The 8th International Conference on Disability, Virtual Reality and Associated Technologies

31 August - 2 September 2010
Viña del Mar / Valparaíso, Chile

Book of Abstracts & CD Proceedings

Edited by

Paul Sharkey, Jaime Sánchez

The 8th International Conference on

Disability, Virtual Reality and Associated Technologies

Proceedings

Edited by:

Paul Sharkey
Jaime Sánchez

31 August to 2 September, 2010

Viña del Mar / Valparaíso, Chile

AN INTERNATIONAL SOCIETY FOR VIRTUAL REHABILITATION CONFERENCE

ICDVRAT 2010

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Conference Schedule at a Glance

Tuesday, 30 August, 2010

08:30	Registration opens from 08:30
09:10	Welcome
09:20 – 11:00	Session I: Navigation & Motion
11:00	Coffee
11:30 – 12:45	Session II: Visual Impairment
12:45	Lunch
14:20 – 16:00	Session III: Brain Injury & Memory Training
16:00	Coffee
16:30 – 17:45	Session IV: Virtual Environments Design & Analysis
19:00	Reception

Wednesday, 1 September, 2010

09:00 – 11:00	Session V: Upper Limb & Hand Rehabilitation
11:00	Coffee
11:30 – 13:10	Session VI: ArtAbilitation
13:10	Lunch
14:30 – 16:10	Session VII: Games for Rehabilitation
16:10	Coffee
16:40 – 18:00	Session VIII: Poster & Breakout Session
19:00	Banquet

Thursday, 2 September, 2010

09:00 – 11:00	Session IX: Balance & Gait
11:00	Coffee
11:30 – 11:00	Session X: Speech & Audio
12:30	Lunch
14:00	Conference Closed

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Proc. 8th Intl Conf. Disability, Virtual Reality & Associated Technologies
Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010
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Contents

Abstracts & Information on Viña del Mar/Valparaíso

xv *Viña del Mar, Valparaíso*, **J Sánchez**, University of Chile, CHILE

xvii *Abstracts from all papers*

liii *Author index*

Session I Navigation & Motion
Session Chair: Jaime Sánchez

1 *Exploring the intelligent agents for controlling user navigation in 3D games for cognitive stimulation*, **R M E M Costa**, **D S Souza**, **I Mendonça**, Universidade do Estado do Rio de Janeiro, BRAZIL

7 *Assessing navigation in real and virtual environments: a validation study*, **S T Koenig**, **G P Crucian**, **J C Dalrymple-Alford**, **A Dünser**, University of Canterbury, NEW ZEALAND

17 *Wearable device to assist independent living*, **R J McCrindle**, **V M Williams**, **C R Victor**, **A P Harvey**, **S R Nyman**, **J Barrett**, **H Hogarth**, **P Levene**, **R Smith**, **P Panek**, **G Edelmayer**, **P Mayer**, **P Needham**, **N Floratos**, University of Reading/Brunel University/ Bournemouth University/Docobo Limited, UK, Technical University of Vienna, AUSTRIA and e-ISOTIS, GREECE

27 *Designing a workplace for workers with motion disability with a computer simulation and virtual reality techniques*, **P Budziszewski**, **A Grabowski**, **T Tokarski**, **M Dzwiarek**, **B Kurkus-Rozowska**, **J Jankowski**, Central Institute for Labour Protection – National Research Institute, POLAND

Session II Visual Impairment
Session Chair: Mauricio Sáenz

33 *Listening to complexity: blind people's learning about gas particles through a sonified model*, **O Lahav**, **S T Levy**, Tel-Aviv University/University of Haifa, ISRAEL

41 *Using augmented reality to support the understanding of three-dimensional concepts by blind people*, **C Kirner**, **T G Kirner**, **R S Wataya**, **J A Valente**, Federal University of Itajuba/Adventist University of Sao Paulo/State University of Campinas, BRAZIL

51 *Visual tracking and audio-based interfaces for the navigation of people who are blind*, **J Sánchez**, **A Tadres**, University of Chile, CHILE

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Session III Brain Injury & Memory Training
Session Chair: Pawel Budziszewski

61 *PiTaSu: a wearable interface for assisting senior citizens with memory problems*, **T Kuroda**, **G Yamamoto**, **D Yoshitake**, **S Hickey**, **J Hyry**, **K Chihara**, **P Pulli**, Kyoto University Hospital/Okayama University/Nara Institute of Science and Technology, JAPAN and University of Oulu, FINLAND

71 *Designing an ecological virtual task in the context of executive functions: preliminary study*, **X Cao**, **A-S Douguet**, **P Fuchs**, **E Klinger**, Arts et Métiers Paristech/Kerpape Rehabilitation Center/MINES ParisTech, FRANCE

79 *Traumatic brain injury memory training: a virtual reality online solution*, **P Gamito**, **J Oliveira**, **J Pacheco**, **D Morais**, **T Saraiva**, **R Lacerda**, **A Baptista**, **N Santos**, **F Soares**, **L Gamito**, **P Rosa**, Universidade Lusófona de Humanidades e Tecnologias/Centro de Medicina de Reabilitação de Alcoitão/Clínica São João de Deus/Centro de Investigação Social/Instituto Universitário de Lisboa, PORTUGAL

85 *Impact of the physical field of view on the performance in a purchasing task in the VAP-S for patients with brain injury*, **H Cherni**, **A Kadri**, **A Tarruella**, **P-A Joseph**, **E Klinger**, Arts Métiers Paristech/Université Victor Segalen de Bordeaux, FRANCE

Session IV Virtual Environments: Design & Analysis
Session Chair: Sebastian Koenig

93 *Participatory design with children with autism: the development of collaborative virtual environments*, **L Millen**, **S V Cobb**, **H Patel**, University of Nottingham, UK

103 *Post traumatic stress disorder treatment with virtual reality exposure for criminal violence: a case study in assault with violence*, **A De la Rosa-Gómez**, **G Cárdenas-López**, Universidad Nacional Autónoma de México, MÉXICO

109 *Vital signs: quantitative measurement for phobias treatment with virtual reality*, **M Plaza Torres**, Universidad Libre de Colombia, COLUMBIA

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Session V Upper Limb & Hand Rehabilitation
Session Chair: Sarah Kruger

115 *Stroke rehabilitation using m-Health Care and 3D virtual environments – work in progress*, **J Broeren**, **L Pareto**, **B Johansson**, **C Ljungberg**, **M Rydmark**, Trollhättan/Uddevalla NU-Hospital Organization, SWEDEN

123 *Simple camera tracking virtual reality system for evaluation of wrist range of motion*, **D Shefer Eini**, **N Ratzon**, **A A Rizzo**, **S-C Yeh**, **B S Lange**, **B Yafa**, **A Dietz**, **P L Weiss**, **R Kizony**, Tel-Aviv University/Chaim Sheba Medical Center at Tel Hashomer/University of Haifa/Ono Academic College, ISRAEL and University of Southern California, USA

131 *Integrated arm and hand training using adaptive robotics and virtual reality simulations*, **A S Merians**, **G G Fluet**, **Q Qiu**, **S Saleh**, **I Lafond**, **S V Adamovich**, University of Medicine and Dentistry of New Jersey, USA

139 *Study to evaluate a low cost virtual reality system for home based rehabilitation of the upper limb following stroke*, **P J Standen**, **D J Brown**, **S Battersby**, **M Walker**, **L Connell**, **A Richardson**, University of Nottingham/ Nottingham Trent University/Erewash Community Occupational Therapy Service, UK

147 *Remote monitoring and quantification of upper limb and hand function in chronic disability conditions*, **S H Brown**, **J Langan**, **K L Kern**, **E A Hurvitz**, University of Michigan, USA

Session VI ArtAbilitation
Session Chair: Paul Sharkey

157 *Light Arrays: a system for extended engagement*, **D Wilde**, **A Cassinelli**, **A Zerroug**, **R J N Helmer**, **M Ishikawa**, Tokyo University, JAPAN and Monash University/ Commonwealth Scientific and Industrial Research Organisation, AUSTRALIA

165 *Warrior's Journey – a path to healing through narrative exploration*, **J F Morie**, **K Haynes**, **E Chance**, University of Southern California, USA

175 *Extending body & imagination: moving to move*, **D Wilde**, **R J N Helmer**, **M Miles**, Tokyo University, JAPAN and Monash University/ Commonwealth Scientific and Industrial Research Organisation, AUSTRALIA

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Session VII Games for Rehabilitation
Session Chair: Susan Brown

185 *Games for rehabilitation: the voice of the players*, **S M Flynn**, **B S Lange**, Blue Marble Game Co./University of Southern California, USA

195 *Designing engaging, playable games for rehabilitation*, **J W Burke**, **M D J McNeill**, **D K Charles**, **P J Morrow**, **J H Crosbie**, **S M McDonough**, University of Ulster, UK

203 *Designing studies for requirements and modelling of users for an accessible set-top box*, **P Langdon**, **M F Gonzalez**, **P Biswas**, University of Cambridge, UK

213 *SimCoach: an intelligent virtual human system for providing healthcare information and support*, **A A Rizzo**, **B S Lange**, **J G Buckwalter**, **E Forbell**, **J Kim**, **K Sagae**, **J Williams**, **J Difede**, **B O Rothbaum**, **G Reger**, **T Parsons**, **P Kenny**, University of Southern California/Cornell University/Emory University, USA

