

Might Avatar-Mediated Interactions Rehabilitate People Suffering from Aphasia?

Ulla Konnerup

Department of Communication, Aalborg University
ullak@hum.aau.dk

Abstract

Many people suffering from communication disabilities after a brain injury have difficulties coming to terms with their new self as disabled persons. Being unable to deal with these problems verbally exacerbates the condition. As a result they often isolate socially and develop low self-esteem. Identity-creation and language are strongly linked together and there seems to be a lack of addressing identity and social construction in the communicative rehabilitation. Immersive virtual worlds (IVW) are becoming ever more popular in health care and medical training. Experiences from projects in California and Denmark indicate that there is a potential for communicative rehabilitation as well. Studies from Stanford University, California have shown that behavior in a virtual world might have a spillover effect in the real world. This paper argues why and how self-representation and interactions in IVW might trigger re-learning communication and contribute to the recovery of nerve lanes in the brain after an injury.

Introduction

Through my work as a speech therapist I have experienced, that the greatest challenge to people suffering from aphasia¹ after a brain injury is to renegotiate identity. This is substantiated by research (Shadden & Agan, 2004, p. 174; Duchan, Linda, Garcia, Lyon, & Simmons-Mackie, 2001)

Communication and identity are strongly linked together and all the roles that define one's sense of identity within a larger society are modified by stroke and consequently aphasia. Essential for both the aphasics themselves and their specific others are to regain a voice in dialogue with others both privately and in society.

Practicians and researchers have been aware of this for years and Shadden and Agan have suggested group rehabilitation as one way to accommodate this perspective (Shadden & Agan, 2004), but there is still a need for approaches that facilitate a social construction and reconstruction of identity and not only are targeting specific aspects of the language.

The Institute for Speech, Language and Brain Disorders in Aalborg, Denmark, has during the last 12 years focused on developing technology-mediated methods for rehabilitation of people suffering from aphasia. From using software based and individual training-programs in the 1990s over social media in the 2000's until today, where they offer avatar-mediated rehabilitation in Second Life (SL).² Based on the recent work at *The Institute for Speech, Language, and Brain Disorders* this paper presents how rehabilitation IVW offers approaches to provide new contexts in which identity can undergo renegotiation. It argues that involving a person in informal and (non) verbal activities in an avatar-mediated environment might at the same time trigger motivation for re-learning the language and promote cognitive, communicative functions and re-creation of identity.

Aphasia

Aphasia is an impairment of the language function as a result of a brain injury. The injury is due to i.e. apoplexy³ or other injuries where the blood vessels of the brain are damaged.⁴ Aphasia takes many forms depending on which centers of the brain that have been injured and how deeply the patient has been affected. Aphasia leads to communication difficulties in a varying degree. A total loss of the ability to

Copyright © 2013, Association for the Advancement of Artificial Intelligence (www.aaai.org). All rights reserved.

¹ Aphasia is an impairment of the speech-language function as a result of a brain injury.

² *Second Life* is a free 3D virtual world where users can socialize, connect, and create using free voice and text chat.

³ Common designation for cerebral hemorrhage or embolism in the brain

⁴ Head trauma (Accidents – road, work or violence), Illness (tumors, infections)

communicate is, however, rare. Aphasia influences a person's ability to produce and understand speech/language. In addition, the ability to read, write, spell, and calculate is affected. The patient may experience problems of recognizing the correct use of judgment terms (e.g. yes/no), and of recognizing and applying words to certain objects. Aphasia may be accompanied by other disorders such as paralysis, impairment of memory, and lack of concentration. The person with aphasia often exists in a world of chaos and confusion where language and interplaying with the surrounding environment is shattered.

Aphasia may affect anyone, regardless of gender, age, or social status but the risk increases with age. Often long term communication rehabilitation is required (Luria et al 1969). In Denmark, aphasia affects 2.500 to 3.000 people every year. In USA the number of new aphasia cases a year is estimated to 200.000 («National Aphasia Association - \$25 for 25»)

Language is an important element for learning, identity-creation and interaction in social communities. Through language we both form ourselves and others. To understand the major consequences linguistic disturbances can have on a person, I will describe different aspects of the language and what impact language has on thinking and cognition - and thus learning.

