

Transforming Lives Through Story Immersion

Innovation of Aphasia Rehabilitation Therapy through Storytelling Learning Landscapes

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Figure 1. Dr. Janet Whiteside play-testing a Mixed Reality (MR) story-playground with client at Simiosys with a Canon MREAL HMD video-see-through system to immerse participants in a virtual story environment that is staged in scale in front on the tabletop. Copyright © 2014 Simiosys

ABSTRACT

Aphasia is a disease that renders its victims unable to effectively use language. Evidence supports the efficacy of treatment for aphasia yet the effectiveness or transferability of learned communicative abilities to everyday conversation continues to be investigated. In this paper we explore an alternative approach to aphasia treatment based on the art and science of storytelling. Inherent in storytelling are the motivations to share an experience, the cognitive abilities to organize story, and the language system to convey the experience. This approach is based on decades of

research in aphasia therapy and immersive storytelling (in other fields) and has been used to engage a subject's creativity and emotions to produce transformative results in real life. We report on early, promising results that could radically innovate the rehabilitative practice of aphasia.

General Terms

Measurement, Documentation, Performance, Design, Experimentation, Human Factors.

Keywords

Aphasia, Therapy, Immersion, Media, Storytelling, Imagination, Cognition, Rehabilitation, Experiential Media, Mixed Reality, Augmented Reality, Virtual Reality, Play Testing.

1. INTRODUCTION:

Rediscovery of Language through Story Immersion

The state of aphasia robs a subject of their ability to communicate fluidly with words. Caused by a stroke or head injury, a person with aphasia (PAW) can become isolated in a world dependent upon language where one is expected to speak, understand, read and write. This condition impacts over two million Americans and

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can happen to anybody, anytime and anywhere. However, most victims do not even know the meaning of “aphasia” when they first acquire the disability. The inability of communication, even with a mild impairment can lead a person into isolation and depression that can be devastating to the whole family.

Most treatments for aphasia focus on drills and practicing language skills outside of the context of story or other larger meaning structures [1]. In this paper we explore the idea that aphasia treatment might be significantly improved by harnessing the cognitive importance of narrative and storytelling with immersive media (Figure 1). Can the desire to understand and communicate stories help aphasics learn to communicate?

The power of story to immerse, transport, compel and transform has served humanity far beyond mere entertainment. Storytelling, likely the precursor to literature [2] provides a means to communicate important information without having to experience something ourselves. It provides a “low-cost, low-risk surrogate experience” in our imagination [3] [4]. The advancement of all media forms—novels, film, and so on—has needed to be validated by its ability to tell stories. These stories give us a sense of belonging and define who we are personally in the arts, sciences, histories and philosophies. Narrative has been suggested to be a core part of human psychology [5].

The idea behind our intervention is to use the innate importance of story in aphasia treatment. Persons with aphasia (PWA) and their families repeatedly report that what is done in the therapy room is not heard in everyday conversations. In the practice of clinical aphasiology, there has been a movement to transcend the sterile therapeutic environment to a more immersive, multi-sensory environment. The treatment's measure of success is in the PWA's ability to effectively use their regained communication skills in everyday living, including the ability to comprehend stories of others and to create stories, be they real or fictional, that bring people together.

The Life Participation Approach to Aphasia (LPPA) is one such philosophy, which focuses on life re-engagement [6], and tries to relate internal relevance, feelings and memories to the extrinsic mechanics of language.

The Aphasia House, another innovative treatment, offers an intensive rehabilitative program that focuses treatment at the impairment level but within an immersive environment, a re-creation of a home environment filled with memories and relationships that stimulates social participation and the application of language in the form of “conversational story.” The idea to apply immersive media to PWA was first initiated in the Aphasia House. The challenge was to develop a model of service that is so compelling and moving that it engages a person's whole being: “head, heart, and hands.” How well can immersive media (such as Mixed Reality, the spectrum encompassing virtual, augmented, imagined, and actual realities [7]; enhance this “conversational storytelling” method and expose the client to a plethora of communication options while engaged in the fullness of life? The gradual layering of environments, props, memorabilia, and creative exercises help to unravel one's own story and motivates a compelling, long-term reconnection with language.

2. BACKGROUND:

The Power of Immersion to Rehabilitate

The use of virtual immersion therapy (VIT) has experienced significant growth of adoption in other mental health rehabilitation

practices. VIT has surpassed traditional mental health therapy in the treatment of Post Traumatic Stress Disorder (PTSD) with the help of Military research and simulation [8]. The successful innovation of Virtual Reality (VR) simulation in military applications have been able to both build up critical training skills as well as wind-down devastating emotional trauma of war [9]. The use of VIT for the treatment of anxiety disorders such as phobias is also well documented. The full-experience, immersion, presence and participation of the subject in virtual scenarios provided compelling engagements that could help therapists find treatment for the patient by facing fears through safe exposure (doing what you shouldn't, wouldn't and couldn't in real life). Trainees could rehearse compelling life-and-death scenarios to prepare for and rehabilitate from the theater of war and mediating internal turmoil [10].



