the past that illustrate those qualities. The storytelling includes scenes from a warrior’s life, and a conversational avatar agent that can answer questions about the historical parts of the story. We have also created an interactive authoring system to allow users to make their own story to populate the SL storytelling space. Although visualized and experienced in world, the authoring tools and repository for most of the narrative content are web-based. Scripts within Second Life fetch this authored data and media and display it in the appropriate places. We also report on progress in building a tool with which users can author their own storytelling agent as part of the story they create.

Keywords—*Second Life[®]; virtual worlds; OpenMetaverse; intelligent agents; narrative; storytelling; story authoring; narrative psychology; stress reduction; veterans; warriors’ journey; telehealth*

I. INTRODUCTION

A number of barriers inhibit veterans from receiving the full care they need when they return home from conflicts. A sad fact is that only about half of veterans who need help even seek it, and many of those who do will fail to finish their treatment programs [1]. Geography may play a large role as a barrier to care, with 41% of V.A. patients residing in sparsely populated areas without access to appropriate medical facilities within a reasonable distance [2]. A technological solution to this problem would involve some form of telehealth-delivered care. Defined by Bauer and Ringel [3], telehealth is “use of telecommunications and computer technologies to improve the efficiency and effectiveness of healthcare services by liberating caregivers from traditional constraints of place and time.” Virtual worlds (VWs) technology is one potential medium of telehealth that is persistent, easily accessible, and already has

a large network of users that supports ongoing development of VW platforms. The research firm KZERO reports 1.77 billion people are using immersive virtual worlds, 64% of whom are aged 5-15 [4], which implies that the virtual worlds will continue to be a familiar and viable platform in the future. Related to virtual worlds, virtual reality treatments¹ have also shown clinical successes for issues such as PTSD and various varieties of phobias [5, 6, 7]. Virtual reality, however, is not networked, easily accessible or built on a social connectivity, while Virtual Worlds are, making them a potentially important new telehealth modality. On this basis, The University of Southern California’s Institute for Creative Technologies (ICT) set out to explore the uses of virtual world technologies to help address the needs of returning veterans in a project started in 2009 called “Coming Home.”

As part of this effort, ICT designed a variety of offerings for extended supplemental care within the VW of Second Life[®]. The space includes social gathering areas, activities to reduce stress- such as a breath activated running path [8], a labyrinth, Mindfulness-Based Stress Reduction classes adapted to the virtual world [9], and a rock-climbing activity done while wearing instrumented gloves [10]. The most complex of these offerings is a story-sharing experience called “Warrior’s Journey” that seeks to leverage the power of storytelling to aid a returning soldier in readjusting to civilian life [11]. This ambitious development of this particular offering is the focus of this paper.

II. DESIGN

It has been documented that warriors often experience loss of self-esteem and self-worth as a result of psychological problems incurred from their time of service [12]. The Warrior’s Journey experience is designed to be a structural framework to facilitate the use of Narrative Psychology, a recent technique being used to help people reconstruct life narratives to address real life problems such as recovery from traumatic events [13]. Its use is also being explored with returning veterans at select medical facilities

¹ Virtual reality as a treatment modality does not include the persistence or social affordances of virtual worlds.

[14]. By encouraging a veteran to look at past events as a malleable story, a traumatic memory can be perceived as something over which the person has control. In our virtual world version of re-examining one's story, we use a hybrid of traditional linear narrative with imagery along with emergent conversation with an embodied conversational agent (ECA), inspired partly by Ulrike Spierling's work on Interactive Digital Storytelling [15].

The experience is structured within a spiral path inside an ancient tower (Fig. 1), and all stories follow the same ordered presentation of media (Fig. 2). As the participant progresses, four scenes in a story are presented through mixed media (pictures, narrative recordings and ambient audio) along the walls as a user walks up the tower path. These elements are stored on a server external to Second Life® and are streamed into the virtual world via Linden Scripting Language (LSL). Sensors programmed in LSL detect the movement of a user's avatar as they move through the space and trigger media at the appropriate location. When the user reaches the top of the tower, they enter a room inhabited by an avatar embodying the storyteller that relays the final part of the story. This avatar is an intelligent agent controlled by fully interactive custom software, and supported by a database of potential answers to any questions that might be posed to the agent.