Though, in order to define the concept of language, it is necessary to include both the linguistic and the psychological dimension.

In a holistic perspective language is closely related to the individual's lived and live life. It has many forms which represent themselves as spoken language, body language, imagery, and reading and writing. The language should not be seen as an end in itself, but functionalistic as a means of contact, communication and learning.

Apart from being a means of communication language plays an important role in cognition phase. Vygotsky was concerned with the relationship between language and thinking and gave the language a key role in social interaction. Language is fundamental to perception, memory and thinking and thus becomes a tool for intellectual activity. The language also has a regulatory function with the importance of planning and controlling behavior (Luria, Teuber, Pribram, & Haigh, 1966). The acquisition of language is closely related to experience, play, rehearsal and practice. Language and thought are inextricably linked, and are controlling our knowledge and experience of the world. The relationship between the thought and the word is a living process.

The idea is born with the word. A word without thought is a dead thing, and a thought that is not embodied in words, shadow (L. S. Vygotsky, 1971, p. 402).

Fredens (2004) and Shadden, Hagstrom & Koski (2008) argue that the creation of the self is created in communication with others through narratives and life stories. Thus, based on these fundamental considerations on the relationship between language, mental activity and self-creation, it must be assumed that aphasia affects the sufferers self-understanding and has implications for identity and thus might lead to psychological problems. Language difficulties make it hard to communicate with the surroundings, limit the opportunity to test ideas, tell one's life story and consequently weaken the ability to express opinion and hamper the ability to continuously create the self.

Persons with language difficulties are likely to experience a change in the way other people relate and react to them; one is seen as someone with a different identity (Vestberg, 2002). Social relationships can be difficult to maintain because communication is difficult and it becomes difficult to interact. And thus the greatest loss for people suffering from aphasia may be the reduction in the fluidity and flexibility with which communication allows navigation of the complex challenges of life's social actions and interactions (Shadden & Agan 2004). People with aphasia may experience not to be themselves any more (Shadden, Hagstrom & Koski. 2008).

Loss of communication competence has crucial implications for social life and identity, thinking, cognition and learning. If it is not possible to find alternatives and compensation strategies for participation and meaningful debate, it is likely that the intellectual level will gradually decrease:

It is often said that a person's language is at the level of his intelligence. It is probably largely correct. But the opposite also applies: Your intelligence is on par with your language (Goldberg, 2006, p. 109)

This shows how intrusive a language disorder might be for a person's ability to evolve and continue to be oneself.

Rehabilitation

Depending on ones approaches to learning and understanding of science, the speech therapy and the rehabilitation can be conducted in various ways. One is a mechanical reductionist approach, where teaching takes it's point of departure narrowly from the damage localization, or a constructivist, where the driving force for development lies in the ability to create meaning. In the constructivist view, it is not the person suffering from aphasia alone, which has communication difficulties, but the whole family, "the language is communication between people" (Fredens, 2004)

The English speech therapist Carole Pound supports the constructivist point of view considering aphasia as a social

handicap. She has suggested that focus should shift from teaching individuals towards a design of the surrounding environment. There are thus a number of national and international trends in favor of a context-sensitive approach to rehabilitation.

Rehabilitation, Learning and Identity

The communicative rehabilitation is about re-learning various perspective of the language. In the social learning theories language, learning and identity are closely linked together (Wenger, 1999). Learning is viewed, in addition to being a means of developing practice, also as a means of development and change of identities (ibid.). The learner acquires skills, attitudes and values, and this is reflected by the fact that he/she is a person-in-the-world. The identity is created and exists in the interaction with the surroundings, including exchange, meaning negotiation and mirroring (Weick 1995).

Often, training is organized as traditional special education and, unfortunately, often with rather childish pictorial material. I have met many persons suffering from aphasia feeling unworthy and considered as unintelligent persons. Their self-esteem is offended, which is not conducive to a learning situation.

Adult people, affected by a brain injury, often have difficulties coming to terms with the role as a student relearning language competences.

