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# Virtual World Affordances for People with Lifelong Disability

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## **Acknowledgement**

*"You'll never do a whole lot unless you're brave enough to try." – Dolly Parton*

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## **Abstract**

This thesis explores virtual world affordances offered to people with lifelong disability. The central research question is expressed as follows:

*What are the affordances of a virtual world for people with lifelong disability?*

To address this question, the research relies on the exploratory, qualitative method. The empirical portion of the study was conducted through participatory observation and in-depth interviews; data was collected from both novice and experienced users of the virtual world Second Life™. The group of participants consisted of 11 novice participants located in Norway and 7 experienced participants located in the United States and South Africa. Novice participants were recruited through organizations in their local community, such as adult learning centers. The experienced participants were recruited through Virtual Ability Island, a non-profit organization helping people with disability in Second Life ([virtualability.org](http://virtualability.org)). The data collection and data analyses were conducted in 2011 and 2012.

The research approach was applied to gather rich data on users with lifelong disability, to understand their uses of and experiences in the virtual world. By including novice and experienced participants, the thesis explores how individuals with various levels of skills use and experience virtual worlds.

The data analyses were based on themes and theories from previous research and on findings from analyses themselves through the theoretical lenses of Embodied Social Presence theory, Technology Capabilities of virtual worlds, and Quality of Life factors and domains. The results determined through these theoretical lenses were used to identify the affordances offered by virtual worlds to people with lifelong disability.

The research results of this thesis are presented in five articles published or accepted for publication in international peer-reviewed conference proceedings and journals. The thesis summary presents the outcome of the research and describes how the different publications interconnect.

The findings from this thesis show that virtual worlds offer valuable affordances for people with lifelong disability and identify six affordances offered: communication, mobility, personalization, social inclusion, personal development, and joint activity. The study also concludes that the affordances identified may represent constraints to some people because of their disability.

Furthermore, the findings from this study may encourage government decision makers to offer computers in homes, institutions, and other locations in which people with lifelong disability can have access to virtual worlds. By making the appropriate technology available, a substantially greater amount of people with lifelong disability may be encouraged to test virtual worlds and discover the affordances they offer. However, assistive technology and introductory training are required and should be available to those who need it.

This research contributes to theory by applying previous theoretical frameworks (e.g., Embodied Social Presence theory, Technology Capabilities of virtual worlds, and Quality of Life factors and domains) in a new context, which affirms these theories, factors, and domains are helpful when explaining the phenomenon of virtual worlds for people with lifelong disability.

In addition, the perspective of affordances was applied to identify the affordances offered by virtual worlds to people with lifelong disability. By doing this, this study creates a nuanced understanding of affordances offered by virtual worlds. The findings indicate information systems research can benefit from including people with disability, the challenges they may encounter when taking advantage of technology, when developing theories.

The thesis also contributes to the knowledge base of virtual worlds and people with lifelong disability by basing its findings on empirical data. By conducting empirical research, this thesis contributes to a more expansive understanding of the challenges, opportunities, and values virtual worlds offer people with lifelong disability.

Ethical clearance for the research was obtained from the Norwegian Social Science Data Services (NSD). This study is part of a larger project conducted at Molde University College, Norway, that focused on virtual worlds to reduce loneliness for people with lifelong disability, and improving attitudes toward this user group. The project is part of a Strategic College Project funded by the Norwegian Research Council.

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# 1 Introduction

This thesis examines the affordances offered to people with lifelong disability by virtual worlds. Affordances are understood as a co-evolution between humans and the environment (Bloomfield, Latham, & Vurdubakis, 2010). In this thesis, the co-evolution between the virtual environment, represented by Second Life™, and people with lifelong disability will be explored. An affordance perspective builds on the fact that a technology has some identified functionalities or capabilities, but these need to be recognized as social objects (Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007). The lens of affordances is particularly appropriate when studying how people with disability engage with and are engaged by technology (Bloomfield et al., 2010).

People with lifelong disability constitute a large group of the world's population. Approximately one billion of the world's population have some type of disability (Krueger & Stineman, 2011). Due to known participation and inclusion challenges, this study focuses on people with lifelong disability whose impairment has occurred before the age of 22 and on whom the impact of the impairment is lifelong. Lifelong disability include but are not limited to intellectual disability, autism, deafness, epilepsy, polio, and cerebral palsy (Ansello & O'Neill, 2010).

People with disability experience barriers to social inclusion and entering the work force and are less likely to have interpersonal relationships outside of family ties (Ballin & Balandin, 2007). The feeling of being treated as different and not being seen as equal to people without disability is a challenge. This because there is a sense that society treats people with disability as if impairment in one area of function invalidates their abilities or access to opportunity in another area (Hammel et al., 2008). While mobility and accessibility are key issues for people with disability, communication has also been identified as a key issue (Morgan & Balandin, 1997). Communication challenges affect the ability to interact with others and to initiate or maintain friendships. Communication is an important part of being connected and feeling as a part of a community or society; therefore, feelings of exclusion may affect individuals' ability to communicate and become involved (Jackson, 2006). Information and Communication Technology (ICT) has shown promise in helping people with lifelong disability to overcome or reduce these barriers. ICT also empowers people with disability to experience independence, social connections, and inclusion in society (Renblad, 2003).

Virtual worlds, online three-dimensional worlds, offer an environment for entertainment, social settings, employment, and business. Previous research has shown people with disability are active users of virtual worlds (Babiss, 2009). In the context of people with lifelong disability, virtual worlds have been focused on for education (Elleven, Wircenski, Wircenski, & Nimon, 2006), rehabilitation (Standen & Brown, 2005; Stewart, Hansen, & Carey, 2010), and disability studies (McComas, Pivik, & Laflamme, 1998). Virtual worlds offer a safe environment for people with disability to practice skills that may include risks that are too great in the physical world (Standen & Brown, 2005). Research shows virtual worlds offer an environment in which three groups of rehabilitative interventions can be achieved: (1) promoting skills for independent living, (2) enhancing cognitive performance, and (3) improving social skills (Standen & Brown, 2005). In special education classrooms, virtual worlds offer a new opportunity for fieldtrips for students with disability (Smedley & Higgins, 2005). However, research concerning how this group uses and experience virtual worlds is still in an early stage. Thus, to contribute to the knowledge regarding how people with lifelong disability experience the opportunities and challenges offered by virtual worlds and provide a basis for the increased use of virtual worlds by people with lifelong disability, constitutes the main motivation for this PhD thesis.

The thesis is exploratory in nature, due to the low level of knowledge on the subject of people with lifelong disability and their usage of virtual worlds. By applying various theoretical lenses and theoretically identified factors in the data analyses, the thesis builds upon the virtual world knowledge base. This is cross-disciplinary work with an information systems focus, in which both information systems research and disability research contribute to the knowledge base.

From an information systems point of view, this thesis offers a new approach to knowledge about technology affordances. Information systems research tends to study how technology affects people without disability, which leads to assumptions about the nature of the abilities needed to utilize the affordances offered by technology. Thus, through this study we will gain a more nuanced understanding of virtual world affordances. In addition, the notion of affordances is of great interest in information systems research (Hsieh, 2012; Seidel & Recker, 2012; Zammuto et al., 2007), making this research timely and pertinent within the information system research community.

In addition, viewing this topic from an information systems perspective, virtual worlds offer technological capabilities that people with disability may be able to utilize depending on their disability. Figuring out the use of assistive technology and the

level of support people with lifelong disability need to fully experience the opportunities offered by virtual worlds enables the information systems field to gain a fuller understanding of the complexity of the technology and the need to develop less complex virtual worlds. In addition, how continuous use of the technology creates individual value for people with lifelong disability, may prove to be of importance for the information systems community.

### **1.1 Problem statement**

Virtual worlds in which socializing with strangers and friends are main activities promise opportunities for communicating and engaging in activities through a computer. Communication and inclusion in society are challenging for people with lifelong disability. Virtual worlds have proven to be valuable to people with disability for learning social skills. Nevertheless, the manner in which people with lifelong disability use virtual worlds to be included in social groups and interact with others is still in need of research. This leads to a need for research in which we seek to understand what affordances are offered to people with lifelong disability through the use of virtual worlds. Thus, the main research question for this thesis is:

*RQ: What are the affordances of a virtual world for people with lifelong disability?*

This is a very broad research question with many elements. To help address this main question, I have developed four sub-questions.

As a starting point, it is important to know the state of the field. Knowing how many people worldwide live with a disability, it is essential to understand how previous research has covered the field of virtual worlds in relation to people with lifelong disability and how they experience and use technology. Because virtual world research is in the early stages, to fully cover the potential virtual worlds may offer people with lifelong disability I also consider other ICT to be important in this research. It is essential to synthesize former research in the field and identify research areas that are lacking.

Due to the limited research in this field, it is important to explore the technological capabilities virtual worlds offer people with lifelong disability. Virtual worlds are available for those with access to a computer with broadband connection. Identifying technological capabilities offered by virtual worlds is the first step in answering this research question. The ability to take advantage of the capabilities offered and turn

them into affordances is equally important. Thus the first sub-question is formulated as follows:

*RSQ1: What technology capabilities and affordances do virtual worlds offer people with lifelong disability?*

Barriers of use may discourage people with lifelong disability from engaging in the use of virtual worlds; however, those who overcome these technological barriers may experience great value. These aspects need to be explored further, and the relationship to virtual self and others may be an important factor in experiencing the value of virtual worlds. Embodied Social Presence theory (Mennecke, Tripplett, Hassall, & Conde, 2010) was developed to explain how people relate to the virtual environment, virtual others, and virtual self. It divides the relationship to the virtual self and others into five stages. A high experience of Embodied Social Presence increases enjoyment in the use of virtual worlds (Mennecke et al., 2010). Embodied Social Presence theory is presented in-depth in chapter 2. Thus, the second and third sub-questions are as follows:

*RSQ2: How do people with lifelong disability relate to their virtual self?*

*RSQ3: How do people with lifelong disability experience interactions with others in the virtual world?*

Included in the relationship to virtual others, is the social aspect offered by virtual worlds. How people with lifelong disability experience their relationships to virtual others is closely related to the social aspects they experience through use of virtual worlds, however, this needs a more in-depth exploration. Social connections and inclusion are important issues for all humans. However, people with lifelong disability experience them as a challenge in the physical world. Earlier research has shown that ICT may help overcome this challenge. Nevertheless, how virtual worlds may help overcome this challenge and influence people with disability experiences of interpersonal relationships and social inclusion is a question that needs further researched. The fourth sub-question is therefore as follows:

*RSQ4: How do people with lifelong disability experience the social affordances offered by virtual worlds?*

This thesis consists of five research publications presenting the results from this project and an integrative summary of the research and its contributions. To understand the greater context of affordances offered to people with lifelong disability by virtual worlds, the four research sub-questions have been expressed according to the experiences of both novice and experienced users of virtual worlds.

This study was conducted in the virtual world Second Life™. Aligned with previous research, Second Life was chosen because of (1) the large number of users, (2) the range of activities available and (3) the wide range of opportunities (e.g., business, social connections, and education) (Schultze & Leahy, 2009). Because of these particular features, Second Life presents a suitable platform for many people with lifelong disability to explore and prosper in a virtual world. The ability to create an avatar and play with identity gives this platform an advantage for people with lifelong disability.

Through participatory observation and in-depth interviews, data was collected from both novice and experienced users of the virtual world Second Life. The group of participants consisted of 11 novice participants located in Norway and 7 experienced participants located in the United States and South Africa. Novice participants were recruited through organizations in their local communities, such as adult learning centers. The experienced participants were recruited through Virtual Ability Island (ref. [virtualability.org](http://virtualability.org)). Following the data from the exploratory qualitative research, contributions to the four research sub-questions introduced above were presented in the five published papers. The thesis's summary presents the outcome of the research and describes how the different publications fit together.

## **1.2 Structure of the thesis**

Chapter 1 presents the problem, aim, and scope of the thesis. Chapter 2 introduces the related literature and theoretical perspectives for the research questions. Chapter 3 describes the research approach in detail, including the research design, data collection, and analysis. Chapter 4 provides an overview of the five research publications and summarizes the publications and their results. Chapter 5, based on the results from the individual publications, synthesizes the contributions and identifies the affordances offered by virtual worlds for people with lifelong disability. Chapter 5 also presents the limitations of this study. Chapter 6 presents the conclusion of the thesis and implications for future research. In addition, chapter 6 presents implications for knowledge and practice. Appendix A includes example interview guides for the study. Appendix B contains examples of data analysis coding. Appendix C comprises example feedback from individuals attending presentations at Virtual Ability Island. And Appendix D contains the five publications that are the base for the thesis.

## **2 Related literature and theoretical perspectives**

As presented in chapter 1, the phenomenon of interest of this study is virtual worlds in the context of people with lifelong disability. The research questions raised in chapter 1 require a thorough literature review to establish the existing knowledge. The aim for the literature review is not to cover all existing literature within these two domains (i.e., virtual worlds and people with lifelong disability), but to introduce and establish the literature relevant for this research. The literature review was conducted after several iterations of searches. The literature searches have corresponded to each publication in this thesis. An in-depth literature review was conducted during the first two years of the project, with the main results published in Stendal (2012) (article 2 in Appendix D). The aim for the literature review was to synthesize the known research and present fields of study that lacked sufficient research.

The keywords used, individually or in combination, for database searches were: affordances, social, virtual worlds, virtual world, second life, disability, disabilities, lifelong, ICT, information and communication technology, challenges, barriers, opportunities, opportunity, avatar, and avatars. The searches were conducted through the following databases: EbscoHost, ISI Web of Knowledge, and Science Direct. Google Scholar was also used to conduct further searches. In addition, forward and backward searches were conducted to identify additional related literature not found through regular database searches. The results of all these searches are presented in the first part of this chapter. In addition to regular database searches, this section includes facts about intellectual and physical disability.

The choice of theories has emerged through the research process. As the study evolved, different theories were applied to provide lenses for analyzing the phenomenon from different perspectives. These theories are presented in section 2.5 of this chapter.

This chapter is structured as follows: Section 2.1 presents the concept of affordances and its use in previous information systems research. Section 2.2 presents virtual worlds in general, especially the virtual world Second Life. In addition, it presents online social networks and discusses how virtual worlds differ from these. Also, it discusses former research on virtual worlds and people with lifelong disability and presents the research gaps in this field. Section 2.3 discusses people with lifelong disability and the known challenges they encounter. Section 2.4 presents how people with disability use and experience ICT. Section 2.5 presents the theoretical

perspectives applied in this study. Section 2.6 summarizes literature and discusses how it is used as a basis for this study.

## **2.1 Affordances**

The concept of affordances is associated with the work of psychologist J.J. Gibson who defined them as all “action possibilities” or capabilities latent in the environment, objectively measurable and independent of the individual’s ability to recognize them, but always in relation to the actors and therefore dependent on their capabilities (Jones, 2003). Gibson found that every object could be recognized as having an affordance, meaning every object offered the possibility for action (Hutchby, 2001). Affordances are understood as co-evolutions between humans and the environment (Bloomfield et al., 2010). Basically, an affordance perspective builds on the fact that a technology has some identified functionalities or capabilities that need to be recognized as social objects (Zammuto et al., 2007). Affordances should be considered as equally dependent on the capabilities of an environment or object as on the physiological and physical abilities of the user or individual (Glăveanu, 2012). In the context of this thesis, this notion means that virtual worlds offer a variety of capabilities that may become affordances when the user is able to take advantage of their potential.

Previous research has also defined social affordances. Social affordances essentially is that technology affords or offers social practice (Hsieh, 2012). Theorizing about this concept suggests that social affordances create a link among social environments, interactions, and technologies (Hsieh, 2012). Hsieh (2012) further suggested that the social affordances of ICT is technological bounded and socially constructed, in which the users’ knowledge and technological skills together with the context of social interaction creates social affordances. In the context of this study, social affordances are the utilization of perceived capabilities for social practice, how the technology facilitates social relationships, groups and communities (Sutcliffe, Gonzalez, Binder, & Nevarez, 2011), through the use of virtual worlds by people with lifelong disability.

Zammuto et al. (2007) used the affordances lens to capture the interplay between information technology and the organization. The authors described five possible affordances, including the technical and organizational features that together create affordances. They suggested that the affordances offer a way of moving forward in developing conceptualizations of organizations in an era with high focus on information technology (Zammuto et al., 2007).



Hsieh (2012) used the social affordances lens to explore the implications of interactive ICT use on digital inequality. The aim of his work was to better understand the relationships among user characteristics, digital skills, and how ICT is being used for social interaction. He proposed a framework to provide directions for future research in concerning online networking skills and ICT usage concerning social interactions and their implications for digital inequality (Hsieh, 2012).

Analyzing capabilities offered by the technology and asking how and under what situations certain affordances are made manifest, may ensure an understanding of what affordances virtual worlds offer people with lifelong disability. An affordance will be identified through how and when various action possibilities are available or unavailable to a specific actor in a particular setting (Bloomfield et al., 2010). Through a focus on these questions (Bloomfield et al., 2010), the affordances offered by virtual worlds to people with lifelong disability can be identified and understood.

A critique of the affordance perspective is that affordances, like objects and individuals, are subject to constant transformation (Glăveanu, 2012). To understand this constant transformation, the identification of affordances for people with lifelong disability is essential to ensuring further development of the virtual environment.

## **2.2 Virtual Worlds**

Virtual worlds have existed since 1979, such as Colossal Cave Adventure (Davies, 2009), when the first text-based virtual world was created (Sanchez, 2009). The first virtual worlds known as Multi-User Dungeons (MUDs) were text-based and the interaction, environment and communication were all without graphics (Veerapen, 2013). Everything the characters in these virtual environments did, saw, heard or experienced were reported in words on the screen (Bartle, 2010). These early MUDs were fairytale games which were played using directional cues (Sanchez, 2009). Local players were inspired to use the MUD system to write their own virtual worlds for their own computers, and non-local players could access the MUD through packet-switching networks, or dial-up connections (Bartle, 2010). A defining moment in virtual world history was in 1988 when the MUD AberMUD was written in the code language C, which enabled it to be run on Unix operating system and connected to what today is known as the internet (Bartle, 2010).

Following the early MUDs, in 1989, TinyMUD was introduced as a social and creative environment (Veerapen, 2013). In this environment, users spent time creating and building objects. Player activity in TinyMUD centered about creating locations and

objects to populate such locations, and had no formal gaming goal at all (Bartle, 2010). However, they could not interact with the objects created in TinyMUD, which led to the introduction of Multi-User Dungeons Object Oriented (MOOs) (Sanchez, 2009). MOOs allowed their users not only to build objects, but also to interact with and use these objects while playing the game. MOOs were first introduced in 1990, such as LambdaMOO which is considered the social virtual world of the 90's (Bartle, 2010), and some of them are still in use today (Sanchez, 2009). This phase of virtual world development is known as a period of expansion, which also leads to division in usage of virtual worlds. There were three branches of virtual worlds developed after TinyMUDs; MOOs which were widely used within education, Multi User Shared Hallucinations (MUSHes) which were used by narrative-driven role players, and Multi User Chat Kingdoms (MUCKs) which were mainly used for social interaction. None of these had a game driven component. This led to the social/game world split that we know in today's virtual worlds (Bartle, 2010). The next phase of the development of virtual worlds were Massively Multiplayer Online Role-Playing Games (MMORPGs), introduced in 1996, where players entered a graphical, online environment where they could interact with multiple players. When playing MMORPGs, players assumed role-playing characters and the goal was to achieve certain tasks (Sanchez, 2009). Introduced in 1997, Ultima Online turned the tide for virtual worlds. Ultima Online attracted 100,000 players within a year of launch and was considered a world rather than a game (Bartle, 2010). Due to its success, Ultima Online was one of the first real MMORPGs. Ultima Online, considered the breakthrough world, did not anticipate the rapid success and was overwhelmed by the content and experienced severe technical difficulties (Bartle, 2010). The first fully 3-dimensional virtual world was EverQuest, released in 1999, and considered the precursor of today's graphical worlds (Bartle, 2010; Veerapen, 2013).

Today, virtual worlds are recognized as three-dimensional online environments that offer the possibility for communication, social interaction, and economic exchange among users who are represented virtually by avatars (Chesney, Chuah, & Hoffmann, 2009; Jung & Kang, 2010). Virtual worlds are accessed by multiple users and offer users the opportunity to determine their own experiences (Jung & Kang, 2010).

In 2004, one of the best known MMORPGs, World of Warcraft was launched (Bartle, 2010). With more than ten million active users, World of Warcraft is the most successive virtual game of its kind (Koot & Garde, 2013). Users of World of Warcraft interact and work together to complete quests. Players also achieve different abilities

which complement each other while working towards a quest. While playing, users communicate through chat, commonly in English, and join guilds where they can meet other players and coordinate their tactics in the game (Koot & Garde, 2013).

In 2003, three-dimensional social virtual worlds, such as Second Life, Active Worlds and There, were introduced (Sanchez, 2009). Even though there are similarities to the physical world within virtual worlds, this environment offers people the opportunity to be relatively anonymous. Immediately after entering the virtual world, any individual has at least two bodies, a physical and a virtual one, creating a sense of duality (Taylor, 1999). Virtual worlds offer the ability to create an avatar that may represent the individual controlling it in a certain way. People choose for themselves how they will be seen by others; for example, there are many who will cultivate an extreme look with clothes and hair that they would not wear in the physical world (Oishi, 2007). These virtual people are known as avatars and have a new name unrelated to their physical world name. In addition to being a social venue, virtual worlds, such as Second Life and Active Worlds, are environments for educational initiatives (Bulu, 2012). Three-dimensional virtual worlds are used for long-distance learning purposes and as a supplement for traditional classroom teaching (Bulu, 2012), due to their capability to engage students in interactions and activities with each other, the instructor and the environment (Baker, Wentz, & Woods, 2009).

Compared to traditional two-dimensional web environments, a three-dimensional environment crowded with avatars who can move around in the environment (Baker et al., 2009) and interact through text-based chat, voice chat, and animations (Fominykh, 2012). There are multiple reasons why people engage in virtual worlds, including seeking information, socialization, and entertainment. Virtual worlds let people escape from physical-world constraints and pursue unique activities in which they meet and interact with new and existing friends and networks (Jung & Kang, 2010; Kay, 2007). Many people spend time immersed in virtual worlds because they offer an interactive and unique place (Lim, 2009). In addition, the virtual world environment offers rich possibilities, which allows individuals to be aware of information and create identity through the creation of places, objects, and avatars (Prasolova-Forland, 2012).

Social media and social networks (e.g., Facebook and Twitter) are highly used media in today's society. Social networks have been defined as *“web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3)*

*view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site” (Boyd & Ellison, 2007, p. 211).*

Social networking sites are unique in that they allow individuals to meet existing friends and strangers while articulating and making visible their social networks (Boyd & Ellison, 2007). In addition, in recent years, we have witnessed social media used extensively during worldwide events such as the Arab Spring and social movements in Spain (Grabowicz, Ramasco, Moro, Pujol, & Eguiluz, 2012).

While virtual worlds also offer social networking, synchronous communication, and the ability to share, there are two characteristics that distinguish them from traditional two-dimensional social networks (Bulu, 2012). The representation of the physical world within the three-dimensional environment (e.g., light, sound, and motion) offers the user a feeling of being immersed into the virtual environment. Also, because users are represented through an avatar in the virtual world, the feeling of presence, co-presence, and social presence is evident. Users feel socially and physically connected to the environment and to others through the use of virtual worlds (Bulu, 2012). Virtual communities typically emerge and grow based on common interests, for example around political issues, business concepts, hobbies, health topics, religion, and education to name a few (Blanchard, 2008).

Furthermore, in the educational sector, many colleges and universities now offer courses to students through virtual worlds (Fominykh, 2012). Virtual worlds are useful tools in online teaching because they facilitate the engagement of students with an interactive environment (Molka-Danielsen, 2009). Discussion in a virtual world is real-time and simulates a meeting in the physical world, and it offers the opportunity to leave private messages to other avatars and communicate post-time. Interaction in a virtual world creates a sense of community even when a course does not offer any face-to-face meetings (Baker et al., 2009; Hew & Cheung, 2010).

## **Second Life**

Second Life is a three-dimensional, multi-user virtual environment in which users can communicate and participate in a social network within the virtual world (Bell, 2009; Ferry, Gelfand, Peterman, & Tomren, 2008). Second Life is a virtual-reality world created by Linden Lab, in which avatars can visit “islands” for purposes that can be connected to the physical world. The potential to sell products, conduct classes, do research, hold conferences, and conduct recruiting is there (Bugeja, 2008). With

750,000 unique visitors and more than 105 million user-hours in the third quarter of 2010, Second Life is one of the most popular virtual worlds (Mitchell & Khazanchi, 2012).

Large corporations such as IBM and Sony have invested large amounts of money, personnel, and other resources to maintain facilities and stores within Second Life (Atkinson, 2008). Artists participate within this environment by live performances through their animated avatars. Educational institutions offer classes and meeting places within Second Life (Molka-Danielsen, Deutschmann, & Panichi, 2009; Panichi, Deutschmann, & Molka-Danielsen, 2010). Giff Constable, quoted in Atkinson (2008) stated: “*What’s powerful about SL [Second Life] is the social aspect, the sense of togetherness.*” (p. 18).

### **Virtual world research**

Virtual worlds have attracted significant attention from the research community. Businesses are using virtual worlds to meet, build relationships with the public and customers, conduct market research, interview and recruit employees, and provide training (Mitchell & Khazanchi, 2012). Given some of these business objectives, recent research concerning virtual worlds has focused on virtual collaboration (De Nobrega & Rutkowski, 2012) and the business opportunities available in virtual worlds (Stangl, Kastner, & Polsterer, 2012). In addition, colleges and universities are active users of virtual worlds for educational purposes. In Second Life, 170 universities, including Harvard Law School, University of Nebraska at Omaha, and Ohio University, can be found (Mitchell & Khazanchi, 2012).

In the context of people with disability, virtual worlds have been the focus of various research initiatives, including some concerning education (Elleven et al., 2006), rehabilitation (Standen & Brown, 2005; Stewart et al., 2010) and disability studies (McComas et al., 1998). Virtual worlds are used by people with disability (Babiss, 2009). Virtual worlds offer people with disability an environment in which the impact of a disability may be less burdensome than in the physical world, and an environment in which mobility and social interaction may be more simply experienced (Stewart et al., 2010). However, because this field of study being in its early stages, it has yet to be fully explored.

An early literature review described the advantages of virtual realities for children with disability (McComas et al., 1998). It stated virtual realities can minimize the effects of a disability and have positive effects on training and skill enhancement (McComas et

al., 1998). Ford (2001) viewed virtual worlds from both a positive and a negative angle. He asserted that virtual worlds may make many prejudices created by stereotypes found in the physical world moot, but that virtual worlds may also present potential harm for people with disability, such as in cases in which programs fail to provide users the option to conceal a disability (Ford, 2001). Other researchers have considered virtual worlds a huge potential for people with disability (Alm, Arnott, Murray, & Buchanan, 1998; Babiss, 2009). Virtual worlds are believed to allow people with minimal physical mobility to explore virtual spaces with the same freedom as those with no disability (Alm et al., 1998). The ability to walk and move with no disability is viewed as a great advantage in virtual worlds (Babiss, 2009).

Field trips may be a difficult task in special education; however virtual field trips can be offered as an alternative (Smedley & Higgins, 2005). On virtual field trips, the teachers are in better control and the students experience an environment in which any physical barriers may be decreased (Smedley & Higgins, 2005). Virtual field trips as preparation for a physical world experience may also prove to be of value for people with disability (Elleven et al., 2006). In this way, students with disability can learn about physical-world work demands through the virtual world, and the experience can be a part of a successful career exploration (Elleven et al., 2006).

Virtual worlds offer the promise of value for people with disability, but some functionalities offered by the virtual worlds may serve to reconstruct disability (Carr, 2010). The introduction of a voice feature to the virtual world Second Life created the risk that deaf students would be excluded due to their impairment (Carr, 2010). Educators giving lectures through the virtual world need to be aware of the challenges the voice feature can create (Carr, 2010).

In an early article, Jones (1998) asked if virtual reality has a place in the rehabilitation world. He concluded that individuals engaging in virtual realities are showing real life improvements, but added that costs and the minimal research conducted at that time were limitations (Jones, 1998). However, another study indicated the main benefit of virtual reality for people with disability was the ability to engage in a wide range of activities relatively free from the limitations imposed on them because of their disability (Wilson, Foreman, & Stanton, 1997).

In a literature review, Standen and Brown (2005) stated virtual realities were proving to be helpful for people with intellectual disability to learn social skills, skills for independent living, and manufacturing skills. They also expressed there was no evidence the skills learned in a virtual environment cannot be transferred to physical

world settings, with the exception of people with Asperger's syndrome, who tend to experience deficits when considering communication and social understanding, which means they experience difficulties in generalizing the social rules from one setting to another (Standen & Brown, 2005).

A newly published study has shown the opportunities virtual worlds offer people with disability (Stewart et al., 2010). Stewart et al. (2010) presented a case in which an individual who uses a wheelchair in the physical world was able to work, walk, and engage in activities in the virtual world not accessible in the physical world. Becoming independent of the physical environment, a new form of independence and freedom was experienced (Stewart et al., 2010). The authors concluded virtual worlds may enrich the overall quality of life for people with disability and may enhance their physical, emotional, and social adjustment (Stewart et al., 2010).

Despite overall positive conclusions on the potential value of virtual worlds for people with lifelong disability, there has been little empirical research to support these claims. Of the 12 articles on virtual worlds for people with disability identified through the literature review presented in publication 2 (Stendal, 2012), only three were based on empirical data. The research approaches used in the three empirical studies were interviews/observation and case study. The remaining articles were conceptual papers, editorials, and literature reviews. This indicates a need for empirical research and rigorous analyses of the possibilities and challenges virtual worlds offer people with disability (Stendal, 2012). The research reviewed indicated the importance of bringing research disciplines together to further build on the knowledge about the potential and promises of virtual worlds for people with disability. However, the empirical studies reviewed (Carr, 2010; Smedley & Higgins, 2005; Stewart et al., 2010), did not specify the theoretical basis applied, which implied there was a need to examine the possibilities present in current, appropriate theories. The theoretical lenses applied in this study will be presented in section 2.5.

### **2.3 People with lifelong disability**

The United Nations (UN) Convention (Leonardi, Bickenbach, Ustun, Kostanjsek, & Chatterji, 2006) defined disability as follows:

*“Persons with disabilities include those who have long-term physical, mental, intellectual, or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others”* (pp. 1220).

The UN definition includes all types of disability. However, in the context of this thesis, it is important to define lifelong disability specifically. Ansello and O’Niell (2010) defined it as follows:

*“Developmental disabilities, as federally defined, are chronic impairments that occur before age 22 that may affect functional abilities in matters of self-care, learning, mobility, language, economic self-sufficiency, capacity for independent living, and other everyday skills. The impact of the impairment is life-long while the causes are many, including chromosomal anomalies, birth trauma, mother’s lifestyle during pregnancy, adverse drug reactions, and accidents such as automobile and diving that produce traumatic brain or physical injury. Thus, developmental disabilities, being functionally not categorically defined, are heterogeneous and might include individuals with Down syndrome, autism, deafness, epilepsy, polio, cerebral palsy, and the survivors of any number of untoward events that occur during life’s developmental (under age 22) stage”*(pp. 106-107).

Self-care, mobility, transportation, and housing are taken for granted by most people without disability. However, for people with disability, they are challenges (Greenwood, 1987). Due to the sense that society treats people with disability as if impairment in one area of function invalidates their abilities or access to opportunities in another area (Hammel et al., 2008), some people with lifelong disability experience problems with access to a range of community activities and have difficulties gaining acceptance within the general community (Ballin & Balandin, 2007).

Mobility and accessibility are general issues for people with physical disability, further, communication is identified as a key issue for people with lifelong disability (Morgan & Balandin, 1997). Communication challenges are closely connected to the ability to interact with others and to initiate or maintain friendships (Jackson, 2006). These challenges include hearing, vision, and speech impairments, which can lead to people with disability becoming isolated from their community (Greenwood, 1987).