Upon entering the tower, the participant chooses which story to experience from a menu board, which lists titles of inspirational stories that emphasize ethical and honorable qualities of warriors through the ages. Though fictitious, these stories are based on historically accurate societies.



Figure 1. Warrior's Journey Storytelling Tower

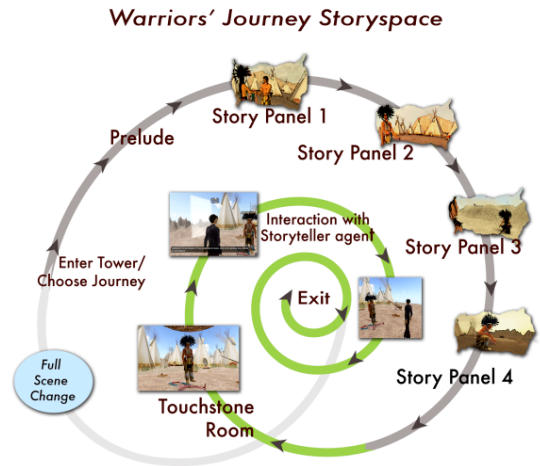


Figure 2. The structure of the Warriors' Journey Storyspace

The narratives focus on ideals and situations soldiers can recognize: protecting a people, maintaining honor, dedication to duty, dealing with injury, loss of friends, and learning to live and adapt to changed situations.

The first two inspirational stories we produced are from very different cultures and time periods. The first is constructed around the life of a Dog Soldier, an elite Native American plains warrior from the Cheyenne nation in the mid-nineteenth century. The Dog Soldier is most famously known for staking himself to the ground with a leather “dog rope” before battling enemies [16]. In his story, he reveals how and why he fought to protect his people. At the end, looking back on his warrior life, he must come to terms with losing his comrades over the years he defended his people. The second story relates the life of a Japanese Samurai warrior near the beginning of the Tokugawa Shogunate. A calligrapher before going off to war as a Samurai, he is wounded in battle, losing the use of his writing arm. At the close of his story, he finds a way to regain a meaningful life in spite of his injuries.

Four wall panels are used to introduce the story from the warrior's perspective (Fig. 3). A narrative voice-over describes each scene in the wall panels with the warrior's spoken voice. The fifth and final scene of the story takes place in a large room at the top of the tower. Here, media and virtual objects are placed to improve immersion by giving the appearance that your avatar is standing at the edge of a Cheyenne encampment or standing inside the house of a Japanese Samurai. The final portion of the story is told directly to the user through an artificially intelligent avatar agent who appears as the protagonist of the story, e.g. the Dog Warrior or the Samurai himself.

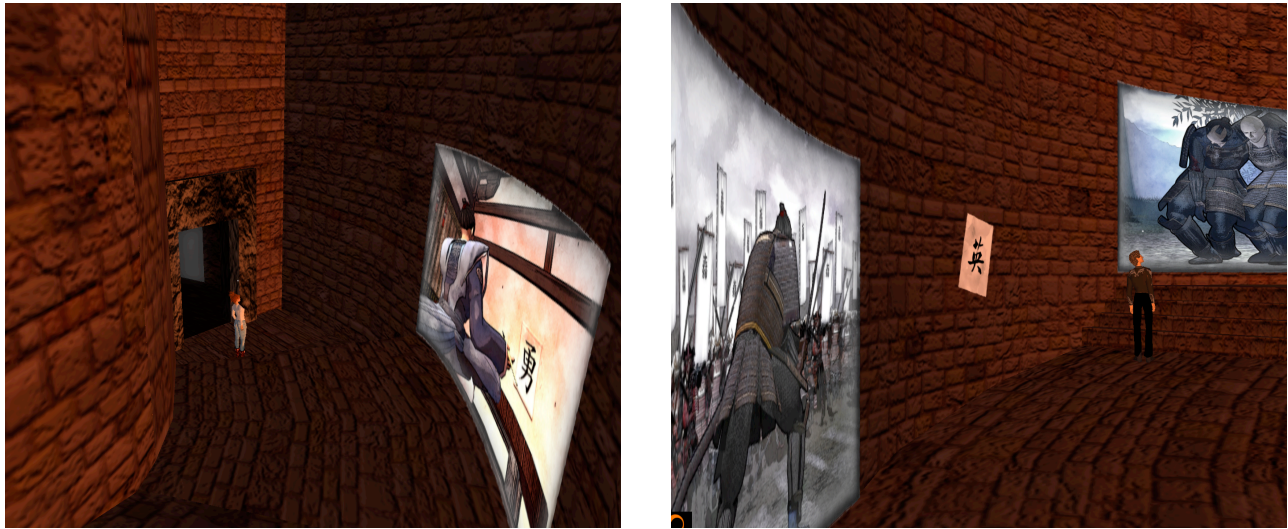


Figure 3. The spiral tower path with story image panels situated on its walls.