Session VIII Balance & Gait
Session Chair: Sheryl Flynn

223 *Development of an interactive stepping game to reduce falls in the elderly*, **B S Lange**, **S M Flynn**, **C Y Chang**, **W Liang**, **C L Chieng**, **Y Si**, **C Nanavati**, **A A Rizzo**, University of Southern California, USA

229 *Virtual reality approach to gait training in service members with lower extremity amputations*, **S E Kruger**, Walter Reed Army Medical Center, USA

235 *Continuation of balance training for stroke subjects in home environment using virtual reality*, **I Cikajlo**, **M Rudolf**, **N Goljar**, **Z Matjacic**, University Rehabilitation Institute, SLOVENIA

241 *Audio-visual biofeedback system for postural control*, **M Milosevic**, **K M V McConville**, Ryerson University, CANADA

249 *Development of an interactive rehabilitation game using the Nintendo® WiiFit™ Balance Board for people with neurological injury*, **B S Lange**, **S M Flynn**, **C Y Chang**, **A Ahmed**, **Y Geng**, **K Utsav**, **M Xu**, **D Seok**, **S Cheng**, **A A Rizzo**, University of Southern California, USA

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Session IX Speech & Audio
Session Chair: Orly Lahav

255 *Development of a voice-based rhythm game for training speech motor skills of children with speech motor disorders*, **D Umanski**, **D Kogovšek**, **M Ozbič**, **N O Schiller**, Leiden University, THE NETHERLANDS and University of Ljubljana, SLOVENIA

263 *Robotic vocalization training system for the auditory-impaired*, **M Kitani**, **T Hara**, **H Hanada**, **H Sawada**, Kagawa University, JAPAN

273 *Automatic speech recognition for assistive technology devices*, **A P Harvey**, **R J McCrindle**, **K Lundqvist**, **P Parslow**, University of Reading, UK

283 *Basic study toward automatic generation of glove-type command input device with optimal number of sensors*, **Y Tabata**, **T Kuroda**, **K Okamoto**, Kyoto College of Medical Science/Kyoto University Hospital, JAPAN

Posters Poster Session

291 *Virtual environments for exposure in obsessive-compulsive disorder*, **G Cárdenas-López**, **S Muñoz**, Universidad Nacional Autónoma de México, MÉXICO

295 *Integrative approach for designing collaborative technologies for social competence training in children with autism spectrum conditions*, **S V Cobb**, **L Millen**, **T Glover**, **S Parsons**, **S Garib-Penna**, **P L Weiss**, **E Gal**, **N Bauminger**, **S Eden**, **M Zancanaro**, **L Giusti**, University of Nottingham/University of Birmingham, UK and University of Haifa, Bar Ilan University, ISRAEL

299 *Videogame for improving orientation and mobility in blind children*, **J Sánchez**, **J P Rodríguez**, Universidad de Chile, CHILE

303 Author Index

Internet address references within the papers presented in this volume were accessed and checked to be valid during the week 1–8 July 2010.

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Introduction

The purpose of the 8th International Conference on Disability, Virtual Reality and Associated Technologies (ICDVRAT 2010) is to provide a forum for international experts, researchers and user groups to present and review how advances in the general area of Virtual Reality can be used to assist people with Disability.

After a peer review process, the International Programme Committee selected 35 full papers for presentation at the conference, collected into 9 plenary sessions: ArtAbilitation; Balance & Gait; Brain Injury & Memory Training; Games for Rehabilitation; Navigation & Motion; Speech & Audio; Upper Limb & Hand Rehabilitation; Virtual Environments: Design & Analysis; Visual Impairment. There will be an additional Poster Session with 3 poster presentations. The conference will be held over three days between the 31st August and 2nd September at the Hotel San Martín, Viña del Mar, Chile.

ICDVRAT is now in its 14th year, with biennial conferences in the series previously held in Maidenhead, UK (1996), Skövde, Sweden (1998), Alghero, Sardinia, Italy (2000), Veszprém, Hungary (2002), Oxford, UK (2004), Esbjerg, Denmark (2006) and Maia & Porto, Portugal.

In 2006 and 2008, ICDVRAT was held in conjunction with ArtAbilitation, in 2006 as a parallel conference and in 2008 as an integrated plenary conference, the latter having three sessions spanning ArtAbilitation, Helping through Music and Interpretations. It was envisaged that ArtAbilitation could remain integrated with ICDVRAT in 2010. However, there were insufficient submissions to enable this, though ArtAbilitation remains as one of the sessions in this conference. In future years, ArtAbilitation and ICDVRAT will return to being separate conferences, though papers in this area will still remain welcome at future ICDVRAT events.

Abstracts from this conference and full papers from the previous conferences are available online from the conference web site *www.icdvrat.reading.ac.uk*. We are also pleased to be able to provide the complete ICDVRAT archive on CD-ROM with this volume.

Acknowledgements

The Conference Chairs would like to thank the Programme Committee, for their input regarding the conference format and focus, and for their commitment to the review process, as well as the authors of all the papers submitted to the conference, the Organization Committee, Conference Sponsors, and the students who help out over the period of the conference.

We would like to take this opportunity to thanks Tony Brooks for his invaluable support for hosting both conferences in Esbjerg, and his contributions to the subsequent two meetings.

On behalf of ICDVRAT 2010, we welcome all delegates to the Conference and sincerely hope that delegates find the conference to be of great interest.

Jaime Sánchez and Paul Sharkey

Tháinig Long ó Valparaíso

Pádraig de Brún, 1889-1960

Tháinig long ó Valparaíso
Scaoileadh téad a seol sa chuan
Chuir a hainm dom i gcuimhne
Ríocht na Gréine, Tír na mBua.

"Gluais," ar sí, "ar thuras fada
Liom ó scamall is ó cheo
Tá fé shleasaibh gorm Andes
Cathair scáfar, glé mar sheod."

Bhíos óg is ní imeoinnse
Am an dóchais, tus mo shaoil
Chreideas fós go raibh i ndán dom
Iontaisí na ndán 's na scéal.

Ghluais an long thar lintibh mara
Fad ó shin is a crann mar ór
Scríobh a scéal ar phár na hoíche
Ard i rian na réaltean mór.

Fillfidh sí aris chugam áfach
Chífead cathair bhán fén sléibh
Le hais mara na síochána
Creidim fós beagnach, a Dhé.

Original in Gaelic,
the old tongue of Ireland

There came a ship from Valparaíso
Slackened sail ropes in the bay
Her name evoked an image of
A sunlit kingdom, a land of wonders.

"Come ," she said, "away with me"
"Away from cloud and from the mist
There you'll find, beneath the blue Andes,
An awesome city, shining like a gem."

But I was young and would not travel
My time of hope, my life beginning;
My destiny lay, I still believed,
In poems and stories yet to unfold.

The ship sailed over the sea's horizon
Far from me, its mast like gold
She wrote her story on the parchment
High amidst the great stars that night.

She will return to me, however
The white mountain city, I'll still perceive
Beside that ocean of peace
I shall yet be, if I believe.

English translation:
John Brendan Sharkey

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Viña del Mar / Valparaíso, Chile

Jaime Sánchez

Universidad de Chile, CHILE

Founded as a seaside resort for the upper class, Viña del Mar emerged from the division of the "La Viña del Mar" hacienda of Dolores Perez. Her daughter and sole heiress, Mercedes Alvarez, married the businessman and politician José Francisco Vergara, who created a plan that would give birth to this coastal city. Shortly after the plan was passed in 1874, the Municipality of Viña del Mar was created.

Currently, Viña del Mar is recognized as the Tourism Capital of Chile, and as a "Garden City" due to the fact that it is surrounded by large swaths of green areas. The city has 13 beaches (approximately 3.5 kilometers), the most important of which is located in Reñaca, the city's main beach, which has a life of its own and includes all the installations and infrastructure necessary to receive a large number of tourists. It has a very unique architecture, with beautiful residential neighborhoods complete with chalets surrounded by beautiful gardens and a number of modern high-rises, most of which are located on the beachfront. In walking through its streets, and as a testimony to the golden age of Viña del Mar, one can find palaces and antique buildings that date back to the beginning of the 20th century.

Neighboring the Garden City is Valparaíso, one of the oldest cities in Chile. Its origins date back to 1536, and in its position as the main port of the kingdom, it played a determining role in the process of national emancipation. It is the headquarters of the nation's Legislative Branch, and the declared capital of the country's cultural institutionality, housing the regional government as well as the base of the Chilean Navy.

The urban configuration of Valparaíso is determined by its local topography, which is dominated by 44 hills that form a natural amphitheatre with a view of the ocean that merges with the sky. The streets at the foot of the hills, the thin alleyways, the stairs, lookouts, the houses hanging out over the abyss and that seem to be within arms' reach of the passengers riding the age-old elevators, the rocky sea-swept crevices, are all traits of a city that admires itself from the hill tops.

Getting to Know the City

In beginning a walk down San Martin Boulevard, one can find the Viña del Mar Casino, which was inaugurated on December 31st of 1930. Today the Municipal Casino is a symbol of the garden city, and is considered to be one of the most complete and modern casinos in the world, with cabaret shows in which several top artists have performed. The main aesthetic attraction, in addition to its refined architecture, is that it possesses a privileged ocean-side view. In continuing down San Martín Avenue, one can find the most famous restaurants and pubs in the city. During the day, an excellent panorama is to dine in one of the many fine restaurants in the area, accompanied by a delicious Chilean wine. When the night falls, San Martín Avenue becomes a bustling center of activity and bohemia.