Figure 2. TBI Client making coffee at home (top left, clockwise), repeating task in MR Kitchen with virtual kitchen capture texturing physical chroma-key cabinets, Therapist within the virtuality guiding client, Client's point of view making coffee, using procedural knowledge. Copyright © 2014 Simiosys

At the University of Central Florida, we have pioneered the use of Mixed Reality (MR) in the rehabilitation of cognitively impaired patients suffering from memory loss due to Traumatic Brain Injury (TBI). MR melts the boundaries between the real and virtual artifacts and environments and allows the inclusion of direct personal interaction of the therapist and family to relate with the client (figure 2). A 2006 pilot study demonstrated the promise of immersive MR to improve the transfer of training from the clinic to the home using a single TBI patient [11]. The immersion was efficacious and the participant decreased in time on task and number of errors when he transferred from the clinic MR scenario to his real kitchen at home.

We suspect this success was due in part to two reasons. First, the patient made use of multiple sensory modalities. Through the use of real appliances and real food, the patient was able to engage multiple senses to feel the heat of the oven, the cold of the fridge, the smell of the coffee and the taste of the bagel. We hypothesize that the environment along with therapeutic rehearsal helped to reconnect functional procedural memory to circumvent impaired working memory. The participant rehearsed established routines in an errorless environment sufficiently to re-establish patterning and build confidence to function more successfully within his home.

More studies are needed, with broad and persistent data capture from perceptual computing provided to provide a? the detail analysis to better isolate when and how improvement was made.

Second, the TBI participant was engaged in content that was personally meaningful to him. By connecting the brain, relationships and physical activity (head, hearts and hands) to fully engage the participant, the therapy more fully immersed them to the extent he could initiate specific enabling life skill tasks (e.g., making breakfast).

In 2014 in conjunction with Simiosys and Canon USA, we designed a similar MR applied to PWAs in an immersive, interactive storytelling tabletop interface. In the mixed reality session, a virtual campsite for the PWA was created. The participants were seated in front of a table filled with physical and virtual objects, and the surrounding environment was transformed into a forest scene. Since this was mixed reality rather than virtual reality; the physical props and the therapist were able to join the PWA within the virtual scene. The PWA was asked to tell a story first with only the real props, and then repeat the same story using the mixed reality scene (figure 1& 4). In the analysis of the verbal story communicated, participants under more meaningful words in more complete sentences with fewer empty words. The initial pilot test demonstrated an improvement of flow. The playful and social engagement of personal storytelling combined with the fantasy immersion stimulated a condition where we observed a more normal flow of words and communication.¹

To understand why there was success on these two pilot tests with both language and transference, we needed to investigate iterative, exploratory play-testing in a clinical environment. Play-testing is an entertainment convention where promising ideas are casually tested on audiences to reveal obvious good and bad characteristics about products, such as computer games. In our version of play-testing, we also use it to connect the foundation of cognitive science with heuristics from entertainment, and to apply emerging experiential learning theories to actual therapy. How and why is story immersion effective and how can the convergence of media such as simulation, perceptual computing and adaptive and active technology provide affordable and practical solutions?

3. Storytelling as a Tool for Immersion; Immersion Media as a Tool for Story

We have all, at one time or another, been “lost in a book.” For those who read novels, we often cherish this experience of a good fiction and look forward to returning to that space and time because it seems delightfully disconnected from the real world. This escapism of pure imagination is far from the dream state, yet some would equate the story experience of a good novel with experiencing a dream in the conscious state of mind and being “transported” to another place and time in full awareness [12]. The actual written form of the novel is only a fraction of the story experience. The literature merely sparks a larger story simulation within our imagination where we fill in all the details and elaborate on a highly personal version of that story [13] [4].

This demonstrates how the author’s imagination, as expressed in words, interacts with the audience’s simulative imagination to construct an immersive story experience in the mind of the audience (many times without high-technology). The medium of



Figure 3. Story Box created with memorabilia that represents a character’s story. Participants collaboratively extract a story from the contents using different techniques of a historian, reporter, detective, fiction writer, insurance claim writer or another character. Copyright © 2014 Simiosys

the book is merely a linear arrangement of symbols of sounds or images. It’s the understanding of a work of artful storytelling that transforms symbols into emotions, meaning and immersion. Where aphasia robs people of the ability to tell and read stories through language, it does not rob the client’s ability to imagine stories themselves, though they are represented in images and other non-linguistic representations. It is for this reason that we start from within the PWA’s own imagination to find affective pathways to creatively reconnect with the meaning and relationship of the words.