Identity is constructed through a persons lived life, through social discourses and through language-in-use. The negotiation of identity is an ongoing process. (Weick, 1995; Lev S. Vygotsky, 1986; L. S. Vygotsky & Luria, 1993) The philosopher John Dewey describes identity as something non-static, something that must be maintained and continuously renewed, and he agrees with Wenger that identity is created through activity and participation.

Life is a self-perpetuating process in which we act in relation to and influenced by the surrounding environment (Dewey, 2004, p. 23)

In line with this understanding the philosopher Mead had made an explanation of how self and society is connected and acted in relationship to one another (Mead, 1967). If learning is considered as social participation and interaction in which our identities are accomplished through language it is an intrusive intervention in a person's life to get a brain injury that restricts one's communicative competence.

The indication that the greatest challenge to people suffering from aphasia after a brain injury is to renegotiate identity (McCarthy & Moje, 2002; Shadden & Agan, 2004; Wertsch, 1993; Aujoulat, Luminet, & Decache, 2007; Shadden & Koski, 2007; Simmons-Mackie & Elman, 2011) makes it crucial though to address identity

creation in the process of relearning communicative abilities. Otherwise people with communication disabilities will be stocked in a vicious circle of low self-esteem and with reduced possibilities for learning. Simmons-Mackie (1998) argues that the general aim of authentic rehabilitation should be to prepare and assist people to integrate into a community and stresses the importance of social affiliation as a means of maintaining and developing identity.

Facilitating participation in the community entails passing the responsibility to the individual over a gradual period in order to develop autonomy, to enhance self-esteem and to take greater ownership of the issues that the people suffering from aphasia faces (Code & Herrmann, 2003).

Although the focus in aphasia intervention has shifted from recreation/relearning the correct language to a greater emphasis on communication acts, conversation moments, quality of life, life participation and regaining a feeling of belonging to society and family, there is still a need for approaches that facilitates the social construction, acceptance of social others and reconstruction of identity/self without targeting explicitly some aspect of linguistically communication (Shadden & Agan, 2004, s. 174) As identity plays a central role in the communicative rehabilitation of people suffering from aphasia, the communicative rehabilitation practices should address significant identity and motivational issues for the rehabilitation and in particular the importance of belonging, sociality and meaning

Technology-mediated Rehabilitation

For the last two decades, ICT facilitated speech therapy has been under discussion among speech therapists. A dominant view on learning within the discipline has put human-human interaction in focus, which some therapists had difficulties to reconcile with the use of technology. They were afraid that it would create an additional disturbing element in the communication between people who had communication difficulties (Konnerup & Schmidt, 2006) This concern has resulted in some resistance to technology-mediated rehabilitation. Most technology-mediated rehabilitation has had focus on the technological options to improve speech and language production than on the communicative, participatory and opinion-making dimension (Petheram, 2004). Some research and practices within the field have though had an interest in web 1.0 (transmission, sending, receiving and reading (Wertsch, 1993; Fredens, 2004) and an incipient use of web 2.0 (Konnerup & Schmidt, 2006). New social media offer great opportunities for this group of participants who potentially are marginalized in the communication- and learning society. Research indicates, that interacting and participating in media-rich web 2.0-based communities of practice strengthen

cognition, communication, acting competency and, in the broader sense, personal and social mastering (ibid.).

Avatar-mediated Rehabilitation

Virtual reality has demonstrated itself as an impactful method for behavioral and mental health domains. At *The Institute of Creative Technologies (ICT) at The University of Southern California* they have been doing more interesting research and developing projects concerning virtual humans and virtual worlds. One field is using Virtual Reality (VR) for mental health therapy, motor skills rehabilitation, cognitive assessment and clinical skills training. Another is the project *Coming Home*, which is a part of their U.S. Army Research. *Coming Home* implements intelligent virtual humans within an online virtual world for the benefit of veterans with post-deployment mental health issues. (Morie & Chance, 2011) Some of the research foci in the project have been:

- Advantages of the *customized environment* that can be part of the psychological healing process
- A large *social* component that facilitates strong peer support
- An *embodied* component in the form of one's personal avatar that may represent their inner feelings. (USC, 2012)

Coming Home has both in design and purpose many similarities to the pilot course *The Institute of Speech, Language and Brain Disorders* offers to people suffering from aphasia. Both projects are conducted in SL. SL is an free online world, that people can enter, explore and interact in by logging in on the Internet. Using keyboard and mouse people can control a graphical digital representation of oneself, a so called avatar (Carr & Pond, 2007). The person who controls the avatar can decide it's behavior and personalize it's appearance.

