Rehabilitation of People with a Brain Injury Through the Lens of Networked Learning. Identity Formation in Distributed Virtual Environments

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Abstract

This paper will demonstrate how avatar-mediated interactions and learning in networks might lead to identity formation and rehabilitation of language after a brain injury. With references to Vygotsky's notion of the social origins of higher mental functions (1978) and Hutchins claims that cognition is something that is embodied and externally distributed. (Hutchins, 1995), we will discuss identity formation after a brain injury in relation to Networked Learning (NL). The discussion is based on data from the first author's research (Konnerup, 2015) on avatar-mediated rehabilitation of people with aphasia[1] (PWA). Rehabilitation is conceived as a collaborative endeavour, conducted in a social virtual community with peer-to-peer interactions. Central is the comprehension that relearning language is embodied and related to social interactions and renegotiation of identity.

Individuals who lose the ability to communicate find it difficult to re-tell their own story and are at risk of being marginalised (Duchan, Linda, Garcia, Lyon, & Simmons-Mackie, 2001; Shadden & Agan, 2004). Although the focus in aphasia intervention has shifted from relearning correct language to a greater emphasis on life participation and regaining feelings of belonging to society and family, there is still a need for concrete suggestions for approaches that provide new contexts within which identity formation can be renegotiated.

In recent years, learning via online social networks has been recognised as a means of constructing learning and identities through participative interactions. Additionally, avatar-mediated activities in games, online communities, and E-learning have become a part of everyday play, communication, and learning. As these methods are still in their infancy, reflections on traditional forms of learning, teaching and rehabilitation, are needed. Teachers and/or speech therapists need a deeper understanding of these methods, and to become skilled in practicing technology-mediated teaching. We will discuss the positions that rehabilitation in online communities and NL share; how insights from NL pedagogy can inform the development of rehabilitation; and, conversely, how our finding add perspectives to NL. In doing so, we will introduce the concept of locale framework, and how a specific setting and embodied interactions might trigger autobiographical memory, relearning communication competencies and renegotiation of identity.

Keywords: Avatar, identity, autobiographical memory, cognition, rehabilitation and learning

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[1] Aphasia is an impairment of language function due to a brain injury. Aphasia takes many forms and influences a person's ability to produce and understand speech/language, to read, write, spell, and calculate. Aphasia may also be accompanied by other disorders, such as paralysis, cognition problems, and a lack of concentration. People with aphasia often experience chaos and confusion, in which language and interplay with surrounding environments in which language and interplay with surrounding environments are lost.

Introduction

Renegotiating of identity is a major challenge for people who experience communication disabilities following a brain injury (Duchan et al., 2001). Identity, and the multiple roles that define a person's sense of who he or she is within a larger society, are strongly linked to communication and language (Shadden & Agan, 2004, p. 174). From a sociocultural perspective, language has many manifestations. It expresses itself as spoken language, written language, body language, and as imagery. Language should not be seen as a goal in itself, but as a means of contact, communication, and learning; thus, it can be characterized as the bringing-into-speech of a person— and, therefore, of a part of identity and learning (Konnerup, 2015). According to Vygotsky (1978), language is an important factor in the formation and maintenance of identity, and the development of psychological processes and social relations . In order to arrive at a coherent sense of the self, individuals engage in communicative interactions, through which identities are established and modified. Thus, an individual identity is created and exists in the person's interaction with his or her surroundings, via meaningful exchanges of opinions, reflections, and mirroring (Vygotsky, 1978). With that in mind, it is obvious that the loss of communicative competences has crucial implications for social life, identity, thinking, cognition, and learning. During the last 20 years, issues of identity have been addressed in research into the consequences of brain injury. A research project from Australia, about *what people with aphasia want*, revealed that their primary goals involve activity and participation components (Worrall et al., 2011, p. 309)