Another important area of the city is Valparaíso Street, known as "The Heart of Viña". This is an open air shopping market, with restaurants, hotels and traditional spots of the Garden City. It is the main street, and a common meeting point at which the art, culture and commerce of this young city are combined. It is also the civic and financial neighborhood of Viña del Mar. At any of the commercial galleries on Valparaíso Street, one can find bookshops, clothing and sports stores, and fine jewelry. On Valparaíso Street it is normal to see street performances by musicians and artists, cartoonists and portrait artists, which makes for a rather nice family walk.

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At the end of Valparaíso Street is the Plaza Vergara, where the famous Victorian Carriages can be found. For more than 120 years, the people of Viña del Mar and tourists have taken rides in these carriages, and this has become a traditional ride through the city. These elegant horse-drawn carriages date back to the years in which Viña was founded. In addition to the Plaza Vergara, there are three points in the city at which one can walk through the traditional areas of Viña del Mar, and feel as if in Victorian England.

In order to get to know the coastal area of the city, it is an excellent idea to walk down San Martin Avenue towards Las Salinas, to sit on any of the beautiful beaches in this area, sun tanning or enjoying the sunset and the waves. In the year 2000 the open air Naval Canon Museum was inaugurated, where some of the retired pieces of Chilean Navy artillery are exhibited. Some of these canons were used on ships that fought in the War of the Pacific and the Second World War.

History through Buildings

The Quinta Vergara is one of the most beautiful parks in the region. In this park one can find the Vergara Palace, which was built by Madame Blanca Vergara de Errázuriz. Work on the palace, which is predominantly Venetian in style, began in 1906 and it was finished in 1910 under the watchful eye of the architect Ettore Petri. Today the Palace is the home of the Museum of Fine Arts. Also within the confines of the palace there is an amphitheatre, which has been renovated and which receives thousands of visitors every February for the International Music Festival of Viña del Mar, the most prestigious music award ceremony in Latin America.

The Wulff Castle, originally owned by Gustavo Wulff, a German merchant who arrived to Chile in 1881, was built in 1906 in the German-French style, and is based in stone. Afterwards in 1920, a large tower was added as well as an English-style wing. Upon the death of Mr. Wulff in 1946, the castle was passed on to Esperanza Artaza Matta. She had the Castle remodeled into its current form.

In 1906 Mr. Fernando Rioja, a wealthy Spanish banker from Valparaíso, purchased 40,000 square meters within Viña del Mar and had the architect Alredo Azancot build his residence. Known today as the Rioja Palace, it is noted for its salon-like grandeur, the large dining room and the Imperial Hall. As such, the musical lodge with its two interior balconies, the Boulles salon, the pink room, the blue room and the library are all exceptional aspects of this building. This exuberant display is representative of the era of the "Belle Époque" that the wealthy class of Viña del Mar experienced at around 1910. Mr. Fernando Rioja passed away in 1922. His family inhabited the mansion until the death of Madame Sara Ruiz, Rioja's widow, in 1950. In consideration of the palace's cultural and aesthetic value, it is currently a museum in which finely finished furnishings in the Baroque, Imperial, Rococo and Chesterfield styles, brought over from Spain and France, are exhibited within its lavish halls.

The Municipal Theatre, inaugurated on October 11th of 1930, makes up part of the cultural and artistic history of the garden city. Its beautiful and imposing structure is in the classical style, consistent with Corinthian Greco-Roman simplicity, but with an elegance that begins at the entryway, which includes staircases that highlight the facade. Numerous celebrities have performed on its stage, as well as a large number of ballet companies, operas and wide-ranging performances in the world of the performing arts.

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Session I:
Navigation & Motion

Exploring intelligent agents for controlling user navigation in 3D games for cognitive stimulation

R M E M Costa, D S Souza, I Mendonça

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20550-013 – Rio de Janeiro, BRAZIL

ABSTRACT

Despite the many research efforts addressing the development of environments for Virtual Rehabilitation processes, only few of them consider a modeling step before system implementation. Our previous experience in developing virtual environments for stimulating cognitive functions stresses the necessity of adopting some Software Engineering practices. These open new possibilities to extend or integrate the system with others applications. The objective of this paper is to introduce some technical aspects related to modeling and implementing a multi-agent game for training memory and attention. We explore the integration of multi-agent model methodologies and present initial results of an experiment made with two specific languages for building three-dimensional virtual environments.

(a) *(b)*

Figure 1. *Image of the facade of the house (a) and the entrance of the kitchen and the agent (b).*

R M E M Costa, D S Souza, I Mendonça, Exploring the intelligent agents for controlling user navigation in 3D games for cognitive stimulation, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 1–6, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Session I:
Navigation & Motion

Assessing navigation in real and virtual environments: a validation study

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ABSTRACT

For navigation ability, a transfer of knowledge from virtual training environments to real-world scenarios has been shown in several studies in the past. The purpose of this investigation is to demonstrate the equivalence of a series of navigation tasks in complex real-world and virtual buildings. Instead of testing knowledge transfer in very simple environments, identical tasks are performed in either version of a complex building. 29 participants are shown twelve landmarks, followed by a battery of tasks which are carried out in the real building by half of the participants, whereas the other half performs identical tasks in a virtual model of the same environment. No significant differences or effects were found, but due to the multifaceted nature of the gathered data and large variability within groups, overlap of both groups' distributions was minimal. To discover the underlying factors of this variability, further research is needed. Usability and future development of virtual environments are discussed.

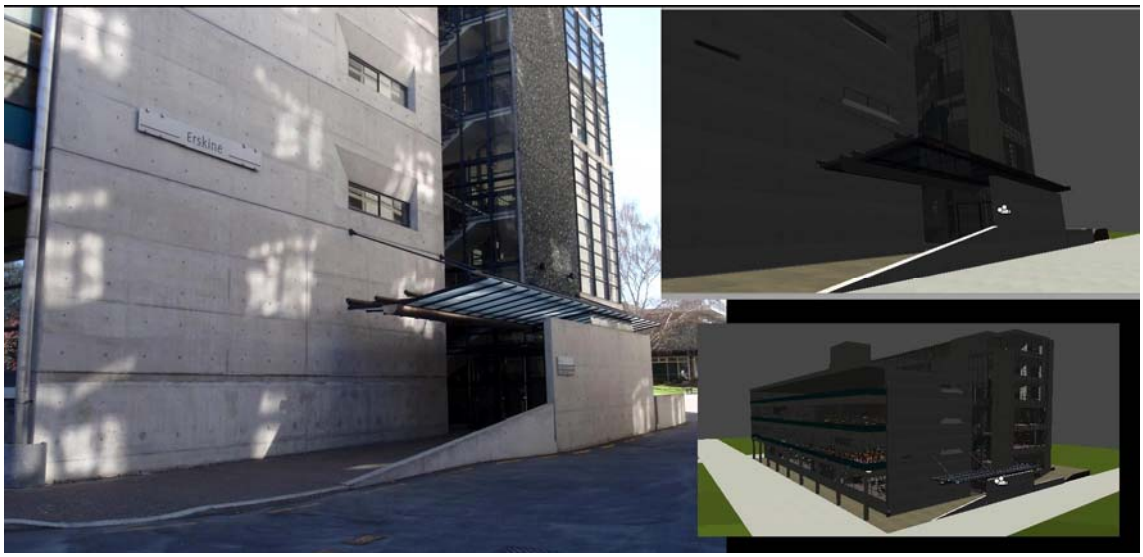

Figure 2. *Erskine Building (side entrance), real building and virtual counterpart rendered in Unity Game*

S T Koenig, G P Crucian, J C Dalrymple-Alford, A Dünser, Assessing navigation in real and virtual environments: a validation study, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 7−16, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Session I:
Navigation & Motion

Wearable device to assist independent living

R J McCrindle[1], V M Williams[2], C R Victor[3], A P Harvey[4], S R Nyman[5], J Barrett[6], H Hogarth[7], P Levene[8], R Smith[9], P Panek[10], G Edelmayer[11], P Mayer[12], P Needham[13], N Floratos[14]

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[2,3]School of Health Sciences and Social Care, Brunel University, Kingston Lane, Uxbridge, Middlesex, UK

[5]School of Design, Engineering and Computing, Bournemouth University, Dorset, UK
[8,9]Docobo Limited, 21 High Street, Bookham, Surrey, UK

[10,11,12]Fortec, Technical University of Vienna, A-1040 Favoritenstrasse, Vienna, AUSTRIA

[13]Cardionetics Limited, Grenville Place, Bracknell, Berkshire, UK

[14]e-ISOTIS, 40 Klitaimnistras, Athens, GREECE

ABSTRACT

Older people increasingly want to remain living independently in their own homes. The aim of the ENABLE project is to develop a wearable device that can be used both within and outside of the home to support older people in their daily lives and which can monitor their health status, detect potential problems, provide activity reminders and offer communication and alarm services. In order to determine the specifications and functionality required for development of the device user surveys and focus groups were undertaken and use case analysis and scenario modeling carried out. The project has resulted in the development of a wrist worn device and mobile phone combination that can support and assist older and vulnerable wearers with a range of activities and services both inside and outside of their homes. The device is currently undergoing pilot trials in five European countries. The aim of this paper is to describe the ENABLE device, its features and services, and the infrastructure within which it operates.