Due to the variety of challenges people with disability encounter, disability services are increasingly required to provide individual and responsive services (Bigby & Knox, 2009). A larger group of people with disability are now reaching older age, indeed most people with mild to moderate intellectual disability now live as long as people without disability (Bigby & Knox, 2009; Buys et al., 2008). Until recently, prior to the availability of antibiotic and improved care for people with disability, the life expectancy for people with intellectual disability was 20-30 years; now the life expectancy is no different than the general population (Balandin & Morgan, 2001).



This change in the expected lifespan has created challenges for governments in terms of lifestyle support issues (Buys et al., 2008). It is important to focus on individual needs and not only services when making decisions on behalf of this group (Bigby, 2002; Bigby & Knox, 2009; Buys et al., 2008). The need a person with disability has when aging is closely related to the individual life experience before aging. Experience with paid employment can be limited, social networks can be few, and a partner or children may not be present. Not many people in this group have assets for their retirement and most have some level of dependency on formal and informal support for their everyday living (Bigby, 2002). As people with disability age, their need for formal support from government services to replace informal support from family, mainly parents, will increase (Bigby, 2002).

This research aims to examine the possibilities virtual worlds offer people with lifelong disability to overcome some of the challenges they experience in the physical world. The research may enlighten governmental agencies and health professionals to include virtual worlds in their offer of services to people with lifelong disability.

### **2.3.1 Diversity among lifelong disabilities**

In this section, information about intellectual and physical disability is introduced. This information is gathered from organizations working with and for specific groups within the disability group, including the American Association on Intellectual and Developmental Disability (AAIDD) and the Association for the Physically Disabled (APD).

#### **Intellectual disability**

Intellectual disability is characterized by significant limitations in both intellectual functioning and adaptive behavior (AAIDD, 2012). Intellectual disability affects many everyday social and practical skills and originates before the age of 18. Intellectual functioning refers to the general mental capacity, which includes learning, reasoning, and problem solving (AAIDD, 2012).

In addition, people with intellectual disability may encounter challenges with conceptual, social, and practical skills. Conceptual skills include language and literacy, money, time and number concepts, and self-direction. Social skills include interpersonal skills, social responsibility, self-esteem and the ability to follow rules and obey laws. Practical skills include activities in daily living, occupational skills, healthcare, routines/schedules, use of money, and use of technology (AAIDD, 2012).

## **Physical disability**

Physical disability refers to a broad range of disabilities that include paralysis and hearing impairment (APD, 2012). There are different degrees of physical disability. When mild, it may cause only slight disruptions in a person's life. However, when severe, it may affect the whole body and have significant impact on an individual's daily activities (CerebralPalsyAlliance, 2012). A physical disability such as cerebral palsy may cause uncontrollable or unpredictable movements, muscles may be stiff, and in some cases cause shaking movements or tremors.

People with a physical disability may rely on assistive tools such as wheelchairs, crutches, canes, and prosthetics to obtain mobility. Others may rely on assistive technology (e.g., hearing aid) or augmentative and alternative communication (AAC) to communicate with others (APD, 2012).

### ***2.4 ICT and people with lifelong disability***

The main focus of this thesis is not on ICT. However, there is a body of research on the use of ICT for supporting communication and social interaction among people with disability that is important when exploring the use of virtual worlds within the same group. While the focus of this research is on virtual worlds, the research this thesis represents can be positioned within the overall focus on how different forms of ICT, including virtual worlds, may support social connections and activities for people with lifelong disability. Thus, when exploring the specific affordances and experiences of virtual worlds, it is natural to start out with previous research on other ICTs as a base. ICT, in this context, can include computer games, assistive technology (e.g., voice augmentation systems), or online communication tools (e.g., the Internet, e-mail, and instant messaging).

How people with disability use ICT for various reasons has been the focus for many streams of research, such as disability studies (Guo, Bricout, & Huang, 2005), educational studies (Passerino & Santarosa, 2008), information systems research (Söderström, 2009a), and rehabilitation studies (Coles, Strickland, Padgett, & Bellmoff, 2007). Anderberg and Jönsson (2005) identified three main categories of how people with significant mobility or physical impairment experiencing the use of ICT in their day-to-day lives. These three main categories are independence, learning, and communication.

## **Independence**

Independence is important to most of us, but for people with disability, independence is not easily achievable. However, with the use of ICT, independence can be obtained in various ways. One of the most important aspects of independence is the sense of being in control of one's own life (Gutierrez & Martorell, 2011; Lathouwers, de Moor, & Didden, 2009). Through the use of ICT, people with disability cultivate the ability to make their own decisions, independent of the health professionals or personal assistants who are assigned to them (Moser, 2006). One example of gaining independence is the use of ICT (e.g., assistive technology and computer with Internet) mounted on a wheelchair, enabling a person with multiple disabilities to move around without the assistance of another person. With ICT, people with disability are able to maintain a budget and make decisions from their own home that will affect their day-to-day lives (Moser, 2006). ICT can also provide people with disability the opportunity to express their opinions (e.g., through blogs) and is viewed as a great opportunity not to be controlled by others (McClimens & Gordon, 2009).

A great advantage experienced by people with disability while using ICT is the sense of being independent of the physical environment (Anderberg & Jönsson, 2005). Through the Internet, from the security of their own home, people with mobility disability experience the opportunity to meet others, maintain existing friendships, and build new ones (Bradley & Poppen, 2003; Guo et al., 2005; Seymour, 2005).

## **Learning**

Through the use of computers and the Internet, information becomes accessible for people with disability (Anderberg & Jönsson, 2005). Johnson and Hagarty (2003) presented a study in which students with mild to moderate learning disability used websites to locate information in relation to their interests. Their study showed websites prove to be a valuable and motivating educational asset for the students.

ICT, in special education settings, supplies students the tools to follow and participate more fully in the educational environment (Lewis, Trushell, & Woods, 2005). The authors noted that children with Asperger's syndrome had a moderately increased ability to interact with classmates who did not have a disability, through the use of ICT. This applied in both social and educational settings.

Experiments using computer games for training people with disability or the use of community-based ICT for teaching people with disability computer skills, showed some success. Coles et al. (2007) reported that children demonstrated improvement of

knowledge after studying street and fire safety through a virtual gaming environment. They noted that such virtual gaming environments offer children the joy of playing a game, at the same time they learn new skills.

## **Communication**

One of the challenges many individuals with disability experience is difficulty with communication (Greenwood, 1987). Communication is closely related to being connected and feeling part of a community or society. People with disability use technology to access the online world just as people without disability do, and are able to engage in online interactions with like-minded friends or peers (Söderström, 2009b). Having obtained ICT skills, people with disability are likely to experience being perceived as equals in the eyes of others when communicating through online media (Gardelli, 2008). Through ICT, people with disability can communicate in new ways, so their feelings of inadequacy decrease (Gardelli, 2008; Lidström, Ahlsten, & Hemmingsson, 2011). ICT allows communication through both text and voice, which may help to break down the barriers of communication (Söderström, 2009b). The ability to meet new and existing friends through the use of ICT has been shown to be of value to people with disability. ICT removes geographical boundaries and allows for communication and interaction with individuals throughout the world (Söderström, 2009b).

Closely related to being met as equal is the ability to choose what to disclose. This ability enables people with disability to have control over disclosure of impairment not typically available in social interactions in the physical world (Bowker & Tuffin, 2002). Bowker and Tuffin (2002) stated the nature of the online medium invokes a standard assumption of normality, which may also apply to virtual worlds. It becomes everybody's choice what to disclose and it is a participatory right (Bowker & Tuffin, 2002). Not all are interested in concealing their disability, even though the ability to do so is available in the environment. There are multiple online help-groups and cultures that are dedicated to specific disability, or are available for discussing issues related in general to disability (Babiss, 2009; Stewart et al., 2010). Through these forums, or virtual groups, information and experiences are exchanged which is helpful in defusing a disability (Davidson, 2008; Finn, 1999). By talking about and discussing the issues important to them, people with disability also experience a sense of self-worth by being able to help each other (Stewart et al., 2010), while at the same time support to educate others and refute prejudices and misconceptions (Anderberg & Jönsson, 2005).

## **Barriers of use of ICT for people with lifelong disability**

There are barriers for people with disability when considering access to and use of ICT. One barrier relates to the environment, such as near family or support staff. Anderberg and Jönsson (2005) reported that the human filter, be it a personal assistant or a family member, in some cases becomes a hindrance for meeting new people. When people with disability are in social settings, the personal assistant or family member, may prevent them from making the connections they want (Anderberg & Jönsson, 2005). A Spanish exploratory study indicated that support staff and other close relations often make choices for people with disability and deny them the opportunity to access a computer or the Internet (Gutierrez & Martorell, 2011). The authors also concluded that there is no reason why people with a mild to moderate intellectual disability should not be able to use the Internet. Caregivers may not trust people with disability to use ICT or may not understand the importance of such use, and therefore make decisions on their behalf. By communicating through the Internet, for some, the human filter is broken down and enables people with disability to independently meet and communicate with others (Bunning, Heath, & Minnion, 2010; Renblad, 2003).

Another barrier is access to technology and the Internet. A survey study in China indicated that a minority of people with disability have access to the Internet; this represents a digital divide (Guo et al., 2005). People with disability who have access experience a significant increase in frequency of social interactions and reduction of existing barriers in the physical and social environment. The authors suggested researchers should focus on how ICT can be made more accessible for people with disability. This recommendation is supported by a U.S. study (Dobrinsky & Hargittai, 2006). Based on nationally representative data about U.S. Internet use, the authors concluded that people with disability are less likely to live in a household with computers and thus are less likely to use computers or engage in online activities. While this research is old and the world's Internet access and use has increased since 2005/2006, newer statistics show that there is still a need for improvement in this area. Only 54 % of Americans living with a disability use the Internet and only 41% of the same group have broadband at home (Fox, 2011). Though this PhD project does not aim to explore how to ensure better access to the Internet for people with lifelong disability, this research may lead health professionals and government agencies to understand the value of access for people with lifelong disability.

## **2.5 Theoretical Perspectives**

Through the research process, theories were identified to help explore the research questions presented in chapter 1. The selection of theories for this thesis, as presented earlier, was an ongoing process. The set of theoretically identified technology capabilities (Davis, Murphy, Owens, Khazanchi, & Zigurs, 2009) provided a guide to identify the technology affordances virtual worlds offer people with lifelong disability. Embodied Social Presence theory (Mennecke et al., 2010) was chosen because it deals with how people experience their relationship to their virtual self and to others. In addition, to help understand the social affordances virtual worlds offer people with lifelong disability, the set of factors and domains used for Quality of Life research (Schalock, Keith, Verdugo, & Gómez, 2011) were used as a guide.

### **2.5.1 Technology capabilities of virtual worlds**

Virtual worlds have a set of identified technology capabilities. Virtual worlds, labeled as “metaverses” by Davis et al., (2009), have a defined set of capabilities for communication, rendering, interaction, and team process. These capabilities are not seen as static, but are dynamic and evolving because avatars use them during their time in virtual worlds. In the context of this thesis, the first three capability categories of communication, rendering, and interaction are considered. The fourth technology capability category, team process, does not apply in the context of this thesis and therefore is not included in the discussion. This is due to not examining teams, but rather focusing on individuals in the context of this thesis. In addition, it is important to note that the identified capability category interaction does not define interaction with others in the traditional sense. It is defined as interaction (e.g., create and modify) with objects in the virtual world, not among humans.

#### **Communication**

Communication is intrinsic to humans; the ability to connect and communicate with others is important in most environments and contexts. Virtual worlds offer communication possibilities through both text chat and a voice feature. This enables people to communicate in real time and obtain immediate feedback on their comments or statements (Carr, 2010). In the physical world, we rely on more than the spoken word, for example, by using body language and facial expressions. However, it may be difficult to use this multi modal communication in virtual worlds, due to the complexity of such animation. In addition, online communities may have their own written language that in every day spoken conversation is not used (Campbell, 2011). Through experience with communication channels, communication richness increases

(Carlson & Zmud, 1999). Communication support in the virtual world means there are multiple ways to communicate. The virtual world Second Life offers public text chat, private instant messaging (IM), group IM, public voice chat, private voice chat, and group voice chat. However, to use these different communication tools effectively requires training, and lack of training may discourage potential users from adopting the technology (Davis et al., 2009).

### **Rendering**

Rendering is the process of creating or executing life-like images on the screen. Within the concept of rendering, two capabilities are described, personalization and vividness. One of the important factors offered by virtual worlds is the embodiment the avatar represents (Mennecke et al., 2010). Through an avatar, people in virtual worlds are able to create and play with a representation of themselves in a way not available in the physical world, a process described as personalization. As presented in section 2.2, many individuals create avatars that cultivate an extreme look.

Virtual worlds are three-dimensional reproductions of the physical world, and this is described as vividness. Within virtual worlds, there is the possibility for communication, social interaction, and economic exchange among users (Chesney et al., 2009; Jung & Kang, 2010), a lifelike representation of the physical world in the virtual world.

### **Interaction**

Interaction is the extent to which users can participate in modifying the form and content of the virtual world in real time. However, such actions require training and knowledge and can be a difficult to perform. Virtual worlds such as Second Life enable users to create the content, in other words, people are able to build, create, and modify objects, environments, and their own representations in real time (Jung & Kang, 2010). Interaction also includes the capability of mobility. Virtual worlds also provide the users with the ability to move around in an environment free from physical laws (Standen & Brown, 2006). Consequently, virtual world users are able to fly and teleport. For people with lifelong disability, this allows an individual, who in the physical world uses a mobility aid, to move around freely, to walk, run, or dance (Stewart et al., 2010).

The theoretically identified technology capabilities do not consider the challenges people with physical and intellectual disability may encounter when attempting to take advantage of them. However, these capabilities may create insight into the issues

posed in research sub-question 1 presented in chapter 1, which aims to understand the technology capabilities and affordances offered by virtual worlds for people with lifelong disability.

### **2.5.2 Embodied social presence theory**

Social presence has been defined as the degree of awareness of other individuals in an interaction and, also, the appreciation of an interpersonal relationship through such interaction (Short, Williams, & Christie, 1976; Tu & McIsaac, 2002). It is widely agreed that social presence should be viewed as an experience, which varies from moment to moment, and differently among individuals (Shen & Khalifa, 2008; Tu, 2000). Building on previous research (Schultze & Leahy, 2009), presence is of a situated and dynamic nature. Social presence is not a set measurement and differs among individuals and situations (Biocca & Harms, 2002; IJsselsteijn, van Baren, & van Lanen, 2003; Steptoe, Steed, Rovira, & Rae, 2010; Tu, 2000; Tu & McIsaac, 2002).

With the introduction of virtual worlds, Social Presence Theory has gone through further development. Schultze (2010) stated that in 2002 as the thought of social presence moved towards the user's experience of virtual other's warranted changes to the original theory. The shift suggested that the user's perception of social presence and the social cues displayed through the mediated medium were more important than the medium's suggested capabilities. This reconceptualization of social presence theory led to a more people oriented and less medium oriented focus in ongoing research (Lowenthal, 2010), where people might experience social presence even when the medium does not provide any physical co-location (Bulu, 2012).

In 2008, social presence was conceptualized as a multi-dimensional continuum (Schultze, 2010), where the connection with interpersonal trust was highly regarded (Bente, Rüggenberg, Krämer, & Eschenburg, 2008). Avatars in the virtual worlds function as a focal point and enhance the interaction taking place. Interacting through avatars enable individuals to feel connected to others and feel a greater sense of social presence in the virtual world (Bulu, 2012).

In 2010 Embodied Social Presence Theory was introduced to create this multi-dimensional notion of social presence, by combining the concepts of embodiment and mediation (Mennecke et al., 2010). Embodied Social Presence is used to discuss social presence in virtual environments (Mennecke et al., 2010). The sense of social presence with others is important when using technology for communication, as is the



relationship and sense of social presence between the individual and the avatar (Bulu, 2012). In a physical environment, social presence begins with acknowledging the presence of others, equally, in a virtual environment the acknowledgement of the avatar as a representation of self is crucial (Durlach & Slater, 2000; Schultze & Leahy, 2009).

Mennecke et al. (2010) presented a framework for Embodied Social Presence with five stages that elaborate on social presence in a virtual environment. The framework includes recognition of the digital self and the virtual environment engaged. It also focuses on the appropriation of the avatar as a tool in the social interaction and therefore an important factor in the social presence. Mennecke et al. (2010) suggested the perception of Embodied Social Presence is achieved through a complex process in five stages beginning with the perception of embodied presence and co-presence and ending with the perception of self and others engaged in interactive and task-focused activity.

The first stage, *recognition of the other*, involves observing other avatars participating in activities. Mediated embodiments, such as pictures and other representations of others, may automatically trigger a sense of social presence (Biocca & Harms, 2002). In a three-dimensional virtual world, unlike in text-based virtual worlds, presence is rearticulated to others and self by adding an avatar (Taylor, 2002).

The second stage includes *recognition of the digital self*, where the user creates a perception of the digital self, embodied in his or her own avatar. Schultze and Leahy (2009) stated there are various ways of viewing one's avatar, such as the avatar as a three-dimensional cursor or the avatar as a possible self. The strength of an individual's relationship to his or her own avatar is perceived differently by individuals and may be related to the length of time spent with the avatar (Bailenson, Beall, Blascovich, Raimundo, & Weisbuch, 2001; Wolfendale, 2007).

In the third stage, *collaborative engagement*, the users start interacting with others using avatars and through the avatars' actions. Schultze and Leahy (2009) presented the avatar as an object of play and as a tool. Avatars are tools for interaction and communication, as well as for collaborative activities with other avatars.

The fourth stage, *appraisal of the "real" other*, involves an individual having some understanding of the others as individuals. Virtual worlds offer a representation of self and others. Such representations may be misunderstood as not real (Schultze, 2010). It is important to remember and understand there are real people behind each avatar.

Schulze (2010) noted that the encounters in the physical world and the virtual world are similar.

The fifth and final stage, *reflection on and appraisal of the self*, occurs with the development of the users' perceptions of their own digital self, engaged in activities with other avatars. Mennecke et al., (2011) stated this represents a shift in focus on the virtual and real self, as the user perceives him- or herself as a component of the environment manifested in his or her avatar.

In research based on photo-diary interviews with 14 participants, Schultze and Leahy (2009) identified four social presence categories in the virtual world: Virtual Me, The Avatar as Possible Self, The Avatar as a Character, and Scripted Character. In these categories, Virtual Me represents an integrated avatar-self relationship in which the participants never perceive themselves as separate from their avatar. Scripted Character represents a completely segmented avatar-self relationship in which the avatars do not represent the participants in any way, but are used as tools to engage activities, for example, in role-plays. In the two middle categories, The Avatar as Possible Self and The Avatar as a Character, there is a more dynamic avatar-self relationship. The Avatar as Possible Self allows participants to explore an alternative self or the real self, which is not likely in the physical world. The Avatar as a Character implies a sense of connection between the avatar and self, in which participants refer to their avatar as her or him, yet the participants have control and make the decisions.

Mennecke et al. (2010) stated that the embodiment of self in the virtual environment can be seen as a tool for communication and symbolic interactions. They viewed the virtual body as a tool for mediating communication; therefore, the actions of the virtual body have embedded perceptions. Embodied Social Presence theory not only attempts to explain the communication between users in the virtual environment but also takes into account the relationship and communication between avatar and user.

This is new theory and has been used as a framework in empirical research to account for the higher levels of perceptual engagement that users experience as they engage in activity-based social interaction in virtual environments (Mennecke, Triplett, Hassall, Conde, & Heer, 2011). These researchers examined the proposed Embodied Social Presence theory in a qualitative study, in which data was collected from two graduate courses in e-commerce. The data consisted of reflections from students involved in the courses on their experiences in Second Life. Mennecke et al., (2011) stated that users experience a greater sense of engagement, encouragement, and task performance

when they experience Embodied Social Presence. Furthermore, the authors indicated the sense of Embodied Social Presence will evolve over time. Biocca and Harms (2002) stated that social presence is suitable for self-reporting by individuals, such as was the case in the study by Mennecke et al. (2011).

To summarize the literature concerning Embodied Social Presence theory, it can be applied to understand how people with lifelong disability experience the relationship to virtual self and others. However, the theory does not take into account the ability (physical or intellectual) of the user to be able to take advantage of the possibilities present in the virtual worlds. This research does not suggest any extensions or alterations of Embodied Social Presence theory; however, it does affirm the theory in a different context than originally used as suggested by Harlow (2010). By applying this theory, in this new context, there is a possibility of creating a nuanced picture that also considers people with lifelong disability and their experiences of relationships to virtual selves and others.

**2.5.3 Quality of life**

Factors and domains identified by Quality of Life research (Schalock et al., 2011), presented in Table 2.1, can be used to identify and understand the social affordances virtual worlds may offer people with lifelong disability. Quality of Life factors include individuals’ perception of independence, social participation, and well-being as important focal points.

<b>Factor</b>	<b>Domains</b>
Independence	Personal development Self-determination
Social Participation	Interpersonal relations Social Inclusion Rights
Well-being	Emotional well-being Physical well-being Material well-being

**Table 2.1 Quality of life factors and domains (Schalock et al., 2011)**

**Independence**

As presented in section 2.4, independence is important for all humans. ICT can be used by people with lifelong disability to develop independence and control over their

own lives. An increase in control over their own lives creates a sense of personal development (Parsons, Daniels, Porter, & Robertson, 2006). An important issue in personal development is education (Verdugo, Arias, Gómez, & Schalock, 2010). Education and learning lead to the opportunity for empowerment and independence (Smedley & Higgins, 2005).

A self-determined individual is defined as someone who determines his or her own fate or course of action without interference from others. Intrinsic and extrinsic motivations are important factors in self-determination (Wehmeyer, 1998). Intrinsic motivation implies people engage in an activity because of an interest in the activity, and derive satisfaction from the activity itself (Gagné & Deci, 2005). Motivation, where the reason for engaging in an activity is external, and the satisfaction for performing the task is physical or verbal rewards, is known as extrinsic motivation (Gagné & Deci, 2005). It has been stated, the likelihood for continuous use of technology is higher when the motivation for use is intrinsic (Sørebø, Halvari, Gulli, & Kristiansen, 2009).

### **Social Participation**

People with lifelong disability experience a barrier to social participation in their daily lives (Balandin, 2011; Ballin & Balandin, 2007). Participation is defined by Hammel et al. (2008) as “being a part of” an activity, context, social scene or social group. Meaningful participation involves the social interaction component, as in socializing in or out of the home, and experiencing a sense of personal security within a social environment (Hammel et al., 2008).

People with lifelong disability are less likely to have interactions because of limited and small social networks than people without disability (Ballin & Balandin, 2007). The sense of social connection is described as central to community participation. This includes both very personal and intimate connections (e.g., friendships and partnerships) and connections of a more public and social nature (e.g., colleagues and student-teacher social connections) (Hammel et al., 2008). Not being included in society and not feeling part of the community is also a barrier for people with lifelong disability. The feeling of being treated as equal is not only important for all humans, but it is a human right.

## **Well-being**

Emotional well-being includes mental stability, self-concept, and lack of stress and negative feelings. When a person experiences emotional well-being, they are content with life and have a good self-concept (Verdugo et al., 2010).

The theory of Quality of Life has been critiqued by researchers (Moons, Budts, & De Geest, 2006) who claimed there were no consensus on the definition and measurements. Furthermore, it was stated that Quality of Life is most useful when defined in terms of life satisfaction (Moons et al., 2006). I do not intend to measure Quality of Life in the traditional terms, but to use the factors and domain to qualitatively understand the experiences of people with lifelong disability while using virtual worlds. The critique raised by Moons et al. (2006) may be accurate, however, in this context, it is not accurate, the aim is to understand the social affordances for people with lifelong disability through use of virtual worlds, as opposed to specifically measuring Quality of Life. In summary, the literature on Quality of Life can be useful to illustrate issues raised in research sub-question 4 of chapter 1.

### ***2.6 Summary of the literature***

This review has identified how a range of ICT and virtual world applications are used by people with disability for enjoyment, employment, communication, friendship, education, and discussion. Individuals using ICT experience increased independence and empowerment. Being able to participate in educational, workforce, and social settings using ICT, provides experiences of inclusion and may reduce feelings of isolation. Nevertheless, ICT can work against these positive outcomes for people with disability and result in increased feelings of exclusion. Low level of access to ICT, due to the cost of acquiring a computer, say, or caregivers' lack of ICT experience, can represent barriers and are examples of people with disability not able to take advantage of the promises offered by technology. Exclusion when using ICT has also been reported when people with disability are not accepted as equals by their peers. Lack of computer skills and incompatible technical support are also reasons for exclusion and may lead to reduced level of use.

People with disability have experienced success in developing social skills and skills for independent living through training in custom-designed virtual worlds, although research on this is limited. Inclusion by their peers and escaping prejudice, through use of virtual worlds, is of value to people with disability. In the special education classroom, virtual worlds offer an opportunity to visit locations throughout the world

using virtual field trips. However, the technology is complex; this may be a barrier for people with disability wishing to engage in virtual worlds.

Although virtual worlds are promising and may enrich the overall quality of life for people with disability (Stewart et al., 2010), they may not be suitable for everyone (Standen & Brown, 2006). Standen and Brown (2006) stated the current three-dimensional technology excludes those who have profound disability and who have a limited understanding of the three-dimensional space.

<b>Research Question</b>	<b>Contributions from the literature</b>
<i>RSQ1: What capabilities and affordances do virtual worlds offer people with lifelong disability?</i>	Capabilities theoretically identified (Davis et al., 2009) People with lifelong disability may experience great value in virtual worlds, however, the technology may not be available due to misalignment between capabilities and human abilities (Krueger & Stineman, 2011)
<i>RSQ2: How do people with lifelong disability relate to their virtual self?</i>	Embodied Social Presence Theory (Mennecke et al., 2010) Identifying with virtual self (Schultze & Leahy, 2009)
<i>RSQ3: How do people with lifelong disability experience interactions with others in the virtual world?</i>	Embodied Social Presence Theory to understand how to relate to virtual others (Mennecke et al., 2010)
<i>RSQ4: How do people with lifelong disability experience the social affordances offered by virtual worlds?</i>	Quality of life factors to explain how people with lifelong disability experience value of use of virtual worlds (Schallock et al., 2011)

**Table 2.2 Contributions from the literature relevant for the research questions**

Based on the literature review, presenting the areas that are lacking research efforts and the theoretical perspectives that help understand the different aspects of the field, a summary of how this literature contributes to the research questions are presented in Table 2.2. Thus, Table 2.2 illustrates the link between theoretical lenses and research sub-questions. Each of the presented theories represents different views on the phenomenon of virtual worlds for people with lifelong disability and represents a lens to answer specific research sub-questions. Due to their diverse foci, together, they form the basis with which to explore the main research question presented in chapter 1. Through an exploratory qualitative research approach, using the theoretical lenses

presented in section 2.5, this thesis aims to identify the affordances offered by virtual worlds for people with lifelong disability.





### **3 Research approach**

This chapter will describe the research approach chosen to answer the stated research questions in chapter 1. This chapter is structured as follows: First, a discussion of the research design that has been chosen for this research. Second, the ethical clearance, recruitment, data collection and data analysis is described. Third, the validity issues are presented.

#### **3.1 Research design**

In trying to understand how virtual worlds create personal value and possible challenges for participants engaging in a virtual world, a qualitative research approach was chosen. Qualitative research is appropriate when we need a complex and detailed understanding of an issue that is new or poorly understood (Creswell, 2007). As discussed in chapter 2, there are limited studies in the field of virtual worlds and people with lifelong disability. The need to explore and understand how people with lifelong disability experience virtual worlds makes this research suitable for the qualitative tradition (Creswell, 2007). When examining the most appropriate research method to be applied to this PhD project, three methods were discussed: Action Research, Field Experiment, and Ethnography/Netnography.

Action research is an intervening approach that aims to improve the subject and generate knowledge, preferably at the same time (Kock, 2011). The discovery of the planned actions is guided by a theoretical framework that will identify a desired future state for the organization and the changes needed to achieve the identified state (Baskerville & Wood-Harper, 1996). Through this project, as a researcher, I participated in the activities that occurred in the virtual world. I had theoretical frameworks that guided my data collection and data analysis. However, these theoretical frameworks did not guide the actions made in the virtual world or identify a desired future state. The aim of the research was to understand the participants' experiences within the virtual world from their point of view, not to create change; and therefore, action research was an inappropriate research approach.

Field experiments are also a research approach used in virtual world research. Field Experiments aim to identify the precise relationship between chosen variables through situations in real-life (Galliers, 1992). These relationships are analyzed through quantitative techniques and aim to make generalizable statements (Galliers, 1992). Even though identification and isolation of variables could be executed, the aim was not to uncover a precise relationship between variables but to understand the

experiences of the participants in a non-controlled environment. Thus, field experiments would not be an adequate research approach for this study.

A third research approach considered as possible was ethnography. Ethnography is a research method in the discipline of social and cultural anthropology, but has also expanded into the information systems field (Harvey & Myers, 1995). In addition to traditional data sources such as interviews, documents, and minutes of meetings, the researcher relies on data collected through participant observation (Howitt, 2010; Myers, 1999). Applying an ethnographic research approach in computer mediated communities is called netnography (Langer & Beckman, 2005). While this project could have used the ethnographic/netnographic research method, this method requires a group of participants with a commonly learned language and patterns (Myers, 1999). Within the group of participants in my study, the individuals were in different geographical locations, did not have a commonly learned language, and did not know each other; the only similarity the participants shared was lifelong disability. While some participants were co-located during sessions in Second Life, they were all novice users of the technology and had yet to create a common language and understanding of the environment they experienced.

Nevertheless, I chose to use ethnographic data collection techniques in an exploratory qualitative research approach. Because of the aim of this study, to understand and explore how people with lifelong disability experience virtual worlds, ethnographic data collection techniques are appropriate. Through using both participant observation and in-depth interviews, the data provides both the spoken description of how people with lifelong disability experience virtual worlds and the opportunity to observe and note the same experiences.

Through qualitative research, I have the opportunity to report my interpretation of the participants' meanings and experiences, which may provide understanding and groundbreaking work within the field of virtual worlds for people with lifelong disability. This project used an iterative process between literature reviews and empirical study. To establish the state of the field, a literature review was conducted in the early stage. However, as new issues arose during the research process, further literature reviews were needed.

### ***3.2 An exploratory qualitative study***

Because the aim was to understand and identify the affordances offered to people with lifelong disability by virtual worlds, this study applied a qualitative research approach.

### **3.2.1 Ethical clearance**

Ethical clearance for the research was obtained from the Norwegian Social Science Data Services (NSD) and is part of a Strategic College Project funded by the Norwegian Research Council. As a part of the NSD ethical clearance, as researcher, I was not permitted to meet with the participants face-to-face. Therefore, these meetings were conducted by the project manager and research team members of the Strategic College Project.

This study included two groups of participants, novice users and experienced users of Second Life. The application Second Life was chosen as the environment for this study, and none of the participants received any monetary reward for participating. All participants were over the age of 18, diagnosed with a lifelong disability, able to sign an informed consent form, and able to use and have access to a computer with broadband. All participation was based on informed consent and participants could withdraw from the project at any time with no reason given and no penalty.

### **3.2.2 Recruitment**

This study includes 18 participants, 11 novices, and 7 experienced. In this section, the recruitment process of participants is detailed. While the novice participants offer the ability to understand the initial challenges and opportunities experienced when engaging in the virtual worlds, including experienced users of Second Life offers the opportunity to better understand the social affordances such technology provides people with lifelong disability when used over time. Including the experienced users was important to ensure the data in this study also included long-term effects for people with lifelong disability. The data from the two participant groups (novice and experienced) complement each other and ensure a more complete picture of the experiences of virtual worlds.

#### **Novice participants**

Group 1 (ref. Table 3.1) consisted of 11 novice participants, all located in Norway, and recruited through organizations in their local communities (e.g., teaching services). The recruitment was conducted through the research team, from the larger project, at Molde University College's networks. The management of services for people with lifelong disabilities throughout Norway was sent information explaining the project and asked to invite people who, in their opinion, could give informed consent. Potential participants were invited to contact the research team or to register their

interest with the manager. The potential participants in this study were required to have access to a computer with broadband.