When the participant enters the tower room, the avatar agent finishes narrating the end of the story via a recorded voice and gestural animations. Text then appears, telling the user they can now ask the storyteller any questions about the story they wish. The agent is programmed to be able to answer questions the user might have about the story or even the personal history and feelings of the warrior.

Questions are relayed to the agent via text. These queries are statistically analyzed and algorithmically matched with the best possible answer using Leuski and Traum's NPCEditor software [17]. The agent may respond with leading questions if the analysis does not reveal an answer it can answer with high confidence. All communication is done through local IM chat in SL. OpenMetaverse, an open source library of protocols for agents within Second Life, accessed via custom C#, is used to control the agent within the virtual world.

III. CHALLENGES

One of the challenges we had to overcome in presenting these stories in the virtual world was limited environmental space. Our areas in Second Life were designed to hold many types of activities for users, and we wanted to contain all the story-based activities in a single themed area. We did not want to use the standard technique of teleporting a person to a skybox, as we wanted the stories to be rooted to the storytelling tower. Therefore, we needed to come up with a way to show different stories within that iconic space. One large challenge was determining how to swap out all assets "on demand" (i.e. when a user makes a new menu choice). These assets included the wall images along the path, the audio associated with them, the environment at

the top of tower, and the full persona of the storytelling agent himself.

As the standard Second Life tools for media display are limited to a single stream at a time, with concomitant file size limitations, we had to find a work around to accommodate our needs. We determined that using our own media server system was the most advantageous to be able to support the changes needed for each story. The wall images on the path are swapped out in two different ways. For user-authored stories, all images are combined into one large image on a private server, streamed into SL via LSL, and then offset to give the appearance that each original image is separate and appears in the appropriate place. This also has the added bonuses of eliminating the standard upload cost (paying with Linden dollars) of placing media directly into the environment and overcomes restrictions on file size. The appropriate text for each story is retrieved from a database on our private server and then displayed in SL as the user moves close to each picture. The second way media is swapped is employed only in the pre-created inspirational stories. The pictures for each of these stories don't need to be changeable, so the media stream is instead used to play mp3s of story and music rather than displaying text. Images for the inspirational stories are stored in SL, but, to the user, they appear to be displayed in the same way as the user-authored stories.

Environmental set pieces in the top of the tower are automated via LSL to appear in the scene according to the selected story. When the user is engaging with the Cheyenne Dog Soldier, the room creates the illusion that the user and the agent are standing outside an encampment (a panoramic image displayed across the walls), with various pieces of 3D set dressing extending into the physical space.



Figure 4. Two scenes occupy the same virtual space. All the elements, including the intelligent agent and its knowledge base, swap out when a new story is selected from the in-world menu.

When the narrative being experienced is the Japanese Samurai, all of the previous set pieces have their transparency and position adjusted via LSL, while other pieces become visible to give the appearance of being inside a room in a traditional Japanese home from several hundred years ago (Fig. 4). Lighting is also adjusted via LSL to illustrate the change of venue from outside to interior. Messages are sent via LSL to the agent/storyteller that tell him which avatar to use (changing his body, skin, hair, and attire to match the new scene), as well as which dialogue library to use, both when telling the story and when answering questions.

IV. AUTHORIZING A STORY AND A STORYTELLER

After the text edit has been completed, the paper is ready for the template. The ultimate goal of this storytelling activity in the Coming Home project is to use the stories of others to inspire veterans to tell their own personal story that can be added to our Second Life story environment. Allowing users to create such stories requires an easy-to-use system that elicits the story from the user, allows them to upload supporting media such as images, text and audio, and a means to define the appearance and knowledge base of the storytelling agent. To accomplish this, we have created a set of online authoring tools that assume no expert knowledge of virtual world programming or building. Although the final visualization occurs in Second Life, we chose a web interface for the authoring suite because Second Life did not have sufficient tools to accommodate our technical needs. Our authoring system consists of a secure, online suite of authoring tools created using php, with a concomitant MySQL database that stores user information and story content.