Figure 1. *PPT1 Concept A*

Figure 2. *PPT1 Concept B*

Figure 3. *PPT1 Concept C*

R J McCrindle, V M Williams, C R Victor, A P Harvey, S R Nyman, J Barrett, H Hogarth, P Levene, R Smith, P Panek, G Edelmayer, P Mayer, P Needham, N Floratos, Automatic speech recognition for assistive technology devices, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 17–26, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Designing a workplace for workers with motion disability with computer simulation and virtual reality techniques

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B Kurkus-Rozowska, J Jankowski

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ABSTRACT

This paper describes preliminary results of a project aimed at adapting workplaces for workers with motion disability with computer simulation and virtual reality techniques. For this task, special software called the Troll and a computer human model with a visualization of maximal arm reach and preferred working space were developed. The Troll can be used to create a virtual working space, to adjust the human model's measurements and constraints to reflect a disabled person, and to analyze necessary modifications. The Troll also makes it possible to conduct research in an immersive virtual reality environment to assess a modified workplace and, if necessary, add further modifications.

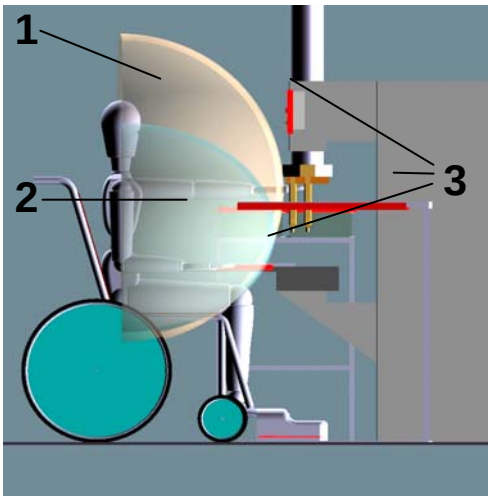

Figure 1. *Computer model of a person in a wheelchair with a visualization of maximal arm reach (1), preferred working space (2) and accessible working areas of the workplace (3)*

P Budziszewski, A Grabowski, T Tokarski, M Dzwiarek, B Kurkus-Rozowska, J Jankowski, Designing a workplace for workers with motion disability with a computer simulation and virtual reality techniques, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 27−32, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Session II:
Visual Impairment

Listening to complexity: blind people's learning about gas particles through a sonified model

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ABSTRACT

Students who are blind have been integrated at public schools with sighted students. Because most of Science Education curriculum resources are based on visual representations such as diagrams, charts, models (real and digital), and exploration in science laboratories, students who are blind are lack in participating and collecting the information from first hand. The current research project is based on the assumption that the supply of appropriate information through compensatory sensory channels may contribute to science education performance. In the research system - Listen to complexity system the user is interacting with dynamic objects in a real life scenario.

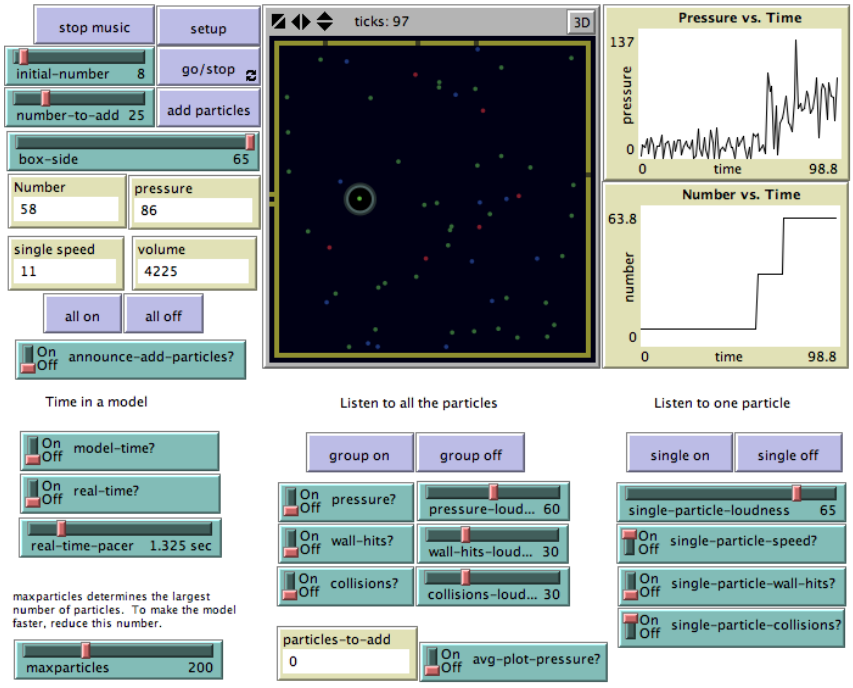

Figure 1. *User Interface.*

O Lahav, S T Levy, Listening to complexity: blind people's learning about gas particles through a sonified model, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 33–39, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Using augmented reality to support the understanding of three-dimensional concepts by blind people

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ABSTRACT

Seeing and describing real and imaginary three-dimensional scenes from the observer's viewpoint is an intuitive activity for non-impaired people, but it is difficult for congenitally blind people, once it involves abstract concepts for them, such as: perspective, depth planes, occlusion, etc. This paper discusses the problem related to understanding three-dimensional concepts by blind people and presents physical environments and procedures supported by an augmented reality tool in order to help blind people to understand, describe and convert three-dimensional scenes into two-dimensional embossed representations, like painting. To verify how the blind people can acquire those concepts, we developed an augmented reality application, working as an audio spatial tutor to make the perspective learning process easy. That application was tested with ten congenitally blind people, who understood the perspective concepts and made comments about the experience. Finally, we discuss the learning method and technical aspects, pointing out directions to improve the augmented reality application and ways to release it.

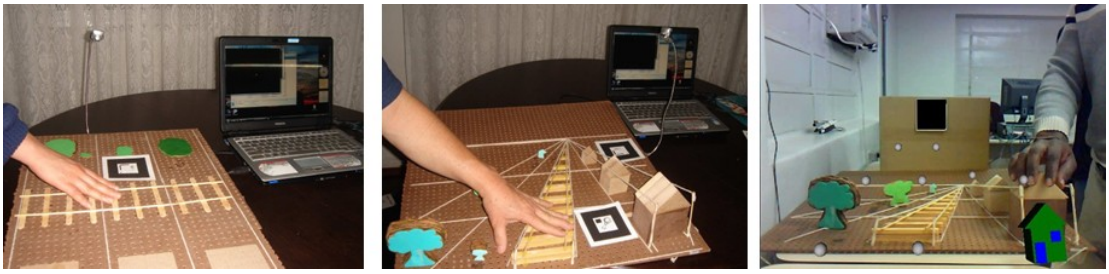

Figure 8. The *Audio Spatial Tutor in action.*

C Kirner, T G Kirner, R S Wataya, J A Valente, Using augmented reality to support the understanding of three-dimensional concepts by blind people, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 41–50, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Session II:
Visual Impairment

Augmented reality application for the navigation of people who are blind

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ABSTRACT

A person who is blind can be capable of locating objects and also other people, such as a sighted person, by just using audio cues. In this research we present the design, development and evaluation of ARTAB, a technological assistant for people who are blind that uses Augmented Reality to identify a set of objects in an indoor environment. As a result, we generated audio-based representations that allow a user to determine the position of an object relative to the angle of vision of the video capture device for navigation purposes. The usability testing performed allowed us to detect that it is not trivial to assign sound effects so that the variation of such effects would imply changes in the position of an object. The continual variation of the sound pitch does not generate the contrast necessary for the blind user to be able to obtain a certain kind of information. However, users generally perceive ARTAB as a useful tool for assisting orientation and mobility tasks.

Figure 4. *Users who are blind utilizing ARTAB. A) The user focuses on the object that he wants to ask about, using neck and body movements. B) One member of our research team, in his role as the facilitator, analyzes what the user perceives through the system.*

J Sánchez, A Tadres, Visual tracking and audio-based interfaces for the navigation of people who are blind, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 51–60, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

PiTaSu: a wearable interface for assisting senior citizens with memory problems

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ABSTRACT

Little research has been carried out on specialized wearable user interfaced designs to assist memory impaired senior citizens. This paper proposes and implements PiTaSu (Picture based Tapping on wall Surfaces) to realize direct user interface system to offer visual feedback and tactile feedback. PiTaSu is based on a pictorial based Augmented and Alternative Communication (AAC) system. PiTaSu consists of a body-worn or shoulder-attached mobile projector, a camera and an accelerometer wrist band. The projector shows information that will help assist the memory impaired senior citizen in their daily task. The camera and the accelerometer detect a tapping position and tapping trigger. Experimental results have demonstrated that a senior citizen can use PiTaSu without learning special skills, and the projection based user interface has potential. Therefore, PiTaSu can assist memory-impaired senior citizens as a daily task reminder.