We created several physical boxes filled with objects that were indicative of character, setting, and story (Figure 3). Sample objects included old photographs, short letters, children’s toys, and other artifacts. The boxes were designed to tell a story based on object relationships, layering, and the element of surprise or juxtaposition of theme. Working with conversational partners, the PWA was challenged to create a plausible narrative using the provided objects. Critically, there was no right or wrong solution as long as the story made logical and narrative sense. We explored the use of role-taking and shared story creation within an “elegant corpse” style framework. Through using the boxes to initiate story, we observed that the PWA was less focused on saying each word correctly. Instead, they were able to focus on communicating intent through story where intent and communication is the purpose of re-learning language. Further, the PWA used fewer overt cueing mechanisms and was able to find ways around linguistic blocks without impeding the flow of the story.

During the play-testing, we invited the (PWA and therapist) contribution of their creative imagination to connect the meaning behind disparate artifacts unveiled from a container we call Story

¹ see video <http://simiosys.com/blog/?p=459>

Boxes. Each item and its manner of packing and choice of wrapping were crafted to reveal story elements. As if conducting forensic analysis, a narrative was constructed, with notes, documents and photos that are designed to jump to assumptions and find the words, meaning, construction, concept and catharsis of a plausible and compelling story. Using improvisation techniques, a rule of accepting any suggest as truth (yes, and) it forced the co-storytellers to create, express and challenge novel ways to prompt or self-cue for missing words.

4. REVERSING THE STIMULUS OF LITERATURE

This phenomenon of the author “painting with the audience’s imagination” [7] with language should be able to be reversed to have one’s imagination help with the expression of language. This interactive and two-way procedure is practiced fully with immersive Role-Playing or Alternate Reality Games (RPGs or ARGs) where participants are simultaneously the audience and contributing writers of the stories.

The improvisational and conversational storytelling used in RPGs and ARGs has the potential of transforming a more traditional “drill and practice” therapy into an interactive exchange of thought through “call and response.” At its core is the idea that every person has the innate ability and desire to tell story. When robbed of the flow of words from aphasia, story has the potential to unlock the flood of thought into a transmittal of ideas where “head, heart, and hand” are engaged and tap into full primal expression behind the language. Hypothetically, the PWA is loosed from the constraints of aphasia and empowered to focus on the flow of ideas within a larger context that has meaning and relevance for communication and comprehension.

Our recent play-testing of Story Boxes utilized conversational partners. Those trained in working with persons with aphasia (therapists) and those not trained both became collaborative-storytellers. The role of the therapist was two-fold, co-storyteller as well as therapist, providing the scaffolding needed to communicate intended thought. We explored the art of non-linear, interactive and collaborative storytelling to structure compelling, conversational interaction. Thus, communicating story became a transmittal of novel thought and exchange, creating and reinforcing personal relationships. This can help internalize progress for both client and caregiver to better retain and use skills beyond the clinic to contribute to lifelong support and growth.

5. LANGUAGE LEARNING PLAYGROUND

Because the foundation of experiential learning is play (learning by doing) and the importance of narrative in psychology, we incorporated the interplay of play, story and games in our therapeutic interventions. Integrating storytelling activities and core tools of interactive entertainment created a playful language learning landscape of creativity, imagination and joy [14].

In the case of our initial therapy trial, we used a highly functional client that was classified as a person with conduction aphasia according who had scored as a conduction aphasic according to the Western Aphasia Battery – Revised [15], demonstrating deficits particularly in auditory processing, naming, and repetition. Her speech was marked with word finding deficits as well as phonemic paraphasias. The client did not express exceptionally creative talent prior nor had practiced storytelling in her professional or



Figure 4. Virtual characters, props and settings are able to come out of the MR version of Story Boxes and simultaneously interact with the physical tabletop and scaled up to envelope the story participants. Copyright © 2014 Simiosys

recreational life. The use of language and participatory storytelling started slowly and with effort, but the challenges enhanced learning effectiveness (ambiguity and frustration) and the entertainment value escalated participation and progress.

Initially the client was shown Story Grammar Marker, a systematic visual reference of essential story elements to scaffold language into story creation. The use of story grammar cues helped direct a satisfying emotional arc and catharsis. This is because of our shared, innate appreciation for story structure. We discovered that the more the “hands, heart, and head” were involved through various forms of stimuli, the more story elements became included and the more confident the client appeared while creating these stories. For instance, photos of post WWII China combined with a Hong Kong Shipping manifesto to an Army Captain stationed in San Francisco neatly packed in a silk scarf in a hat box with love tokens and wedding pictures prompted assumptions the owner was a war bride reuniting with her husband stateside. But since the paper work was sent by an insurance company, it was presumed the owner (bride) died on the way to reaching her dreams. Unsuspected details arise of children because of pictures of kids, an ivory miniature and a children’s book. The main character became a mother and not a teacher of the children, because that made a more dramatic story drama.