Rehabilitation in groups has been suggested to accommodate the need for changing the focus from individual linguistic training to incorporating communication acts, conversation, quality of life, and regaining the feeling of belonging to society and family (Shadden, Hagstrom, & Koski, 2008). Since 2004, The Institute of Speech, Language, and Brain Disorders in Aalborg, Denmark has offered courses in online social communities for people with communication disabilities. Research related to those courses indicates that interacting with and participating in media-rich web-based communities might strengthen cognition, communication; and, in a broader sense, personal and social mastering. The possibilities for networking with peers from one's own home have been particularly successful (Dirckinck-Holmfeld, Petersen, & Konnerup, 2004; Konnerup & Schmidt, 2006). In 2010, The Institute of Speech, Language, and Brain Disorders broadened its online courses to include the avatar-mediated virtual environment, Second Life (SL). Konnerup (2015) revealed that avatar-mediated rehabilitation in Immersive Virtual Environments (IVE) facilitates alternative ways and compensation strategies for telling one's story, presenting oneself, participating in meaningful social interaction, training cognitive abilities, and the renegotiation of identity. Through embodied interactions, persons with aphasia (PWA) have demonstrated the capacity for immersing themselves in the interactions and scenarios of Second Life to a great extent, leading them to experience a high degree of presence (Konnerup, 2015) Furthermore, by offering a variety of ICT-mediated and multimodal communication tools, and by meeting a variety of perception modes, IVE offer a possibility to act and communicate in networks, to re-tell one's life-story, and renegotiate ones identity. The avatar-mediating aspect helped participants to feel immersed, and that they actually *were* the avatars. However, the data also revealed some obstacles concerning speech therapists' technical skills and fundamental understanding of ICT teaching methods and pedagogy (Konnerup, 2009) It is crucial to address and qualify this issue in order to develop virtual rehabilitation pedagogy. One approach is to seek inspiration from other similar fields, such as NL.

In this paper, the specific focus will be on how shared memories and embodied social interactions in IVE trigger communication and renegotiation of identity.

Data

In 2011 and 2012 The Institute of Speech, Language, and Brain Disorders conducted two pilot courses within an IVE, Second Life. Pilot 1 was a set up by one speech therapist, experienced with IVE, for 6 less experienced colleagues. The primary goal was to develop a framework for rehabilitation through pedagogical and didactic discussions, and at the same time to educate the speech therapists, through activities, to conduct PWA courses themselves. Pilot 2 was a six-week rehabilitation course for 9 PWAs, conducted by the 6 speech therapists involved in pilot 1. In pilot 2, the goal was to study the avatar-mediated methods, and to investigate how PWAs with differing difficulties and diagnoses could benefit. The pilot courses were based on social interactions and activities in a community-centred perspective. Besides joining the group sessions, all participants were encouraged to go online in SL unaccompanied, between the formal sessions. The pilots were observed, and videotaped, followed by interviews and workshops with the participants (Konnerup, 2015)

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In social learning theories, learning and identity formation are closely linked (Vygotsky, 1986). Identity is created through communication and collaboration in social communities, and is something that must be maintained and sustained throughout a person's life, retold, and reinterpreted through language with narratives and images. In this research on rehabilitation in virtual communities, the approach is based on socio-constructivist conceptions that learning and knowledge are culturally and historically interdependent. Inspired by Vygotsky, Lave and Wenger (1991) introduced the concept of situated learning in which they emphasise that knowledge and skills must be contextualised and pedagogically structured as reflections of everyday situations, and that learning is a process where the learner becomes involved in a community of practice, representing beliefs and behaviours. Situated learning theory is in line with Vygotsky's social development theory (1978), which claims that social interaction plays a fundamental role in the development of cognition, language, and identity. Besides considering learning as a means of developing practice, learning can also be viewed as a means of development and change of identities (Wenger, 2000). It is crucial for learning, identity, and self esteem, to be part of a community, both with peers and with family and friends. A focal point of communities of practice is a common goal. Each participant contributes their own repertoire and their own history to be distributed. In a virtual community of practice, people have the opportunity to share experiences, meanings, and repertoires, and thus create a shared culture (Konnerup, 2015).

In relation to learning following a brain injury, it is relevant to include cognitive learning in order to gain insight into how each person can restore strategies for learning. However, we do not believe that human cognition can be viewed in isolation and that cognition is limited to the brain; instead, cognitive processes must be seen as part of a wide range of social contexts.