(a) (b) (c) (d)

Figure 4. *Detect finger-tip pointing position from outlier image. (a) one of outliner images, (b) the result of labelling operation, (c) the outlier's edge, (d) finger-tip pointing position.*

T Kuroda, G Yamamoto, D Yoshitake, S Hickey, J Hyry, K Chihara, P Pulli, PiTaSu: a wearable interface for assisting senior citizens with memory problems, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 61–69, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Designing an ecological virtual task in the context of executive functions: a preliminary study

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[2]Kerpape Rehabilitation Center, Ploemeur, FRANCE

[3]MINES ParisTech, Paris, FRANCE

ABSTRACT

Brain damage is a major cause of disability that often leads to deficits in executive functions with dramatic consequences on activities of daily living. While rehabilitation approaches of the dysexecutive syndrome are still limited, virtual reality has shown its potential to propose innovative intervention strategies based on ecologically valid functional tasks. The Therapeutic Virtual Kitchen (TVK) was designed as an assessment tool to help therapists and their patients with brain injury. In the TVK, some ecological virtual tasks may be configured by the therapists for patients' assessment and rehabilitation. The purpose of this paper is to validate the feasibility of the TVK with healthy subjects and patients with brain injury in Kerpape Rehabilitation Center.

Figure 1. *Kerpape real kitchen (left) and the TVK (right).*

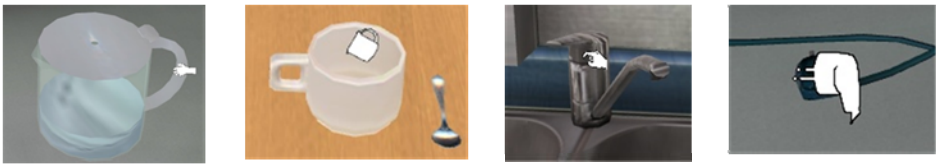

Figure 2. *Four mouse visual cues.*

X Cao, A-S Douguet, P Fuchs, E Klinger, Designing an ecological virtual task in the context of executive functions: preliminary study, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 71–77, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Traumatic brain injury memory training: a virtual reality online solution

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[2]Centre of Medical Rehabilitation of Alcoitão, Rua Conde Barão, Alcoitão, PORTUGAL

[3]Clinic of São João de Deus, Rua António Patrício, 29, Lisbon, PORTUGAL

[4]CIS, ISCTE/IUL, Avenida das Forças Armadas, Lisbon, PORTUGAL

ABSTRACT

This study aims at assessing an online portal where patients with traumatic brain injury (TBI) can carry on memory and attention exercises outside clinic premises. The training took place in a VR setup where one TBI patient had to complete a set of 10 online VR sessions. The neuropsychological evaluation was carried out with the PASAT (Paced Auditory Serial Addition Task) at pre, during and after treatment assessments. The results showed an increase in working memory and attention levels from the first to the final assessment, which can suggest that VR applications may promote the autonomy and increase in overall quality of life of these patients. The average time for task conclusion was of 5 minutes.

Figures 1-3. *Daily life activities; Working memory task; Visuo-spatial orientation task I.*

P Gamito, J Oliveira, J Pacheco, D Morais, T Saraiva, R Lacerda, A Baptista, N Santos, F Soares, L Gamito, P Rosa, Traumatic brain injury memory training: a virtual reality online solution, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 79–84, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Impact of the physical field of view on the performance in a purchasing task in the VAP-S for patients with brain injury

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[3,5]EA 4136, University of Bordeaux, FRANCE

[4]Kerpape Rehabilitation Center, FRANCE

ABSTRACT

In VR-based cognitive rehabilitation, there is a particular interest in subject's performance in the virtual tasks in which the patients are engaged. This performance is function of many factors among which the characteristics of visual information delivered by the virtual system. This study was designed to examine the impact of the physical field of view (PFOV) on the performance in a virtual task in the Virtual Action Planning Supermarket (VAP-S) among patients with brain injury and control subjects. Results show that, for all the participants, there is no significant difference between the main VAP-S variables in two experimental configurations (large FOV and small FOV), except for the number of incorrect actions that increases in the small FOV situation. We conclude in suggesting some explanations about the impact of the PFOV on patient use of the visual VAP-S information.

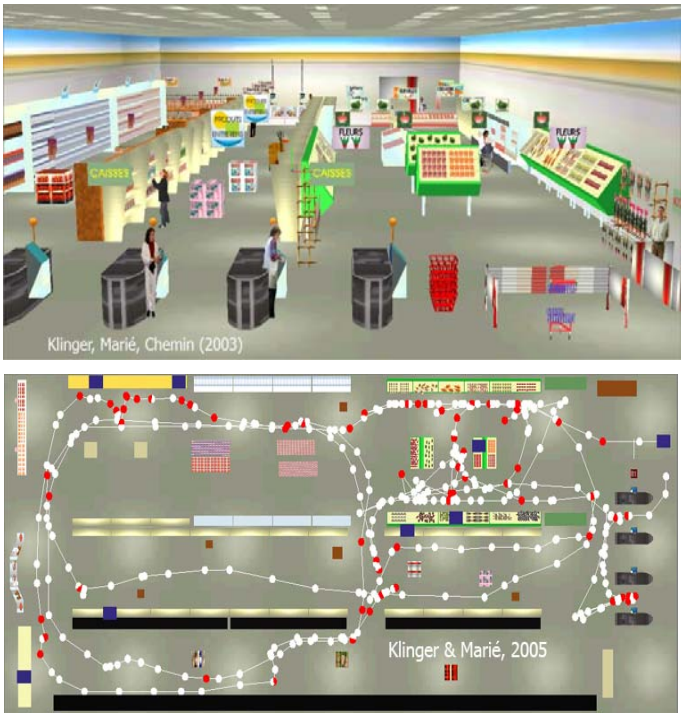

Figure 3. *The Virtual Action Planning Supermarket.*

H Cherni, A Kadri, A Tarruella, P-A Joseph, E Klinger, Impact of the physical field of view on the performance in a purchasing task in the VAP-S for patients with brain injury, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 85–91, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Participatory design with children with autism

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University Park, Nottingham, UK

ABSTRACT

The COSPATIAL (Communication and social participation: collaborative technologies for interaction and learning) project explores how we can develop effective and useful educational technologies in the form of shared active surfaces (SAS) and collaborative virtual environments (CVEs) to support the enhancement of social skills for children on the autism spectrum. The UK design team comprises technology developers, design engineers, educational psychologists as well as teachers from both mainstream and autism specialist schools. A user centred design approach is used to make decisions and review prototype development using CVE technology. The team is then involved in detailed specification of CVE scenarios and iterative review of prototypes. The involvement of teachers throughout the entire process is crucial, but in order to understand the primary user further and implement concepts optimally it is also desirable to involve the target end users directly in the design process. This paper describes the participatory design approach for elicitation of user requirements and CVE scenario design that is being used with typically developing children and how these methods have been adapted to facilitate involvement of children on the autism spectrum.

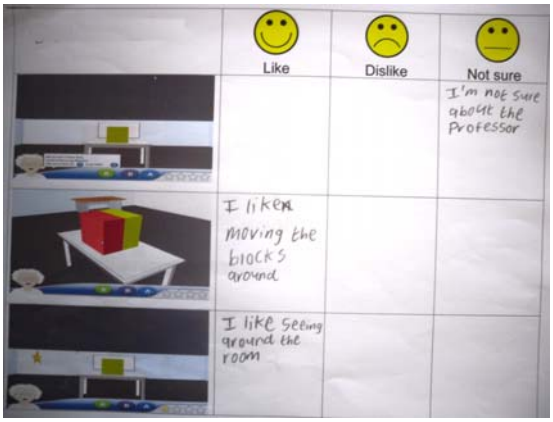

Figure 3. *Individual feedback worksheets used in prototype review with students with ASCs.*

L Millen, S V Cobb, H Patel, Participatory design with children with autism: the development of collaborative virtual environments, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 93–102, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Post-traumatic stress disorder treatment with virtual reality exposure for criminal violence: a case study in assault with violence

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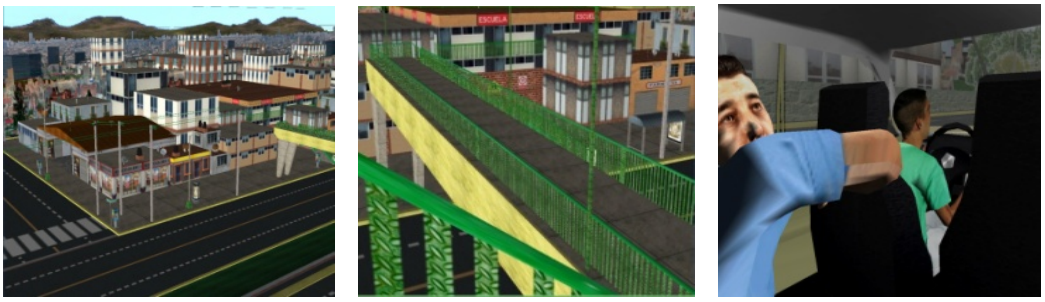
ABSTRACT

The criminal violence is attached with mental health problems as depression and substance use and abuse. However one of most important psychological problems linked with the victims of violence is post traumatic stress disorder (PSTD). In Mexico, according to the ENSI-5 in 2009, 11% (6,800/for each 100 thousands of habitants) of the population over 18 years, experienced a crime. One in four of the people victim of violence develops PSTD symptoms. Due to this socially relevant problem and based on the efficacy treatments, it is important to design treatments involving the use of Virtual Reality (VR), because it can help overcome some of the limitations of traditional therapy using exposure. The present paper expounds a case study of treatment program to PTSD in assault with violence.