Initially, teachers and support staff were introduced and trained by a member of the research team in the use of Second Life prior to the training of the participants. This ensured the teachers were able to support the participants locally during the Second Life sessions. Upon the completion of teachers' training, the participants who agreed to partake in this study were introduced and helped to create accounts and avatars in the virtual world. I did not participate in these training sessions, nor did I meet the participants in the physical world, permitting them anonymity as offered by virtual world's expected affordance of "choice to disclose" (section 2.5). While I was informed of the disability of each of the participants, discussions or disclosure of information that were related to the disability were controlled by each participant. In addition, face-to-face interaction with the participants was outside of the ethical clearance for me as the researcher in this part of the project. When the training sessions were completed, in-world sessions were scheduled by convenience of the participants and teachers.

The participants were in four groups and located in two municipalities in Norway. To ensure the anonymity of the participants, the locations in Norway will not be disclosed.

### **Experienced participants**

Group 2 (ref. Table 3.1) consisted of seven experienced users. These users were recruited with the help of Virtual Ability Inc. ([virtualability.org](http://virtualability.org)), which operates an island in Second Life to support people with disability entering into the virtual world. During two in-world presentations of the project, people attending the presentation were asked to participate in the study. Six of the participants were from and located in the United States and one was from Finland, but located in South Africa.

During the two in-world presentations, the experienced participants were given information about the project and asked to participate in two in-depth interviews for approximately two hours per interview. Those who attended the in-world presentation were given information to contact the project manager, to request informed consent forms and give notice they were interested in the study. This ensured the anonymity of all participants' personal information; only one member of the research team stored the information. After the informed consent form was submitted, I was notified by the

project manager of the participant's avatar name and made contact through Second Life to schedule in-world interviews.

For the experienced users, in addition to recruiting through presentations, it was important to obtain access to information-rich participants. To ensure this, a partial snowball sampling of experienced participants was used (Patton, 2002). This meant that at the end of each interview, the experienced participants were asked to suggest possible participants who could further enlighten the issues discussed.

<b>Group</b>	<b>Participant</b>	<b>Disability</b>	<b>Location</b>	<b>Primary language</b>
Novice	Pevit Torana	ID	Norway	Norwegian
	Mix Mofat	ID	Norway	Bulgarian/Norwegian
	Solvita Silka	PD	Norway	Norwegian
	Trinaka Lika	ID	Norway	Norwegian
	Rolatina Endora	ID	Norway	Norwegian
	Gjagra Gralt	PD	Norway	Norwegian
	Missara Melsa	ID	Norway	Norwegian
	Siltar Siana	ID	Norway	Norwegian
	Sophy Salk	ID	Norway	Norwegian
	Artol Merlit	ID	Norway	Norwegian
Experienced	Leos Marth	ID	Norway	Polish/Norwegian
	Agonra Sircka	PD	USA	English
	Kalnika Gublic	PD	USA	English
	Sunger Alista	PD	USA	English
	Ahroun Wolf	ID	USA	English
	Maria Butterfly	PD	USA	English
	Kirana Merkini	PD	South Africa	Finnish/English
Landira Crunge	PD	USA	English	

**Table 3.1 Participants in this study**

Table 3.1 presents the list of participants in this study. To ensure the anonymity of the participants, all avatar names mentioned in this thesis are pseudonyms. In addition, the participants are categorized into physical (PD) and intellectual (ID) disability. Participants' disability included Cerebral Palsy, Autism Spectrum Disorder, Hearing Impairments, Downs Syndrome, Prader-Willi syndrome, mild to moderate intellectual disability, and physical disability. The difference in disability between the two participant groups is important. Among the novice participants, the participants mainly had intellectual disability, which may have created a barrier of use when entering the virtual world.

### **3.2.3 Data collection**

#### **Novice participants**

During a period of 8 weeks, the 11 novice participants met with me in weekly sessions of one-and-a-half hours to engage in various activities in Second Life. The data collection with the novice participants was conducted in 2011 and 2012 (ref. Table 3.4). The participants engaged in activities such as visiting amusement parks, playing miniature golf, and playing soccer. The participants were followed to and in the Second Life sessions by their teachers, who provided support if needed. The teachers' role was to give technical support for the participants when a situation which was challenging occurred, such as assisting the participants to teleport or accepting objects sent to them in the virtual world. The teachers assisted the participants with practical situations, but had no influence, nor were they directly involved in the observation sessions. The sessions with novice participants were conducted as group sessions, 2-3 novice participants in each group. During sessions, the participants in each group were physically located in the same room. While not ideal, this was done because of the need for assistance from teachers and to gain access to computers running Second Life.

Table 3.2 illustrates the structure of sessions with novice participants in Second Life. Times for the sessions had been scheduled and the participants entered Second Life from their locations. Each session started at Kamimo Island, an educational island co-developed by Molde University College. Having one location for meeting simplified the process of entering into Second Life. As shown in Table 3.2, the sessions were iterative with some habitual processes. The meeting location and end location for each session were the same; however, locations and activities during the sessions were diverse (ref. Table 3.3). Table 3.3 illustrates examples of locations visited during the sessions with novice participants in Second Life and possible activities at these specific locations. Figure 3.2 shows novice participants engaging in leisure activity in Second Life.

The first session with each of the novice participant groups was situated at Kamimo Island and the first activity was to become friends in Second Life. By doing this exercise, the participants became familiar with answering requests which appeared on their screens. In addition, at Kamimo Island there is a football field and a diving board that were used to learn basic techniques for using Second Life. At the football field, the participants learned to use the arrow keys on their keyboard to navigate the avatar in the environment while engaging in an activity. Also, because the location of the

diving board in Kamimo Island is visible from the football field, the participants learned how to fly from one place to another. The diving board is operated by an action ball that animates the avatars to perform different dives. By performing the diving board activity in the first session, the participants became familiar with the action needed to take advantage of action balls in Second Life.



**Figure 3.1 Observation of leisure activities with novice participants**

One goal for the remaining sessions was to encourage the participants to express interests in activities they wanted to engage in, not activities suggested by me. I did not want the sessions to be researcher-driven, because of the goal of making the participants master the virtual world as a tool for them for continuous use. To ensure this, I asked the participants what their wishes for activities were (ref. Table 3.2). In addition, I made notes of activities they expressed liking in the physical world to be able to suggest locations in Second Life where they could engage in similar activities. If the novice participants did not express any specific activities they wanted to engage in, I suggested two choices based on participants' comments during informal conversations. Thus, the activities engaged in during Second Life sessions with the novice participants were controlled by the participants. Toward the latter sessions with the novice participants, they more often suggested the locations to visit and the activities to engage in without any prompting from me. Locations which were visited repeatedly upon request from the participants were the Ohana Rock Club and Second Norway to go dancing, and locations in which the participants could go shopping (ref. Table 3.3).

Another goal for the observation sessions with the novice participants was to enable the participants to meet others and socialize. The participants socialized with each other and with me during the sessions, but also were given the opportunity to socialize

outside of our group. To enable this, we visited locations such as Ohana Rock Club, Muddy's Music Café, and Second Norway (ref. Table 3.4), where the participants were able to meet other avatars outside of their group. The sessions allowed me to observe the participants in social settings and when interacting with others outside of our group.

I was available to assist and guide the participants and was a participatory observer in the activities in Second Life, though I was not in the same geographical location. Communication during sessions in Second Life, among the participants and I was mainly through the voice feature offered by Second Life. However, when voice was unavailable, communication was using text-chat. During or immediately after the session, the teachers reported to me about challenges and assistance required by the participants during the sessions. The teachers did this through IM in Second Life. The data reported by the teachers were used as a supplement to the reports by the novice participants and analyzed concerning the technological challenges encountered.



<b>Phase</b>	<b>Activities</b>
Meeting phase	<ul style="list-style-type: none"> <li>• Meet in Kamimo Island.</li> <li>• Greeting of the participants as they enter SL. <ul style="list-style-type: none"> <li>○ Hi, how are you?</li> <li>○ Have you been in SL since we were here last?</li> <li>○ What did you do when you were here?</li> </ul> </li> <li>• Talk about activities they want to engage in. <ul style="list-style-type: none"> <li>○ What do you want to do today?</li> <li>○ If no specific activity is chosen, I suggest two activities for choice.</li> <li>○ If activity is chosen, I provide teleport to the location of activity.</li> </ul> </li> <li>• Prepare teleport. <ul style="list-style-type: none"> <li>○ I provide teleport/inform which teleport already provided.</li> <li>○ Participants teleport first.</li> </ul> </li> </ul>
Main phase/Activities	<ul style="list-style-type: none"> <li>• <b>Scenarios in the main phase to be repeated as needed</b></li> <li>• Meet at location after teleporting.</li> <li>• Participants get to look around and explore the location.</li> <li>• Find activity: <ul style="list-style-type: none"> <li>○ If new activity, I show or tell participants how to do the activity.</li> <li>○ If participants encounter problem, I assist them to do the activity.</li> </ul> </li> </ul> <p>When and if participants do not want to stay at location or with the activity:</p> <ul style="list-style-type: none"> <li>○ Ask what they would like to do next.</li> <li>○ If no suggestions, suggest two new activities for choice.</li> </ul> <ul style="list-style-type: none"> <li>• In all scenarios: <ul style="list-style-type: none"> <li>○ Ask if this is difficult or easy? What specifically?</li> <li>○ How do you feel about this activity?</li> <li>○ Did you like it here?</li> <li>○ What do you like about this location?</li> <li>○ If meeting others, <ul style="list-style-type: none"> <li>▪ How did you like meeting those people?</li> <li>▪ How did you like talking with them?</li> </ul> </li> </ul> </li> <li>• Toward the end of main session, provide teleport or inform to teleport back to Kamimo Island.</li> </ul>
Closing phase	<ul style="list-style-type: none"> <li>• Meet back at Kamimo Island. <ul style="list-style-type: none"> <li>○ Did you enjoy this session?</li> <li>○ What did you like or dislike the most?</li> <li>○ What activity would you like to do again?</li> <li>○ What would you not like to do again?</li> </ul> </li> <li>• Prepare for next meeting: <ul style="list-style-type: none"> <li>○ Next meeting will be in “number of weeks.”</li> <li>○ Thank you for a nice time, see you next time</li> </ul> </li> </ul>

**Table 3.2 Plan of sessions in Second Life**

In the fourth and eighth week of the study, all novice users participated in an individual, in-depth interview about their experiences in the virtual world. Interviews were conducted by phone, because it was decided to devote the Second Life sessions solely to activities and interaction. The interviews were designed to be semi-structured and in-depth. To ensure an open and focused process, interview guides combined with informal conversation were used (Patton, 2002). Because I did not meet the participants face-to-face, only through Second Life, informal conversation was important to create trust between the participant and me (Jacobsen, 2005). Interview guides were developed based on three sources: (1) the identified research sub-questions, (2) related literature, and (3) knowledge from earlier interviews and sessions. While it is most beneficial to ask open-ended questions to obtain rich information, when interviewing some of the novice participants, this was not completely successful. Due to their disability, some of the participants were not able to provide reflective answers. This required closed-ended or multiple-choice questions, to enable the novice participants to provide answers. An example of an interview guide for novice participants is included in Appendix A. To ensure the right information was documented in these cases, I asked multiple questions concerning the same issue. Due to differences in experience level of the participants and focus in each interview, there were multiple sets of interview guides that evolved throughout the study (Patton, 2002).

<b>Location</b>	<b>Activities</b>
Arcachon	Boating, water scooter, hot air balloon ride, lying on beach, and building a sand castle
Black Horse Saloon	Dance
CCC-Mini Golf	Miniature golf
Chamonix City	Ice skate, ski, sledding, and ice hockey
Chelsea's Diner	Bowling and arcade
Cherokee Historic park	Horseback riding
Christmas Wonderland	Sleigh ride and shopping
Freebee store	Shopping
Funfair Dreams	Bumper cars, carousels, roller coasters, maze, and Ferris wheel
Grand Canyon	Horseback riding, hiking, and boating
Great Wall of China	Walk the wall
Kamimo Island	Football/soccer, Dancing, Diving board
Muddy's Music Café	Dancing
Native American Park	Horseback riding
Ohana Rock Club	Dancing
Parktown Zoo	Zoo
Prim Hearts Amusement Park	Roller coasters, monorail, free fall tower, go-carts, Ferris wheel, water slides, carousels, and haunted house
Second Norway	Water scooter, dance, hot air balloon
SL Surfing association	Surfing and lying on the beach
The Loose Moose Lodge	Dance
The Lunatorium	Underwater dancing
Virtual Ability Island	Playground, shopping, and sail boat
Virtual Africa	Watching wild animals and boating

**Table 3.3 Examples of locations visited and activities available during sessions**

### **Experienced participants**

The experienced users participated in two individual, in-depth interviews, lasting approximately two hours each, and each exploring their experiences with the virtual world, their relationship to their avatars, and their relationship with other avatars in the virtual world. All interviews were conducted in-world; as with the novice participants, I only met the experienced participants in the virtual world. With the exception of interviews with one participant, the interviews were conducted using text chat in the Second Life setting. Because of a physical disability, one participant had difficulties communicating through text and preferred the voice feature in Second Life for communication and interaction. The remaining six participants expressed being more comfortable with text chat when communicating with people with whom they do not have a close relationship. The experience level of the participants in this group ranged from 1 to 7 years as active members of Second Life. The experienced users reported

using the virtual world for various activities such as social activities, meeting friends, engaging in activities with friends, participating in classes, helping others to master Second Life, building and designing objects, and employment.

As discussed earlier, the interviews were designed to be semi-structured and in-depth interviews. Two different interview guides were developed to ensure different foci (i.e., technological and social) in the two interviews and ensure rich data collection. An example of an interview guide for experienced participants is available in Appendix A.

Figure 3.3 illustrates interviews with experienced users. I met the participants in Second Life at a location chosen by them.



**Figure 3.2 Interviewing experienced participants**

Table 3.4 summarizes the data collection activities and the documentation of these. “Application data” means logs of Second Life activity was automatically stored by the application. In addition, for each Second Life session with novice participants, teachers’ comments containing amount of support required were collected.

<b>Month.Year</b>	<b>Participants</b>	<b>Activities</b>	<b>Documentation</b>
04/05.2011	Experienced	Presentation at Virtual Ability Island	Application data
05/06.2011	1 <sup>st</sup> Group Novice	Observation	Personal notes, application data
05/06.2011	2 <sup>nd</sup> Group Novice	Observation	Personal notes, application data
06.2011	1 <sup>st</sup> Group Novice	1 <sup>st</sup> Interview	Notes from interviews
06.2011	2 <sup>nd</sup> Group Novice	1 <sup>st</sup> Interview	Notes from interviews
08.2011	Experienced	Presentation at Virtual Ability Island	Application data
08/09.2011	Experienced	1 <sup>st</sup> Interview	Application data, personal notes
09/10.2011	1 <sup>st</sup> Group Novice	Observation	Personal notes, application data
09/10.2011	2 <sup>nd</sup> Group Novice	Observation	Personal notes, application data
10.2011	1 <sup>st</sup> Group Novice	2 <sup>nd</sup> Interview	Notes from interviews
10.2011	2 <sup>nd</sup> Group Novice	2 <sup>nd</sup> Interview	Notes from interviews
11/12.2011	3 <sup>rd</sup> Group Novice	Observation	Personal notes, application data
12.2011	3 <sup>rd</sup> Group Novice	1 <sup>st</sup> Interview	Notes from interviews
01/02.2012	3 <sup>rd</sup> Group Novice	Observation	Personal notes, application data
02/03.2012	3 <sup>rd</sup> Group Novice	2 <sup>nd</sup> Interview	Notes from interviews
03/04.2012	4 <sup>th</sup> Group Novice	Observation	Personal notes, application data
04.2012	4 <sup>th</sup> Group Novice	1 <sup>st</sup> Interview	Notes from interviews
04.2012	Experienced	2 <sup>nd</sup> Interview	Application data, personal notes
04/05.2012	4 <sup>th</sup> Group Novice	Observation	Personal notes, application data
05.2012	4 <sup>th</sup> Group Novice	2 <sup>nd</sup> Interview	Notes from interviews
<b>Summary</b>	<b>Total of 18 participants</b>	<b>Total of 32 SL sessions and 32 interviews</b>	

**Table 3.4 Data collection activities**

### 3.2.4 Data analysis

This study aimed to understand and explore how people with lifelong disability experience virtual worlds. Each participant applied their own meaning to activities and experiences.

The data has been examined using content analysis. Content analysis is a well-known and used mode of analysis of qualitative data. Patton (2002) stated: “*Content analysis is used to refer to any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings*” (p. 453).

The data analysis in this study started with established theory (e.g., Embodied Social Presence Theory, Quality of Life factors and domains, and Technology Capabilities) as a starting point, also referred to as directed content analysis (Hsieh & Shannon, 2005). Using an established theory as a guide for data analysis, I began identifying key concepts as the initial coding categories. An example of the content analysis is found in Appendix B.

Data analysis starts with a thick description, with no attempt at interpretation (Patton, 2002). For analyzing observations, there are means of describing the data that can be helpful, such as organizing them chronologically or based on individuals. These different means of organizing the data may not be mutually exclusive (Patton, 2002). By organizing the observation data in this study based on both chronological order, to tell the story from beginning to end, and individual order, to describe the similarities and differences among the participants, a broad and focused view of the results were provided. Patton (2002) stated there was no specific point in time when data collection stopped and data analysis started. Through the data collection period, there was some data analysis performed simultaneously, which guided the ensuing data collection.

I chose to manually code the data through the analysis to allow myself the freedom to review the transcripts repeatedly, with and without codes, to avoid getting locked into the coded themes as the only way of looking at the data as described by Walsham (2006). This permitted me to revisit blank transcripts of all the data, and to recode the data without being locked into previous codes. Table 3.6 illustrates the use of theories during data collection and analysis.

<b>Theory guiding data collection and analysis</b>	<b>Used in this study</b>
Embodied Social Presence Theory (Mennecke et al., 2010)	Stages of ESP used to develop questions in interview guides for both novice and experienced participants. Used as a basis for analysis to understand relationship to virtual self and others.
Technology Capabilities (Davis et al., 2009)	Capabilities theoretically identified; used to develop questions in interview guides for both novice and experienced participants. In addition, for novice participants, used as a guide for observation. Used as a basis to understand challenges experienced in use of virtual worlds.
Quality of Life (Schalock et al., 2011)	Domains and factors for independence and social inclusion used as a guide for interviews of novice and experienced participants. Used as a basis for analysis to understand independence and social affordances offered by virtual worlds.

**Table 3.5 Use of theory in data collection and analysis**

Codes used in this data analysis were derived from the theories (ref. Table 3.5) and are presented in Table 3.6.

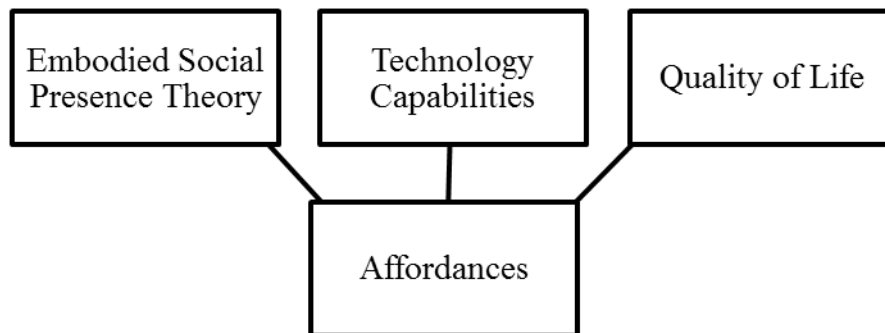
<b>Theory</b>	<b>Codes</b>
Technology Capabilities	Feedback, multiplicity of cues and channels, language variety, channel expansion, communication support, personalization, vividness, interactivity, mobility, and immediacy of artifacts
Embodied Social Presence Theory	Recognition of other, recognition of digital self, collaborative engagement, appraisal of the “real” other, and reflection on and appraisal of self
Quality of Life	Independence, personal development, self-determination, social participation, interpersonal relations, social inclusion, well-being, and emotional well-being

**Table 3.6 Codes derived from theories**

By using these codes, I could answer the sub-questions presented in chapter 1, reported in publications 3-5 (ref. Table 4.1).

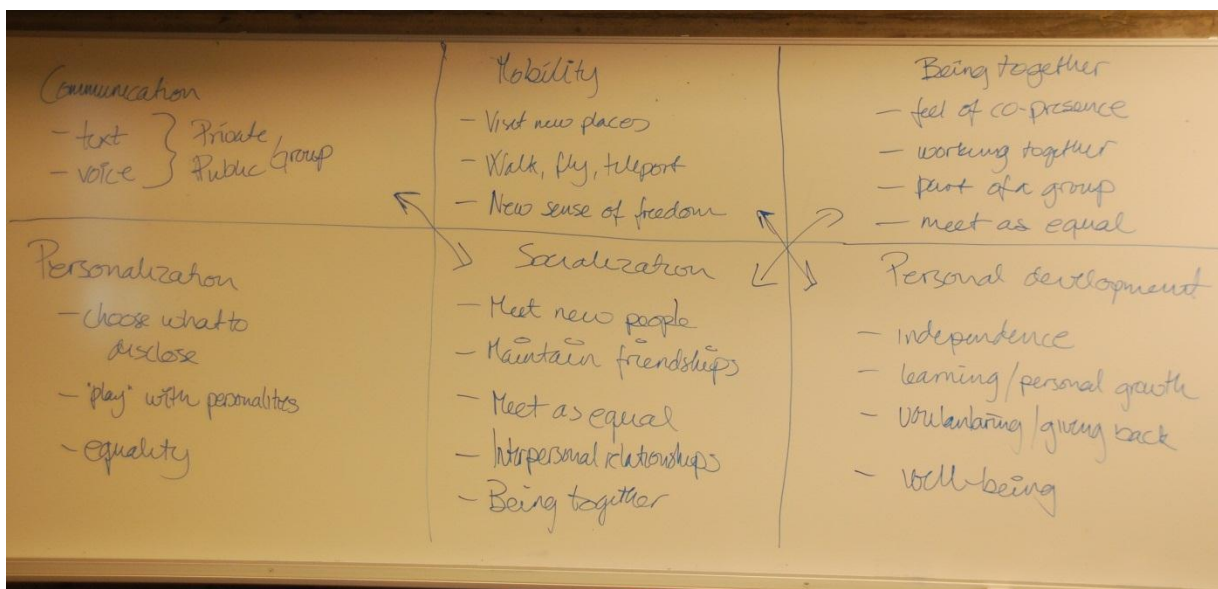
Further analyses were conducted using the findings from the initial analysis to analyze and identify the affordances offered for people with lifelong disability by virtual

worlds. Figure 3.3 illustrates how the three applied theories form the foundation for identification of affordances for people with lifelong disability.



**Figure 3.3 Theory used to identify affordances**

Hsieh (2012) suggested theorizing about social affordances creates a link among social environments, interaction, and technologies. This analysis was conducted using mind-mapping and drawing connections based on the results from previous coding to ensure a larger picture and identification of the affordances offered. To better understand the connections among the findings presented in the publications, I used large black/white boards to map the similarities and differences. Figure 3.4 illustrates the analysis conducted to identify the six affordances, based on findings from publications presented in chapter 4.



**Figure 3.4 Analyses to identify affordances**



Through this analysis, based on an affordance perspective, I was able to identify the six affordances presented in this thesis by combining and grouping together the findings from previous analyses.

The data analysis was iterative and ongoing during and after the data collection phase.

- Analysis was conducted to identify major patterns from the data based on the existing theories to help answer the research questions.
- A list of codes was identified by the existing theories (ref. Table 3.5) used in the directed content analysis.
- The interview transcripts and observation data were analyzed based on the underlying theories (ref. chapter 2). Hand-coding was done on interviews and observation data printouts and was supplemented by mind maps and tables.
- Interview data from various participants were grouped and compared, dependent of categories and presented to illustrate the various experiences expressed.
- Results from the confirmatory analyses based on underlying theories, was exploratory examined to identify affordances of virtual worlds for people with lifelong disability (ref. Figure 3.3).

### **Observation**

One focus of observation from the novice participants was the challenges they experienced during their time in Second Life. These observations were guided by the theoretically identified Technology Capabilities presented in chapter 2. The observation data was supplemented by information retrieved from the teachers who supported the novice participants, which focused on the level of assistance novice participants needed during the sessions. Because some of the novice participants were reluctant to admit how much assistance they required from their teachers in Second Life, gathering this information from the support staff, as well as obtaining it from focused observation during sessions proved to be important. To gather information in regards to technical challenges from the experienced participants, they were asked to describe the challenges of virtual worlds for people with lifelong disability they had observed, as well as what challenges they had personally encountered.

### **Interviews**

The themes for the first series of interviews with all the participants included relationship to virtual self, possibilities, challenges, and activities. The interviews

were guided by Embodied Social Presence Theory, theoretically identified Technology Capabilities, and the need to explore how people with lifelong disability experience virtual worlds. For novice participants, interview data were complemented with the observations during sessions. During sessions, I observed how they talked about themselves, about each other within the group, me (as a part of the group), and others outside the group.

The second series of interviews focused on social affordances offered by the virtual world and were guided by theoretically identified factors and domains from Quality of Life research. In addition, these data were complemented with observation data of how novice participants acted and related to other avatars they met during sessions. During the sessions, they were asked their opinion in relation to the activities they engaged in.

### **3.3 Validity issues**

Exploratory, qualitative research cannot claim to report an absolute fact, however, can report an interpretation of other people's interpretation or experience. It is important to note there may be multiple descriptions of an experience when conducting qualitative research, and the researcher is an instrument for interpreting such information (Bryman, 2008). This is why exploratory, qualitative research requires validation. To minimize such issues, the following measures were taken to ensure that the results were validated. To ensure transparency, I have tried to document as much detail as possible about the research steps conducted.

Qualitative research seeks to develop theories and concepts that are generalizable. The empirical study presented in this thesis has generated rich data and therefore provided rich insight into a phenomenon as described by Walsham (1995). In addition, in accordance with Lee and Baskerville (2003), this study generalizes from theory to descriptions. By applying the three theories (ref. Table 3.6), this study uses a theory confirmed in one setting to describe another setting.

Furthermore, triangulation methods were required and applied to validate this research. Patton (2002) stated there are four basic methods of triangulation to verify and validate qualitative research, (1) methods triangulation, (2) triangulation of sources, (3) analyst triangulation, and (4) theory/perspective triangulation. Of these triangulation methods, triangulation of sources was applied.

Triangulation of sources means cross-checking the consistency of information derived at different times and different means within qualitative methods (Patton, 2002).

Patton (2002) stated that within qualitative methods, triangulation of sources can be obtained through comparing observations with interviews and comparing the perspectives of people from different points of view. This study is based on both interview data and observation data; however, observation data was only collected from the novice participants. In addition, there was diversity among the participants who offered their various views on the phenomena. By obtaining data from both experienced and novice users of Second Life, it was possible to compare the perspectives of people from different points of view. Because data was derived from different perspectives and by different means, triangulation of sources could be used.

While the data collection period lasted for 1 year with 18 participants, it might be argued that it is a limited set of data. However, through the year, descriptive observation data and interview data were produced. In addition, while triangulation of sources means cross-checking for consistency, different results between interview data and observation data does not mean the data are invalid (Patton, 2002). As seen from the data, some of the data does not correspond between the sources; this, however, does not lower the validity of the findings. Consistency in overall patterns of data or reasonable explanations for differences in data from various sources contribute to the overall credibility of the findings (Patton, 2002). Describing inconsistent reports from participants has shown there are multiple experiences of similar issues/situations; this helps build the line of reasoning presented in this study.

To further validate the findings, I conducted two presentations in Second Life at Virtual Ability Island. During these presentations, participants from this study and non-participants, including other researchers, were present. I presented the findings and invited questions and discussions of such findings. By giving both participants and others the opportunity to give their opinion of the findings, I had the opportunity to validate my findings and my interpretations. An example of the discussions during these presentations is included in Appendix C. In addition, through presenting papers containing initial ideas and findings for fellow researchers at workshops (Stendal, Molka-Danielsen, & Balandin, 2010) and local conferences (Stendal, Molka-Danielsen, Munkvold, & Balandin, 2011), I received feedback to further develop the research process and validate the initial findings.

There are ethical issues with doing research in a virtual world. Because the researcher has to participate in the world to study it, issues such as representation, privacy, and responsibilities to various stakeholders arise (McKee & Porter, 2009). McKee and Porter (2009) stated it is essential to recognize research in virtual worlds cannot be

conducted as in the physical world. While participating in a virtual world it is important to respect the norms of the community or communities studied. They also point to the importance of striving for transparency by the researchers, identifying themselves as researchers when in researchers' roles. To ensure transparency, I made sure participants were aware they were a part of a research project and that they understood the time of interactions with me was limited.

## 4 Research publications

The research described in chapter 3 has led to five publications addressing the research sub-questions presented in chapter 1. Table 4.1 presents a list of the publications, included in full text in Appendix D. Papers 1 and 2 represent the literature review and background material for my research. Papers 3, 4, and 5 are presented in the order of technical challenges, relationship to virtual self, and social affordances offered by virtual worlds to people with lifelong disability. How each publication relates to the presented research questions is illustrated in Table 4.2.

No.	Title	Published
1	Stendal, K., Balandin, S., & Molka-Danielsen, J. (2011). Virtual worlds: A new opportunity for people with lifelong disability?	<i>Journal of Intellectual &amp; Developmental Disability</i> , 36(1), 80-83
2	Stendal, K. (2012). How do People with Disability Use and Experience Virtual Worlds and ICT: A Literature Review	<i>Journal of Virtual Worlds Research</i> , 5(1)
3	Stendal, K. and Molka-Danielsen, J. (2013). Capabilities and Affordances of Virtual Worlds for People with Lifelong Disability	Proceedings of the 21 <sup>st</sup> International Conference of Information Systems Development, Prato, Italy
4	Stendal, K., Molka-Danielsen, J., Munkvold, B. E., & Balandin, S. (2012). Virtual Worlds and People with Lifelong Disability: Exploring the Relationship with Virtual Self and Others (Best Paper Award)	Proceedings of the 20 <sup>th</sup> European Conference of Information Systems, Barcelona, Spain
5	Stendal, K., Molka-Danielsen, J., Munkvold, B. E., & Balandin, S. (2013). Social Affordances for People with Lifelong Disability through using Virtual Worlds	Proceedings of the 46 <sup>th</sup> Hawaii International Conference of System Sciences, Maui, Hawaii, IEEE

**Table 4.1 Research publications**

<b>Research Sub-Question</b>	<b>Publication no.</b>
RSQ1: What technology capabilities and affordances do virtual worlds offer people with lifelong disability?	3
RSQ2: How do people with lifelong disability relate to their virtual self?	4
RSQ3: How do people with lifelong disability experience interactions with others in the virtual world?	4, 5
RSQ4: How do people with lifelong disability experience the social affordances offered by virtual worlds?	5

**Table 4.2 The relationship between research sub-questions and publications**

In this chapter each publication will be presented as follows: An introduction that includes the research focus, followed by a description of the findings.

#### ***4.1 Why is this research important?***

Stendal, K., Balandin, S., & Molka-Danielsen, J. (2011). Virtual worlds: A new opportunity for people with lifelong disability?

The first publication represented an opinion and perspective piece that lays the foundation for why this research is important.

##### **4.1.1 Presentation**

This first publication was a conceptual paper focusing on the question: Do virtual worlds represent a new opportunity for people with lifelong disability? The aim of this publication was to delve into the field of virtual worlds and lifelong disability to explore the possibilities this relatively new technology offers. In this publication, we discussed the possible benefits and challenges people with lifelong disability may experience through the use of virtual worlds. We also presented challenges people with lifelong disability experience in the physical world. In addition, we reported on the few publications in which custom-designed virtual worlds have been used for learning and training social skills.

### **4.1.2 Findings**

This publication concluded people with lifelong disability may experience great value when engaging in activities through virtual worlds. Virtual worlds offer an environment in which people are free of physical constraints. The ability to create an avatar of personal choice, thus giving the opportunity to choose what to disclose, is an important affordance. In addition, virtual worlds offer the opportunity to meet others and create friendships on equal terms. We also stated there is a need for research in the area to investigate the challenges and possible barriers people with lifelong disability may encounter when wanting to participate in a virtual world. These challenges may vary among disability groups and virtual worlds may not be suitable for all. However, for those who overcome the possible barriers, virtual worlds may offer a new way of communication and participation that can lead to a fuller and more satisfying life.