Understanding Cognition as Socially Shaped

Cognition is an expression of the active mental processes that are related to knowledge, such as: perception, action, emotion, attention, memory, and higher cognitive functions; e.g., language and thinking (Fredens, 2004). Within cognitive science, the first generation was linked with information technology, and the brain was regarded as a mental processor of information. In response to criticism of ignoring the body's impact on thinking and cognition, and inspired by the French phenomenologist Merleau-Ponty, a second generation of cognitive science arose with the concept of the *embodied mind* (Gallagher & Zahavi, 2012). Hutchins (1995) developed a third generation of cognition, called "distributed cognition". In many ways, this generation is similar to the second, but it focuses on the fact that cognition, *besides* being socially and culturally based, is also action-based and mediated by artefacts. With reference to Vygotsky's (1978) notion of the social origins of higher mental functions, Hutchins (1995, p. 283) emphasises that cognition is not an individual mental process, but a process that experiences an external stage in social interactions. This leads us to an understanding of cognition—besides being socially and culturally shaped, mediated by materials and materiality—as also being action-based and distributed across a network of persons. Which again argue that speech rehabilitation would be qualified by a networked learning pedagogy.

With reference to the classical understanding of cognition, cognition occurs when one derives implications or associations from an observation, fact, or event . The learning process implies several cognitive abilities that allow attainment of learning goals. These abilities include solving new tasks, requiring: the formulation of objectives; planning; selection of alternative behaviours to achieve those objectives; and comparing plans, to establish the likelihood of success. In this process, environmental/contextual information is fundamental in order to follow guidance from previous experience; to implement new plans when the environment has not been anticipated; to obtain feedback when a change has occurred in the environment; and to then develop and test new plans (Rabbit, 2005). In this sense, we will present how the IVE provides the context for actions and learning in the rehabilitation process.

The Virtual Setting

The setting—whether a physical or computer-mediated world—mediates our cultural practices, social actions, and cognition. A virtual learning space must afford learning; designing for learning necessitates an understanding of how people learn, and requires more than an inventory of elements and assignments . To clarify the concept of setting, we adopt the term *locale framework,* inspired by the work of Fitzpatrick (2003); in the following, we demonstrate how a specific locale framework can trigger memory, interactions, and language. The locale framework is developed for system design and based on activity theory, as formulated by Leontjev (1978), Engeström , Miettinen, and Punamäki-Gitai (1999), and especially Strauss' sociological research on social worlds, action, and interaction (2008). What makes this relevant in this context is the unit of the *locale*. Fitzpatrick explains the concept as follows:

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> Locale doesn't exist a priori as does space or a room. A locale is the place constituted in the on-going relationship between people in a particular social world and the "site and means" they use to meet their interactional needs, i.e., the space together with the resources available there, resources including whatever constitute the "thing" involved in the accomplishment of work, be they objects, artefacts, tools features mechanisms and so on. As such, the framework is based on a metaphor of the place as the lived interaction with space and resources.
>
> (Fitzpatrick, 2003, p. 90)

Interpreting the locale as embracing the entire concept of settings, actions, situation, resources, tools, and artefacts, we obtain a framework that defines both the virtual learning space and the learning situation. Artefacts, meaning, situation, and cognition mediate actions, and learning becomes a part or a result of these actions. This approach is in line with the previous description of cognition and learning.

A virtual learning space allows a greater extent to design for any desired *locale*. Combined with artefact and the actual socio-cultural-political situation, locale refers to the place constituted in the on-going relationship between people in a particular social world and the world's space and artefacts. In the rehabilitation project at The Institute of Speech, Language, and Brain Disorders, some particular scenarios in SL have functioned as a kind of locale, as they trigger participants' memory and make them act and communicate spontaneously. The primary learning space in SL is based on a very well known (in a Danish context) fictive provincial town called Korsbæk. Korsbæk is known from a television series called Matador, which first aired on Danish television in 24 episodes, from 1978 to 1981. At that time, there only was one TV channel in Denmark, so nearly all Danes watched Matador. Since then, the series has been rebroadcast many times. The series concerns life in a small town, and viewers follow the town's inhabitants from 1928 to 1947. The series has become a shared cultural heritage for most Danes. Several PWA have used DVDs of the series as part of exercises on listening to Danish language. Thus, the participants have a relationship with the space. The series is familiar to participants, several of whom have expressed a kind of reunion joy in encountering the known buildings and persons.