Figures 2-4. *City view; Bridge view; Taxi view.*

A De la Rosa-Gómez, G Cárdenas-López, Post traumatic stress disorder treatment with virtual reality exposure for criminal violence: a case study in assault with violence, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 103–108, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Vital signs: quantitative measurement for phobias treatment with virtual reality

M Plaza Torres

Universidad Libre, Engineering Faculty, Bogotá, COLOMBIA

ABSTRACT

The level of the phobia condition and its progress is done by the evaluation that the doctor does of the patient, without having a control of the variables of measurement that show an indication of the medical evolution of the treatment. The possibility of identify variables that might be measured and of being able to determine the evolution of the patient and the level of the illness would be of benefit to medical discipline. The article talks about the efforts to carry out a research with the goal of measuring vital signs on people who are placed in a relaxed environment and then compare them with vital signs measured under condition of an artificial environment. At the end of this research, we are trying to determine if the virtual environment has any influence in the person's psychological change seen through the changes of the controlled vital signs.

Figure 2. *Virtual reality equipment.*

M Plaza Torres, Vital signs: quantitative measurement for phobias treatment with virtual reality, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 109–114, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Telehealth using 3D virtual environments in stroke rehabilitation – work in progress

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[2]Laboratory of Interaction Technology, University West,
SE-461 86 Trollhättan, SWEDEN

[3]Institute of Neuroscience and Physiology, University of Gothenburg,
SU/Sahlgrenska, SE-413 45 Göteborg SWEDEN

[4]Institute of Biomedicine, Mednet, University of Gothenburg,

Box 420, 405 30 Göteborg SWEDEN

ABSTRACT

We have now started testing a telehealth system for stroke rehabilitation in a rural area in Sweden (NU- Hospital Group Area). For collection of assessments and audiovisual communication, the telehealth system has bidirectional contact with the home-based units. To date, three stroke subjects' participated; they were instructed to play 3D computer games with the hemiplegic upper extremity. The intervention led to clinical changes for all subjects. The analysis of the audiovisual communication revealed that the both stroke subjects and therapists were not yet effective in regulating their turn taking process. The data suggests the feasibility of a distance based approach using 3D virtual environments for upper extremity rehabilitation after stroke.

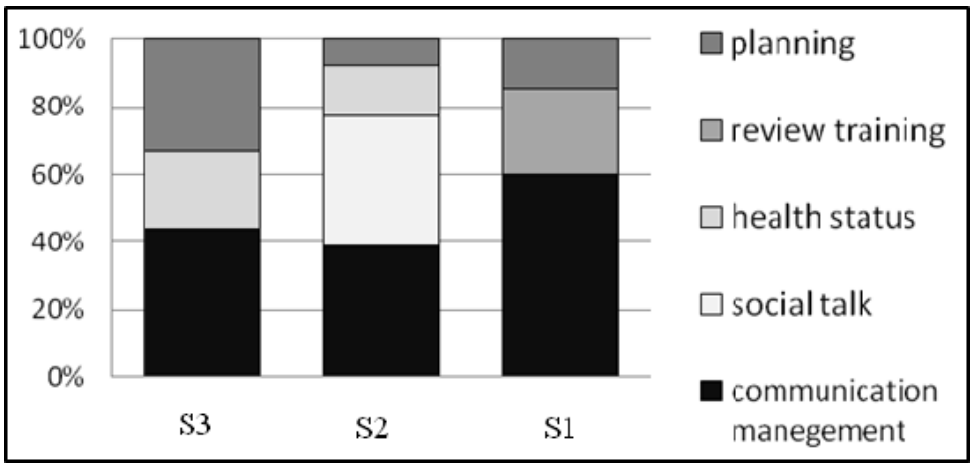

Figure 3. *Content analysis of the e-meetings.*

J Broeren, L Pareto, B Johansson, C Ljungberg, M Rydmark, Stroke rehabilitation using m-Health Care and 3D virtual environments – work in progress, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 115–122, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

A simple camera tracking virtual reality system for evaluation of wrist range of motion

D Shefer Eini[1,2], N Ratzon[1], A A Rizzo[3], S-C Yeh[3], B Lange[3], B Yaffe[2], A Daich[2], P L Weiss[4], R Kizony[2,4,5]

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ABSTRACT

Clinicians assess wrist and hand function to identify pathology, monitor effectiveness of treatment, and determine the readiness to return to work and other activities. The goniometer, the conventional evaluation tool used to assess range of motion (ROM), is most suited to the measurement of passive and active joint ROM under conditions that entail static, non-functional movements. Instruments that measure ROM during complex, dynamic tasks may encumber the movement. We have adapted a simple optical tracking device that uses a low-cost webcam to track two diodes, referred to as the Virtual Wrist Tracker (VWT), to assess wrist ROM in 30 subjects, aged 18-65 years; fifteen patients had sustained orthopaedic injuries and 15 were control subjects. ROM was assessed by a standard goniometer and by the VWT under two conditions: visual auditory feedback and auditory pacing feedback. The results of test-retest analysis of control subjects demonstrated good reliability for the VWT during wrist extension and moderate reliability during wrist flexion. High, significant correlations were found between the ROM for wrist extension and flexion as measured by a goniometer and via the VWT in the research group and for wrist extension but not for wrist flexion in the control group. A repeated measures ANOVA mixed design showed no significant differences in wrist extension ROM or in wrist flexion ROM during the performance of the task with visual and auditory feedback versus a task with auditory pacing, nor was there interaction effects between task type and group during extension and flexion. Wrist ROM in either direction increased as the participant progressed from one target rectangle to the next; statistically significant interaction effect was found between ROM in target position and group indicating that the difference between the targets in the control group was significantly different than in the research group. Finally, both groups enjoyed performing the VWT tasks but the control subjects felt greater presence, success and control. The VWT appears to be a reliable and valid tool for assessing wrist ROM during dynamic activities.

D Shefer Eini, N Ratzon, A A Rizzo, S-C Yeh, B S Lange, B Yafa, A Dietz, P L Weiss, R Kizony, A simple camera tracking virtual reality system for evaluation of wrist range of motion, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 123–130, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Integrated arm and hand training using adaptive robotics and virtual reality simulations

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ABSTRACT

Virtual Reality simulations interfaced with robotic arm devices are being used for training the upper extremity of people post-stroke. The benefit has been hypothesized to be the ability to provide repetitive task practice, directed visual and auditory feedback, learning algorithms and graded resistive and assistive forces. All of these elements can be manipulated to provide individualized motor learning paradigms. We have developed a unique exercise system, interfaced with complex virtual reality gaming simulations that can train both the upper arm and the hand of people in the chronic phase post-stroke. After two weeks of intensive training, eleven subjects, were able to more effectively control the limb during hand interaction with the target as demonstrated by improved proximal stability, smoothness and efficiency of the movement path. This was in concert with improvement in the distal kinematic measures of fractionation and improved timing. These changes in kinematic measures were accompanied by robust changes in functional tests of upper extremity motor control, the Wolf Motor Function Test, the Jebsen Test of Hand Function and the 9-hole Peg Test.

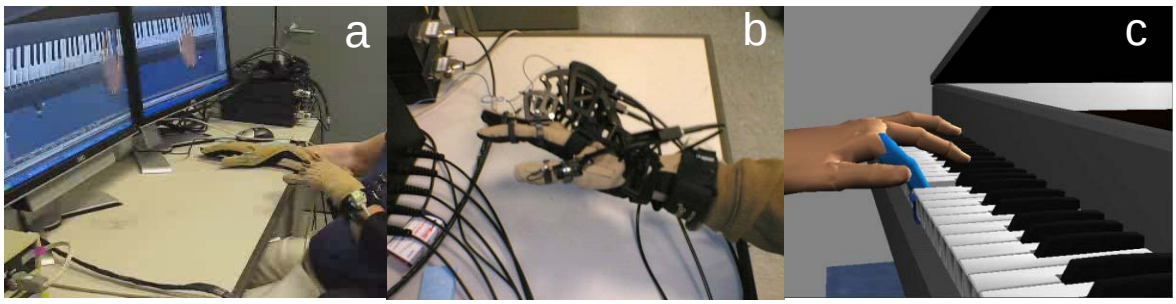

Figure 1. *(a).Picture of subject wearing a CyberGlove instrumented glove using the Piano Trainer Simulation; hands shown in a first person perspective. (b). CyberGrasp haptic device worn over a CyberGlove. (c).Picture of independent finger flexion as subject moves his hand to the cued key.*

A S Merians, G G Fluet, Q Qiu, S Saleh, I Lafond, S V Adamovich, Integrated arm and hand training using adaptive robotics and virtual reality simulations, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 131–138, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Study to evaluate a low cost virtual reality system for home based rehabilitation of the upper limb following stroke

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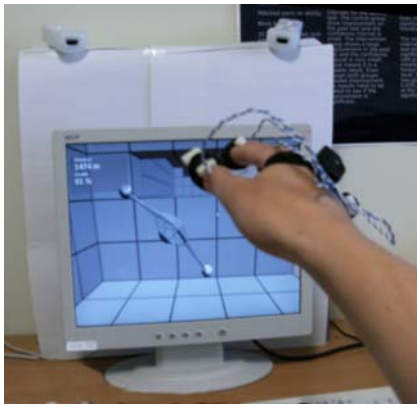
[4] Nottinghamshire Community Health NHS Trust, Nottinghamshire, UK,

ABSTRACT

Stroke survivors with continuing impairment in their upper limb find it difficult to access the early intensive, task specific practice that research has shown is necessary for motor recovery. A systematic review of studies that investigate the effects of robot-assisted therapy on motor and functional recovery in patients with stroke found significant improvement in upper limb motor function but the systems reviewed are expensive, require technical support and are hospital or laboratory based. This paper describes the development of a low cost home based system together with a suite of games which would allow patients to practice the movements required for activities of daily living at the frequency required. The ongoing feasibility study is described.