## **4.2 Exploring the field**

Stendal, K. (2012). How do People with Disability Use and Experience Virtual Worlds and ICT: A Literature Review

The second publication presented an in-depth literature review to establish the state of the field of virtual worlds and people with lifelong disability.

### **4.2.1 Presentation**

This publication aimed to clarify the state of the knowledge base concerning virtual worlds and people with lifelong disability. Through an in-depth literature review, the goal of this publication was to create a starting point for further research. In total, 54 journal articles were included in the review. The literature review took into account research conducted in the field of ICT and people with disability. This is due to the closely related natures of the research, both dealing with people with disability using and taking advantage of technology available. In any research, it is important to create a synthesis of the area to be able to fully understand and further explore such area (Webster & Watson, 2002). To organize the findings, the papers were classified according to overall themes (i.e., access to technology, inclusion, exclusion and empowerment, and training and rehabilitation). At this stage of the process, it was essential to obtain a broad focus point to ensure a good understanding of the state of the field.

### **4.2.2 Findings**

Of the 54 articles included in this review, only 12 articles concerned virtual worlds and people with disability. In addition, I found there is a lack of empirical research conducted in the field of virtual worlds and people with disability. Only 3 out of the 12 articles that focused on virtual worlds and people with disability were based on empirical research. The remaining papers were conceptual papers, literature reviews, and editorials. The main finding from this literature review was that there are major areas that require further research in the field of virtual worlds and people with lifelong disability. The literature review identified several research gaps. However, in this thesis, only three of the identified research gaps are discussed in-depth because these influenced my research.

First, open-access, multi-user virtual worlds, such as Second Life, have not been in great focus for research. Previous research concerning virtual worlds and people with lifelong disability has focused on custom-designed virtual worlds in which few individuals have access and the settings are pre-set from a researcher's point of view. Open access multi-user virtual worlds offer people with lifelong disability the opportunity to be active members of a community, not available through custom-designed virtual worlds used for special purposes and situations. Therefore, this thesis focuses on how people with lifelong disability use and experience open access multi-user virtual worlds for leisure activities and as a social arena.

Second, some of the identified articles stated virtual worlds were complex and may discourage some people with disability from using the technology (Standen & Brown, 2006). Further, researchers have stated there is a need for developing less complex virtual worlds. With this as a starting point, in publication 3, I examined the technology capabilities and affordances offered by virtual worlds to people with lifelong disability.

Third, social and leisure activities in virtual worlds are a topic that has not been extensively researched. Virtual worlds offer an environment that invites people to engage in leisure activities and create social ties; however, it has not been in focus of the research community. Knowing how people with disability discover the great value of using the Internet and ICT to engage in social and leisure activities, it is important to explore how virtual worlds may also provide such opportunities for people with disability. Thus, in my fourth and fifth publications, I focus on the social aspects of virtual worlds for people with lifelong disability.



In general, the findings from this literature review provided a solid knowledge base and understanding of the phenomenon in focus for this thesis.

### **4.3 Technical affordances using virtual worlds**

Stendal, K. and Molka-Danielsen, J. (2013). Capabilities and Affordances of Virtual Worlds for People with Lifelong Disability

The third publication aims to understand the technical capabilities and affordances offered by virtual worlds for people with lifelong disability.

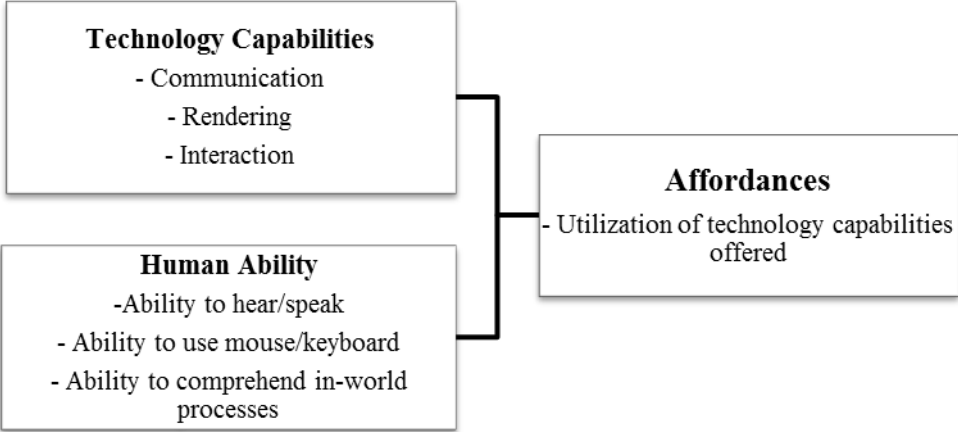
#### **4.3.1 Presentation**

The background for this paper is the previously reported complexity of virtual worlds. The aim for this paper is to understand the technological affordances offered by virtual worlds to people with lifelong disability. While previous conceptual research has suggested there are opportunities offered by virtual worlds for this group, there has been a lack of research concerning the technical challenges faced by this group (Krueger & Stineman, 2011). Technical challenges may discourage people with lifelong disability to enter the virtual worlds, thus, they would be unable to take advantage of the opportunities and possibilities offered by the technology. This publication aims to show what identified technology capabilities of virtual worlds (Davis et al., 2009) are possible to turn into affordances for people with lifelong disability (ref. chapter 2.5).

#### **4.3.2 Findings**

In this publication, we follow upon all technology capabilities for virtual worlds identified by Davis et al. (2009) as possible affordances for people with lifelong disability. However, all people with lifelong disability are not able to utilize and make these capabilities into affordances. Dependent on the different disabilities there are a variety of challenges (e.g., ability to use the mouse and keyboard and the ability to use voice feature). This publication calls for further in-depth research to uncover the specific challenges for each disability group. There is a need for standards for virtual worlds that take into account these different challenges people with lifelong disability face when trying to utilize the capabilities offered by virtual worlds. In addition, it is important to note that eight sessions in the virtual world have proven to be an insufficient amount of time to fully experience and utilize the technology capabilities offered by the virtual environment.

The results show the technology capabilities (Davis et al., 2009) offered by virtual worlds can become affordances for people with lifelong disability. However, the results also show that being able to utilize these capabilities and convert them into affordances is dependent on the human ability as shown in Figure 4.1.



**Figure 4.1 Technology capabilities and affordances of virtual worlds**

This publication shows that the theoretically identified technology capabilities (Davis et al., 2009) are helpful to explain and understand how people with lifelong disability experience the challenges and barriers when using virtual worlds. This research also discusses how the diversity of disabilities creates various challenges for people with lifelong disability.

An important implication from this research is that not all people with lifelong disability are able to use virtual worlds without difficulty. Virtual worlds offer a wide variety of possibilities; however, if people with lifelong disability are unable to access and use virtual worlds, they are not able to take advantage of these possibilities. This publication shows the barriers of use and possible workarounds (e.g., human translators) people have developed.

The results show that a disability influences a person’s ability to fully utilize the capabilities that virtual worlds offer, as seen in Table 4.3. The results presented in this paper especially support the identified affordances communication, personalization, mobility and personal development, to be presented in chapter 5.

	<i>Capability</i>	<i>Affordances</i>	<i>Challenges</i>
Communication	Feedback	Synchronous communication in both voice and text	Physical disability may cause text based communication to be difficult Hearing impairment excludes use of voice feature
	Multiplicity of cues and channels	Communication with a variety of users in different channels and different levels of privacy	For people with a hearing impairment, or for others when voice feature malfunctions/is unavailable, text may not show underlying cues in communication
	Language variety	Communication with worldwide users of virtual worlds	Understanding and use of jargon and online language depends on experience with online media
	Channel expansion	Richer communication through multiple channels	Steep learning curve to learn how to use communication channels
	Communication support	Multiple communication channels to support different needs	Multiple channels may be challenging and distracting for those with intellectual disability, especially for novice users
Rendering	Personalization	Creating a personal avatar. Choice of disclosure, playing with identity and anonymity	Takes time to master, especially for those with intellectual disability
	Vividness	Rich sensory representation of the physical world	Novice users may use objects in unforeseen ways
Interaction	Interactivity	Modify content in virtual worlds (e.g., add on to existing objects)	Dependent on experience and skill level
	Mobility	Teleporting/flying/walking	Controlling the avatar through keyboard and/or mouse clicks
	Immediacy of artifacts	Building and creating content in virtual worlds	Dependent on experience and skill level

**Table 4.3 Capabilities, affordances and challenges of virtual worlds (from publication 3 (Stendal & Molka-Danielsen, 2013))**

## **4.4 Exploring the relationship with virtual self and others**

Stendal, K., Molka-Danielsen, J., Munkvold, B. E., & Balandin, S. (2012). Virtual Worlds and People with Lifelong Disability: Exploring the Relationship with Virtual Self and Others

The fourth publication represents an exploration of people with lifelong disability's relationship to virtual self and others.

### **4.4.1 Presentation**

While there are barriers and technological challenges using virtual worlds for people with lifelong disability, it is important to examine the possible opportunities that can be experienced when having access to virtual worlds. One important aspect of virtual worlds is the relationship to virtual self. Embodied Social Presence theory (Mennecke et al., 2010) was developed to explain how people experience their relationship to their virtual self and to others. Mennecke et al. (2010) claimed when people experience high levels of Embodied Social Presence they are more likely to continuously use and enjoy virtual worlds.

This publication aims to explain how people with lifelong disability experience and view the relationship to their virtual self and how they experience interaction with others in the virtual world.

### **4.4.2 Findings**

Through the use of Embodied Social Presence theory, we find that people with lifelong disability develop strong relationships with their virtual self. However, it is important to note this is a process that requires time. The time required to recognize others in the virtual environment is instant, however, the novice participants did not excel to the further stages of Embodied Social Presence. Eight sessions proved to be an insufficient amount of time to fully experience Embodied Social Presence and a longitudinal study of this phenomenon is required.

One of the main capabilities understood through Embodied Social Presence is the ability to choose what to disclose. When designing and building an avatar, people with lifelong disability has the option to choose whether they want their avatar to reveal their disability. Through this affordance, people with lifelong disability are able to work around or avoid some of the prejudice they experience in the physical world. However, it is important to note prejudice is also present in the virtual world.

This publication is the first attempt to apply Embodied Social Presence theory in a context not originally used. Previous research used Embodied Social Presence theory as a framework to study engagement that users experience in activity-based, social interaction in a virtual environment. Data was collected from two graduate courses in e-commerce (Mennecke et al., 2011; Mennecke et al., 2010). The different levels of experienced Embodied Social Presence may also be dependent on the individual's disability; however this requires further research.

<i>ESP Stage</i>	<i>Novice Participants</i>	<i>Experienced Participants</i>
Recognition of Other	Soon referred to each other's avatars as "him," "her," and "you." Showed the recognition of space, through vocalizations and laughter	Were aware of others present in the environment Perceived others as communication partners
Recognition of Digital Self	Did not express a clear feeling of connection to their virtual self A virtual body that they controlled through their keyboard or mouse commands	A close connection between virtual self and the individual participants Choose what to disclose
Collaborative Engagement	Demonstrated through their engagement in activities together Talked about things they saw and experienced together	Expressed that one of their main goals in using Second Life is the social aspect of the virtual world The ability to meet people across geographical boundaries and interact with people they would not otherwise meet
Appraisal of the "Real" Other	Aware that the other avatars in their group represented each person in the physical room with them	Clear that they understood there is a human behind every avatar they interact with in Second Life
Reflection on and Appraisal of Self	Not in agreement if they really had engaged in the activities in Second Life	Indicated they immerse into the virtual reality

**Table 4.4 Participants' experience of the five stages of embodied social presence**

Table 4.4 illustrates the findings and the differences between the novice and the experienced participants' experiences at the five stages of Embodied Social Presence.

The results presented in this publication support the identified affordances: communication, personalization, social inclusion, and joint activity, to be presented in chapter 5.

#### **4.5 Social affordances offered by virtual worlds**

Stendal, K., Molka-Danielsen, J., Munkvold, B. E., & Balandin, S. (2013). Social Affordances for People with Lifelong Disability through using Virtual Worlds

The fifth publication explored the social affordances virtual worlds offer people with lifelong disability.

##### **4.5.1 Presentation**

One of the main reasons for people with lifelong disability to use virtual worlds is the social affordances they offer. This publication represented an exploration of the social affordances offered by virtual worlds to people with lifelong disability.

Quality of Life is a multi-conceptual framework (Schalock et al., 2011) that identifies various factors and domains important for individuals. Using these factors as guidelines, we explore how people with lifelong disability experience independence, social inclusion, and emotional well-being through the use of virtual worlds.

##### **4.5.2 Findings**

This publication aimed to explore how people with lifelong disability experience social affordances offered by virtual worlds. Through the help of Quality of Life factors, we identified a positive effect for most of the participants. However, how the participants experience the different Quality of Life factors appears to be dependent on their level of familiarity with using virtual worlds.

The experienced participants stated social interaction, interpersonal relationship, and feeling as part of a community to be important factors in their use of virtual worlds. The ability to initiate and maintain friendships with people on a global arena and meeting as equals are seen as factors that are most important to people with lifelong disability. The findings from this research indicated that people with lifelong disability may experience a high level of independence, social inclusion, and emotional well-being through use of virtual worlds. However, to be able to fully experience and enjoy the opportunities social affordances offer people with lifelong disability, our findings indicate it will require them to acquire a level of ability enabling them to use the virtual world without external support. Eight sessions in the

virtual world was an inadequate length of time to reach this level of confidence. The identified outcomes were grouped together according to the domains and factors of Quality of Life and presented in Table 4.5. The findings presented in publication 5 support the identified affordances: communication, personal development, social inclusion and personalization to be presented in chapter 5.

<i>Factor</i>	<i>Domain</i>	<i>Outcome</i>
<b>Independence</b>	Personal development	Independent from physical constraints Freely explore new environments without human interference Learning, formal and informal Volunteering, helping others
	Self-determination	Experienced participants, high level of intrinsic motivation Novice participants, moving from extrinsic towards intrinsic motivation
<b>Social participation</b>	Interpersonal relations	Meet as equals, avoid prejudice Choose what to disclose Global social connections Ability to develop close social connections from own home, safe environment Acquaintances Partners Developing friendships
	Social Inclusion	Meet as equals, avoid prejudice Choose what to disclose Meet like-minded people with similar interests Feel part of a community or group Be around others
<b>Well-being</b>	Emotional well-being	Build self-esteem Feel good about self Feel a part of society

**Table 4.5 Social affordances offered by virtual worlds**

## 4.6 Summary of the focus of the publications

Based on the exploratory qualitative study, five peer-reviewed conference and journal papers have been produced. The five papers are published or accepted for publication. Figure 4.2 maps the individual papers to correspond with the affordances identified through this research to be presented in chapter 5.

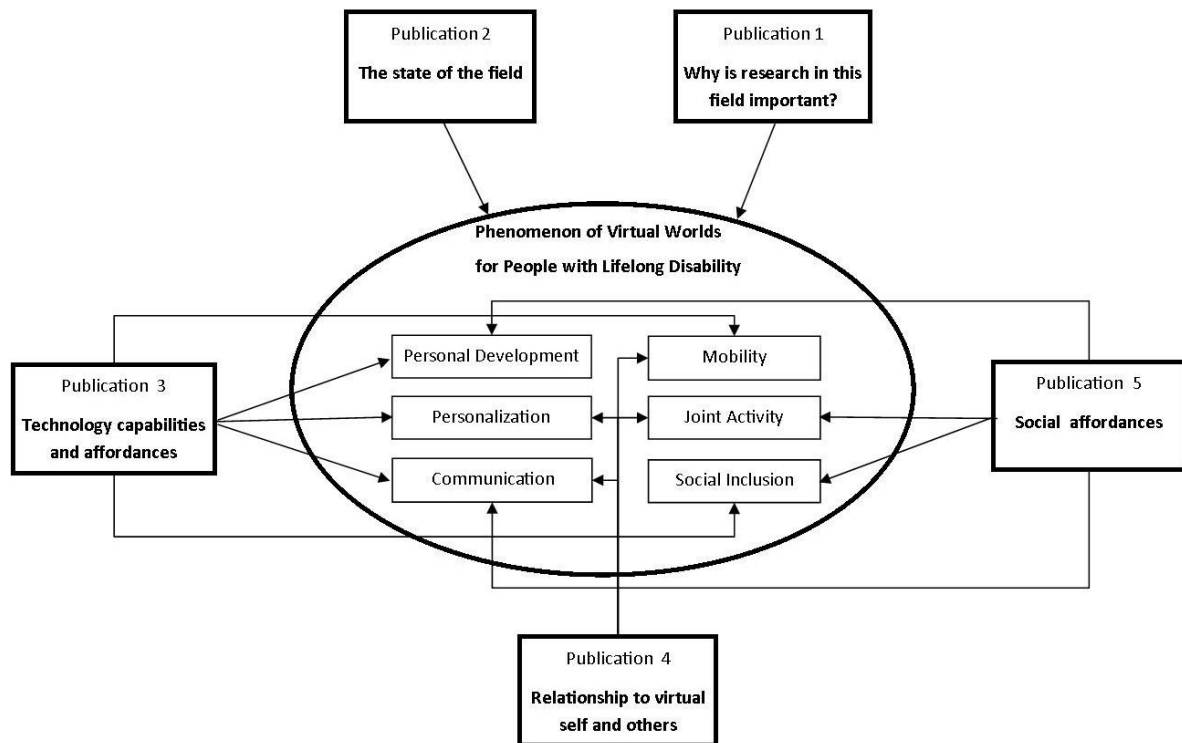


Figure 4.2 Papers' relationship to identified affordances

As shown in Figure 4.2, publications 1 and 2 explored the field of virtual worlds for people with lifelong disability. Publication 3 related to the affordances personal development, personalization, communication, mobility, and social inclusion. Publication 4 related to the affordances mobility, personalization, joint activity, and communication. Finally, publication 5 related to the affordances personal development, joint activity, social inclusion, and communication.



## 5 Contributions

The purpose of the research presented in this thesis has been to explore the research question: *What are the affordances of a virtual world for people with lifelong disability?* To answer this question, a qualitative research project has been conducted to explore how people with lifelong disability use and experience virtual worlds. This research has resulted in five publications presented in chapter 4. This chapter discusses the contributions of this study.

As discussed in chapter 2.5, two of the applied theoretical lenses (Technology Capabilities (Davis et al., 2009) and Embodied Social Presence Theory (Mennecke et al., 2010)), in their original form, do not consider physical or intellectual disability as constraints or barriers for experience when using virtual worlds. Quality of Life factors and domains (Schalock et al., 2011) do not consider virtual worlds in their original form; in addition, traditionally these factors and domains are used in quantitative research. Through this study, I show that the Quality of Life factors and domains can be helpful to understand the affordances offered by virtual worlds to people with lifelong disability. These factors and domains can also be used in a qualitative context in addition to a quantitative measurement framework. Although, I do not suggest specific alterations of existing theories, and this research shows that they all are useful in explaining how people with lifelong disability, specifying the assumptions of human ability or in what environment research will be conducted when applying these theories should be considered. By doing this, we will gain a more nuanced understanding of the affordances offered by the virtual worlds. In addition, this research affirms that these theories are useful in a different context than originally used, which constitutes a contribution to theory as suggested by Harlow (2010).

As discussed in chapter 2, affordances are understood as a co-evolution between humans and the environment (Bloomfield et al., 2010). In this thesis, the co-evolution between the virtual environment, represented by Second Life, and people with lifelong disability has been explored. The main contribution to theory of this thesis is the identification of six affordances offered people with lifelong disability by virtual worlds.

In traditional information systems research, in which people without disability are studied, assumptions are often made about the nature of abilities needed to utilize the capabilities offered by the technology. Through the analysis presented in chapter 3, the original findings (ref. chapter 4), were used to identify patterns and themes to

identify the six affordances. Table 5.1 presents the affordances identified. Each of the affordances will be presented and discussed in-depth throughout the chapter.

<b>Affordance</b>	<b>Definition</b>
<b>Communication</b>	The ability to communicate with others through various means in the virtual world
<b>Mobility</b>	The ability to move around in the virtual environment, independent from others and physical constraints
<b>Personalization</b>	The ability to choose what to disclose and customize representation through an avatar
<b>Social inclusion</b>	The possibility to experience social inclusion, create and maintain friendships, and experience close interpersonal relationships in the virtual world
<b>Personal development</b>	The possibility of personal growth and learning in the virtual world
<b>Joint activity</b>	The ability to engage in activities together with others in the virtual environment

**Table 5.1 Virtual world affordances for people with lifelong disability**

I have identified six affordances of virtual worlds for people with disability. These affordances are generic and can be utilized by all individuals; however, utilization of these affordances can be dependent of human ability and will in some cases be experienced as a constraint. This chapter describes both the utilizations of affordances and the constraints some people with lifelong disability will encounter when using the technology. The contributions presented through this research show a nuanced understanding of virtual world affordances, in which individuals with disability encounter barriers of use concerning the technology, not visible to people without disability.

Based on the findings presented in publications 3–5 (ref. Table 4.1), the affordances and corresponding constraints will be introduced in this chapter. This thesis contributes to the knowledge base by empirically identifying some of the challenges people with lifelong disability encounter when entering into the virtual world to utilize the capabilities it offers. Previous research stated that complexity and lack of standards may have prevented people with disability from using virtual worlds (Krueger & Stineman, 2011; Standen & Brown, 2006; Stewart et al., 2010).

Figure 5.1 illustrates how the theoretical lenses influences the identified affordances presented through this chapter.

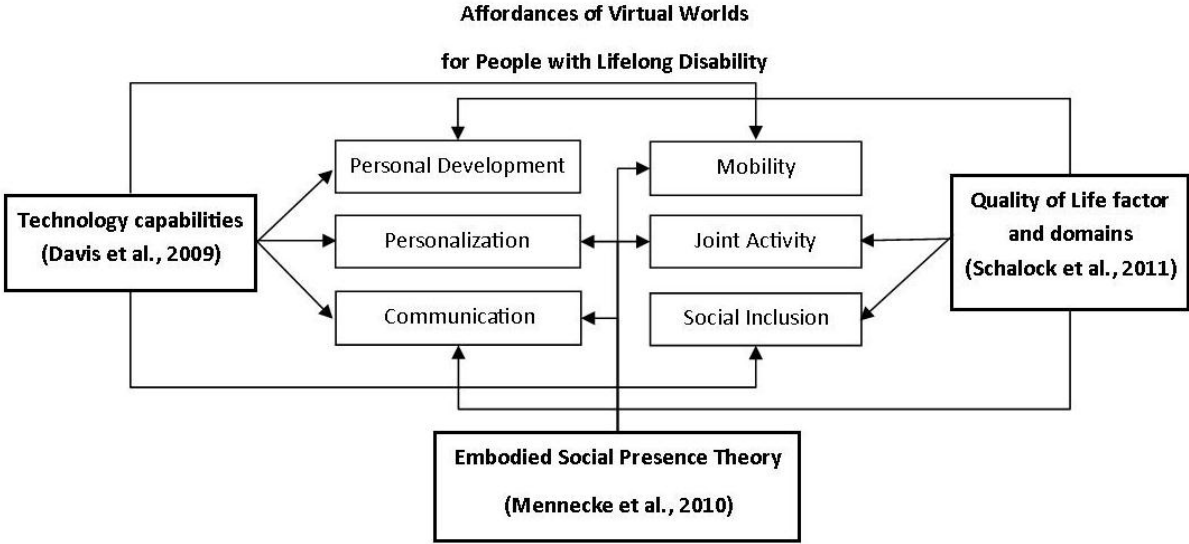


Figure 5.1 Theoretical contribution to identified affordances

Observation and interviews conducted with the novice users of Second Life were in Norwegian, and any quotes from these participants have been translated to best reflect their meaning. The interviews with the experienced users of Second Life were conducted in English and quotes are taken directly from the interviews (through voice chat or IM).

**5.1 Affordance 1: Communication**

I define the “communication” affordance as the ability to communicate with others through various means within the virtual world. Communication is known as one of the main challenges people with lifelong disability encounter in the physical world (Jackson, 2006), which indicates this affordance as an important factor for engaging in virtual worlds for people with lifelong disability. Second Life offers its users the ability to communicate through both voice and text. Davis et al. (2009) defined communication as an important capability of the virtual worlds. While Schalock et al. (2011) and Mennecke et al. (2010) do not specifically mention communication in their frameworks, the capability is important to establish interpersonal relationships and collaborative engagement. Text communication is an affordance for some people with lifelong disability while it is a constraint for others. Interestingly, the same group who

experiences text communication as an affordance will experience voice communication as a constraint. This will be shown in the discussion in this section.

### **Text communication**

Communication through text is widely used in Second Life. For people with a hearing impairment, the text feature offered by virtual worlds gives them a new and improved way of communicating with a much larger group than they experience in the physical world. Landira Crunge indicated that the possibility to communicate through text is one of the main reasons why Second Life is an important tool for her: *“One [reason] is my hearing loss and I don’t for the most part have to worry about understanding someone as they will type”*. Kirana Merkini also stated communication was made easier for her in Second Life by the possibility to communicate by text: *“It’s easier to interact with people here; don’t need a sign language.”*

While use of text-based communication gives this group of people a new communication feature, it can also create difficulties. Not all people with lifelong disability are able to use this communication channel. People with a physical disability that affects their mobility in arms or hands may encounter difficulty in using a keyboard while communicating. In my study, this was shown by Maria Butterfly who, because of her physical disability, was not able to use the keyboard for efficient communication in text. However, she felt text-based communication was important to her overall communication in Second Life. She stated the use of voice-to-text software helped her reach more people than she could reach with only using voice communication. *“I also didn’t realize I could use assistive technology. I use Dragon software to convert voice into text in SL [Second Life], and it works very well for me. When I found out it was there, and that it could be used with SL, it helped me a lot. Made me more social to when I could use it. When I can type (text-chat) I reach more people. It helped me a lot to communicate with more people in a timely fashion.”* (Maria Butterfly). However, such assistive technology is not often compatible with Second Life, which makes it hard to take advantage of in the virtual world (Krueger & Stineman, 2011). This is illustrated by Sunger Alista: *“People with disabilities often already use and have integrated various adaptive technologies. Often, these are not compatible with SL [Second Life]. One area I have heard a lot of frustration about has been the voice-to-text interface - or lack of one, actually. Remember, one cannot even begin to deal with the steep learning curve if one cannot even interact successfully with the program!”*

Use of a keyboard also requires training. The participants, who have an intellectual disability that could be a constraint for them when using a keyboard, experienced difficulty because of lack of training in using a keyboard. *“It is hard, because it is hard to find the letters”* (Rolatina Endora). For them, typing and following text-based communication was difficult.

A group that found text-based communication a little difficult was the participants with intellectual disability. Low level of literacy is a known challenge for people with intellectual disability (Ballin & Balandin, 2007), which can complicate communication through text for this group. Missara Melsa indicated textual explanations were difficult for her to follow. Because text based communication can appear in public, group and private communication streams, it was seen as confusing at times. During observation sessions, this was demonstrated when I communicated through a group channel and the participants answered through the public communication channel. When asked about this, Missara Melsa answered: *“It can be a little distracting when there are a lot of things happening on the screen at one time”*.

In addition, for people who are deaf or have a hearing impairment, when meeting a person who is not able to use text communication, the inability to communicate becomes a constraint. Kirana Merkini explained: *“Yes, I’ve met a blind person here couple of times, one uses voice only. Hard to interact with person like that”*. Participants have reported that when they do meet other individuals who are unable to type, they try to work around the problem. One solution that has been reported is asking hearing individuals to type, translating the voice communication being received from the person unable to type.

However, while multiple communication channels were a challenge for some, the ability to choose the privacy level of the text communications performed in the virtual worlds was seen as a great functionality. *“Once I was in there with Siltar Siana, and we used the group chat so that nobody could see what we were writing. It is great, because it is not all we want others to read”* (Gjagra Galt).

### **Voice communication**

While text communication is an affordance for people with a hearing impairment, others see the voice feature offered by Second Life as an affordance. People with a physical disability, which hinders their ability to use the keyboard efficiently, find the voice feature a very important tool for communication. The voice feature offers this group the opportunity to communicate even when text communication affordance is

unavailable or a constraint. Solvita Silka, who has a physical disability, stated: *“It is easier to talk than to write. At home I have a program that helps me to write, but in Second Life it is easier to talk”*. However, assistive technology, such as voice to text and gaze control systems, do not integrate well with virtual worlds, which creates barriers and constraints for some people with lifelong disability (Krueger & Stineman, 2011).

In addition, the voice feature enables the communication affordance for those with an intellectual disability. As discussed earlier, low literacy is a known challenge for people with an intellectual disability, which is a barrier that can be lessened by the voice feature offered by the virtual worlds. I witnessed this through the observation sessions with the novice participants. When the voice feature was unavailable or malfunctioned, communication was limited compared to when they could communicate freely through voice.

While the voice feature is an affordance of communication for a large group of people with lifelong disability, it is important to realize that those with a hearing impairment once again can feel excluded (Carr, 2010). Some events arranged in the virtual worlds solely use the voice feature as a communication channel, which excludes the participation of people with a hearing impairment. *“Of course, I am left out of trainings or classes or seminars only offered in voice...that’s frustrating, but it’s exactly the same as RL [Real Life]”* (Sunger Alista).

### **Language and complexity**

For the novice participants, Norwegian was their main language, which created some difficulty. Though Second Life is available with Danish menus and directions, the main language in Second Life is English. This created some challenges when trying to communicate with others and was a major barrier for the novice participants, independent of their disability.

Furthermore, communication channels operating simultaneously while participants were engaging in activities in the virtual world created distraction and confusion for some. Due to this confusion, some of the participants with an intellectual disability did not communicate frequently in the virtual world, but concentrated on participating and enjoying the activities in which they were engaged. This information concerning distraction and confusion demonstrates that virtual worlds, as established to date, are too complex for some people with intellectual disability and there is a need to further develop standards to support universal design, as suggested by researchers in the past

(Krueger & Stineman, 2011; Standen & Brown, 2005). In addition, assistive technology, as suggested by Kruger and Stineman (2011), could lessen the complexity of use in virtual worlds.

## **5.2 Affordance 2: Mobility**

*“In RL [Real Life] I can’t dance, here I can dance with the stars.”* (Maria Butterfly).

I define this affordance as the ability to move around in the environment, independent from others and physical constraints. The main benefit of virtual world technologies, for people with lifelong disability, may be the ability to engage in a wide range of activities relatively free from their physical constraints and limitations imposed on them by the physical world (Standen & Brown, 2005; Wilson et al., 1997). Davis et al. (2009) identified mobility as a technology capability offered by virtual worlds. Mennecke et al. (2010) stated being able to use the environment the virtual worlds offer as an important factor which makes virtual worlds different from other online environments. While both these theoretical perspectives agree that mobility is an important factor and capability of the virtual worlds, they do not account for the difficulties some people with lifelong disability may experience to utilize this affordance. The constraints will be shown through the discussion in this section.

In the physical world, being dependent on a wheelchair in many situations hinders a person’s mobility. Previous research stated virtual worlds enable people with minimal physical mobility to explore virtual spaces with the same freedom as people without disability (Alm et al., 1998). The ability to walk and move freely is identified as an advantage of virtual worlds (Babiss, 2009). Second Life offers people with a physical disability the opportunity to be independent from their disability. Gjagra Galt, who has severe physical disability and uses a wheelchair in the physical world, had a new experience when she was able to spend time in Second Life dancing. Being able to perform dance moves in Second Life gave her a sense of dancing that she could not achieve in the physical world. Maria Butterfly explained about being free from her disability in Second Life: *“Maria [her avatar] taught me how it would be like to have an able body, and going through the motions of having an able body.”*

Furthermore, not being dependent on outside assistance (e.g., caregivers) to visit new locations or hanging out with friends is experienced as an important factor of the mobility affordance. In the physical world, people with a physical disability are often dependent of others to be able to move around. People with an intellectual disability are often closely supervised and decisions to visit new places or move around in their

local community without supervision are made by caregivers or family members. The virtual worlds offer people with both physical and intellectual disability the opportunity to move around in the environment without being dependent on family members or other caregivers. The affordance of mobility offered by the virtual worlds, visiting locations from the safety of their own home, is a very important factor for people with lifelong disability.