In the following scene, the speech therapist, Patricia, is going to have a virtual training session in SL with the PWA Helen. Helen is 59 years old and has suffered from aphasia for 10 years. Her ability to grasp the meaning of spoken words and sentences and to be critical of her own speech is impaired. Producing speech is not greatly affected; she speaks fluently but does not always use the correct words. She easily gets distracted, makes associaations and has difficulties changing subject in a spoken conversation. It transpires that on the previous evening, Helen went to the virtual Korsbæk dancing school without guidance from any professional. The dancing school is run by one of Matadors central figures, an elderly lady named Miss Møghe, and is located at the Postgården restaurant. Helen is excited because she has taught herself to use the tool that animates her avatar to dance. She is eager to show this to Patricia. Patricia has not previously been to that virtual location, and she exclaims with warmth in her voice, "Oh, there is Miss Møghe", when she spots the piano player. Helen (the PWA) teaches Patricia (the speech therapist) to dance, and both of there avatars are laughing and dancing together while they are talking:

Patricia: You are so fine!...it's kind of fun. Have you seen yourself from the front, Helen?
Helen: It is nice from the front. I did [last night]. I had fun for a very long time.
Helen: One can really learn to dance here, don't you think so? Because there are so many options, so ... eh... you can see... you can see the different dances... ehhh, and can learn from them, actually, those steps, you can use them. Wow, it's wild! Hahahahahaha.
Patricia: Do you feel it in your own body, Helen?
Helen: Ya, I feel a kind of jerk. It's like when we were riding the horses. It's awesome! It's like my bike. I'm so pleased with my bike. I think it's cosy here in Korsbæk. I like it.

Figure 1 Helen and Patricia are dancing

It is not only the setting and the figures that put them in a shared mood. Patricia and Helen have a shared cultural heritage with Korsbæk, but also with experiences of the different dances. The dances (and their names) that are available as resources in Miss Møghe's virtual dancing school are known from real life. Helen and Patricia are approximately the same age, so dancing the special John Travolta moves from the film Saturday Night Fever especially excites them[2]. While dancing, Patricia and Helen laugh a lot, remembering their youth. Helen is very observant about the steps and considers whether it is possible to learn from the movements and practice them with her real body. She emphasises that it feels as if she is dancing herself.

Helen and Patricia evaluate the course during Helen's last session, and Helen is sorry that the course has ended:

Helen:	Now we have finally reached the point, where we eh ... can use, it; here in Korsbæk, I think this is the most cosy place.
Patricia:	I agree.
Helen:	And you learn more. You really get in-depth with it... eh, and it definitely has something to do with that we are from DK.
Patricia:	What are you thinking, Helen?
Helen:	Suppose, for instance, we go to Africa. Then, we just walk around and see some animals, but it's just something you SEE - it's not something you DO. In Korsbæk, you can go dancing with Miss Møghe, it makes you happy, and you think of all the publications [broadcasts] back then. It was over a long, long time—for how long? We did watch many episodes on the television, didn't we?

Helen's statements demonstrate that the locale means a lot for learning. There is a difference between being an observer (seeing) and being an actor (doing). Korsbæk is not any town; it is a particular town with lots of shared memories. The participants subconsciously know what to do in certain situations, triggered by the setting, the *locale*. When they are hearing, Miss Møghe is playing the piano at Postgården, they do not send mail or borrow books—no, they are drawn to dance! It is demonstrated that these culture-dependent actions, certain dances, biking, etc., motivate learning. The avatar-mediated actions, the setting (locale), and the materials make them want to dance, bike, or feel thirsty for coffee. Their moods are affected: some laugh a lot, some get angry; they

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[2] A well-known U.S. film from 1977