The authoring phase begins when the user chooses the “Create your own story” menu item in the Story Tower. This sends them to an external website where they set up an account and a password. The web-based authoring tools contain a 2-dimensional prototypical mock-up of the appearance of the media within the virtual world. The user is led through authoring the text and uploading media for each of the four wall panels. These reside on our secure server where we prepare them to be streamed into Second Life on viewing, as described above.

For the fifth and final scene, the author must finish telling the story (essentially filling in a fifth panel) and then create the storytelling avatar agent. For this last element of the story experience, the user can choose from a library of premade starting avatar appearances. A photo of each avatar appears as the user selects the corresponding button (Fig. 5). The final phase is to populate the virtual human

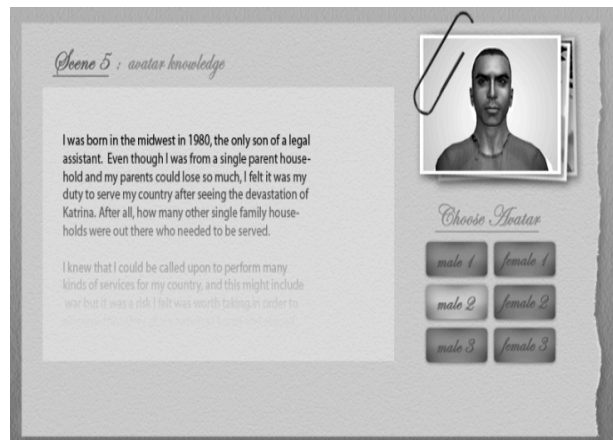


Figure 5. Part of the authoring system on the web: Choosing the agent avatar look.

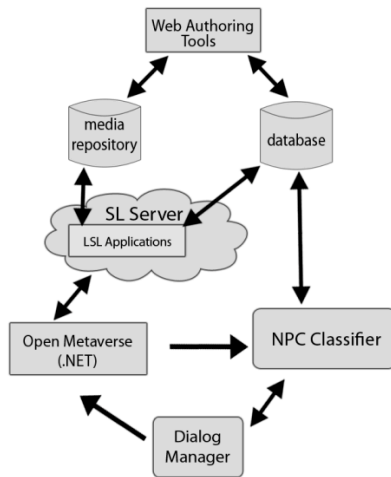


Figure 6. Schematic of the virtual world authoring system.

with a knowledge base of information and responses that support the story.

Custom LSL scripts within Second Life fetch this authored data and media from our server to populate the story environment in the virtual world. These scripts also pass commands to the agent to change clothes, start and stop animations, and replace the current dialogue library with the newly authored one. While it has been a non-trivial task to implement these aspects such that they display and function within Second Life while externally storing much of the media content, ECA knowledge base, and authoring tools on the web, it does allow for expansion to other virtual world platforms. Other virtual world platforms, such as OpenSim, could access this same narrative content provided there is a scripting language in place with functionality similar to LSL (Fig. 8).

V. NEXT STEPS

All the elements are in place for participants to start using this system at the time of this writing. We are currently working with a small pilot group to test our system and provide feedback for the authoring activity to ensure its readiness for public testing. After integrating feedback from the pilot group we plan to open it up to members of a Second Life veterans group we have been working with since 2009, and will report on those results as they become available. Ultimately we hope to incorporate this within a treatment program at a military health care facility so that it can be utilized as a supplemental form of telehealth care that connects therapists and patients in new and potentially beneficial ways.

We believe that being able to author both a potentially therapeutic story as well as an intelligent avatar agent greatly expands the usefulness and engagement that a

person can have with a virtual world. Not only veterans and military personnel can benefit from such a system, but also disaster relief and aid workers, who may benefit from therapeutic narrative after encountering stressful situations. While our system has been tailored specifically for therapeutic use, we envision other possibilities as well. For example, a narrative-based game system could model our approach to populate the game space with user authored stories and/or virtual agents. As this work progresses, we welcome additional suggestions for it use.

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