The easy access from home computers makes SL fit for rehabilitation. SL is in many ways a virtual replicate of the real world. It is possible for a small amount of money to personalize the environments. Some would argue that the graphical appearance could be more realistic, but research has shown that a photographically realism of the display does not increase the feeling of social presence (Sanchez-Vives & Slater, 2005, p. 337). In rehabilitation purposes parameters as embodiment and the feeling of presence has demonstrated to create positive effects for the learning task (Phillips, Ries, Kaeding, & Interrante, 2010) In a IVW you have a connectivity and a peer support offered by a social network that not only give information but also elicits to stay and interact by letting the users experience the world in first person

Environments like SL offer the features as embodiment, presence, collaboration, user-centeredness, context-awareness, and cross-real interactions to enhance the learn-

ing experience. Through avatar mediation, immersive virtual worlds open up for bodily immersion and interaction, affording users the semantics of place, including deixis, indexical language, and body orientation. Compared to many other technologies, the characteristics of IVW are the presence of avatars, a shared space, and shared activities. Avatars can communicate via text, symbols, verbal and non-verbal channels. The multimodality conveys not just language symbols, but also information about the interlocutors themselves. Schroeder (2010) noted that in the context of virtual environments, media richness is often called 'co-presence' and that the feeling of "being there" make users feel they are together in the same (virtual) space (Schroeder, 2010). With a focus on the community as the agent of situated learning the users will be enrolled in what Dourish (2001) define as embodied interaction:

...the creation, manipulation, and sharing of meaning through engaged interaction with artifacts (Dourish, 2001, s. 126)

Finally the avatar-mediated rehabilitation in IVW opens up for new concepts of peer-based rehabilitation making use of intelligent agent technologies for simulating peers as a motivational tool for the learner, e.g. giving emotional feedback or encouraging the learner to try a different solution.

Why Virtual Worlds Trigger Learning

So why do IVW trigger learning and how might it rehabilitate people suffering from aphasia? In relation to the pilot course in SL at *The Institute of Speech, Language and Brain Disorders*, Aalborg University (AAU) has conducted research⁵. The empirical work consisted of:

- Establishment of a project group (people suffering from aphasia, relatives and speech therapists)
- Qualitative interviews (before and after the pilot courses)
- Workshops (dialog/ activities about needs and wishes for aphasiac)
- Pilot courses (observations, videotape)

The data show first and foremost that one strong motivational factor is the social networking. People enjoy to socialize from their own home computer. Even though it can be difficult to learn to use the tools and navigate in the environment they are struggling to learn it. Some participants are impressed by the possibilities of the virtuality. They are proud of themselves when they succeed and they enjoy meeting like-minded people. They use time to design and re-design the appearance of their avatar, so they feel comfortable. It is interesting to follow

⁵ Results are not yet published

how most of them switch from calling their avatar "mine" or "the" to after a few sessions to call them "me". It shows how immersed they feel.

The learning situation changes from a traditional teacher-student situation to social interactions with fellow sufferers, teachers and social others interacting in a meaningful adult environment. you go from desk training, to sessions designed after the participants' wishes. Examples of this are travelling to remote destinations, a quiet day on the harbor or taking a dance class at the local dance school. The point of departure is the social interaction, but step-by-step words are added.

In addition to the textual and pictorial representation and smiley emoticons, avatars makes it possible to use different registers of movement and emotion expressions. They can wave, dance, fight, and kiss. IVW offers the use of multiple modalities and sensory stimuli at once. They can use the communication form they master and even act nonverbally. The social interactions trigger a more spontaneous behavior where the people are not necessarily stuck in their role as disabled and incompetent. They might even weave the formal learning sessions into their more informal social life on the Internet connecting with friends and creating social networks.