With the mutual collaboration of the narrative world swirling around the props, the focus became less on the PWA’s performance and words themselves, and more on the story telling intent. By using story telling intent and creativity as a focus in therapy, the client’s ability to stimulate creative options for self-cueing evolved. This helped to correct phonemic paraphasias, to name independently. Additionally, the client’s skills observed in immersive active engagement in storytelling transcended to conversation. The preliminary data from the exploratory study of storytelling yielded increased engagement and decreased anxiety over loss of words. We also witnessed improved self-esteem and a very strong resolve to continue the rigor of therapy.

The conclusion of the experiment in play-testing story was that when one can mitigate the frustration of relearning language one can increase creative determination and resilience needed for overcoming obstacles and more effectively reach a critical flow and understanding in expressing oneself. This process through “call and response” of story rather than the “drill and practice” of traditional therapy produced immediate and obvious improvement. In leveraging our innate ability and drive to tell and enjoy stories, we



Figure 5. Simiosys Real World Lab being set up at the UCF Aphasia House to develop daily dialogue and explorations with practitioners and augment traditional therapy with virtual assets and tools. Perceptual and mobile computing to be integrated for sharing, capture and analysis. Copyright © 2014

provide an immersive learning landscape that more directly provides the confidence and command of conversation and communication. By de-emphasizing precision of language as the goal and focusing on a more complex, interactive process of communication, we can better prepare a client for their optimum engagement with continuous hope and growth to improving their condition.

To see the transference of skill in the PWA's life, we prompted the client to independently contact a retailer to repair an electronic device. The client's encounter required them to advocate, decision make, and purchase for themselves. Their success provided preliminary evidence of the efficacy of our approach. In future work we will slowly add additional layers of augmentation effects, whether props, mixed reality, or imaginary worlds on the art of storytelling.

6. FUTURE WORK:

Tools for Measure & Techniques for Analysis

Our preliminary studies show that storytelling and immersion (physical augmented with digital) can have a beneficial role to play within the rehabilitation process for TBI and aphasia. Conversational storytelling is of particular interest because it more closely models unscripted conversation.

Further research is needed to determine to what extent storytelling can help people with aphasia reclaim their ability to communicate. We have seen an early indication that storytelling may help improve confidence, and increase propensity for the client to engage in conversation. If storytelling can also be used as a means to structure conversation and provide internal cueing devices, then it may have additional benefits as a tool that clients can use at home and outside the therapist's office.

However, we need to build the tools that can simultaneously immerse and prompt story and also capture response communication to gain objective and quantitative data to validate our observations and assumptions. As in the work with TBI rehabilitation, the same technology that senses and perceives the world and behavior may also be captured to identify patterns that

can lead to new methods for rehabilitation. Even more exciting is the possibility that this research can show us how to leverage storytelling in ways that have never been achieved.

The key is to develop the next generation technology together with the next generation techniques so solutions can be integrated with ubiquity of consumer devices so Aphasia Therapy is a life long improvement. Lifelong learning is a necessary goal for people who have aphasia, because they will struggle with their ability to communicate for the rest of their lives. If storytelling can help aphasics practice language, find ways to navigate language blocks, and increase confidence, then it may be an important tool for approaching the future of aphasia therapy and rehabilitation.

7. CONCLUSION

Our two pilot-studies show preliminary evidence that aphasia treatments can be improved by focusing on three things: multi-sensory immersion, engaging in tasks that resemble real-world tasks (such as making breakfast), and encouraging the communication of story rather than decontextualized bits of language.

With more rigorous experimentation and novel methods for measure, this could lead us to solutions where our own creative abilities to challenge our imagination can lead to lifelong improvement. However, we will need better tools and conventions to stimulate, capture and analyze the complexity of interactive imagination. The goal to transform what has been the burden of aphasia with the hope of optimal engagement and continual improvement has been the overarching goal of rehabilitation. The art of storytelling, within an immersive environment, may aid in the transference of new learning to the PWA's real life.

8. ACKNOWLEDGMENTS

We wish to thank Dr. Margarite Torrenza from the Aphasia House for supporting our investigation; Yutaka Terenishi for over a decade of support from Canon Inc.; Matt Johnston and Julie Hook for helping us make creative leaps with our Promotype for Human Experience Modeling; Fellow VIT Colleagues at the UCF Communication Disorder Clinic; Eric White from Drive Studio and Justin Link and Ryan Clark from Chronosapien for their work creating our storytelling environments. We want to especially thank Tamura Hideyuki from Ritsumeikan University for original inspiration and pioneering vision for Mixed Reality.

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