It is important to note that to be able to teleport, fly, walk, or navigate an avatar in the virtual world; a person is dependent on the ability and knowledge to use a mouse or keyboard. Physical disability can turn this affordance into a constraint instead of an opportunity. Controlling the avatar while walking or flying is sometimes a challenge; however, the participants realized that with practice, controlling the avatar became an easier challenge and they did accomplish the task.

In addition, for those with intellectual disability, the complexity of navigating in the virtual environment can be a constraint. This was evident during the observation session with the novice participants with an intellectual disability. Moving from one location to another in Second Life is done through teleporting. Landmarks were given to the participants and the participants needed to accept these landmarks to be able to teleport to the given location. Teleporting requires using the menus in the application window and choosing the wanted location, and was a challenge for the participants. Even after doing this multiple times, help to perform teleporting was still required.

From the analysis, it is evident that the mobility affordance is important for both people with physical and intellectual disability. People with an intellectual disability require additional support to be able to utilize the affordance due to the complexity of the virtual world application, but the freedom of mobility offered through the virtual worlds is indicative of personal value, which is important to recognize.

### **5.3 Affordance 3: Personalization**

I define the affordance “personalization” as the ability to choose what to disclose and customize representation through an avatar. Compared to other online media (e.g., Facebook and forums) virtual worlds also offer a representation of self and there is a relationship between the physical and virtual self, in addition to the relationship with others when engaged in the virtual world. In the physical world, people with lifelong disability experience prejudice due to their disability (Hammel et al., 2008). The virtual worlds offer an environment in which physical world prejudice may be avoided or worked around (Ford, 2001). Davis et al. (2009) and Mennecke et al. (2010) both



stated personalization and the ability to create a persona in the virtual world that represents the individual controlling the avatar as important within virtual worlds. However, they do not consider the difficulties that the complexity of the technology may pose on people with disability. In this section, I will discuss these factors in depth.

Users of virtual worlds spend time personalizing their avatars and are continuously making changes representing them in a manner they feel comfortable with at all times (Oishi, 2007). Making changes to the avatar's physical appearance (e.g., body shape, size, color etc.) in Second Life is a standard procedure, with multiple steps. When changing clothing, hair, or accessories for the avatar, there are no set standards. These procedures change depending on who developed the clothing, hair, or accessories in Second Life. Because of this, the participants had to learn multiple techniques to enable them to change their avatar's appearance. Figure 5.1 demonstrates the personalization of an avatar in Second Life.



**Figure 5.2 Personalization of an avatar**

Due to the technical process to make changes to an avatar in Second Life, the participants with an intellectual disability experienced performing these changes to be a challenge. *“It was hard to change clothing, I couldn't do it”* (Trinaka Lika). Most of the participants in this group did not excel to the level of mastery of personalization of their avatar. When they wanted to make changes to their avatar, extensive assistance from their teacher and me was necessary. However, the joy they expressed when having personalized their avatar to represent them in a way they enjoyed was evident. When asked about how it felt to change clothing on her avatar Sophy Salk answered: *“It was great. Finally I have summer clothes on.”*

While the technical process created challenges for some, the personalization affordance was experienced as a great value offered to people with lifelong disability. The ability to choose what to disclose was expressed as a great advantage. Only two of the experienced participants chose to disclose their disability through their avatar. Angora Sircka uses a wheelchair in the physical world; in Second Life his avatar also uses a wheelchair. He spends much of his time in Second Life volunteering on Virtual Ability Island and he feels displaying his disability through the avatar helps break the ice when communicating with novice users of Second Life. *“In Virtual Ability, most folks have disabilities of some sort. Some are still learning to be “okay” with that . . . to integrate that into who they are. I think it helps some people to talk about it”* (Angora Sircka). While a physical disability, such as use of a wheelchair, can be visible also in the virtual world, hearing impairments cannot be seen. Sunger Alista states in her profile in Second Life that she is deaf and only communicates through the text chat. *“Because I enjoy meeting new people and conversing with them. And thus, they will know and chat in text”* (Sunger Alista).

The rest of the participants did not discuss their disability during the sessions in Second Life; they enjoyed being able to keep their anonymity and not having to disclose their disability. Some of the participants expressed not understanding why one would want to bring a disability into the virtual world when it is not necessary. The personalization affordance offers people with disability the ability to be anonymous when and if desired. Missara Melsa expressed anonymity as a very significant option offered in the virtual world: *“It suits me well [to be anonymous]. Because I have had problems on Facebook, I like to be anonymous in places like this. I tell very little about myself if I don’t know the ones I talk with.”* Ford (2001) viewed virtual worlds from both a positive and a negative angle. He stated virtual worlds may remove many prejudices created by stereotypes found in the physical world, but that virtual worlds may present potential harm for people with disability, such as some programs failing to provide users the option to conceal a disability (Ford, 2001). Second Life does offer this option for their users; however, it is important to note that prejudice is present also in the virtual world, which makes the affordance of personalization such an important one for people with lifelong disability.

Furthermore, the personalization affordance does not only cover the opportunity to choose what to disclose, but also the ability to experiment with various representations of personality traits. Virtual worlds offer their users the ability to take any form they want, human or non-human (Oishi, 2007). As the only participant choosing to be

represented by a non-human avatar, Ahroun Wolf stated the wolf has always been a representation of his personality; and therefore he chose a wolf to represent him in Second Life. While this is a strong statement of personality, other participants explained how they experimented with both human and non-human forms within Second Life. Kalnika Gublic changes the hair and skin color of her avatar frequently. Being able to change her avatar to fit her mood at any given time is important to her. When asking Sunger Alista how her avatar represented her, her quick response was: *“Which avatar? I have over 200. LOL”*. She collects free avatars in Second Life and likes to play around with changing them. When asked if she switches them often, she replied: *“Mostly when I have an audience. LOL”* Landira Crunge also plays with different avatar forms in Second Life. *“Personality wise, it’s the same as the RL [Real Life] me, except when I’m in a tiny fox avatar or just playing around with other creature avatars.”* When asked how it felt to switch between human and non-human representation she answered: *“Fun ☺ It’s like you can take on a whole different personality”* (Landira Crunge). Not only is the opportunity to choose an avatar that is non-human present, the virtual world does not constrain the gender you want your avatar to present. Leos Marth, a female in the physical world, chose a male avatar to represent her in the virtual world. *“I like boys, that is why I wanted my avatar to be a boy”*, Leos Marth explained.

However, as stated in earlier research, it takes time to establish a close relationship to one’s own avatar (Bailenson et al., 2001). The study also indicates over time the participants feel immersed into the virtual world and experience the environment as “real” as the physical world, which is in accordance with previous research (Wolfendale, 2007). The participants stated the closeness to their avatar and the ability to create an avatar who does not visibly display their disability to avoid prejudice is important.

#### **5.4 Affordance 4: Social inclusion**

The affordance “social inclusion” refers to the ability to experience feeling part of a community, creating and maintaining friendships, and experiencing close interpersonal relationships within the virtual world. Virtual worlds offer the ability to meet as equals, which to people with lifelong disability may not be experienced in the physical world. Social inclusion is an important factor for experiencing quality of life (Schalock et al., 2011), in addition to personalization of avatars, which enables people with lifelong disability to meet as equals (Davis et al., 2009).

In the physical world, people with lifelong disability experience challenges when wanting to socialize (Ballin & Balandin, 2007). One of the main reasons people with lifelong disability engage in virtual worlds is the social aspect they offer. *“Well, social aspect for one.. I’m retired and live alone, so it gives me something to do..”* (Landira Crunge). Creating and maintaining connections, friendships, and close relationships are possible through virtual worlds, and the opportunity to communicate through various means (e.g., text and voice) offers people with lifelong disability a safe environment to explore the social connections they can encounter. An extended network of possible connections and friendships offers people with lifelong disability a new way of communicating and building self-esteem. Ahroun Wolf, who has Autism Spectrum Disorder, uses the virtual world to meet new and maintain existing friendships in a way not possible for him in the physical world. Due to his disability, social interaction is difficult; however, in the virtual world he experiences being able to meet as equal and having an environment that allows him to be socially active. *“Predominantly to maintain connections with people I already know from SL [Second Life]. At one point I did seek out new social contacts, but that’s gotten to be few and far between. I would like to get back to meeting new people. I met my mate here after all, I hate missing the opportunities to meet other quality people to call friends and companions”* (Ahroun Wolf).

For some of the participants, meeting new people and maintaining a social connection was much easier through the virtual world than the physical world. People with a hearing impairment will, in the physical world, often be excluded due to their communication solely being through sign language, while in the virtual world the communication affordance allows them to communicate through text and reach a larger group of individuals. Individuals with physical disability experience being seen as equal and not being excluded due to physical appearance and prejudice, as experienced in the physical world (Hammel et al., 2008). Kalnika Gublic explained why she thinks it is easier to meet people in the virtual world compared to the physical world: *“I don’t have to use energy to have them see past the chair”*. The opportunities for social participation, meeting others on equal terms and avoiding some of the prejudice experienced in the physical world, are all important factors for people with lifelong disability when engaging in virtual worlds. It is important to note, as previously discussed, there is prejudice in the virtual worlds as in the physical world, however, it is easier to avoid in the virtual world. Because the virtual world offers multiple locations easily accessible, if the feeling of being unsafe or uncomfortable

becomes unbearable, the opportunity to change location or turn off the application provides an easy escape. From the safety of one's own home or another familiar physical location, people with lifelong disability have the opportunity to explore the virtual world. As illustrated by Ahroun Wolf: *"I think the biggest thing is -- here... I'm in control. I'm safe. If I don't like a situation, no matter how good a hacker a person is, their ability to control me is limited by my ability to pull a network plug or flip a power switch. If someone has me physically bound—I am in very real danger."*

For those with an intellectual disability it may be hard to connect with people in the virtual world. The complexity of the virtual world combined with low literacy, indicates people with an intellectual disability experience challenges when trying to communicate and create friendships. The majority of the novice participants with an intellectual disability only interacted with other participants and did not create friendships with non-participants while engaging in activities in Second Life. Those who did attempt it, found it difficult to approach others. One problem I observed during the sessions was the inability to understand personal boundaries, which resulted in other individuals (non-participants) to relocate and discontinue contact. However, it cannot be determined if this is solely because of their intellectual disability, as the limited length of time spent in the virtual world can also have an impact on the outcome. The complexity of use may have been, to some extent, dictating how well the group of novice participants with an intellectual disability was able to utilize the social inclusion affordance to create new friendships.

Interpersonal relationships are a challenge for people with lifelong disability in the physical world. People with a disability are less likely to have interpersonal relationships than their non-disabled peers (Ballin & Balandin, 2007). Within the virtual worlds, the participants reported they have experienced many types of relationships, from acquaintances to close personal relationships, such as spouses and partners.

### **5.5 Affordance 5: Personal development**

The personal development affordance is defined as the process of personal growth and learning through the virtual worlds. Feeling as part of society and being able to give back and help others is important for people with lifelong disability in the physical world (Hammel et al., 2008). Personal development is an important part of the factors and domains found in the Quality of Life framework by Schalock et al. (2011) however, their use of the framework does not include use of virtual worlds. From the technology capabilities perspective (Davis et al., 2009), learning and personal growth

through learning is stated as important factors through use of virtual worlds. The findings also indicate that people with lifelong disability can experience virtual worlds as being a valuable addition to their lives in the physical world. Feeling as part of society, being able to give back, help others, to learn and an increased feeling of well-being through the virtual worlds, creates an added value for people with lifelong disability.

Independence is important to all and for people with lifelong disability this is not easily obtained (Ansello & O'Neill, 2010). As discussed earlier, virtual worlds offer environments in which people with disability are able to be independent of outside assistance and take advantage of the mobility affordance. Through the mobility affordance, people with disability also have the opportunity to explore and take advantage of the personal development affordance identified through this research.

It is important to all humans to be seen as valuable participants of the community and society, this also applies to people with lifelong disability (Hammel et al., 2008). Education and learning are important factors to establish personal development. Within the virtual worlds many universities and colleges offer classes, in addition to other organizations offering courses (Hew & Cheung, 2010). However, learning is not restricted to formal education (Richardson & Molka-Danielsen, 2009), it also can cover learning how to use a technology. While affordances are available and constrained by the ability of the human actor in an environment, in this regard there were also differences between novice and experienced users of the virtual world. The learning curve of use in virtual worlds is very complex and at times difficult. The novice participants were only using Second Life over a period of eight sessions, during these sessions they experienced the challenges of use and were engaged in activities through the virtual world. However, they were very excited about learning to use this new technology. Gjagra Gralt expressed her first weeks in Second Life to be hard, but very educational and fun. The feeling of mastering the technology made her feel more confident and enjoy her time in Second Life much more. Leos Marth said: *"It is a little hard, but it is getting better, I want to get good at this."* The participants explained the learning curve of Second Life may be a barrier to the possible opportunities and affordances offered by the virtual world. Agonra Sircka expressed a decisive opinion when asked his thoughts about introducing virtual worlds to people with lifelong disability: *"Accessibility—how to overcome the barriers successfully—to move quickly toward a level of independent mastery. The goal should be interacting—with the VW [virtual world] and with others—not just having to figure out how to do*

*that . . . A lot of folks with disabilities have to spend disproportionate amounts of their life “figuring out” how to do things that others take for granted. If that “learning curve” can be short in a VW, then people with disabilities can be equals in actual interactions.”* While the novice participants were experiencing the learning curve as the project progressed, they expressed the progress they made over the eight weeks as being important for them. This was especially shown in the final session when Trinaka Lika exclaimed with a cheer that she managed to teleport without assistance. During later interviews she said: *“I teleported on my own the last time, it became easier.”* Most of the novice participants had an intellectual disability, which may have made their need for support even greater; however, the feeling of mastering different aspects of the virtual worlds was still present.

Previous research has stated the complexity of a technology may prevent or discourage people with lifelong disability to use the technology (Söderström & Ytterhus, 2010). This is illustrated by the example of Landira Crunge who quit using Second Life at one point due to the lack of support to learn how to use the technology. When she returned, she received help from a friend to master Second Life and today assists other people with disability to overcome the initial barriers of using Second Life.

Virtual worlds have also been used for more formal education by the participants. Maria Butterfly first started using virtual worlds because she wanted to participate in a college course. When she had completed the course she decided to continue using Second Life and still spends time participating in classes and courses offered through the virtual world. The ability to participate in courses with others and be a part of the community offered through such activity lead to personal growth for her.

Moreover, the capabilities of interactivity and immediacy of artifacts display the need for extensive training to be able to utilize these capabilities and convert them into affordances. Virtual worlds are complex applications and being able to build or modify objects requires special skills, but with the skill, the affordance of personal development is evident.

Another part of personal development and participation is the ability to give back to society through voluntary work. Through Virtual Ability Island, some of the participants, such as Landira Crunge, does voluntary work to help novice users with disability overcome the initial barriers of entry to Second Life. In addition, Sunger Alista works with people with disability by building objects in Second Life to assist them with their use and needs in the virtual world. During sessions, Mix Mofat helped the other participants in his group use the virtual world and enjoyed helping them

when possible. Gjagra Gralt assisted her teacher when showing other people with lifelong disability how to use Second Life and enjoyed being there to ensure they would like using the technology as much as she did. Hammel et al. (2008) indicated that because people with lifelong disability often are deprived of the opportunity to help others and give back to society, they do not feel as they participate in all facets of the community. Stewart et al. (2010) stated the virtual world as being a great environment for people with lifelong disability to help and enjoy the feeling of participating by giving back to society through volunteer work.

A result of the affordance personal development can be the feeling of well-being. Stewart et al. (2010) implied that through participating in the virtual worlds, people with lifelong disability may experience a higher sense of well-being. Ahroun Wolf implied through his interviews that without technology and the virtual worlds there would be no quality to his life. *“I have none without my computers. Without my cocoon of technology... there would be no quality to my life at all”* (Ahroun Wolf). While this may be an extreme case, the virtual worlds offer an environment for people with lifelong disability to feel better about themselves and feel as part of a society and community: *“SL [Second Life] has given me a reason to exist more than just so because of my kids. I do feel a sense of being needed in SL more so than in RL [Real Life].”* (Landira Crunge)

The affordance of personal development may be dependent on disability, such as people with an intellectual disability will require a longer period to develop the skills needed to independently master the technology.

### **5.6 Affordance 6: Joint activity**

I define the affordance “joint activity” as the ability to engage in activities together with others in the virtual environment. Mennecke et al. (2010) indicated through their stages of Embodied Social Presence that joint activity is important to fully experience Embodied Social Presence. They stated the feeling of participating in a collaborative task increases the experience of virtual worlds and motivates for continuous use of the technology. Further, through the Quality of Life framework there is an understanding that social inclusion is important for increased perception of life quality (Schalock et al., 2011). Previous research has identified the possible positive outcomes offered by virtual worlds for people with lifelong disability (ref. section 2.2). Through this research, these conceptual predictions have been explored empirically.



An important capability offered by the virtual worlds is the environment that it represents. There are environments that represent the physical world as we know it; in addition there are non-real environments that we can only imagine. However, the rich sensory representation of the physical world in the virtual world is evident for the participants. Virtual worlds offer an environment in which the feel of a physical world is present, with exception of sense of smell or physical touch (Davis et al., 2009). Over time, the participants began to feel immersed in the virtual world and a feeling of being an actual participant, not simply a person controlling the avatar. The majority of the novice participants expressed being impressed by the scenery and liveliness of the environment, but some did not feel they were actually engaging in the activities. This statement is consistent with the research conducted by Mennecke et al (2010), who introduced the five-stage model of Embodied Social Presence and indicated the time aspect of feeling presence in the virtual worlds.

Engaging in activities together with others was reported as an important factor for the participants. Through observation, I noticed the novice participants continued to ask for locations where they would be near other avatars. When they engaged in activities, such as dancing, in a location without other avatars nearby they soon became bored. Although they still wanted to dance, it was important to be around others when engaging in activities. When taken to a location in which there were other avatars present, the novice users spent the entire session in one location. One example was Sophy Salk's experience. At Second Norway, the Norwegian Island in Second Life, she had the opportunity to dance with a male avatar. She did not like the style of dance they were doing and asked me how to change it. I suggested she should click on a dance ball (an object to animate the avatar), so she could choose her own style of dancing. She then answered: "*No, I want to dance with him.*" The opportunity to dance with another individual was more important than the style of dance. Being able to participate and engage in an activity with others is viewed as important for people with lifelong disability.

## **5.7 Limitations**

This research is a part of a PhD study using a set timeframe, which can create the possibility that it may not produce the same results using a different timeframe. In addition, the time spent in Second Life with novice participants was limited. This implies that the observation time could benefit from a longer timeframe. Furthermore, because of different data collection methods among novice participants (i.e., observation and interviews) and the experienced participants (i.e., interviews only), it

may be argued that different data was collected. However, the data collected through the two methods supplement each other. In addition, the data collection was conducted within a rather heterogeneous group, with participants representing various disabilities. Due to the variety, it is hard to generalize within and across the two groups (novice and experienced). Furthermore, due to these differences, it is also challenging to draw overall conclusions. However, the study represents an early stage to understand how people with lifelong disability use and experience virtual worlds.

This study also has limitations due to the number of participants in each of the two studied groups (novice and experienced). When inviting organizations and institutions to recruit novice participants in this study, some functioned as gatekeepers, which subsequently may have prevented individuals from participating. When not being able to speak with possible participants directly, others (e.g., caregivers, family, and teachers) took it upon themselves to decide if the study would be of interest to possible candidates. Due to the decisions made by gatekeepers for potential participants during the recruitment period, only 11 individuals were recruited as novice participants. While observation and interviews of these novice participants supplied valuable data, a larger group of participants may have been beneficial. When recruiting experienced participants, the potential candidates attended a project presentation in Second Life and were offered the opportunity to participate in this study. Due to limited time, only two presentations of this project were given in Second Life, therefore, the optimal amount of participants may not have been obtained. However, the experienced participants partaking in the study were able to contribute with valuable and informative data.

Due to scheduling dependence on teachers as well as the novice participants, these participants were physically located in the same room during Second Life sessions. This may have created a limitation in the perspective that the novice participants communicated more with each other in the same room, than they did with each other in the virtual world. By being located physically together, the nature of engaging in the activity with the others using Second Life in the same room may have overridden the feeling of engaging in activities together within the virtual world. Also, if located in different physical locations their perception of avatar-person relationship could have been reported differently.

All participants were within the definition of lifelong disability and represent six different disabilities. Thus, to specifically contribute to challenges and possibilities for each disability group, a greater amount of participants in each disability group would

have been beneficial. However, the aim was not to explore the affordances for people with a specific disability, but to understand how people with lifelong disability experience the virtual world.

Furthermore, as discussed in chapter 3, this study includes people with mild to moderate intellectual disability. A known challenge for people with intellectual disability is the difficulty to express and formulate their experiences. During conversations and interviews with some of these participants, only closed-ended questions (e.g., yes/no questions) or multiple-choice questions could be asked. This can cause misinterpretation in the data collected from these participants, though all precautions were taken to prevent any misconceptions. By asking closed-ended questions, the participants could be led in a certain direction when answering the questions. However, to prevent researcher bias in this concern, multiple questions were posed in a positive and negative form, to ensure the responses from these participants were as accurate as possible.

In this study, the participants' origins were from various countries, which could represent cultural differences. Cultural experiences may direct how people with lifelong disability experience the use of virtual worlds. While this has not been a focus in this study, it is an issue to be considered for future research.

Due to some of the discussed challenges, another limitation is observation of social challenges, which in further research should be considered more closely. While some have been identified and described, there might be others which have not been discussed through this work.

Finally, a limitation of this research is the lack of association to the participants' life in the physical world. The scope of this research did not consider how use of virtual worlds affected the participants' life in the physical world.



## 6 Conclusion and implications

This chapter presents a summary of contributions to knowledge and the implications for practice drawn from this research. In addition, this chapter suggests future research areas.

### 6.1 Summary of contribution to knowledge

Through empirical research, this thesis contributes to the knowledge base on how people with lifelong disability use and experience virtual worlds, and focuses on answering the overarching research question:

*What are the affordances of a virtual world for people with lifelong disability?*

This research has demonstrated there are various affordances offered to people with lifelong disability through use of virtual worlds. This has been examined through four research sub-questions. The research started with a literature review to identify the domain of the research. The literature review showed the field of study is still at an early stage and in great need of further research. How people with disability use and experience use of ICT has been researched in previous studies. However, virtual worlds' impact on people with lifelong disability remains an under-researched area.

This research identifies six affordances offered to people with lifelong disability by virtual worlds, as shown in Table 6.1. The identified affordances presented in this thesis are communication, mobility, personalization, personal development, social inclusion and joint activity.

It is important to note that these affordances are not only dependent on the technology, but also dependent on human abilities (e.g., people with a physical disability may have challenges when using keyboards and mouse to utilize the affordance of mobility in the virtual world). This thesis identifies some of the technological and social challenges various disability groups meet when engaging in the virtual worlds. In addition, this research argues for further motivation to create solutions (e.g., Universal Design) to overcome these challenges and enable an increased number of people with lifelong disability to take advantage of the possibilities virtual worlds offer. In addition, some of the social affordances virtual worlds offer people with lifelong disability are identified and discussed.

It is important to note, while this thesis identifies six affordances there may be others affordances not identified through this work. Table 6.1 presents the identified affordances.

<b>Affordance</b>	<b>Value</b>	<b>Constraints</b>
<b>Communication</b>	Enables people with lifelong disability to communicate with others through various means (e.g., text and voice communication).	Text communication for some people with a physical disability Voice communication for some with a hearing impairment
<b>Mobility</b>	Enables people with lifelong disability to navigate the environment relatively free of physical constraints and outside assistance.	Requires the ability to use keyboard to navigate avatar within the virtual environment. May be difficult for people with a physical disability. People with an intellectual disability may experience the processes required to navigate difficult.
<b>Personalization</b>	Enables people with lifelong disability to choose what to disclose, meet as equals and customize representation through an avatar.	Difficult for some with an intellectual disability, because of the complexity of personalizing the avatar. Some people with a physical disability may find it difficult to personalize their avatar because mobility of arms is needed to perform the task.
<b>Social Inclusion</b>	Enables people with lifelong disability to create new and maintain existing friendships. Also, enables the feeling of being included into society and feel part of the community.	Some people with an intellectual disability may experience connecting to others difficult because of lack of social cues and low literacy.
<b>Personal Development</b>	Offers the opportunity for people with lifelong disability to experience personal growth and learning through the virtual world.	Learning curve of virtual worlds is hard for all. People with intellectual disability may experience learning how to use virtual world difficult because of the complexity of the application.
<b>Joint activity</b>	Enables people with lifelong disability to engage in activities in the virtual environment together with others.	Some people with an intellectual disability may experience not being able to read social clues and engaging in joint activity. Difficult for people with a physical disability when unable to use action balls to perform the activity.

Table 6.1 Affordances offered by virtual worlds to people with lifelong disability

## **6.2 Implications for practice**

For practice, the results from this research show how virtual worlds are valuable for people with lifelong disability. This research considers the phenomenon of virtual worlds for people with lifelong disability. These findings are valuable for practice

when deciding to introduce virtual worlds to people with lifelong disability and offer them the opportunity to use this new technology.

People with lifelong disability experience having the decision of use made for them by caregivers (e.g., assistants or family members), which can be one of the most difficult barriers to overcome. Decision makers, health professionals, and family members must be informed of the positive values virtual worlds offer and be receptive to the new technology and its opportunities. As discussed in the limitations of this study (chapter 5), in some cases, because of others associated with the potential participant acting as gatekeepers, possible participants were not offered the opportunity to decide whether or not they were interested in participating.

Many virtual worlds applications are free to use and available to all; however they may be complex in use. This research documents the technological and social opportunities and challenges virtual worlds offer people with lifelong disability. The findings from this research can be utilized by governmental agencies and health care professionals to introduce this rather new technology to those individuals who may benefit from it. The findings can help practitioners understand the opportunities offered by virtual worlds, and the positive outcomes experienced by people with lifelong disability using virtual worlds.

However, it also shows there are barriers for people with lifelong disability to use virtual worlds. The results document there is a need for support for people with lifelong disability to overcome the initial entry barriers. This requires practitioners to be prepared to assist, guide, and support people with lifelong disability to acquire the level of confidence that enables them to utilize virtual worlds without continued assistance.

Furthermore, the findings may encourage decision makers to offer computers in institutions and other locations in which people with lifelong disability can have access to virtual worlds. By making the appropriate equipment available, a substantially greater amount of people with lifelong disability may be encouraged to test virtual worlds and discover the affordances virtual worlds offer. However, it is important to note assistive technology may be required and should be available to those who need it.

For developers of virtual worlds and assistive technology, this research documents a need for developing less complex virtual worlds, accessible and usable for people with lifelong disability, also mentioned by former research (Krueger & Stineman, 2011;

Standen & Brown, 2005). There is a need for intuitive user interfaces and easier procedures to perform actions in the virtual world. In addition, this research indicates there is a need for close collaboration between developers of virtual worlds and developers of assistive technology, to create software (e.g., text to voice systems and other assistive technology) compatible and helpful for people with lifelong disability. Through the identification of affordances and constraints of virtual worlds to people with lifelong disability the former assumption of ability needed for experiencing the virtual worlds have been reduced. By developing text to voice software that are compatible with Second Life, more people with physical disability may be able to take advantage of the affordances offered by virtual worlds as suggested by Krueger and Stineman (2011). In addition, people with an intellectual disability will benefit from less complex virtual worlds, where the interface has less distractions and/or functionalities, as suggested by Krueger and Stineman (2011) and Standen and Brown (2005).

### ***6.3 Implications for further research***

This research has established a firm starting point for further research in the area of virtual worlds and people with lifelong disability. As stated in publication 2 (ref. Appendix D), there is multiple areas which are lacking sufficient research, and this thesis has not addressed all these topics. Questions raised in publication 2 that have not been answered by this thesis include: access to all, employment in virtual worlds, and volunteering in virtual worlds. In this section, these topics are discussed, in addition to the implications related to the research presented in this thesis.

When discussing access to all, it has been reported there is a relatively low amount of people with lifelong disability who have access to Internet and the virtual worlds (Fox, 2011). Future research should focus on how to ensure this group acquires more access and assistance to use the technology available to them.

In addition, employment for people with lifelong disability in virtual worlds is an area which can benefit from further research. In the fourth quarter of 2010, the web merchandise sales volume of Second Life was 956 million USD (Linden, 2011), which indicates large sums of money are invested through transactions performed in Second Life. The statistics from Linden (2011) indicates there is a possibility to earn a living through the virtual world. To date, this has not been in focus of the research community concerning people with lifelong disability. For people with lifelong disability, who are less likely to have paid employment, it may represent a new opportunity.



Furthermore, there are multiple organizations and self-help groups present in the virtual worlds. This represents a possibility for people with lifelong disability to give back to the community and help others. Previous research has shown that people with lifelong disability have a strong desire to be able to help others and participate in the community by giving back (Hammel et al., 2008). Future research should focus on this possibility and examine how giving back to society through virtual worlds may have a positive impact on individuals' lives.

This thesis establishes an indication of the technological challenges virtual worlds pose for people with lifelong disability. This thesis also indicates that the technological challenges experienced by people with lifelong disability are dependent on their individual ability. However, as discussed in the limitations, the number of participants within each of the disability groups is low; thus, this study does not fully cover the specific challenges met when using virtual worlds. Future research should focus on specific disability groups, and explore in-depth the challenges they meet when using virtual worlds. In addition, such research can explore the need for assistive technology and explore the compatibility such technology has to virtual worlds. Future research should examine the need for universal design in virtual worlds, to ensure more people with lifelong disability access to virtual worlds in the future. The research field, in addition, would benefit from a longitudinal study to explore the amount of time required for people with a specific disability to overcome the initial technology challenges virtual worlds represent, and the amount of time required to be fully confident using the virtual world applications.

This thesis states people with lifelong disability, over time, may establish a strong bond to their virtual self and others. While this study (publication 4, Appendix D) shows novice participants are not experiencing all stages of Embodied Social Presence and experienced participants are experiencing all stages of Embodied Social Presence, there is no indication as to the length of time required to experience all stages of Embodied Social Presence. This requires a longitudinal study with multiple participants.

The participants included in this study are from different countries, with different cultural backgrounds. Culture may influence the way people with lifelong disability experience social participation and inclusion through the virtual world. Future research should focus on the importance of cultural background when engaging in virtual worlds.

This thesis represents a starting point to understand the social aspect for people with lifelong disability using virtual worlds. However, being an exploratory study, it does not measure these affordances. Future research should focus on how virtual worlds have a social impact on people with lifelong disability. In addition, a longitudinal study to examine the overall effects virtual worlds may have on people with lifelong disability and their quality of life is warranted. Furthermore, with the widespread use of online social networks (e.g., Facebook and Twitter), a natural prolonging of this research is to compare the impact of online social networks to the impact virtual worlds (e.g., Second Life) have on people with lifelong disability.

This study has introduced virtual worlds to 11 novice participants, with the assistance of caregivers or teachers in their local communities. Future research should focus on how virtual worlds can be introduced to people with lifelong disability, in a manner where the identified barriers of use and technological challenges are reduced to a minimum. A considerable amount of people with lifelong disability feel disconnected or excluded from the community, and with the introduction of virtual worlds, this technology represent a new and most valuable tool for people with lifelong disability to become included in the community and independent of physical constraints.

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## **Appendix A - Interview guides**

As mentioned in section 3.3.3, multiple semi-structured interview guides were created, based on the experience level of the participants. Enclosed in this section are examples of two of the interview guides used in this study; one example for novice participants and one for experienced participants. The interview guides were created to cover themes based on the sub-questions presented in chapter 1. All interviews started with an introduction of the nature of the interview and a clarification that the participants could choose not to answer any question they felt was too personal.

As mentioned earlier, the interview guides were slightly modified throughout the research process. The example presented here concerning novice participants, is the second version of the interview guide and includes multiple closed-ended questions. In addition, when conducting the interviews multiple choices were provided for some of the participants to answer (e.g., listing activities we had engaged in). Interview guides for novice participants were originally created in Norwegian; the enclosed version is the English translation.

The enclosed interview guide for experienced participants is the interview guide used for the first interview. In addition to the questions in the interview guide, several questions were prompted by the information the experienced participants shared. The interview guide was used to ensure all the identified themes were covered.