Research in communication and social psychology has shown that people mirror/mimic each other's speech patterns and postures (Van Baaren, Holland, Steenaert, & Van Knippenberg, 2003). According to theories of mirror neurons, experiences and acting on performance level stimulate nerve cells and develop them again (Rizzolatti & Sinigaglia, 2008). Research has demonstrated, that watching an avatar that resembles you can influence your thoughts, feelings, and actions – a phenomenon called "doppelgänger" effect (Blascovich & Bailenson, 2011). Brain imaging research suggests, that people project themselves onto these avatars. When people think about themselves, they recruit brain regions similar to those activated when they process information about their avatars (Caudle, 2011)

Embodiment seems to be another important trigger for learning. Embodied phenomena are ones we encounter directly rather than abstractly (Dourish, 2001, p. 100) and embodied personal representation constitutes a potential to have a strong effect on people. More participants in the danish SL project tells stories about how their mind and body have been so immersed in SL, that they have actually had a sense of being there. Riding horses is one example, flying in a hot air balloon another.

To some participants the virtual world seems to be a kind of a "bufferzone" meaning a confident place, where you can entrust private matters to the speech therapist.

Based on the ongoing danish project it is still to early to conclude if the interactions in SL enforce the participant to transfer there experiences and virtual self into society, but

related research at Stanford gives som clue of what to be expected.

Spillover Effect to Real-Life

At *The Virtual Human Interaction Lab* (VHIL) at Stanford University they have been doing studies about to what extend users transfer their avatar's behavior to their own real-world behavior. One study is about confidence and height (heights correlate with leadership and confidence in social situations (Blascovich & Bailenson, 2011, p. 105). Increasing people's height virtually had an influence on their behavior in the real world. A similar study has been made with attractiveness changes and with the same results. Yee and Bailenson (2007) has named this result for Proteus Effect after the Greek god Proteus which name means the ability to take on many different self representations (Yee & Bailenson, 2007).

The Proteus Effect is an important theoretical framework in understanding behavior in virtual environments and makes us believe in the pedagogical potentials in avatar-mediated learning and therapy. It might be a powerful means to rehabilitation of people suffering from aphasia.

Conclusions

Rehabilitation in IVW is still in it's infancy but research at USC and AAU indicates a great potential. Interactions in IVW trigger learning for more reasons. The environment appears adult and meaningful. It allows interest-based and situated learning. You can access a social network from your home computer and combine different kind of communication tools. Finally you can act through an avatar and slowly reveal who you are and rebuild your new identity in a kind of a safe bufferzone. Brain research and research about the spillover effect to real life indicate a positive outcome of both identity creation and restoration of the nerve lanes in the brain. New head monitored or handheld immersive technologies as Kinect and Xbox allows people to use more elaborate gestures and should encourage development of avatar-mediated, social and Internet based rehabilitation for people suffering from aphasia.

References

- Aujoulat, I., Luminet, O., & Deccache, A. (2007). The perspective of patients on their experience of powerlessness. *Qualitative health research*, 17(6), 772–785.
- Blascovich, J., & Bailenson, J. (2011). *Infinite Reality: Avatars, Eternal Life, New Worlds, and the Dawn of the Virtual Revolution*. HarperCollins.
- Carr, P., & Pond, G. (2007). *The unofficial tourists' guide to Second Life*. St. Martin's Griffin.