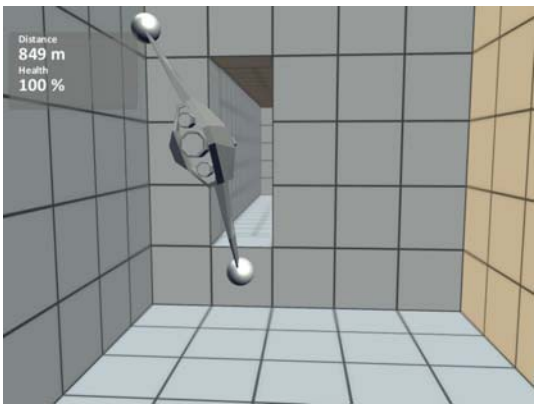


Figure 4. *Space race game showing player's hand position (left)***;**
Figure 5. *Screenshot of the space racegame (right).*

P J Standen, D J Brown, S Battersby, M Walker, L Connell, A Richardson, Study to evaluate a low cost virtual reality system for home based rehabilitation of the upper limb following stroke, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 139–146, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Remote monitoring and quantification of upper limb and hand function in chronic disability conditions

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ABSTRACT

This paper describes a convenient, home-based telerehabilitation system designed to improve upper limb and hand function in adults with cerebral palsy. The training program incorporates a variety of computer-guided sensorimotor activities such as unilateral and bilateral reaching, reaching and grasping, object manipulation, and tactile discrimination tasks. Quantitative measures of performance are uploaded to the laboratory after each training session for further analysis. Webcam monitoring of performance occurs periodically throughout the training period. Twelve adults with cerebral palsy completed a 40 min/day, five days/week training program over eight weeks. Temporal measures of performance indicated significant improvement in reaching and hand manipulation ability as well as improved tactile discrimination. Preliminary analysis of the time course of change revealed variable patterns within and across participants. The capacity to measure change throughout a training program provides an opportunity to investigate how learning occurs over time in chronic disability. Compliance was excellent with subjective reports indicating improvement in activities of daily living. Future development includes a fully automated system with stand alone modules which allow for customization of training protocols depending upon specific needs of the user.

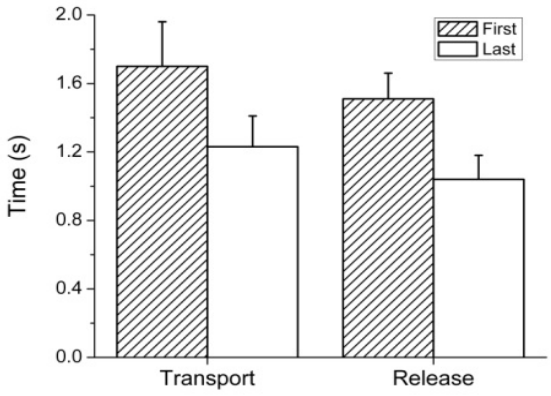

Figure 2. *Mean time required to reach, grasp and place an object (transport) and release and return to home position (release) during the first and last training session (more affected hand). Data are mean (+1 SE) for all 12 participants (p<.01).*

S H Brown, J Langan, K L Kern, E A Hurvitz, Remote monitoring and quantification of upper limb and hand function in chronic disability conditions, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 147–155, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Light Arrays: a system for extended engagement

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ABSTRACT

We present the development vision of a range of interactive body-worn lighting systems for performance, play, rehabilitation and dis- or altered- ability support. The systems combine experimental and off-the-shelf technologies to arrive at outcomes that require and inspire extended physical and expressive engagement, and afford a range of different learning opportunities. We discuss the context and background, our aims and approach – mixing art, design and engineering methodologies. We then outline a number of scenarios of use and their relevance to ArtAbilitation. Our aim is to open up a dialogue with the ArtAbilitation community in the early stages, to generate collaborative interest and inform development.

Figure 4. *In-visible garments for two – mapping movement and posture of one participant onto another participant's "skirt.*

D Wilde, A Cassinelli, A Zerroug, R J N Helmer, M Ishikawa, Light Arrays: a system for extended engagement, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 157–164, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Session VI:
ArtAbilitation

Warriors' Journey: A Path to Healing through Narrative Exploration

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ABSTRACT

The Warriors' Journey is an interactive narrative experience that is part of the online, virtual world healing space of the Coming Home Project (www.cominghomecenter.org) at the University of Southern California's Institute for Creative Technologies. This project is exploring new ways to reach veterans who are returning from recent conflicts and who often have mental health issues or difficulty fitting back into their home communities. We are looking at the affordances of online 3D virtual worlds to address some of the issues that may prevent or deter veterans from getting the help they need. We are exploring the use of specific therapies within the virtual world space, as well as social and enrichment activities designed around the needs of this group. *The Warriors' Journey* is one such activity that engages participants in stories to emphasize and reinforce common ideals of honorable warriors throughout history. After experiencing these stories, participants are then encouraged to construct their own warrior's story within the Coming Home space. It is hoped that such activities may help contribute to a more positive sense of self-esteem, a restructured life narrative, and a feeling of control over the stresses incurred during their service to their country.

Figure 1. *An image from the warrior's life.*

Figure 2. *The Story Tower structure.*

J F Morie, K Haynes, E Chance, Warrior's Journey – a path to healing through narrative exploration, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 165–174, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Extending body and imagination: moving to move

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ABSTRACT

We present a range of body-worn devices that have evolved from a common design intent: 'to move the body through real and virtual extension'. These devices encourage people to move in extra-normal ways, and thereby view and experience their bodies from perhaps hitherto unknown perspectives. They provide a rich playground for self-expression, as well as learning opportunities that we believe might be relevant for people with physical challenges and unconventional or altered abilities. Our desire in presenting this work to the ArtAbilitation community is to open up a dialogue and examine opportunities for engagement.

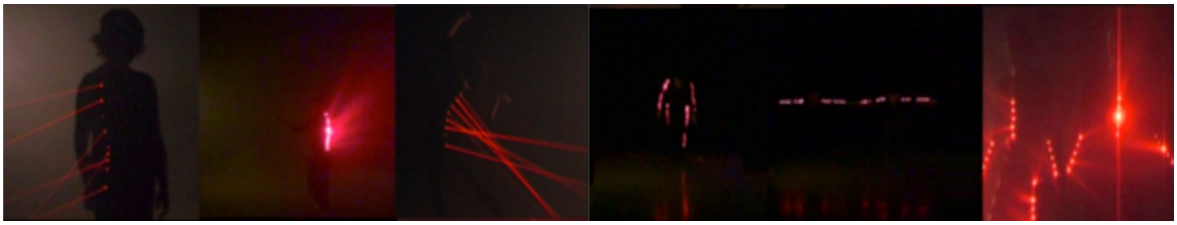

Figure 4. *Light Arrays [Wilde, 2008].*

Figure 5. *hipDrawing and some hipDrawn images (2009) [Wilde, 2007-2011]*

D Wilde, R J N Helmer, M Miles, Extending body & imagination: moving to move, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 175–183, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Games for rehabilitation: the voice of the players

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ABSTRACT

The purpose of this study is to explore the use of video games from the perspective of the disabled player. Over 150 participants responded to an online survey exploring the use of video games for rehabilitation. The respondents represented 9 countries throughout the world. The survey consisted of questions regarding subject demographics, living situation, activities of daily living assistance requirements, use of assistive devices, and computer use. Other questions addressed the responders' disability. Video game play experience, activity, game play, controller use and accessibility are addressed. Questions regarding the use of currently available off the shelf video games in rehabilitation are explored. Lastly, we surveyed the future of video games and how they can be improved for rehabilitation and leisure enjoyment. The results of this survey are presented. In general, individuals with disabilities enjoy playing video games and play video games often. However, players with disabilities would appreciate educating the game industry about disabilities and how to makes games with a more "universal game design".

Table 3. *Ability to perform activities of daily living*

Pleaae tell us how you perform the following activities (choose all that apply)	I choose not to perform	Independently	with a device	with a personal assistant	I am unable to perform	Response Count
I feed myself	1	121	6	7	13	145
I bathe myself	1	99	3	31	13	144
I groom myself	1	106	6	23	13	145
I dress myself	1	101	1	33	14	145
I do my bowel routine	2	110	1	23	9	142
I do my bladder care	2	110	6	19	9	143
I use the toilet	3	110	2	15	17	145
I transfer from bed to chair	2	102	6	20	13	140
I am mobile on level surfaces	2	106	26	3	12	145
I am mobile on stairs	3	75	20	11	41	145

S M Flynn, B S Lange, Games for rehabilitation: the voice of the players, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 185–194, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Designing engaging, playable games for rehabilitation

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ABSTRACT

Stroke is a leading cause of severe physical disability and can result in of a range of impairments, including loss of balance, attention and concentration deficiencies, pain, weakness and paralysis. This paper reports on the design of serious games for upper limb rehabilitation following stroke. In particular, we focus on identifying principles of video game design which are important in the context of rehabilitation and show how these principles can be implemented. We also report on an evaluation of the games for playability, usability and engagement.