At the end of the interview, all participants were asked for any comments, suggestions or information they felt had not been included. In addition, the experienced participants were asked if they knew other individuals they believed would be interested in participating in this study.

## Interview Guide Novice Participants

<b>Interview Guide Novice Participants</b>
<b>General:</b>
Can you tell me a little of how the experience has been for you in SL? What did you like most? What did you like least? What has been hard? What has been easy?
<b><i>Virtual Self</i></b>
Do you feel that your avatar is you? How do you feel the avatar is you? Is your avatar different from you? How was it to change clothes on your avatar? How do you feel about being in SL? Do you feel like you really have participated in the activities in SL?
<b><i>Interaction with others in the virtual world</i></b>
How has it been to talk with others in SL? How did it feel? Was it different than talking with someone in the physical world? Have you made any friends in SL? Do you feel that those you talked with were there with you?
<b><i>Possibilities virtual worlds offer for activities</i></b>
Which activities have you liked in SL? How did you like doing activities in general in SL? Is it different from doing activities in the physical world? Are there other activities you would like to do in SL?
<b><i>Difficulties when engaging in a virtual world</i></b>
How was it for you to be new in SL? How do you think it is now? What opportunities have you had in SL? What challenges have you had in SL? Would you like to continue to use SL on your own? At home or somewhere else? How could things have been easier for you?
<b><i>Support</i></b>
How was it to get help from me in SL? -What was hard? -What was easy? -How could it have been easier? How was it to get help from your teachers for SL? -What was hard? -What was easy? -How could it have been easier? What kind of help would you need more of? What kind of help would you need less of? Would you like to use SL alone, without a teacher or me? -Why? Why not?

## Interview Guide Experienced Participants:

<b>Interview Guide Experienced Participants</b>
<b>General:</b>
<p>How long have you used virtual worlds?            How often do you use virtual worlds? (How much time do you spend in the virtual world?)            Why did you start using virtual worlds?            What do you use virtual worlds for?            Can you tell me how you experience Second Life?</p>
<b><i>Virtual Self</i></b>
<p>How do you feel connected to your avatar?            How does your avatar represent you?            Can you tell me about how it feels to be in the virtual world?            How does it feel when you change/re-dress your avatar?            Do you feel present in the virtual world?                Can you explain how?</p>
<b><i>Interaction with others in the virtual world</i></b>
<p>How do you interact with others in the virtual world?            How does it feel when you are interacting with others in the virtual world?            What kind of relationships do you experience in the virtual world?            Do you feel the others as being present in the virtual world with you?                If so, can you explain how?</p>
<b><i>Possibilities virtual worlds offer for activities</i></b>
<p>What activities do you engage in when in the virtual world?            How does it feel to engage in activities in the virtual world?            How does it differ from physical world activities?            Why do you engage in activities in the virtual world?            What are the important factors for activities in the virtual worlds?</p>
<b><i>Difficulties when engaging in a virtual world</i></b>
<p>How did you experience being new in the virtual world?                Can you give me an example of this?            How do you experience use of virtual worlds now?            What do you feel are the possibilities and opportunities the virtual world offers you?            Why is the virtual world an important tool for you?            What do you feel are the challenges for engaging in the virtual world for people with lifelong disability?                How do you think this can be changed?</p>
<b><i>Virtual worlds available for people with lifelong disability</i></b>
<p>What do you think is important to think about when introducing the virtual world to people with lifelong disability?            How do you think engaging in the virtual world affects new users?</p>





## Appendix B - Coding example

The table below illustrates an example of the coding procedure applied in publication 5. The left column illustrates domains identified through the Quality of Life (QoL) framework. The right column contains original text from the interviews; for the sake of this demonstration it contains random interview quotes.

Domains of QoL	Original text
Personal development Self-determination Interpersonal relations Social Inclusion Emotional Well-Being	<p>But for me, it's primarily a <u>social venue</u> for 'physical' contact with people I may never see or touch or hear in person. Plus it's a venue for <u>exploring new ideas and experiences, solo or collaboratively.</u></p> <p>Many of my friends I met during my first few months of being on SL -- so many of these friendships are over five years old... rather impressive for me. <u>They provide a sort of social stability.</u></p> <p><u>Global interconnecting-</u> interactions with folks I would never have had a chance to interact with, on topics of mutual interest.</p> <p><u>Friendships-</u> across various boundaries</p> <p><u>Learning-</u> I am a learner by genetic makeup. SL has offered me opportunities to develop deeper knowledge and understanding on a wide variety of professional topics, including some in peripheral professional fields.</p> <p><u>Technical interest-</u> I am fascinated by the ways technology can mediate the development of relationships, enhance problem solving and solution creation, and influence collaboration.</p> <p><u>Fun</u></p>



## Appendix C - Example of feedback at Virtual Ability Island

The text below is an example of feedback from attendees at a presentation of relationship to virtual self and others for people with lifelong disability. GH was facilitating and typing my (KS) voice presentation. Participants in this study, researchers (in addition to me) and other people with disability attended the presentation in Second Life. Date and time is SLT, this is equal to Pacific Time USA.

[2012/08/27 10:40] M: I know enough to not judge a person by their avatar, I check to see if they bothered to create a profile, then interaction and communication

[2012/08/27 10:41] G H: KS- It has to do with how you experience interaction with others. It started as telecommunication, how you feel you are speaking to the person on the other side of the phone.

[2012/08/27 10:41] A B: do people project their physical disabilities to their avatars?

[2012/08/27 10:41] G H: KS- In VWs you have an embodied avatar.

[2012/08/27 10:41] M: Yes

[2012/08/27 10:41] V V: Well, I find you can tell people's character by their avatar.

[2012/08/27 10:41] P G: I have a friend who does. He is an amputee and he wears a prosthesis in SL.

[2012/08/27 10:42] A B: Activities of avatars and interactions mo

[2012/08/27 10:42] G H: KS- Only one in my study showed a physical disability.

[2012/08/27 10:42] P G: I met a man in a wheelchair here when I was new.

[2012/08/27 10:42] A B: Thanks

[2012/08/27 10:42] G H: KS- There are different ways to view that.

[2012/08/27 10:42] V V: And you know that all of them \*had\* a physical disability?

[2012/08/27 10:43] G H: KS- Not all had a physical disability, but I know who does.

[2012/08/27 10:43] M: My very best and closest friend in SL has DID in First Life and had a dozen different avatars and accounts.

[2012/08/27 10:43] P G: Draxtor Despres has done some movies inside SL with disabled veterans who portrayed their disabilities for the movie.

[2012/08/27 10:44] A B: I found it was years before I was comfortable walking gracefully in SL though I adopted normal looking av (Barbie lol)

[2012/08/27 10:44] M: Correct

[2012/08/27 10:44] T B: Yep!

[2012/08/27 10:44] G H: KS- When I first started, I referred to the physical world as the Real World, but that's not right. Here it is real also. I try to remember that.

[2012/08/27 10:45] V V: Isn't that still done in the SL profiles?

[2012/08/27 10:45] G H: KS- @ Vulcan I don't know.

[2012/08/27 10:45] V V: /me checks his profile.

[2012/08/27 10:45] G H: KS- It is respect. I have had a lot of fun in here.

[2012/08/27 10:45] M: It varies as SL viewers evolve and change over time.

[2012/08/27 10:45] G H: KS- I've met a lot of great people. I can't say it isn't real. It is!

[2012/08/27 10:45] G H: KS- I met my best friend online. It's real.

[2012/08/27 10:45] E: Respect, yes.  
[2012/08/27 10:45] G H: KS- It has to do with respect.  
[2012/08/27 10:46] A I: It is real--people say "it's just pixels" when they want to dismiss some behaviors.  
[2012/08/27 10:46] G H: /me nods to A.  
[2012/08/27 10:46] G H: KS- agrees with A  
[2012/08/27 10:46] A B: me too and she in second life now , and is rl friend  
[2012/08/27 10:46] P G: It is real from the moment you log in. I never liked to use adjectives to define my friends so I speak of people I meet here as their name I call them when mentioning them to others in person.  
[2012/08/27 10:46] V V: In my profile I see Real World Profile Picture and Real world Biography.  
[2012/08/27 10:46] T B: We don't want to end up assuming a "real world" that has no computers in it. And also, humans have always had "virtual" aspects to their existence: vws do something new, but they also build on what was before...  
[2012/08/27 10:47] T B: whispers: Also, people often type "rl  
[2012/08/27 10:47] M: the outfit I am currently wearing was given to me as a gift from a grad student doing her thesis on SL economics and gift giving  
[2012/08/27 10:47] G H: KS- agrees with T B  
[2012/08/27 10:47] iS B: /me turns to TB and taps her nose then points at him  
[2012/08/27 10:47] iS B: You got it exactly, T B  
[2012/08/27 10:47] A B: How does this effect communication?  
[2012/08/27 10:47] T B: Quickly but when you talk to them more, you see how they see sl as real too  
[2012/08/27 10:47] TB: /me smiles back at iS B  
[2012/08/27 10:47] P G: I have heard some people who have been in SL for over 5 years refer to SL and FL (rather than RL).

## Appendix D - Research publications

No.	Title	Published
1	Stendal, K., Balandin, S., & Molka-Danielsen, J. (2011). Virtual worlds: A new opportunity for people with lifelong disability?	Journal of Intellectual & Developmental Disability, 36(1), 80-83
2	Stendal, K. (2012). How do People with Disability Use and Experience Virtual Worlds and ICT: A Literature Review	Journal of Virtual Worlds Research, 5(1)
3	Stendal, K. and Molka-Danielsen, J. (2013). Capabilities and Affordances of Virtual Worlds for People with Lifelong Disability	Proceedings of the 21 <sup>st</sup> International Conference of Information Systems Development, Prato, Italy
4	Stendal, K., Molka-Danielsen, J., Munkvold, B. E., & Balandin, S. (2012). Virtual Worlds and People with Lifelong Disability: Exploring the Relationship with Virtual Self and Others (Best Paper Award)	Proceedings of the 20 <sup>th</sup> European Conference of Information Systems, Barcelona, Spain
5	Stendal, K., Molka-Danielsen, J., Munkvold, B. E., & Balandin, S. (2013). Social Affordances for People with Lifelong Disability through using Virtual Worlds	Proceedings of the 46 <sup>th</sup> Hawaii International Conference of System Sciences, Maui, Hawaii, IEEE

OPINIONS & PERSPECTIVES

## Virtual worlds: A new opportunity for people with lifelong disability?

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**Keywords:** *virtual worlds, second life, lifelong disability*

### Introduction

The use of technology and the Internet in our society is increasing. In Norway, for example, about 85% of the population use the Internet monthly (Gallup, 2008). There is every indication that this number will increase, based on the current development of a new IP-address system to handle the IP shortage we will encounter (Tseng, Lee, Kung, Chou, & Chen, 2005). People use the Internet for a range of activities including private and business purposes, and in particular for maintaining and developing social contact (di Gennaro & Dutton, 2007). Indeed, communication through social networking sites where the main focus is on creating and maintaining friendships is increasingly important to individuals, including young people (di Gennaro & Dutton, 2007). Online social network sites such as Facebook<sup>TM</sup>, Twitter<sup>TM</sup>, and MySpace<sup>TM</sup> are used for sharing information about day-to-day life with friends and family, and for connecting with strangers who share the same interests (Subrahmanyam, Reich, Waechter, & Espinoza, 2008). With the help of an avatar—a three-dimensional online character that is created in the virtual world to represent the user and can be personalised in the greatest detail—social interaction with strangers and friends can occur in virtual worlds, like Second Life<sup>®</sup>. Being equipped with both a first and a last name, the avatar can be seen as an embodiment of the user's real self within a virtual world.

### Virtual worlds

Virtual worlds, such as Second Life, are the latest star in the online communication sky. Within virtual worlds, communication and networking with other individuals throughout the world are the focus. Virtual worlds are three-dimensional web-based environments, where the user can be represented as an avatar and move around exploring the environment (Baker, Wentz, & Woods, 2009). In the real world, we are constrained by physical laws; however, virtual worlds eliminate these laws, and everything and anything is possible (Standen & Brown, 2005). A range of leisure activities, social interactions, and economic exchange opportunities are offered through virtual worlds. Furthermore, many education and training institutions offer programs for students and staff in virtual environments. One of the major players in this virtual world environment is Second Life. This three-dimensional environment, created by Linden Lab, provides a context for avatars to communicate and socialise with other avatars in a variety of settings (Bell, 2009). Some of the activities offered through Second Life include socialising with friends in bars and discos, viewing art, selling and buying products, conducting classes, research, attending virtual conferences, and job recruitment (Bugeja, 2008).

### New opportunities

Currently, there are few reports on how people with lifelong disability are using virtual worlds. Also, it is

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not known what minimum skills are required to use a virtual world successfully. At the very least, users must be able to access and use the Internet and have some literacy skills if they are to access a virtual world independently. Therefore, virtual worlds may not be suitable for those with high support needs. Consequently, studies within such an environment may be a natural next step in researching the value virtual worlds can have for people with lifelong disability. Nevertheless, a range of people with lifelong disability are using virtual worlds, including people with Asperger syndrome and those with cerebral palsy. For example, in Second Life there is an island (“Brigadoon”) for the sole use of people with autism and Asperger syndrome, and a nightclub called “Wheelies” for people who use wheelchairs, including those with cerebral palsy. Yet, to date, there are few reports on the social use of virtual worlds by people with lifelong disability.

Virtual worlds have been used to train people with intellectual disability in social skills (Parsons, Leonard, & Mitchell, 2006; Standen & Brown, 2005; Strickland, Marcus, Mesibov, & Hogan, 1996). Custom-designed virtual worlds are being used to repeat specific social situations to promote knowledge and understanding that may be used in the real world. Standen and Brown (2005) suggested that a simple virtual world can be created for people with intellectual disability to perform a particular task until it becomes familiar. They noted that virtual worlds allow for the addition of new features that can be added and revised over time to vary the situation or increase the complexity to support new learning.

Parsons et al. (2006) conducted a study of training social skills within a specifically designed virtual environment for two adolescents with autism spectrum disorder. The two participants were introduced to two social settings in the virtual environment (a cafe and a bus), where they were trained in social skills. The level of complexity of the two settings was increased when one level of complexity was successfully completed. One participant was able to apply the knowledge learned in the virtual environment to the real world environment. The other participant in this study was not able to relate the virtual world training to situations encountered in the real world. The authors concluded that virtual environments can be a tool for useful and meaningful social skills training, yet the results of this small study also indicate that the skills learned in a virtual world may not be easily generalised to the real world by all. This is an area that requires further exploration, particularly as there are few studies reported where non-

custom-designed virtual worlds are being used for social interaction by people with lifelong disability.

Virtual worlds, including Second Life, are places that offer the possibility of being anonymous. The individual behind the avatar can reveal or disclose whole or parts of their identity according to their own level of comfort (Oishi, 2007). Using this option, people with lifelong disability choose whether, when, and how to disclose their disability. The physical visualisation of people within a virtual environment creates a sense of presence in a shared space and a shared environment (Mennecke, Triplett, Hassall, & Conde, 2010). Thus, the anonymity a virtual world offers may have a positive affect on individuals who, in real life, find it hard to socialise with others; in turn, this may help establish a greater confidence level when interacting with others.

Indeed, virtual worlds also support fantasy. Participants often customise their avatars with an extreme look not usually worn in real life (Oishi, 2007). In addition, because participants have the flexibility to decide how the avatar will look, each individual can make a choice on how to be perceived within the virtual world. While some will spend time and effort to create an avatar that resembles how they look in real life, others will use their imagination to create an avatar in a totally different image (e.g., an animal or insect). Therefore, people with physical disability have the option to create an avatar with the same disability in the virtual world as in real life. People with lifelong disability have reported discrimination in real life as a result of their disability (Ballin & Balandin, 2007); in the virtual world, the option to not display the disability is available. With the possibility of supporting both fantasy and real-life experiences, virtual worlds attract a wide range of users with different goals for their virtual engagement.

Individuals with lifelong disability may experience physical, financial, and transport difficulties with community access in real life; a virtual environment promises the possibility to establish and experience social interaction from the safe environment of a person’s own home. In addition, there are opportunities such as conducting business, attending courses, learning a new language, and joining a range of groups, including virtual travel groups, which, to date, have been unexplored in the field of lifelong disability. Additionally, a virtual world is not limited by the physical laws experienced in real life. This gives the possibility for people with lifelong disability to participate in a range of activities that in real life may not be readily accessible. The ability to communicate through both text and voice means

that those who use augmentative and alternative communication can participate in a virtual world without declaring their communication disability if they so choose.

Nevertheless, as noted above, virtual worlds are currently not accessible to all. One of the greatest challenges for interacting in a virtual world is the complexity of technology. This may create an obstacle for people with intellectual disability, and prevent them from participating in activities online (D'Aubin, 2007). This, coupled with a need for assistance from staff who may not be familiar with virtual worlds or virtual world technology, is an area that requires additional research (Molka-Danielsen & Balandin, 2009).

### Conclusion

Technology is progressing rapidly into our day-to-day communication and social lives. Social networking sites allow us to keep in touch with old friends, colleagues, and business partners, and to communicate with strangers who have the same interests as we do. Through these sites we are able to connect on different levels with different people, and keep informed about other individuals or activities we would like to attend. This form of communication is increasing, and is becoming an important gateway to the world around us.

We know that one of the greatest challenges for people with lifelong disability is creating and maintaining friendships and being included in communities of their choice (Balandin, Berg, & Waller, 2006; Ballin & Balandin, 2007; McVilly, Stancliffe, Parmenter, & Burton-Smith, 2006). Virtual worlds can be used by people with lifelong disability, who may have experienced challenges in connecting with their peers without disability, to meet others on their own terms. By being able to create their avatar the way they please, they are in control of the situation. Because virtual worlds offer the possibility of communicating through both text and voice, communication can become less of an obstacle while interacting with others.

There are potentially many opportunities of both personal and social value for people with disability who engage in virtual worlds, as indicated in the study by Parsons et al. (2006). Virtual travellers can visit virtual Barcelona or attend a jazz concert in virtual Montmartre. The technology, although complex, eliminates many of the common barriers to social participation and opens up possibilities for creating and maintaining friendships. By exploring the possibilities offered through the use of virtual worlds, people with disability may experience the

sense of actively participating as a member of a community, which may impact positively on their quality of life.

At the same time, it is important to recognise and understand the challenges created by this technology and accept that not all people with lifelong disability will choose or be able to interact in a virtual world. We require research to identify what specific challenges people with a range of lifelong disabilities experience and if and how these can be overcome. It is important to investigate if a virtual world such as Second Life can be useful to individuals with lifelong disability, not only for educative and training purposes, but also to increase social interaction and to reduce loneliness. People with lifelong disability experience frequent challenges with inclusion and participation in their surrounding communities; virtual worlds may be a gateway to overcome these and develop new friendships and relationships. Through engaging in a virtual world, people with lifelong disability have the possibility of meeting other individuals with similar interests and participating in activities, and deciding whether to reveal their disability or not, which is often not possible in the real world. The impact of this and the full range of opportunities that virtual worlds offer to people with lifelong disability have yet to be investigated. Nevertheless, virtual worlds may offer a range of new and exciting opportunities for people with lifelong disability, and those who support them, to participate in communities and new activities of their choice.

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# **How do People with Disability Use and Experience Virtual Worlds and ICT: A Literature Review**

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## **Abstract**

There is wide agreement that information and communication technology (ICT) is a valuable tool for people with disability. Several research disciplines have focused on how people with disability can take advantage of the technology available for social, educational and personal purposes. Virtual worlds represent the latest addition to the technologies available, yet there is little research on how people with disability use and experience virtual worlds. A review of research conducted in different disciplines on the affordances and challenges of virtual worlds and ICT for people with disability is presented here. The main objective was to highlight areas that lack sufficient research in the field of virtual worlds for people with disability. Understanding how use of ICT influences people with disability is important to identify the possibilities and challenges virtual worlds offer to this group. Findings from this study indicate that there is little empirical research exploring the social aspects, work opportunities and personal value virtual worlds may offer people with disability. The research reviewed points to the importance of bringing research disciplines together to accelerate knowledge about the potential and promises of virtual worlds for people with disability.

## 1. Introduction

Self-care, mobility, transportation and housing are issues that are taken for granted by most individuals. However, for those with a disability these issues can be challenging (Greenwood, 1987). People with disability may experience problems both with access to a range of community activities and in gaining acceptance within the general community (Ballin and Balandin, 2007). Challenges include being treated differently and not being perceived as equal to non-disabled peers. Societies may treat people with disability as though an impairment in one area of functioning invalidates their abilities and opportunities in others (Hammel et al., 2008).

Information and communication technology (ICT) holds great promise for people with disability because it can reduce or eliminate many barriers, which under other circumstances might impair or prevent people with disability from participating in day to day activities (D'Aubin, 2007). ICT support for people with disability has been a well-researched topic, however, there is limited research on the affordances and challenges of specific technology such as virtual worlds (VWs) for this group (Stendal, Balandin and Molka-Danielsen, 2011).

This paper synthesizes findings from different research disciplines focusing on the use and experience of ICT and virtual worlds (VWs) for people with disability. By understanding the opportunities and challenges of ICT for people with disability, we can build a broader understanding of the possible impact virtual worlds may have on people with disability. The author reviewed 54 articles, extending earlier reviews in specific areas such as VWs for rehabilitation (Standen and Brown, 2005), ICT to support caregivers of people with disability (Mattila et al., 2007), and the use of virtual reality by children with disability (McComas, Pivik and Laflamme, 1998).

The aims of this paper are to (1) present an overview of the research specific to the opportunities and challenges people with disability experience with ICT and VWs, (2) illustrate the status of research in this area, and (3) identify gaps that warrant further exploration. It can be argued that highlighting the primary research topics in this review will encourage cross-disciplinary research efforts in the future.

First, this paper presents the concepts of ICT, VWs and disability. Next, the research method is described followed by an overview of the reviewed papers and the findings from the review process. Finally, a discussion of the key findings and recommendations for future research are presented along with implications for practice and research.

## 2. Concepts

### 2.1 Disability

People with disability have been defined by the United Nations (UN) Convention as follows:

Persons with disabilities include those who have long-term physical, mental, intellectual, or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others (Leonardi et al., 2006, p. 1220).

People with disabilities often encounter difficulties such as accessibility and mobility in their day-to-day life. Accessibility and mobility are key difficulties for people with physical disability and communication impairment is often a problem (Morgan and Balandin, 1997). Many adults with lifelong disability have communication impairment. This impacts on the individual's ability to interact with others, to initiate or maintain friendships and to participate as a member of a community or society

(Jackson, 2006). Challenges related to communication (e.g., hearing, speech and/or language disorders), visual and other sensory impairments can lead to isolation (Greenwood, 1987).

## **2.2 ICT and Disability**

ICT opens new opportunities for people with disability. Technology promises to enable and empower people with disability to the same degree as their non-disabled peers (Anderberg and Jönsson, 2005). ICT, in the context of this paper, includes computer games, assistive technology (e.g., voice augmentation systems), and online communication tools (e.g., internet, e-mail, and instant messaging). Due to the main goal of this paper, virtual worlds are discussed separately in the next section.

## **2.3 Virtual Worlds**

Compared to traditional two-dimensional web environments, a three-dimensional VW environment adds a dimension in which the users are represented visually as avatars and can move around in the environment (Baker, Wentz and Woods, 2009; Minocha, Tran and Reeves, 2010). There are multiple reasons why people engage in VWs. These include seeking information, socializing and enjoying entertainment. VWs facilitate escape from real world constraints and allow participants to pursue unique activities through which they can meet and interact with others (Jung and Kang, 2010). VWs offer an interactive and unique place to engage in various activities, consequently, some people spend large amounts of time immersed in VWs (Lim, 2009).

## **3. Research Method**

The goal of a literature review is to collect and structure the large amount of accumulated knowledge in a specific area (Bryman, 2008; vom Brocke et al., 2009), and to identify the research gaps or unanswered research questions in an area (Bryman, 2008). In an effort to ensure a comprehensive and systematic method, the search procedure used here was based on that of Haddara and Zack (2011). The search was conducted between March and April 2011.

1. An initial search was conducted through EbscoHost and Web of Science. The search, limited to title and abstract, used combinations of the following keywords: ICT, virtual worlds, disability, disabilities, information communication technology, and support. This search returned 373 articles.
2. Next, a search through Google Scholar was conducted. The search procedure was restricted to the same keywords used in the previous step but limited to title only. This resulted in 63 additional articles.
3. The abstracts for the selected articles were read to ensure their relevance to the review. Only journal articles directly addressing how people with disability used and experienced ICT or VWs were selected. 45 articles were selected based on these criteria.
4. Finally, backward and forward searches were conducted based on the identified articles (vom Brocke et al., 2009). Through this search, 9 additional articles were selected, resulting in a total sample of 54 articles for this review.

## **4. Literature Review**

The 54 articles reviewed were published in 39 different outlets. Four main research disciplines were represented by the reviewed literature: Disability Studies, Information Systems (IS)/ICT research, Rehabilitation research, and Education research. There was some overlap between research disciplines.

All articles were classified into a concept matrix (Table 1) which includes research method, type of VW/ICT, and main themes of the research, as suggested by Webster and Watson (2002). Webster and Watson (2002) explained that a literature review needs to be concept-centric to succeed in synthesizing the literature. They indicated that a concept matrix provides a structure to the literature review, but also helps in clarifying the concepts from the literature review for the reader. Table 1 shows the concept matrix of the literature of this paper. The main themes identified in the review were: (1) Access to technology, (2) Inclusion, Exclusion and Empowerment, and (3) Training and Rehabilitation. Access to technology implies that how likely people with disability will have access to computers and the Internet. Inclusion, Exclusion and Empowerment, covers the outcomes of access to technology experienced by people with disability. Training and Rehabilitation, discuss how technology can be facilitate training for real life situations or experiences.

Table 1 also shows the type of VW/ICT on which the reviewed literature focuses. The “Assistive technology” category includes visual aids or technology to help individuals function in daily life. The “Other ICT” category includes e-mail, computer games, cell phones, and text handling systems. The “Custom-designed VW” category represent VWs which have a set context and not necessarily available for all, while the “Open Access Multi-user VW” category describes VWs, such as Second Life or other VWs, in principle available to all.

In addition, Table 1 shows the main research methods used by the reviewed literature. The “Other Method” category reflects articles that did not explicitly state the research method, articles based on multiple studies using multiple research methods, and articles not based on primary empirical data (i.e. editorials and conceptual papers).

These categories were not mutually exclusive and some articles were categorized within several technology and/or theme categories.

Article	Theme		Type VW/ICT					Research Method						
	Access to Technology	Inclusion, Exclusion, Empowerment Training and Rehabilitation	We-based	eLearning Tool	Assistive Technology	Other ICT	Custom-designed VW	Open Access Multi-user VW	Experiment	Case Study	Interview/Observation	Survey	Review	Other Method
Babiss (2009)	X							X						X
Banes and Walter (1997)	X		X						X					
Bowker and Tuffin (2002)	X		X							X				
Bradley and Poppen (2003)	X		X								X			
Bricout and Baker (2010)	X		X											X
Brodin (2010)	X		X								X			
Brodin and Lindstrand (2003)	X			X							X			
Brodin and Lindstrand (2004)	X		X										X	

Article	Theme		Type VW/ICT					Research Method						
	Access to Technology	Inclusion, Exclusion, Empowerment Training and Rehabilitation	We-based	eLearning Tool	Assistive Technology	Other ICT	Custom-designed VW	Open Access Multi-user VW	Experiment	Case Study	Interview/Observation	Survey	Review	Other Method
Bunning, Heath and Minnion (2009)		X	X	X						X				
Bunning, Heath and Minnion (2010)	X		X	X										X
Burstin and Brown (2010)			X				X					X		
Carr (2010)		X					X			X				
Coles, Strickland, Padgett and Bellmoff (2007)			X			X		X						
Davidson (2008)		X	X									X		
Davies, Stock and Wehmeyer (2001)		X	X											X
Dobransky and Hargittai (2006)	X		X								X			
Douglas (2001)		X		X	X				X					
Drigas, Koukianakis and Glentzes (2009)		X	X											X
Elleven, Wircenski, Wircenski and Nimon (2006)			X				X							X
Finn (1999)		X	X						X					
Ford (2001)		X					X							X
Grimaldi and Goette (1999)		X	X								X			
Guo, Bricout and Huang (2005)	X		X								X			
Gutierrez and Martorell (2011)	X	X	X			X					X			
Johnson and Hegarty (2003)		X	X							X	X			
Jones (1998)			X				X							X
Kenway (2009)		X	X											X
Lathouwers, de Moor and Didden (2009)	X		X								X			
Lewis, Trushell and Woods (2005)		X				X				X	X			
Li-Tsang, Lee, Yeung, Siu and Lam (2007)			X	X										X
Lidström, Ahlsten and Hemmingsson (2011)	X		X								X			
McClimens and Gordon (2009)		X	X						X					
McComas, Pivik and Laflamme (1998)			X				X					X		
Michailakis (2001)		X				X			X					
Moisey (2007)		X			X				X					
Moser (2006)		X	X		X									X
Myhill (2002)		X	X			X			X					
Parsons, Daniels, Porter and Robertson (2006)		X	X							X				

Article	Theme			Type VW/ICT					Research Method						
	Access to Technology	Inclusion, Exclusion, Empowerment	Training and Rehabilitation	We-based	eLearning Tool	Assistive Technology	Other ICT	Custom-designed VW	Open Access Multi-user VW	Experiment	Case Study	Interview/Observation	Survey	Review	Other Method
Parsons, Daniels, Porter and Robertson (2008)	X						X								X
Passerino and Santarosa (2008)		X			X						X				
Renblad (2003)		X		X			X					X			
Seymour (2005)		X		X							X				
Seymour and Lupton (2004)		X		X											
Smedley and Higgins (2005)			X					X			X				X
Sohlberg, Fickas, Ehlhardt and Todis (2005)		X					X				X				
Standen and Brown (2005)			X					X						X	
Standen and Brown (2006)			X					X							X
Stewart, Hansen and Carey (2010)		X							X		X				
Söderström (2009a)		X		X							X				
Söderström (2009b)		X		X		X					X				
Söderström and Ytterhus (2010)		X		X		X					X				
Taylor (2005)		X					X								X
Williams, Russell, Rattray and Grimes (2007)		X		X											X
Wilson, Foreman and Stanton (1997)			X					X						X	

**Table 1: Concept Matrix of the Literature Review**

In the following section the main research findings in each theme are presented, and representative studies are cited.

**4.1 Theme 1: Access to Technology**

Seven studies focused on the people with disability’s access to technology and related opportunities and challenges.

A common theme emerging from these studies was whether it is likely that people with disability have ready access to ICT. A survey study in China indicated that a minority of people with disability have access to the internet; this represents a digital divide (Guo, Bricout and Huang, 2005). People with disability who have access experience a significant increase in frequency of social interactions and reduction of existing barriers in the physical and social environment. The authors suggested researchers focus on how ICT can be more accessible for people with disability. This recommendation is supported by a U.S. study (Dobrinsky and Hargittai, 2006). Based on nationally representative data about

America's internet use, the authors concluded that people with disability are less likely to live in a household with computers, and thus are less likely to use computers or engage in online activities.

In addition to reduced access to computers and ICT, there are other barriers for people with disability. One barrier relates to the environment, such as near family or support staff. A Spanish exploratory study indicated that support staff and other close relations often make choices for people with disability, and deny them the opportunity to access a computer or the internet (Gutierrez and Martorell, 2011). The authors also concluded that there is no reason why people with a mild to moderate intellectual disability should not be able to use the internet. Care givers may not trust people with disability to use ICT or may not understand the importance of such use, and so make decisions on behalf of people with disability. Parsons et al. (2008) also pointed to the need to understand the relevance and usefulness for people with a disability when introducing communication technology. In contrast, a Swedish study based on interviews with children with physical disability demonstrated that the children were more likely to be engaged in ICT activities in their spare time, compared to their non-disabled peers, who were engaged in a broader range of activities outside of school (Lidström, Ahlsten and Hemmingsson, 2011). Unable to participate in after school activities with their non-disabled peers, the children with disability turned to technology in their leisure time.