- Caudle, K. L. (2011). Reward and self-regulation in online digital environments. Dartmouth College.
- Code, C., & Herrmann, M. (2003). The relevance of emotional and psychosocial factors in aphasia to rehabilitation. *Neuropsychological rehabilitation*, 13(1-2), 109–132.
- Dewey, J. (2004). *Democracy and education*. Dover Pubns. Hentet fra <http://www.ilt.columbia.edu/publications/dewey.html>
- Dourish, P. (2001). *Where the Action Is: The Foundations of Embodied Interaction*. The MIT Press.
- Duchan, R., Linda, J., Garcia, A. K., Lyon, J. G., & Simmons-Mackie, N. (2001). Life participation approach to aphasia: A statement of values for the future. *Language intervention strategies in aphasia and related neurogenic communication disorders*, 235.
- Fredens, K. (2004). *Mennesket i hjernen: en grundbog i neuropædagogik*. Systime Academic.
- Goldberg, E. (2006). *The wisdom paradox: How your mind can grow stronger as your brain grows older*. Gotham Books.
- Konnerup, U., & Schmidt, D. (2006). *Det virtuelle miljø - en mulighed for nye læreprocesser i rehabiliteringen af afasiramte*. Aalborg. From projekter.aau.dk/.../Speciale_26_maj_2006.pdf
- Luria, A. R., Teuber, H. L., Pribram, K. H., & Haigh, B. (1966). *Higher cortical functions in man*. Basic Books New York.
- McCarthy, S. J., & Moje, E. B. (2002). Identity matters. *Reading Research Quarterly*, 37(2), 228–238.
- Mead, G. H. (1967). *Mind, Self, and Society: From the Standpoint of a Social Behaviorist*. (C. W. Morris, red.). University Of Chicago Press.
- Morie, J. F., & Chance, E. (2011). Extending the reach of health care for obesity and diabetes using virtual worlds. *Journal of Diabetes Science and Technology*, 5(2), 272–276.
- National Aphasia Association - \$25 for 25. (Undated). Hentet Januar 17, 2013, fra <http://www.aphasia.org/25-for-25.html>
- Petheram, B. (2004). Editorial Computers and aphasia: A means of delivery and a delivery of means. *Aphasiology*, 18(3), 187–191.
- Phillips, L., Ries, B., Kaeding, M., & Interrante, V. (2010). Avatar self-embodiment enhances distance perception accuracy in non-photorealistic immersive virtual environments. I *Virtual Reality Conference (VR), 2010 IEEE* (s. 115–1148). IEEE.
- Rizzolatti, G., & Sinigaglia, C. (2008). *Mirrors in the brain: How our minds share actions, emotions, and experience*. Oxford University Press, USA.
- Sanchez-Vives, M. V., & Slater, M. (2005). From presence to consciousness through virtual reality. *Nature Reviews Neuroscience*, 6(4), 332–339.
- Schroeder, R. (2010). *Being There Together: Social Interaction in Shared Virtual Environments: Social Interaction in Shared Virtual Environments*. Oxford University Press, USA.
- Shadden, B. B., & Agan, J. P. (2004). Renegotiation of identity: The social context of aphasia support groups. *Topics in Language Disorders*, 24(3), 174.
- Shadden, B. B., & Koski, P. R. (2007). Social construction of self for persons with aphasia: When language as a cultural tool is impaired. *JOURNAL OF MEDICAL SPEECH LANGUAGE PATHOLOGY*, 15(2), 99.
- Simmons-Mackie, N., & Elman, R. J. (2011). Negotiation of identity in group therapy for aphasia: the Aphasia Café. *International Journal of Language & Communication Disorders*, 46(3), 312–323.
- USC. (2012). Coming Home. Website. Hentet fra <http://projects.ict.usc.edu/force/cominghome/>
- Van Baaren, R. B., Holland, R. W., Steenaert, B., & Van Knippenberg, A. (2003). Mimicry for money: Behavioral consequences of imitation. *Journal of Experimental Social Psychology*, 39(4), 393–398.
- Vestberg, P. (2002). Hjerneskode og personlighed. *Kognition og Pædagogik*, 12(43).
- Vygotsky, L. S. (1971). *Tænkning og sprog*. Hans Reitzels forlag.
- Vygotsky, L. S., & Luria, A. R. (1993). *Studies on the history of behavior: ape, primitive, and child*. Hillsdale, N.J.: Erlbaum.
- Vygotsky, Lev S. (1986). *Thought and Language - Revised Edition* (Revised.). The MIT Press.
- Weick, K. E. (1995). *Sensemaking in organizations* (Bd. 3). Sage Publications, Inc.
- Wenger, E. (1999). *Communities of Practice: Learning, Meaning, and Identity* (1. udg.). Cambridge University Press.
- Wertsch, J. V. (1993). *Voices of the mind: A sociocultural approach to mediated action*. Harvard Univ Pr.
- Yee, N., & Bailenson, J. (2007). The Proteus effect: The effect of transformed self-representation on behavior. *Human communication research*, 33(3), 271–290.