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say "oops" when bikes collide; they become frightened when they fall into the water, and so on. This indicates that the participants are putting themselves in the place of the avatars and are acting from that perspective Through the common context (Danish TV series), the SL setting allows the participants to interact with information from long- and short-term memory. This common context and the specific situation of each of the participants is characterised by Hodgson as a space in construction, where learning is developed by relational dialogue and interaction (Hodgson, 2008). SL allowed the participants to share memories from the past and positive emotions linked to those memories. This facilitated the emergence of various cognitive abilities as communicative skills, such as long series of spoken dialogues, social interaction, and the suggestions of some plans for the future. The participants were acting (performing some behaviours such as dancing) and, through those performances, rehabilitating or relearning cognitive abilities

With reference to Fitzpatrick's definition of locale, we consider Korsbæk, its inhabitants, the resources and tools, the multimodal systems (i.e., hearing, vision, speaking and writing), the music, the avatar mediation, and the user's socio-cultural and historical situation as a Locale Framework for rehabilitation. From a speech therapy perspective, one can also assume that these actions stimulate language, provide conceptual representation, and, in time, contribute to rehabilitation.

Shared Memory as a Trigger for Learning

As shown, acting in known locales triggers memories, invites participants to act, and affects the mood. But how does memories affect learning? And will triggering memories afford learning?

Memory is a cognitive function related to many different areas of the brain. Memory loss will also affect identity, since identity is shaped and constructed partly from memories of personal experiences and facts about oneself—the so-called autobiographical memories (Hirst, 1994; Rubin, 1988); and partly of socially interactions and retelling one's life story to others. Hirst, Manier, & Apetroaia, (1997)conducted extensive research on autobiographical memory, especially episodic memory, and its importance for the self. He claims that memory is organized as a narrative story, and that "it is not the memories per se, but the interpretation of the memories, or more specifically, the narrative told around the memories" (Hirst et al., 1997, p. 164) that have importance in shaping the self. This shows how intrusive a language disorder might be in relation to a person's ability to evolve and continue to be him- or herself.

In this sense, autobiographical memory can be defined as an explicit memory of an event that occurred at a specific time and place in a person's past, but it could also be related to complex spoken or signed language, narrative production, and comprehension in a socio-cultural environment (Nelson & Fivush, 2004).Thus, autobiographical memory can be seen as an outcome of a social cultural cognitive system wherein personal stories determine how social and cognitive sources are combined. It includes semantic memory, general knowledge base, and episodic memory, memory of an event in time and space as well as the awareness of the self in the experience (Tulving, 2002).

Both semantic and episodic components of autobiographical memory emerge and are retrieved from interactive development across social, cognitive, and communicative domains to serve functional goals (Nelson & Fivush, 2004). In the present project, the SL setting, Korsbæk, reflects how memories from the past are embedded within a social cultural context in which particular forms and contents of experience are valued and shared (Nelson & Fivush, 2004). Memories of the TV series and of all those Saturday nights, sitting with the family at home, the cosy atmosphere and the candies, now enable the participant to act in the learning environment. They dance, practice communicative skills, and interact socially with other participants, thereby integrating perceptions of the self. The locale (here, the virtual environment and the interactions between participants, participant/teacher, participant/setting, and participant/tools) can support the recovery and re-construction of identity. This is consistent with some of Hodgson's positions in the MAMIL research study, on how participants in an online learning community both occupy and are constructed by the learning space (Hodgson, 2008, p. 160). In this sense, the virtual community allows actions and interactions in the present on a performing level, while at the same time participants actively construct their own learning. In rehabilitation situations, narratives about memories or emotions might contribute to elaborate the meaning and/or significance of the events and thus improve the communicative competencies.

In a virtual session, the participants are visiting Genome Island. They are visiting the Bacteria Museum, prompting the following dialogue about bacteria:

Helen: What was it called, the bacterium that we should talk about now ... Ebola?
L: Yes, it is in bursts down in Africa—West Africa.
K   It has also come to Canada?
L: It spreads much faster than it did in the past. They reckon it's because people go much more by plane than they did in the past.

Helen:	Oh, these ones are only bacterium. It is not virus.
Pia:	No, it is only bacteria.
Helen:	Well, we will not find it here.
L:	No, we must find a virus museum. Hahaha.