#### **4.2 Theme 2: Inclusion, Exclusion and Empowerment**

Thirty eight studies focused on the outcomes of use of VVs and ICT. Within this theme, the main topics identified were inclusion, exclusion and empowerment.

Although access to ICT and VVs is a challenge for people with disability, ICT can be positive for those who have access. Access and use of ICT provide an opportunity for people with disability to communicate and interact with others and gain a sense of equality and inclusion. Bowker and Tuffin (2002) interviewed people with disability from New Zealand to explore the meaning of "choice to disclose" in online media. They found the flexibility of online media provided control over people with disability's disclosure of impairment, an opportunity not typically available in real world social interactions. The affordance of "normalization" enables people with disability to be included and treated as equal by their non-disabled peers. Online communities have showed a success for those with a disability (Bradley and Poppen, 2003). Based on a one-year follow up questionnaire, their study indicated that those communicating with the help of ICT discovered a new sense of friendship and show significantly reduced isolation.

ICT in special education settings gives students the tools to follow and participate more fully in the educational environment (Lewis, Trushell and Woods, 2005). The authors noted that children with Asperger's syndrome had a moderately increased ability to interact with their non-disabled classmates with the help of ICT. This applied in both social and educational settings. VVs may also be valuable in improving inclusion. The use of an avatar may help remove prejudices created by stereotypes found in real life, and thus provide a greater sense of inclusion for people with disability (Ford, 2001).

People with disability find online self-help groups and blogging important for feelings of inclusion. McClimens and Gordon (2009) conducted a study in which people with intellectual disability were introduced and trained in writing blogs over six meetings. The authors stated that the participants experienced a new form of inclusion and empowerment when able to express and share their thoughts and feelings online. However, while this study showed people with disability experienced enjoyment from the use of blogs, the authors called for additional research exploring the value of blogging.



Access to information and services through websites, which in other contexts are hard to obtain or are unavailable, gives people with disability a sense of inclusion in society as a whole (Parsons et al., 2006). Closely related to access to information and inclusion is a sense of empowerment. For people with disability, empowerment can be provided by the use of ICT (Renblad, 2003), which facilitates them to make their own decisions. With the help of ICT, people with disability can have access to information needed to make decisions. VWs may also be a means of empowerment for people with disability because they can move around in the virtual environment unconstrained by physical disability (Babiss, 2009). VWs may enrich the overall quality of life for people with disability and enhance their physical, emotional and social adjustment, through social interactions, employment and volunteer work opportunities (Stewart, Hansen and Carey, 2010).

It is easy to focus on the positive aspects of ICT for people with disability but there are obstacles which are important to note. Researchers note there are challenges when utilizing ICT and VWs. Access to the available technology is an important factor, however, if individuals cannot use the ICT provided people with disability may be neglected or excluded by their peers (Söderström, 2009b). Söderström stated that the use of ICT has become a social phenomenon, and without the right training and access, people with disability may experience exclusion rather than the promised inclusion.

Standen and Brown (2006) stated that VWs are a valuable tool for people with an intellectual disability, and virtual environments which are less complex to use are needed. The complexity of using VWs may discourage use, and lead to potential opportunities not being utilized. VWs may present potential harm for people with disability if programs fail to provide users the option to conceal disability (Ford, 2001). Some functionality offered by the VWs may reconstruct a disability (Carr, 2010). As an example, with the introduction of the voice feature to the VW Second Life, deaf students are potentially excluded. Educators lecturing in VWs need to be aware of the challenges the voice feature creates. Carr also called for further exploration of the possibilities and challenges people with disability experience in VWs.

### **4.3 Theme 3: Training and Rehabilitation**

Ten of the studies in this review were mainly focused on social training and rehabilitation with the help of ICT and VWs. This research focuses on the promises of VWs and ICT for people with disability.

Experiments using computer games for training people with disability or the use of community based ICT for teaching people with disability computer skills, demonstrate some success. For example, custom designed computer games which train children with disability what to do in case of a fire, showed an increase in their knowledge about such situations outside the gaming environment (Coles et al., 2007). In this study, children with fetal alcohol disorder played a computer game where they encountered situations incorporating street and fire hazards until mastery. After finishing the game, the children answered questions about what to do in such situations. The children were able to generalize the knowledge they had learned from the computer games into real world situations. This indicated that computer games may be a valuable tool to teach children with disability to avoid injuries and to learn important skills needed in the community.

Custom designed VWs have been in focus in rehabilitation research. In the early rehabilitation research there are few reports based on empirical studies. In a conceptual paper, Jones (1998) concluded that individuals engaging in virtual realities are showing real life improvement, but pointed to the costs and noted the minimal research at that time was a limitation. In a review, Wilson, Foreman and Stanton (1997) stated the main benefit of virtual reality for people with disability is the ability for them to

engage in a range of activities relatively free from the limitations imposed on them by their disability. The research by Wilson, Foreman and Stanton (1997) was based on mostly custom designed VWs (e.g., simulated environments), which were not open for all like the open access multi-user environment we see in VWs these days, such as Second Life.

Custom designed VWs are of value for people with disability in rehabilitation and in educational settings. While field trips may be a difficult task in special education, Smedley and Higgins (2005) suggested that virtual field trips may be a good alternative for children with a disability to visit different locations around the world. They pointed to the importance of teachers familiarizing themselves with the technology to fully utilize the potential of VWs in education. They also noted that teachers would have better control when the students are on a field trip in the VW. Another benefit of bringing virtual field trips into the special education classroom is as preparation for a real world experience (Elleven et al., 2006). The authors stated it is possible that students with a disability can learn about real-life work demands through the VW, and such experience can be a part of a successful career exploration. Also, this paper discusses custom designed VWs as a tool for educating people with disability, where the contexts of the virtual field trips are set up front.

Virtual realities have potential to reduce the effects of a disability and may prove to enhance training and skills development. Custom designed virtual realities are proving to be beneficial for people with intellectual disability to learn social skills, skills for independent living, and manufacturing skills (Standen and Brown, 2005). The skills learned in a virtual environment can be transferred to real life settings, for some but not all people with disability. People with Asperger's syndrome, for example, tend to have communication and social understanding difficulties and experience difficulties in generalization from one setting to another.

#### **4.4 Summary of Research to Date**

This review identifies how a range of ICT and VW applications are used by people with disability for enjoyment, employment, communication, friendship, education and discussion. Individuals using ICT experience independence and empowerment. Being able to participate in education, workforce and social settings using ICT, provides experiences of inclusion and may reduce feelings of isolation. Nevertheless, ICT can work against these positive outcomes for people with disability and result in increased feelings of exclusion. Low level of access to ICT, due to the cost of acquiring a computer, or care givers' lack of ICT experience can represent barriers, and are examples of people with disability not being able to take advantage of the promises offered by technology. Exclusion when using ICT has also been reported when people with disability are not accepted as equals by their peers. Lack of computer skills and incompatible technical support are also reasons for exclusion and may lead to under-use.

People with disability have experienced success in developing social skills and skills for independent living through training in custom designed VWs. Inclusion by their peers and escaping prejudice, through use of VWs, is of value for people with disability. In the special education classroom, VWs offer an opportunity to visit locations throughout the world using virtual field trips. Individuals could also participate in classroom activities from their own homes. However, technology is complex; this may be a barrier for people with disability wishing to engage in VWs.

### **5. Implications and Questions for Future Research**

In this paper, the review shows how technology can offer people with disability a wide range of opportunities and challenges. While there is high focus on ICT for people with disability, there are gaps in the research about the opportunities and challenges that VWs offer to people with disability. The

insights gained from the role of ICT in supporting people with disabilities provide a valid and a very strong starting point when considering opportunities and challenges offered by VWs for people with disability. Based on the literature review, the following challenges and research gaps were identified.

### **5.1 Access to All**

One of the challenges for people with disability is access to technology, which is found in the cross-section between VWs and ICT. A digital divide is present in some countries, and affects people with disability. Access to technology is proving to be of value for people with disability, but lack of access may mean this group is not being able to take advantage of the values technology offer. Ways to ensure access and availability of technology for people with disability warrants research. The statistics on world internet use show only 30.2% of the world population use the internet (InternetWorldStats, 2011). Only 54 % of Americans living with a disability use the internet and only 41% of the same group have broadband at home (Fox, 2011). Such figures indicate there is still a way to go in this area.

### **5.2 Open Access Multi-User Virtual Worlds**

In the twelve articles concerning VWs included in this review (ref. Table 1), eight focused on custom designed VWs where few individuals have access, three articles focused on the VW Second Life, and one focused on another open access multi-user VW. Custom designed virtual environments are designed for a special purpose and do not necessarily give users the opportunity to create content in the VW. However, open access multi-user VWs, such as Second Life, have to date not been in great focus in any research within this field. Open access multi-user VWs offer a venue where people with disability have the opportunity to be a participant and a member of a community. These are challenges people with disability experience in real life, which may be overcome or reduced by the use of VWs. Empirical research focusing on open access multi-user VWs, where in theory, all have access, will help us understand the possibilities and opportunities implied in the technology for people with disability.

### **5.3 Universal Design**

The complexity of VWs may discourage some people with disability from using the technology. The digital divide may not only be in access to technology, but also in the design and usability of VWs. Standen and Brown (2006) stated that there is a need for less complex VWs. There is a demand for universal design to facilitate more people taking advantage of services and products (Bühler, 2001). A set of international standards for VWs were presented in 2011 (Gelissen and Sivan, 2011). These standards represented the first step towards standards within VWs and between VWs and real world contexts. However, for VWs to date there are no standards for universal design. Standards could benefit people with disability who want to take advantage of the possibilities offered by the VW technology (Krueger and Stineman, 2011).

### **5.4 Employment in Virtual Worlds**

Participating through being a part of the workforce is important to people with disability, as a way to contribute to the community. However, people with disability are less likely to be employed than their non-disabled peers (Hammel et al., 2008). VWs offer the opportunity for people with disability to find employment or contribute as volunteers (Stewart, Hansen and Carey, 2010). In the fourth quarter of 2010, the web merchandise sales volume of Second Life was 956 million USD (Linden, 2011), which indicates large sums of money are invested through transactions performed in Second Life. There is a possibility to earn an income through the VW Second Life. Currently it is not known to what extent people with disability are taking advantage of this opportunity or will choose to take this opportunity in

the future. VW employment may represent a possibility for independence and empowerment, which is important for this group.

### **5.5 Volunteering in Virtual Worlds**

On Virtual Ability Island in Second Life, run by Virtual Ability Inc., people with disability are volunteering to help one another in getting familiar with VWs (Babiss, 2009). Virtual Ability Inc. helps members of their community to integrate into the virtual society, and provides an ongoing support. The community offers members information, encouragement, training, companionship, referrals to other online resources and groups, ways to contribute back to the community, and ways to have fun (VirtualAbilityInc, 2012). This possibility to contribute and, at the same time meet new people and establish friendships, from the safety of home is one of the benefits VWs offer to enhance quality of life for people with disability.

### **5.6 Social and Leisure Activities in Virtual Worlds**

VWs, such as Second Life, offer an environment which invites people to play and engage in leisure activities, relaxing and escaping from the real world (Zhou et al., 2010). Mobility challenges or prejudices can hinder or discourage people with disability to engage in activities in the real world. Stewart et al. (2010) noted people with disability experience joy and inclusion by playing and communicating in Second Life. We know people with disability are engaging in various activities in VWs (Babiss, 2009; Stendal, Balandin and Molka-Danielsen, 2011). The possibility to meet and interact with people throughout the world, to have the possibility to choose what to disclose or how to play with identity, supplies the opportunity to socialize in ways not always available in the real world. The presented ICT research shows there is potential for inclusion and empowerment, yet this still requires further research, particularly in the case of people with disability.

### **5.7 Diversity among Disabilities using Virtual Worlds**

An important factor when considering people with disability is the variety of challenges this group encounters, depending on the disability. Challenges incurred with a physical disability may differ from those incurred with an intellectual disability. As previously discussed, universal design may help an increased number of people with disability utilize the possibilities represented by VWs. An aspect requiring attention and empirical research is how different groups of people with disability experience use of VWs. By understanding the differences and challenges met by each group, support staff aiding people with disability will be better equipped to allocate the resources appropriately. Also, it is important to ensure that support staff will not become themselves a barrier to people with disability participating in virtual communities.

### **5.8 The Multi-Disciplinary Nature of the Field**

It is important to recognize the multi-disciplinary nature of research in VWs and ICT (Carr, 2010). The research presented in this review focused on technology and people with disability. The knowledge of ICT use creates a foundation for research in VWs for people with disability, due to the closely related technical aspects and benefits promised by both ICT and VWs. Because this area is focused on both the technological and human factors, it may be of great importance to unite research forces and explore this new opportunity for people with disability across disciplinary boundaries. Researchers have previously suggested a need for an increased focus on VWs in IS research (Walsh and Pawlowski, 2002), and the IS field is viewed as a natural leader in cross-disciplinary research involving humans and technologies (Lanamäki, Stendal and Thapa, 2011). Due to the multi-disciplinary nature of technology and disability,

a strong collaboration among researchers in the fields of IS, disability studies, rehabilitation and education is needed to develop the knowledge base further.

## **6. Conclusion**

This review synthesizes the existing literature and includes suggestions for future research in the domain of VWs and people with disability. Research on ICT for people with disability shows both opportunities and challenges, yet there is little research which focuses on the role of VWs for people with disability. It is important to understand the opportunities and challenges of ICT for people with disability, in order to understand the possible impact VWs may have on people with disability. The research on virtual worlds and disability is in an early stage. Of the twelve articles on virtual worlds for people with disability identified in this review, only three are based on empirical data. The remaining articles are conceptual papers, editorials and literature reviews (ref. Table 1). This indicates a need for empirical research and rigorous analysis of the possibilities and challenges VWs may offer people with disability. Considering the multi-disciplinary nature of the field such as IS, disability studies, rehabilitation and education, multi-disciplinary research teams should work together to ensure more people with disability are able to take advantage of the opportunities offered by virtual worlds.

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# Capabilities and Affordances of Virtual Worlds for People with Lifelong Disability

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## Abstract

Using technology is of great value for people with lifelong disability (PWLD). The internet can help PWLD to be more independent, socially active and to participate in a range of activities. Virtual worlds (VWs) offer an environment with technology capabilities for interaction, rendering and communication. The ability to take advantage of these capabilities may depend on the technology and the ability of the person utilizing it. Using a qualitative study we aimed to explore the differences of ability required to use these capabilities and make capabilities into affordances for PWLD. We found there were differences in PWLD's ability to utilize the capabilities offered, and conclude there is a need for standards for universal design to create sustainable VWs suitable for all.

## 1 Introduction

Technology offers a variety of capabilities for socialization and inclusion. One of the latest technologies to offer communication, rendering and interaction capabilities is metaverses (Davis et al. 2009). Metaverses, also known as virtual worlds (VWs), are immersive, online 3-D representations of the physical world where individuals interact through avatars. An avatar may have a resemblance to the user creating it, or can be created to represent how the user wishes to present him/herself (Adrian 2009). There are multiple reasons why people engage in VWs, including business, work, hobbies, socialization and enjoyment.

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A fairly new research area related to VWs is exploring how people with lifelong disability (PWLD) are using and experiencing metaverses. PWLD are active users of VWs (Babiss 2009), but there is little empirical research showing the challenges and opportunities offered to this group (Stendal et al. 2011).

The United Nations (UN) Convention defines people with disability as follows: “*Persons with disabilities include those who have long-term physical, mental, intellectual, or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others.*” (Leonardi et al. 2006, p. 1220).

Due to known participation and inclusion challenges this study focuses on people with lifelong disability, where the impairment occurred before the age of 22, and the impact of the impairment is lifelong. Lifelong disability includes intellectual disability, autism, deafness, epilepsy, polio and cerebral palsy (Ansello and O'Neill 2010). To date VWs and their promised values have been researched in the context of education and rehabilitation (Standen and Brown 2005), however research concerning how PWLD are able to take advantage of the technology capabilities offered by VWs is yet limited. Psychologist J.J. Gibson defined affordances as all “action possibilities” latent in the environment, objectively measurable and independent of the individual's ability to recognize them, but always in relation to the actor and therefore dependent on their capabilities (Jones 2003). In the context of VWs, we understand this notion to mean that VWs offer a variety of capabilities which in turn may become an affordance when the user is able to take advantage of the capability promised. Motivated by the theoretically defined set of technological capabilities (Davis et al. 2009) and the potential of turning them into affordances, the aim of this paper is to identify the capabilities and affordances for PWLD when using VWs. The research question is:

*What capabilities and affordances do virtual worlds offer people with lifelong disability?*

This study contributes to the understanding of the challenges experienced by PWLD to benefit from the potential opportunities offered by virtual worlds. It also contributes to the theoretically defined technological capabilities by applying them in a different context than Davis et al. (2009).

## **2 Technology Capabilities of Virtual Worlds**

Metaverse capabilities have been defined as a set of capabilities for communication, rendering, interacting and team process (Davis et al. 2009). In the context of this paper we consider the first three capability categories, while team process is not focused since our analysis does not include the virtual team level.

## ***2.1 Communication***

Communication is intrinsic to humans; the ability to connect and communicate with others is important in most environments and contexts (Davis et al. 2009). VWs offer communication possibilities through both text chat and a voice feature. This enables people to communicate in real time and obtain immediate feedback on their comments or statements (Carr 2010). In the physical world, we rely on more than the spoken word alone, for example by using body language and facial expression. The possibility to animate an avatar to show familiar body language supply a great opportunity to obtain rich communication (Saunders et al. 2011). However, it may be difficult to use this multi modal communication in VWs, due to the complexity of such animation. In addition, online communities may have their own written language, which in every day spoken conversation is not used (Campbell 2011). Through experience with the communication channels the communication richness increases (Carlson and Zmud 1999). Communication support in the VW context means there are multiple ways to communicate. The VW Second Life (SL) offers public text chat, private instant messaging (IM), group IM, public voice chat, private voice chat and group voice chat. However, to use these different communication tools effectively requires training, and a lack of training may discourage potential users from adopting the technology (Davis et al. 2009).

## ***2.2 Rendering***

Rendering is defined to be the process of creating or executing life-like images on the screen (Davis et al. 2009). One of the important factors offered by VWs is the embodiment which the avatar represents (Mennecke et al. 2010). Through an avatar people in VWs are able to create and play with a representation of them in a way not available in the physical world. Many will create avatars that cultivate an extreme look, for example with clothes and hair the individual would not wear in the physical world (Oishi 2007). VWs are a three-dimensional reproduction of the physical world, and this is described as vividness (Davis et al. 2009).

## ***2.3 Interaction***

Interaction is defined as the extent to which users can participate in modifying the form and content of the VW in real time (Davis et al. 2009). VWs, such as SL, enable users to create the content, in other words people are able to build, create and modify objects, environments and their own representation in real time (Jung and Kang 2010). VWs also provide the users with the ability to move around in an environment free from physical laws (Standen and Brown 2006). Consequently VW users can fly and teleport. Thus, for PWLD, this allows an individual who

in the physical world uses a mobility aid to move around freely, to walk, run or dance (Stewart et al. 2010).

### ***2.4 Virtual Worlds and People with Lifelong Disability***

Accessibility to technology has been recently discussed (Krueger and Stineman 2011), and is also discussed in the context of VWs. Universal design is a principle, which can be applied for VWs in order to optimize a well-designed virtual environment for all people, regardless of their disability or the assistive technology needed (Krueger and Stineman 2011). There are practical limitations to implementing such solutions, such as cost and complexity. Also, the needs of PWLD are diverse, in other words a solution for one type of disability may not be applicable to another type of disability (Krueger and Stineman 2011). This can be seen by the implementation of the voice feature in the virtual world where people who are deaf once again are faced with their hearing impairment and cannot easily participate in the same activities as their non-disabled peers (Carr 2010).

We have conducted an exploratory qualitative study to explore how PWLD experience the technology capabilities offered by VWs and how turning these into affordances may be a challenge for different groups within the disability group.

## **3 Research Method**

This study includes two groups of participants, a group of novice users and a group of experienced users of Second Life (SL). All participants are over the age of 18, diagnosed with a lifelong disability, able to sign an informed consent form, have access to and are able to use a computer with broadband. Aligned with previous research SL was chosen due to (1) the large number of users, (2) the range of activities available and (3) the wide range of opportunities (i.e. business and education) (Schultze and Leahy 2009). Because of these particular features, SL is a suitable platform for both novice and experienced users to explore and prosper in the VW. All participants gave informed consent and were told they could withdraw from the project at any time with no reason given and no penalty. Ethical clearance from the Norwegian Social Science Data Services (NSD) for the research was obtained.

Table 1 shows a list of participants in this study. To ensure the anonymity of the participants all avatar names in this paper are pseudonyms. Participants' disability included Cerebral Palsy (CP), Asperger's Syndrome Disorder (ASD), Hearing Impairment (IM), mild to moderate intellectual disability (ID) and other physical disability (PD).

With the first group we aimed to explore how novice users with lifelong disability experience the VW. This group consisted of eight participants recruited through organizations in their local community such as adult learning centers.

Over a period of 8 weeks in 2011-12, the eight participants met with the first author (hereafter referred to as ‘the researcher’) in weekly sessions of one and a half hours, and engaged in different activities in SL. In the fourth and eighth week of the study, all participants were interviewed about their experiences in the VW. Interviews were conducted by phone, to ensure the SL sessions were solely used for activities and interaction.

The second group of participants consisted of seven experienced users. These users were recruited with the help of Virtual Ability Inc. (ref virtualability.org), which operates an island in SL to support people with disability entering into the VW. During two in-world presentations of the project, people attending the presentation were invited to participate in this study. The experienced users participated in a longer in-depth interview, approximately two hours, exploring their experiences with the virtual world. All interviews with the experienced users were conducted in private IM or private voice chat. The active SL experience level of the participants in this group ranged from one to seven years.

**Table 1 List of participants in this study**

<i>Group</i>	<i>Participant</i>	<i>Disability</i>	<i>Location</i>	<i>Primary language</i>
Group 1 Novice	Pevit Torana	Intellectual	Norway	Norwegian
	Mix Mofat	Intellectual	Norway	Bulgarian/Norwegian
	Solvita Silka	CP	Norway	Norwegian
	Trinaka Lika	Intellectual	Norway	Norwegian
	Rolatina Endora	Intellectual	Norway	Norwegian
	Gjagra Gralt	CP	Norway	Norwegian
	Missara Melsa	Intellectual	Norway	Norwegian
	Siltar Siana	ASD	Norway	Norwegian
Group 2 Experienced	Agonra Sircka	Physical	USA	English
	Kalnika Gublic	Physical	USA	English
	Sunger Alista	HI	USA	English
	Ahroun Wolf	ASD	USA	English
	Maria Butterfly	Physical	USA	English
	Kirana Merkini	HI	South Africa	Finnish/English
Landira Crunge	HI	USA	English	

The focus of the data collection was to map the challenges and affordances offered by VWs for PWLD. Based on the capabilities presented by Davis et al. (2009) and Gibson’s definition of affordances, our data analysis identified the challenges and affordances offered by VWs to PWLD. Answers from different individuals to common questions were grouped together and along with observations were analyzed for different perspectives on the issues (Patton 1990), which were considered important for understanding how people with lifelong disability experience the capabilities offered by VWs.

## 4 Findings: Affordances offered by Virtual Worlds for PWLD

Observation and interviews conducted with the novice users of SL were in Norwegian, and any quotes from these participants have been translated to best reflect their meaning. The interviews with the experienced users of SL were conducted in English and quotes are taken directly from the interviews. Findings are presented related to the technological capabilities presented by Davis et al. (2009).

### 4.1 Communication

While SL offers multiple communication channels, depending on disability, utilization of these channels present challenges. For the participants with hearing impairment, the voice feature was not an option. Although they were able to use the text chat function they reported challenges when communicating in the virtual world. *“What bothers me the most, is their [other avatars] refusal to type. Especially if the only reason they refuse is because they don't want to type, not because they can't type.”* (Landira Crunge). On the other hand, those who experience difficulty writing due to their physical or intellectual disability feel they are not able to provide the immediate feedback to others as they would like, if the voice feature is not available or malfunctioning. Maria Butterfly uses the software Dragon (see [www.nuance.com](http://www.nuance.com)) to convert voice into text in SL. However, this creates some lag in the conversation which in some cases gives her the feeling of not being able to expand and explain as well as she would like. If one person with literacy impairment and one with communication impairment try to communicate there could be some tension; however one participant noted that there are ways to work around the challenge. *“If a person cannot type, I will however try to find someone in-world willing to translate what they hear and type it to me. That's if the person CAN not type...different from that they are unwilling to type to me.”* (Sunger Alista).

When observing the novice group in SL, the researcher noticed that being able to hear how the participants reacted to different activities and situations enriched the data collection. Through laughter, cheers and comments, the lack of body language did not appear to affect the experience of SL. Furthermore the Norwegian participants struggled with English. The fact that most communication in SL is in English discouraged some of the participants from trying to make contact with others.

Through sessions with the novice users multiple communication channels were used to support the conversations. Public voice chat was used when available. In addition, public chat, private IM and private group IM were used. The novice users expressed being distracted by the variety of communication support, on the other hand they also noted the variety of communication channels was a good thing. Once the researcher and Missara Melsa were talking in the public voice chat



and were interrupted by a stranger who also spoke Norwegian. Missara Melsa found this experience a little frightening, because she did not know the person who started talking and could not see the avatar representing the person. Because of this encounter we started a private IM instead which made Missara Melsa feel more comfortable.

## **4.2 Rendering**

All the participants, except Ahroun Wolf, use human avatars on a regular basis. However, the ability to be anonymous and create their avatar to their liking is of value to all. Ahroun Wolf chose an animal avatar because he identifies with the wolf.

It is important for participants to be able to choose what to disclose, and most participants did not disclose any disability in SL. Only two were open in showing or disclosing their disability. Sunger Alista has posted in her profile information that she has a hearing impairment and only communicates through text. Agonra Sircka chooses to have an avatar which uses a wheelchair, as he does in the physical world. Kalnika Gublic explained that in the physical world, she has to “convince” people she is a person, and she avoids that in the virtual world by not displaying her disability. Also the novice users embrace the possibility for anonymity. *“It fits me very well [to be anonymous]. Because I have had problems with people in Facebook, so I like to be anonymous in places like this.”* (Missara Melsa)

Objects in SL are 3D representations of physical world objects, which represent vividness in SL. This creates a rich sensory environment for users of SL. Some of the novice participants used available objects found in SL in unexpected ways. For example, when visiting Virtual Africa to view elephants, zebras, giraffes and other animals present, the novice users decided to run around in the environment and sit on all the animals. For them the ability to sit on the animals was just as important as the animals being there, and created pleasurable situations for them to enjoy.

## **4.3 Interaction**

Being able to modify objects is dependent on the island where the object is placed. However, we noticed there is a required skill level that has to be accomplished before an object can be modified. Through the eight sessions with the novice users they were able to modify their own avatar; however this is a multiple step operation and requires training and support. Some of the experienced users had developed the required skills. *“I also enjoy making things- well more modifying things. Like especially modifying them so that they are more easily usable.”* (Sunger Alista)

SL also offers the opportunity to build and create new objects in the virtual environment. A few of our participants are skilled builders in SL and taking in-world classes to learn how to build objects. They noted this is another learning curve to overcome, but when they accomplish the basics, the ability to use their creativity in SL is something they enjoy very much. *“Because I’m retired, it gives me something to do and satisfies any creativeness I might want to try”* (Landira Crunge).

The findings of this section are summarized in Table 2.

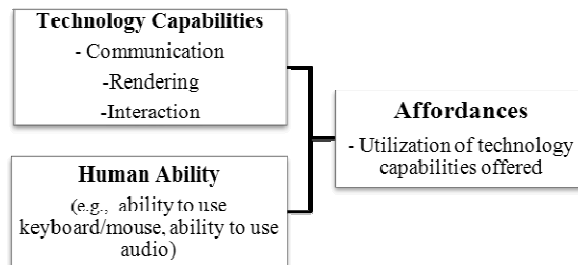
**Table 2 Summarized findings**

<i>Disability</i>	<i>Challenge in VW</i>	<i>Available Solution</i>	<i>Assessment of Available Solution</i>
HI	-Unable to use voice feature	-Voice to text software -Text chat -Find a human translator	-Lag in conversation -Problem for people with low literacy
ID	-Unable to understand non-native languages -Too many communication functions	-Limit communication to native speakers -Use only a few interface communication functions	-Limiting of new contacts
ID	-Use of VW interface	-Training	-Initial support is a critical factor to avoid drop-out
PD, CP	-Use of keyboard/mouse control	-Seek alternative controls or browsers	-No universal design standards for virtual world browsers
All	-Selective disclosure of private information	-Personalization of avatar -Information in public profile	-Offers opportunity for anonymity

## 5 Discussion

The capabilities presented by Davis et al. (2009) were available for all participants, however dependent on participants’ disability and experience level, some of the capabilities did not turn into an affordance based on Gibson’s definition. Figure 1 shows how together, technology capabilities and human ability, create affordances for PWLD in VWs.

**Fig. 1 Technology Capabilities and Affordances of VWs for PWLD**



Communication is an important issue for all humans, and technology is proving to be an important tool for PWLD to overcome some of the barriers they encounter in the physical world. VWs offer the possibility to communicate through public IM/Voice, private IM/Voice and group IM/Voice. Although Maria Butterfly explained she uses voice-to-text software to be able to participate in text chat, common software of this kind does not interface well with VWs (Krueger and Stineman 2011). In addition, those participants with a hearing impairment struggle when other people they meet are unable or unwilling to use text chat when communicating with them. Carr (2010) stated in earlier research educators need to be aware of the possible impact VW voice feature may have on deaf students. She noted deaf students may once again feel the impact of their impairment in the VW.

There were some difficulties using the different communication channels, such as when the researcher asked a question in the private group IM, the participants answered in the public chat. The variety of communication channels showed to be confusing at times for those participants with an intellectual disability. Through the observation of the novice users we see their ability to take advantage of the offered communication channels increase and become richer over time. This can be related to channel expansion where richness of communication through different channels will increase by experience (Carlson and Zmud 1999). However, as mentioned in the concern of feedback, the range of cues and channels available to PWLD depends on both the type and level of disability experienced and the functionality incorporated in the VW. In situations where the voice feature was not available or functioning, the novice participants used short messages such as “haha” and “☺” to express their feelings about the situation. However, for those without knowledge about online language trends, having to express cues in textual form may be difficult (Campbell 2011).

Personalization of avatars is an important factor in VWs (Oishi 2007). This is also true for the participants in this study, where only two of the participants chose to disclose their disability and one participant chose to represent himself as a wolf in the VW. Vividness in SL is represented by the environment being similar to the physical world, though without the feel and smell of the physical world (Davis et al. 2009). The embodiment through an avatar still creates a feel of being present in the VW (Mennecke et al. 2010), which most of the participants experienced.

Mobility is an important issue for PWLD, particularly those with physical disability. In SL, both novice and experienced users noted this is an important affordance in VWs. The ability to walk in the VW may be important for those who use a wheelchair in the physical world. Walking allows them to experience the environment in a new way. Being able to visit new locations, which in the physical world may not be available to them, is seen as a great value. However, we observed that for the novice users the ability to walk, fly and teleport are operations which take time to master and support is needed. Since mobility in VWs is dependent on use of keyboard and mouse skills, those with a physical disability may find it difficult to accomplish this affordance (Krueger and Stineman 2011). Being able to do tasks and participate at a deeper level is important for the self-esteem

(Lidström et al. 2011). However, the novice users did not acquire the level of skills within the eight sessions to be able to modify and create objects. Table 3 summarizes the findings from this study.

**Table 3 Capabilities, Affordances and Challenges of VW for PWLD**

	<i>Capability</i>	<i>Affordances</i>	<i>Challenges</i>
Communication	Feedback	Synchronous communication in both voice and text	Physical disability may cause text based communication to be a challenge. Hearing impairment exclude the use of voice feature.
	Multiplicity of cues and channels	Communication with a variety of users in different channels and different levels of privacy	For people with a hearing impairment or for others when voice feature malfunctions/unavailable, text may not show underlying cues in communication.
	Language variety	Communication with worldwide users of VWs	Slang and online language depends on experience with online medias.
	Channel expansion	Richer communication through multiple channels	Steep learning curve to learn how to use communication channels.
	Communication support	Multiple communication channels to support different needs.	Multiple channels may be challenging and distracting for those with intellectual disability and novice users.
Rendering	Personalization	Creating own avatar. Choice of disclosure, playing with identity and anonymity important to all participants	Takes time to master, especially for those with intellectual disability.
	Vividness	Rich sensory representation of the physical world.	Novice users use objects in unexpected ways.
Interaction	Interactivity	Modify content in VWs.	Dependent on experience and skill level.
	Mobility	Teleporting/flying/walking.	Control the avatar through keyboard and/or mouse clicks.
	Immediacy of artifacts	Building and creating content in VWs.	Dependent on experience and skill level.

In addition to the specific technology capabilities it is important to note that the learning curve for use of SL was steep for most participants. Maria Butterfly said she would not have continued using SL if she had not had help to overcome the entry barriers. Landira Crunge, at one point, stopped using SL due to the difficulties of entry. Through observing the novice users we noticed the difficulty of using the application. Often multiple steps are required to perform tasks in-world for which a novice user with intellectual disability needs support. While the learn-

ing curve for VWs is steep for any individual, those with an intellectual disability may face an entry barrier difficult to overcome on their own (Krueger and Stineman 2011), but not impossible. In summary, based on our assessment of the challenges, we identify a need for universal standards for interface design for VWs, such as W3C's accessibility standards (ref w3.org). We recommend adherence to this initiative in the design of VW interfaces.

## 6 Conclusion

This study is limited in that it is based on a small sample size of the representation of different impairments. We recommend a refinement for further work. We suggest that more in-depth empirical studies of a range of representatives from each disability group will facilitate the identification of specific challenges for each group. Additionally we suggest that eight sessions in SL may not be enough time for novice users to achieve the required skill level to fully experience the VWs.

In conclusion, this study contributes with an identification of the affordances offered by VWs to PWLD. As seen in the discussion, all of the technology capabilities presented by Davis et al. (2009) represent potential affordances for PWLD. However, the different forms of disability may hinder PWLD to utilize the promised capabilities into affordances. We identified several work-around solutions of the participants that enabled VW capabilities to become realized affordances, although these solutions have limited success. Another possible solution or approach is to build sustainable VWs after Universal Design principles, that is to design and develop VWs and their interfaces that are based on the above mentioned principles and which take the different challenges met by PWLD into account (e.g., voice to text technology, support for not being able to use keyboard and intuitive interfaces). In summary, our focus on the experiences of PWLD, contributes by extending the use of the theoretically defined technological capabilities to a different setting than reported in former research by Davis et al. (2009).

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# VIRTUAL WORLDS AND PEOPLE WITH LIFELONG DISABILITY: EXPLORING THE RELATIONSHIP WITH VIRTUAL SELF AND OTHERS

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## **Virtual Worlds and People with Lifelong Disability: Exploring the Relationship with Virtual Self and Others**

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### **Abstract**

*An increasing number of people with lifelong disability are active members of virtual worlds. Through their avatars, people with disability are able to participate in social, work related and educational activities in the virtual world. The aim for this paper was to explore how people with lifelong disability experienced the relationship with their virtual self and others, applying the lens of Embodied Social Presence Theory. Based on data collected through participant observation and interviews with novice and experienced users of Second Life, our findings indicate that the relationship between humans and their avatar is strong. Further, the findings indicate that the relationship with a person's own avatar and others in the virtual world requires time to develop and be meaningful for people with lifelong disability. The ability to create an avatar with no visible disability and to choose what to disclose about a disability, is important affordances offered by the virtual world to people with disability. This study contributes to an understanding of the potential for virtual worlds to support people with lifelong disability in engaging in leisure activities and social interactions.*

*Keywords: Virtual Worlds, Second Life, disability, Embodied Social Presence Theory.*



# 1 Introduction

Presence in computer-mediated environments typically consists of two interrelated phenomena, the sense of being there and the sense of being together (Schultze and Leahy, 2009). These two phenomena are evident in virtual worlds, where humans are represented by an avatar, which in many cases resembles the human it represents. Avatars are technological artifacts that offer a virtual body for communication and provide the affordance of embodiment for people in virtual worlds (Schultze and Leahy, 2009). Embodied Social Presence (ESP) theory is a framework for understanding interactions and communicative activities in virtual worlds (Mennecke et al., 2010). Researchers applying this theory have emphasized the situated and dynamic nature of this form of presence (Schultze and Leahy, 2009) and demonstrated that avatar users experience a greater sense of engagement, encouragement and task performance when they experience ESP (Mennecke et al., 2011).

People with disability are active users of virtual worlds (Babiss, 2009). According to the UN Convention, “*Persons with disabilities include those who have long-term physical, mental, intellectual, or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others*” (Leonardi et al., 2006). People with disability experience a range of challenges in their day to day life, including difficulties with communication, mobility and access to the community (Ballin and Balandin, 2007; Greenwood, 1987). Communication is intrinsic to being connected and feeling part of a community or society, consequently communication impairments can give rise to feelings of exclusion from being an active citizen (Jackson, 2006). Access to computers and the internet has shown to be a positive influence for people with disability helping to empower them in their life, be independent and be part of the community (Davies et al., 2001; Gardelli, 2008). The experience of being treated as different, not being seen as equal to their non-disabled peers is a challenge that is common to most people with disability (Hammel et al., 2008).

To date researchers have pointed to the educational (Smedley and Higgins, 2005) and rehabilitation capabilities (Standen and Brown, 2005) offered by virtual worlds for people with disability. How people with lifelong disability are experiencing and using virtual worlds for leisure activities is an under-researched area that requires more attention (Stendal et al., 2011; Stewart et al., 2010). Motivated by the positive effect of ESP on engagement in virtual worlds documented in previous studies and the theory’s attempt to explain the importance of embodiment in mediated communication (Mennecke et al., 2010), the aim of the present study was to understand how people with lifelong disability experience the relationship with their virtual self and others in virtual worlds. The research question was:

*How do people with lifelong disability relate to their virtual self and experience interactions with others in the virtual world?*

In this paper we present the results of a study that included both novice and experienced users of the virtual world Second Life. Using ESP theory as the lens, we analyzed the different stages of development of virtual self relationship and the affordance of embodiment participants experienced when communicating with others. This study is part of a larger project supported by the Norwegian Research Council that explored how Virtual Worlds can assist people with lifelong disability to engage in meaningful activities and social interactions. Ansello and O’Neill (2010) defined lifelong disability as: “*Developmental disabilities, as federally defined, are chronic impairments that occur before age 22 that may affect functional abilities in matters of self-care, learning, mobility, language, economic self-sufficiency, capacity for independent living, and other everyday skills. The impact of the impairment is life-long while the causes are many, including chromosomal anomalies, birth trauma, mother’s lifestyle during pregnancy, adverse drug reactions, and accidents such as automobile and diving that produce traumatic brain or physical injury. Thus, developmental*

*disabilities, being functionally not categorically defined, are heterogeneous and might include individuals with Down syndrome, autism, deafness, epilepsy, polio, cerebral palsy, and the survivors of any number of untoward events that occur during life's developmental (under age 22) stage” (p. 106-107).*

## **2 Embodied Social Presence Theory**

Social presence has been defined as the degree of awareness of other individuals in an interaction, and also the appreciation of an interpersonal relationship through such interaction (Short et al., 1976; Tu and McIsaac, 2002). The degree of social presence is a subjective measure, where it is combined by the characteristics of the medium used and the user's perception (Tu and McIsaac, 2002). It is widely agreed on that social presence should be viewed as an experience, which varies from moment to moment, and differently between individuals (Shen and Khalifa, 2008; Tu, 2000). Building on previous research (Schultze and Leahy, 2009), we focus on presence as being of a situated and dynamic nature. Social presence is not a set measurement, and will differ between individuals and situations (Biocca and Harms, 2002; IJsselsteijn et al., 2003; Tu, 2000; Tu and McIsaac, 2002). With the introduction of virtual worlds, social presence theory has gone through another development and in this context referred to as Embodied Social Presence (ESP) Theory.

Embodied social presence is used to discuss social presence in virtual environments (Durlach and Slater, 2000; Mennecke et al., 2010). The sense of social presence with others is important, as is the relationship and sense of social presence between the human and the avatar. In a physical environment social presence begins with acknowledging the presence of others, equally, in a virtual environment the acknowledgement of the avatar as a representation of self is crucial (Durlach and Slater, 2000; Schultze and Leahy, 2009).

Mennecke et al. (2010) presented a framework (Table 1) for embodied social presence with five stages which describe the social presence in a virtual environment, extending a model by Biocca and Harms (2002). The framework includes recognition of the digital self and the virtual environment being engaged. It also focuses on the appropriation of the avatar as being a tool in the social interaction and therefore an important factor in the social presence. Mennecke et al. (2010) suggest the perception of ESP is achieved through a complex process in five stages beginning with the perception of embodied presence and co-presence and ending with the perception of self and others engaged in interactive and task-focused activity. The first stage, recognition of the other, involves observing other avatars participating in activities. Mediated embodiments such as pictures and other representations of others may automatically trigger a sense of social presence (Biocca and Harms, 2002). In a 3D virtual world, unlike text-based virtual worlds, presence is rearticulated to others and self by adding an avatar (Taylor, 2002). The second stage includes recognition of the digital self, where the user creates a perception of the digital self embodied in his or her own avatar. Schultze and Leahy (2009) stated there are various ways of viewing an individual's own avatar, such as avatar as 3D cursor or avatar as possible self. The strength of an individual's relationship to his or her own avatar is perceived differently by individuals and may be related to time (Bailenson et al., 2001; Wolfendale, 2007). In the third stage, collaborative engagement, the users starts interacting with others using avatars and through the avatars' actions. Schultze and Leahy (2009) presented the avatar as an object of play and as a tool. Avatars are tools for interaction and communication, as well as a tool for collaborative activities with other avatars. The fourth stage, appraisal of the “real” other, involves an individual having some understanding of the others as individuals. Virtual worlds offer a representation of self and others. Such representations may be misunderstood as not real (Schultze, 2010). It is important to remember and understand there are real people behind each avatar. Schulze (2010) noted that the encounters in the physical world and the virtual world are similar. The fifth and final stage, reflection on and appraisal of the self, occurs with the development of the users' perceptions of their own digital self, engaged in activities with other avatars. Mennecke et al. (2011) stated this represented a shift in focus on the virtual and real self, as the user perceives him- or herself as a component of the

environment manifested in his or her avatar. Table 1 shows the stages in the model by Mennecke et al. (2010) and the implications at each stage.

<i>Stage</i>	<i>Perceptual Focus</i>	<i>Context</i>	<i>Instrumental Tools</i>	<i>Outcome</i>
Recognition of Other	The other social actor's avatar	Other social actor's virtual body engaged in goal-oriented activities in a virtual space	-Avatar Body -Virtual Space -Virtual objects -Verbal Communication -Non-verbal Communication	- Perception of other avatar - Perception of Space
Recognition of Digital Self	Digital self embodied in one's own avatar	Actor's avatar present in the virtual space in proximity to the other social actor's avatar	-Avatar Body -Virtual Space	- Perception of one's own avatar - Perception of Space
Collaborative Engagement	Joint activities	Actor's avatar engaged in goal-directed collaborative activities with the other social actor's avatar	-Avatar Body -Virtual Space -Virtual objects -Verbal Communication -Non-verbal Communication	- Perception of other avatar in action - Perception of one's own avatar in action
Appraisal of the "Real" Other	Actions (verbal and non-verbal) of virtual other	Actor's avatar engaged in goal-directed collaborative activities with the other social actor's avatar	-Avatar Body -Virtual Space -Virtual objects -Verbal Communication -Non-verbal Communication	- Perception of the social actor "behind" the other avatar
Reflection on and Appraisal of Self	Digital self-embodied in one's own avatar	Actor's avatar engaged in goal-directed collaborative activities with the other social actor's avatar	-Avatar Body -Virtual Space -Virtual objects -Verbal Communication -Non-verbal Communication	- Perception of one's own actions as manifested in avatar-based social interaction

*Table 1 The Stages of ESP (Mennecke et al. 2010, p.7)*

In research based on photo-diary interviews with 14 participants, Schultze and Leahy (2009) identified four social presence categories in the virtual world; Virtual Me, The Avatar as Possible Self, The Avatar as a Character, and Scripted Character. In these categories, Virtual Me represented an integrated avatar-self relationship where the participants never perceived themselves as separate from their avatar. Scripted Character represented a totally segmented avatar-self relationship where the avatars did not represent the participants in any way, but were used as a tool to engage activities, for example, in role-plays. In the two middle categories, The Avatar as Possible Self and The Avatar as a Character, there was a more dynamic avatar-self relationship. The Avatar as Possible Self allowed participants to explore an alternative self or the real self which is not possible in real life. The Avatar as a Character, implied a sense of connection between the avatar and self, where participants referred to their avatar as 'her' or 'him', yet the participants had control and made the decisions.

Mennecke et al. (2010) stated that the embodiment of self in the virtual environment may be seen as a tool for communication and symbolic interactions. They viewed the virtual body as a tool for mediating communication; therefore the actions of the virtual body have embedded perceptions. Embodied Social Presence theory not only attempts to explain the communication between users in the

virtual environment, but also takes into account the relationship and communication between avatar and human being.

Embodied Social Presence theory is a new theory that has been used as a framework in empirical research to account for the higher levels of perceptual engagement that users experience as they engage in activity-based social interaction in virtual environments (Mennecke et al., 2011). These researchers examined proposed ESP theory in a qualitative study, where data was collected from two graduate courses in e-commerce. The data consisted of reflections from the students involved in the courses on their experiences in Second Life. They stated that users experience a greater sense of engagement, encouragement and task performance when they experience ESP. Furthermore, they indicated the sense of embodied social presence will evolve over time. Biocca and Harms (2002) stated that social presence is suitable for self-reporting by individuals, such as in the study by Mennecke et al. (2011).

### **3 Research Method**

This study was conducted in the virtual world Second Life (SL). Aligned with previous research, Second Life was chosen due to (1) the large number of users, (2) the range of activities available and (3) the wide range of opportunities (e.g. business and education) (Schultze and Leahy, 2009). Because of these features, SL presents a suitable platform for both novice and experienced users to explore and prosper in the virtual world. Furthermore, the ability to create an avatar and play with identity gives this platform an advantage when exploring embodied social presence and the avatar-self relationship for people with lifelong disability. Due to the limited research conducted in this area, this was an exploratory qualitative study. This study included two groups of participants, novice users and experienced users of SL. All participants were over the age of 18, diagnosed with a lifelong disability, able give informed consent, and able to use and access to a computer with broadband. All participation understood that they could withdraw from the project at any time without giving a reason or incurring penalty. Ethical approval for the study was obtained from the Norwegian Social Science Data Services (NSD).

With the first group we aimed to explore how novice users with lifelong disability experienced virtual self and the social presence of others in the virtual world. This group consisted of five participants, all located in Norway, and recruited through organizations in their local community (e.g. teaching services). One participant has Cerebral Palsy (CP), the remaining four have mild to moderate intellectual disability. During a period of eight weeks in 2011, the five participants met with the first author (hereafter referred to as 'the researcher') in weekly sessions of one and a half hours, to engage in various activities in Second Life. During these sessions, the researcher guided the participants in their exploration of the virtual world. The participants engaged in activities such as visiting amusement parks, playing miniature golf and playing soccer. Online in the virtual world, but located in a different area in Norway, the researcher was available to help and guide the participants and act as a participatory observer in the activities in SL. Communication between the researcher and participants in SL was mainly through the voice feature offered by SL. However, when the voice feature was unavailable, communication was conducted in text-chat. In the fourth and eighth week of the study, all novice users participated in individual in-depth interviews about their experiences in the virtual world. Interviews were conducted by phone; as it was decided to devote the SL sessions solely to activities and interactions in the virtual world. The researcher did not meet any of the participants in the physical world. This protected the anonymity of the participants and the researcher. Consequently, the participants had the opportunity to choose what to disclose about themselves and their disability and maintained control over their own identities, when interacting with the researcher.

The second group that participated in this study consisted of six experienced users. These users were recruited with the help of Virtual Ability Inc. (see [virtualability.org](http://virtualability.org)), which operate an island in SL that supports people with disability entering into the virtual world. During two in-world presentations of the project by the researcher, people attending the presentation were invited to participate in this

study. Within this group three participants have a physical disability, two have a hearing impairment and one participant has Autism Spectrum Disorder (ASD). Five of the participants are from the US and one is from Finland, but is located in South Africa. The experienced users participated in a longer in-depth interview of approximately two hours, exploring their experiences with the virtual world, their relationship to their avatars, and to others in the virtual world. With the exception of one interview, the interviews were conducted using text chat in the SL setting. Because of a physical disability, one participant had difficulties communicating through text and preferred the voice feature in SL for communication and interaction. The remaining five participants said they were more comfortable using text chat when communicating with people with whom they do not have a close relationship. The experience level of being active in SL of the participants in this group ranged from one to seven years. The experienced users reported using the virtual world for a range of activities such as meeting friends, engaging in activities with friends, participating in classes, helping others to master SL, building and designing objects, and work.

To ensure the anonymity of the participants, all the avatar names mentioned in this paper are pseudonyms. Table 2 contains a summary of the characteristics of the participants in the two groups

<b>Participant</b>	<b>Type of user</b>	<b>Disability</b>	<b>Location</b>	<b>Primary language</b>
Pevit Torana	Novice	Intellectual	Norway	Norwegian
Mix Mofat	Novice	Intellectual	Norway	Bulgarian/Norwegian
Solvita Silka	Novice	CP	Norway	Norwegian
Trinaka Lika	Novice	Intellectual	Norway	Norwegian
Rolatina Endora	Novice	Intellectual	Norway	Norwegian
Agonra Sircka	Experienced	Physical	USA	English
Kalnika Gublic	Experienced	Physical	USA	English
Sunger Alista	Experienced	Hearing impairment	USA	English
Ahroun Wolf	Experienced	ASD	USA	English
Maria Butterfly	Experienced	Physical	USA	English
Kirana Merkini	Experienced	Hearing impairment	South Africa	Finnish/English

*Table 2 A summary of the characteristics of participants*

The focus of the data collection was to understand how the participants experienced their use of Second Life. We collected data about communication, experience with activities and how the participants experienced Second Life's interface and technical challenges. Data collection and data analysis were guided by ESP theory, with interview statements and observations categorized and compared across participants according to the different stages of ESP (Mennecke et al. 2010).

## **4 Findings**

The findings presented here are structured according to the five stages described in the Mennecke et al. (2010) framework for Embodied Social Presence theory. Observations and interviews conducted with the novice users of SL were conducted in Norwegian, and any quotes from these participants have been translated. The interviews with the experienced users of SL were conducted in English and direct quotes are used here.



Figure 1 Novice participants playing miniature golf and Interview with Ahroun Wolf

#### 4.1 Recognition of the Other

During the sessions with the novice users of SL we visited multiple locations as a group. The participants expressed excitement with being able to visit diverse locations. They soon referred to each other's avatars as "him", "her" and "you". The recognition of being together with others in the virtual environment was also displayed when they tried to speak to other avatars in some of the locations they visited, or when they spoke about other avatars among themselves. They showed the recognition of space, through vocalizations and laughter, when avatars crashed into each other in the virtual environment. Also, in the individual interviews participants found it amusing when another avatar who was not part of their group tried to mimic their Norwegian language. One participant spoke of another avatar seen in one session: *"She was all alone there. I felt a little sorry for her, being all alone, while all of us were in a group"* (Pevit Torana).

The experienced users of SL stated that they were aware of others present in their environment when they were in-world. For example, during one interview, which took place in the context of a bar in SL, using Instant Messaging (IM), the participant gave as an example of how others are present in the environment, the chat going on in the open environment. *"lol someone asking how old are you in RL [real life]. Usually only newbies ask personal [questions]? In open chat"* (Kalnika Gublic). Ahroun Wolf noted that initially other's avatars are mental models to him when communicating or are present in the shared space in SL. The recognition of others is clear from these experiences reported by the experienced users of SL. They perceive others as communication partners and see also the social attributes of the virtual environment.

#### 4.2 Recognition of Digital Self

The novice users did not express a clear feeling of connection to their virtual self. The novice participants recognized the avatar as a representation of themselves, a virtual body that they controlled through their keyboard or mouse commands. The novice participants made few changes to their avatars over the eight weeks of the project. The changes they made required extensive assistance from the researcher. In the interviews, all expressed contentment with the appearance of their avatars, noted that their avatars did not resemble them in RL, and stated that this was a positive feature. However, they were unable to elaborate on why this was a positive feature. They did not choose to depict or discuss their disability using their avatars at any point in time. One of the novice participants noted that using the pseudonym names of the avatars was a good way of being who she wanted to be rather than having to say who she really was.

The interviews with the experienced users revealed a closer connection between virtual self and the individual participant. Maria Butterfly expressed: *"She is an extension of me. Maria has the qualities I have in RL, she is similar to me."* Ahroun Wolf is represented by a wolf in SL, and when asked why he had a wolf as an avatar answered: *"I suppose to some extent... because it just feels right. I've never*

*known myself by any other symbol. Remove the wolf I wear on the outside here and wear on the inside in real life... and there'd be nothing of me left."*

On the other hand, the experienced users did sometimes depict their disability. Agonra Sircka explained he designed his avatar to display his own characteristics, including using a wheelchair: *"This avatar is designed to visually represent me pretty close to my real self. I use a sports chair in RL. I'm African American in RL. I'm a male in RL."* He explained that his avatar's use of a wheelchair was partly because he spends much time on the Virtual Ability Island: *"When I hang around Virtual Ability places, I think it also opens up conversations a bit"*. Sunger Alista chose to state in her profile in SL that she is deaf and can only communicate through text chat, to avoid misunderstandings with other people she encounters in SL.

### **4.3 Collaborative Engagement**

The interviews and observations demonstrated how both groups experienced collaborative engagement in SL. The novice participants did not always express this in words, but in actions. The way they communicated and interacted with each other and with the researcher during the sessions showed that they recognized others as being there and that they could interact with others. This was demonstrated through their engagement in activities together, and in their comments commenting on each other's dancing or diving abilities in SL or talking about things they saw and experienced together. One of the participants explained he felt "at home" with the group, and enjoyed being together with the others in his group. However, the same participant said about others outside of the group: *"I like others, but it may make things a little harder. It is hard to understand when there are others around"* (Pevit Torana). In other words, he was afraid he would not understand what others said or be able to communicate with them in the way that he felt comfortable.

The experienced participants all expressed that one of their main goals in using SL is the social aspect of the virtual world. They are able to meet people across geographical boundaries and interact with people they would not otherwise meet. *"Great. There is no other platform you can have access to so many personas."* (Maria Butterfly). The experienced users clearly described interactions with others and how it feels is dependent on the situation they are in at the time. Maria Butterfly, because of her disability finds it difficult to type on the keyboard, said: *"Depends on the situation, I can expand more with voice than with text. It depends on the lag, and how many people are around."* For Maria Butterfly writing a conversation in text chat can take too long, whereas the voice feature allows her to express herself in a shorter time.

### **4.4 Appraisal of the "Real" Other**

Since all novice participants were co-located during the sessions, the researcher, through SL, heard them discussing what happened on their screen during the SL sessions. They were aware that the other avatars in their group represented each person in the room with them. However, when the researcher talked to the novice users of SL about the people behind the avatars they were interacting with, these participants did not express ideas of other avatars outside their group being other people. They talked about the avatars only as a virtual object that was in their computer. During the eight sessions they were rarely exposed to any locations where there were large groups of avatars. When they were in this type of environment, the participants, with few exceptions, "became quiet" and did not engage in conversations with others. Pevit Torana and Mix Mofat attempted to initiate some interaction with people outside their group at times, but the attempts were not pursued. Although English presented a language barrier for the novice users, when visiting an environment where others were speaking Norwegian, the group became observers of the other avatars present. In this particular virtual context there was a live DJ, therefore communication was only text based, and they were asked to turn off the voice feature. Nevertheless, they did not express any wish to communicate with the others they met in this environment. When asked about making friends during their time in SL, the

participants indicated each other and the researcher as new friends. Solvita Silka stated that she did not make any friends during her time in SL.

The experienced users were clear that they understood there is a human behind every avatar they interact with in SL. *“Always aware there is a RL person behind the avatar”* (Kalnika Gublic). They noted they had all types of relationships in SL, including friendships and very close personal relationships. Close relationships with others are a strong reason for this group to continue using and exploring SL. Ahroun Wolf explained: *“It takes a long time for me before a person is more than just a mental model I'm trying to build [a model] of a member of Homo sapiens to anticipate their behavior. But once I have that model and move beyond it? Yes. They are real to me even here.”*

The experienced participants were also aware that because there are humans behind every avatar in SL, the same prejudices that occur in RL can be found in SL. Agonra Sircka, noted his avatar, who uses a wheelchair, experiences similar social exclusion in SL as in RL. Even if he experiences social exclusion in SL, Agonra Sircka chooses to display his disability because it is a part of who he is. Two other experienced users, Maria Butterfly and Kalnika Gublic, both use a wheelchair in RL, but choose not to use a wheelchair with their avatars in SL. One reason for this is to avoid experiencing the prejudice they have experienced in RL. *“It goes back to the fact that the people at the keyboard are still people. The environments, be they text or graphics, are more fluid, but the social dynamic still remains.”* (Ahroun Wolf).

#### **4.5 Reflection on and Appraisal of Self**

When novice users are asked if they felt they had really done the activities they engaged within SL, the answers varied. Solvita Silka stated she did not experience that she, as a physical being, had done any of the activities in SL, but pointed out the enjoyment she felt when she had been diving or playing football. Others in the same group stated clearly that they had really engaged in the activities they had pursued in SL. Pevit Torana highlighted the hikes and the beautiful scenery he had experienced. At the same time, the novice users reported that they did not feel a close connection to their avatars. The avatar is just a virtual object they control, nothing more. However, the feeling of doing activities together as a group was noted to be a positive experience for the whole group.

The experienced users of SL differed from the novice users when reflecting and appraising self. They indicated that the virtual reality is something they immerse into with heart and soul. The connection with their avatar is strong enough that they expressed fear of losing it or it being changed without their consent. Kalnika Gublic explained: *“Her face went black once, I freaked out.”* When asked if they felt present in the virtual world when in-world, their unanimous answer was yes. They explained the virtual world is very immersive and the physical world fades into the background. Sunger Alista said: *“I've had meaningful and deep conversations with folks whom I never would have met, ever, in RL.”* Sunger Alista, who is hearing impaired, uses text chat when communicating with others in the virtual world which illustrates that rich communication in SL is not dependent on voice interactions.

## **5 Discussion**

Schultze (2010) noted the paradox of the relationship between technology and the physical body. She presented the notion of the physical body having an inherent limitation in that it is situated and therefore it is possible to be present at only one location at a time; however, using technology, it is possible to experience presence in multiple locations with the help of an avatar, a virtual self. The virtual body, avatar, promises the user the affordance of a “real” body in the virtual world, which may deliver the same information to our surroundings as at provided by the physical body. Through this study, using the lens of Embodied Social Presence theory, we have explored how people with lifelong disability relate to their virtual self and how they experience interactions with others in the virtual world.



When entering Second Life, the recognition of others is almost instantaneous. Almost everywhere you go there are other avatars present. The representation of other is without effort, and is perceived as a being, a mediated other in the virtual environment (Biocca and Harms, 2002). The notion of not being alone was discussed by both the experienced and novice users in this study. Although the experienced users described a stronger connection towards others than the novice users, the novice users also spoke about the presence of avatars in their surroundings.

The recognition of digital self was presented by both groups that participated in this study. However, the experienced users expressed a stronger connection to their avatar than the novice users who only accessed SL for eight weeks. This finding is similar to a results from study by Bailenson et al. (2001) who found that people who had a short relationship with their avatar did not feel any connection with the virtual representation. Wolfendale (2007) concluded that the relationship between human and avatar must be taken seriously, which was supported by the comments from the experienced participants.

Although the novice participants demonstrated limited recognition of the digital self, they participated in collaborative engagement during their time in SL. When communicating with others outside the group, they were more reserved and cautious. Schultze (2010) explained co-presence as virtual togetherness, where avatars share a virtual environment and socially share experiences. The novice participants attempted to take advantage of this co-presence, but because of their limited recognition of digital self and others, were not able to utilize this opportunity to its full extent. The experienced participants however, emphasized the social and collaborative aspects of SL, which are for many, the main reason they engage in SL. They stated that connection with others is important and the opportunity to engage in collaborative activities with people from all over the world is valuable. They demonstrated that they recognized the real other behind other avatars, which did not appear to be so clear for the novice participants,

Appraisal of the “real” other was explained by Mennecke et al. (2010) as an understanding that the other is an individual. As discussed above, the novice participants did not give any indication that a real human was behind the avatars that they met outside their group. A possible explanation for this phenomenon may be that four of the novice participants have an intellectual disability and all experienced language barriers within SL. However, the experienced participants stressed the importance of being aware of the human behind the avatar when meeting both friends and strangers in SL. Furthermore, they were aware and prepared for encountering the same prejudices in the virtual world as they encounter in RL. Schultze (2010) stated that all positive and negative encounters in the RL will also be present in the virtual world because all avatars are controlled by humans. The experienced participants also noted the possibility of creating close and trusting friendships or relationships with others in SL, but emphasized that this may take time.

The final stage in the ESP framework of Mennecke et al. (2010) is Appraisal of the Self, and refers to the perception of self-engaged in interaction and activities with others in the virtual world. The novice participants were not clear when questioned about this. Some felt that they had actually engaged in the activities themselves, while others did not indicate this. However, with the previous stages of ESP in mind, when the participants do not experience the recognition of self in their digital self, it is not surprising that they did not experience being immersed in the virtual world. On the other hand, the experienced participants described how they are immersed in the virtual world and experience their activities in-world as real as any activity in RL.

Most of the participants in this study do not display their disability in SL. SL enables people with disability to disclose whatever they feel comfortable with as discussed by Stewart et al. (2010). Agonra Sircka chooses to be represented in the virtual world by an avatar using a wheelchair, because he feels this makes it easier for others with disability to initiate contact. Stewart et al. (2010) presented a different view; the possibility to create an avatar visibly able, may give the opportunity for others to get to know the person behind the disability. Whereas Agonra Sircka perceives the wheelchair to be part of his personality and an ice breaker for interaction with other users with

disability in SL, others perceive the possibility to present themselves as avatars with no disability as a free haven where people get to know them, and look beyond the disability. This particular affordance offered by the virtual world, the embodiment, may prove to be an important issue for people with disability wishing to explore and express their personality.

## 6 Conclusion

Through this study we have used the lens of Embodied Social Presence theory to explore how people with lifelong disability relate to their virtual self and how they experience interactions with others in a virtual world. We have examined data collected from 11 novice and experienced users of the virtual world Second Life. The findings indicate that people with lifelong disability can develop a strong relationship with their avatar; however this relationship takes time to develop. The novice participants did not show the same strong relationship to their avatars after eight weeks in SL as the experienced participants who have been using SL for a year or more. Relationships and friendships with others may also require time to develop, and also the understanding that another human is represented by the avatar with whom it is possible to interact and communicate. The possibility of creating an avatar with no visible disability is an important affordance of the virtual world for some people with disability. Through this affordance, people with disability can present themselves so that some of the prejudices encountered in the real world are avoided. This exploratory study demonstrates how Embodied Social Presence Theory is useful for explaining the importance of embodiment and presence in a virtual world. Further, our focus on the experiences of users with lifelong disability contributes by extending the use of this theory to a different setting than reported in former research on ESP by Mennecke et al. (2011).

A limitation of this study is the number of participants in each of the two groups. However, since this is an exploratory study it is a starting point for further research in this area. It would be valuable to examine the development of Embodied Social Presence through longitudinal studies. As we have also shown, people with disability experience various levels of ESP depending on their user experience with the virtual world, but the study does not answer how much time is required to fully experience ESP. Mennecke et al. (2011) stated that individuals who experience ESP also experience greater value when engaging in activities and social contexts in virtual worlds. We observed and interviewed people with lifelong disability currently using SL during this study, yet it might be useful in future research to include people with lifelong disability who have used but no longer use SL. This might help develop an understanding about why some people with lifelong disability choose not to continue using SL. In addition, future research might examine the possibilities and challenges virtual worlds offer people with disability.

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