In a multimodal way, the PWAs share knowledge about bacteria and viruses. They learn from each other and from the information at the Bacteria Museum, and they associate what they have seen in the news media. The dialogue was not planned by the speech therapist; however, by taking the participants to a place that she supposed would be interesting to them, she facilitated a *locale* that might afford communication. The participants are triggered by the *locale* to remember the Ebola virus epidemic in West Africa, which is shared knowledge and memory. Everybody brings information and knowledge to the conversation, and they construct meaning and learning.

As Hodgson (2008) argues, routines and experiences in online communities are not longer considered as different from those in face-to face communities. However, we agree with Hodgson that online networks and virtual environments might offer something else than the physical learning environment: they afford making "both narrational and informational social bonds and they are more likely to be interconnected rather than oppositional in their ways of being" (Hodgson, 2008, p. 163). Each participant introduces his/her own life and context, and through social interactions and negotiations of identity and meaning, they create a shared learning space. In the virtual rehabilitation project, the participants have a shared common history: they are all suffering from aphasia and they have a shared goal, namely improving communication competencies and renegotiating their identity. Thus, the learning space becomes more than a place to exchange instrumental knowledge. It turns into a space with shared socio-cultural experiences and shared memories, and at the same time a space to create and construct new experiences and meaning. Usher (2002) is concerned with how experiences in technology-mediated spaces (e.g., cyberspace) form identities and memories. He uses the term 'auto/biography' in the understanding that both individual and collective identities are made of lived and contextualised practices. Thus, there seem to be shared positions about how influential learning spaces—especially the social interactions that emerge out of the specific *locale frameworks* between the participants—are for identity formation. To date, contributions to NL have focused primarily on written discourses. The advent of avatar-mediated IVE introduces immersiveness and the possibility to act with artefacts and embodied cognition. When we design for learning, it is important to think about setting, means, the on-going relationship between the participants as a whole—as a locale framework.

Networked Learning as an Alternative Framework for Rehabilitation

Virtual rehabilitation based on a social-cultural learning perspective is rather new in the speech therapy realm. There is no long tradition within this area, and no shared formulated theory, practice, or pedagogy. In attempting to conceptualise and qualify rehabilitation pedagogy, it is helpful to be informed by the values and pedagogy of NL. The present rehabilitation case and NL share several positions. First and foremost, they have a shared ontological position that learning and teaching are socio-culturally influenced, constructed, and mediated by artefacts (Hodgson, McConnell, & Dirckinck-Holmfeld, 2012, p. 292) Regarding Hodgson et al. (2012), NL could be perceived as a proxy for epistemology, residing both in theory and activity, and in relationship with each other. Learning is thus created *in* actions and associated behaviours (Hodgson et al., 2012, p. 292). Another dominant value that the present rehabilitation project shares with NL is the overall holistic view and keywords as collaboration, dialogue, reflexivity, investment of self, and technology-mediated learning. One of the major challenges in the rehabilitation project was the role of the teacher. For many teachers, the virtual environment is a new landscape that presents challenges with regard to skills and methodological issues. With this paper, we take the first step toward bridging the realm of the speech therapist and NL, and hereby invite wider collaboration.

Concluding remarks

Virtual rehabilitation in speech therapy can offer some of the requirements highlighted in the most recent research on communicative therapy. The IVE offers a local framework that facilitates multimodal activities and permits participation in groups, which facilitate communicative acts with peers and therapists. According to Hutchins (1995), this kind of speech therapy can be considered as action-based and mediated by artefacts. The rehabilitation approach discussed in this paper shares with NL a community-centred perspective (Lave & Wenger, 1991). The participants reflect on their lives and become involved in a community of practice within which they share beliefs and experiences. Furthermore, following Hodgson et al. (2012), collaboration within the IVE supports collective and personal development. In doing so, IVE facilitates a way of being in the world,

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by conveying some features of collective and individual memory and thereby contributing to identity formation. It is not just a network connected by written discourses, but they are immersed and together in a locale framework connected by shared cultural memories and tools.

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