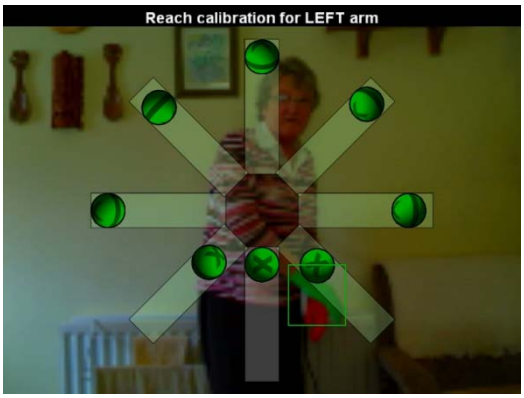

Image 1. *Range-of-movement configuration.*

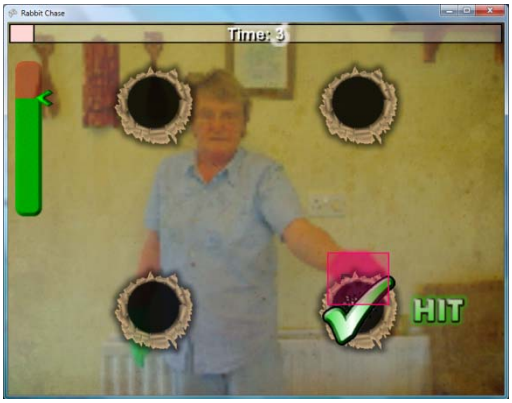

Image 2. *"Rabbit Chase", one handed game.*

J W Burke, M D J McNeill, D K Charles, P J Morrow, J H Crosbie, S M McDonough, Designing engaging, playable games for rehabilitation, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 195–201, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Designing studies for the requirements and modelling of users for an accessible set-top box

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[2] INGEMA, Ingema Grupo Matia,
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ABSTRACT

This paper describes work carried out to address the human centred design process behind the generation of requirements and user data for the prototyping of a user-model intended as part of a TV set-top box intended for use by mild to moderately impaired users. The aim is to develop both the technology and user modelling required within one STB system that will enable individuals with sensory, cognitive and physical impairments to interact with a number of reference applications. In order to do this it will be necessary for the system to categorise users on the basis of their input and interaction performance with a variety of input devices and assign them to a pre-assigned profile in the systems internal user-model. We address the issue of whether a human centred design process can be developed that is in principle capable of adequately generating the required data and specifications. We report the development of an inclusive design approach which subsumes both accessibility and usability. The ultimate aim will be to create a foundation for actual research and development work by identification of requirements from users as well as application and framework developers. We report the requirements analysis of this development and some preliminary results from user focus groups, chosen using an inclusive survey of capability, and interacting with early prototypes of interaction interfaces.

Figure 1. *The Inclusive Design Pyramid*

P Langdon, M F Gonzalez, P Biswas, Designing studies for requirements and modelling of users for an accessible set-top box, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 203–212, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

SimCoach: an intelligent virtual human system for providing healthcare information and support

A Rizzo[1], B Lange[1], J G Buckwalter[1], E Forbell[1], J Kim[1], J Williams[1], J Difede[2], B O Rothbaum[3], G Reger[4], T Parsons[1], P Kenny[1]

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ABSTRACT

Over the last 15 years, a virtual revolution has taken place in the use of Virtual Reality simulation technology for clinical purposes. Recent shifts in the social and scientific landscape have now set the stage for the next major movement in Clinical Virtual Reality with the "birth" of intelligent virtual humans. This paper will present an overview of the SimCoach project that aims to develop virtual human support agents to serve as online guides for promoting access to psychological healthcare information and for assisting military personnel and family members in breaking down barriers to initiating care. While we believe that the use of virtual humans to serve the role of virtual therapists is still fraught with both technical and ethical concerns, the SimCoach project does not aim to become a "doc in box". Rather, the SimCoach experience is being designed to attract and engage military Service Members, Veterans and their significant others who might not otherwise seek help with a live healthcare provider. It is expected that this experience will motivate users to take the first step – to empower themselves to seek advice and information regarding their healthcare (e.g., psychological health, traumatic brain injury, addiction, etc.) and general personal welfare (i.e., other non-medical stressors such as economic or relationship issues) – and encourage them to take the next step towards seeking other, more formal resources if needed.

Figure 1. *SimCoach Archetypes – Female Aviator, Battle Buddy, Retired Sergeant Major.*

A A Rizzo, B S Lange, J G Buckwalter, E Forbell, J Kim, K Sagae, J Williams, J Difede, B O Rothbaum, G Reger, T Parsons, P Kenny, SimCoach: an intelligent virtual human system for providing healthcare information and support, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 213–221, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Session VIII:
Balance & Gait

Development of an interactive stepping game to reduce falls in the elderly

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[2]Viterbi School of Engineering, University of Southern California, 3650 McClintock Ave, Los Angeles, USA

ABSTRACT

More than one-third of people over the age of 65 experience falls each year, and those who fall once are two to three times more likely to fall again. A fall can significantly limit a person's ability to remain self-sufficient. Fall injuries are responsible for significant disability, reduced physical function, and loss of independence. However, falls are not an inevitable result of aging. Systematic reviews of fall intervention studies have established that prevention programs can reduce falls. Physical activities, including strengthening exercises, tai chi, dancing and walking have been demonstrated to improve balance and decrease risk of falls in older adults. Modified dance-based exercises that include step-based movements have been demonstrated to improve endurance and balance in older adults. Dance video games, using a dance mat with areas that the player must step on in time with cues on the screen, have been demonstrated to improve activity and mood and reduce weight in children and youth. However, these dance games often include fast paced music, frequent jumping and an overload of visual information, movement and colors on the screen. This paper outlines the development of a prototype rhythm game that leverages the benefits of step-based exercise and dance video games to improve balance and reduce falls in older adults.

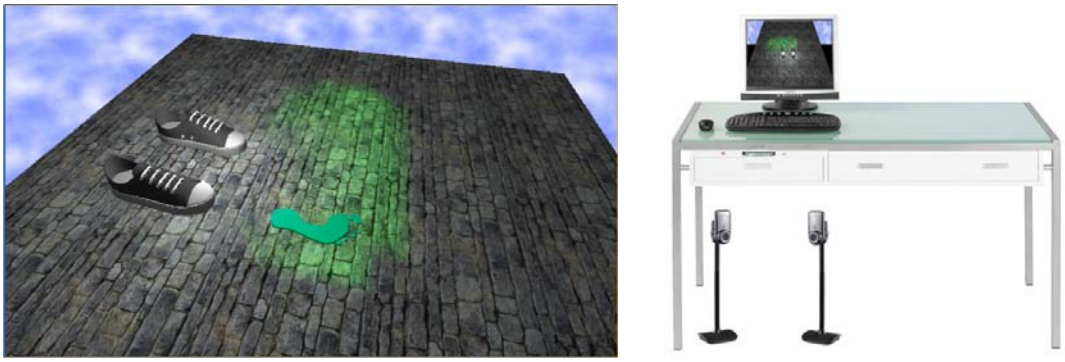

Figure 3. *a) Screen shot of game prototype, b) Set up of screen and cameras.*

B S Lange, S M Flynn, C Y Chang, W Liang, C L Chieng, Y Si, C Nanavati, A A Rizzo, Development of an interactive stepping game to reduce falls in the elderly, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 223–228, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

A virtual reality approach to gait training in service members with lower extremity amputations

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ABSTRACT

Gait training is an essential part of the rehabilitation process for those with lower extremity (LE) amputations. For service members at Walter Reed Army Medical Center, the Computer Assisted Rehabilitation Environment (CAREN) allows virtual reality to be incorporated into gait training as an adjunct to conventional therapies. This retrospective case series examines the self-selected velocities achieved in two different virtual environments (VE) by 11 service members with LE amputations. These VEs allowed participants to progress from level walking to more challenging terrain. Over periods of four to eight weeks, all participants were found to increase their self-selected velocities; progression appears to be individual. The preliminary results obtained indicate that further investigation is warranted.

Figure 1. *Participant walking on the CAREN system during the Continuous Road VE*

S E Kruger, Virtual reality approach to gait training in service members with lower extremity amputations, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 229–234, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Continuation of balance training for stroke subjects in home environment using virtual reality

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ABSTRACT

The objective of the telerehabilitation is a continuation of the rehabilitation process on subjects' home and making the therapists and physicians possible to follow the progress remotely. Hereby the pilot project with virtual reality based tasks for dynamic standing frame supported balance training is presented. Six stroke subjects participated in the preliminary study. The subjects performed the therapy five times a week, each time for up to 20 minutes for three weeks. The results were evaluated by objective game parameters as track time, number of collisions and clinical instruments Berg Balance Scale, Timed Up&Go and 10m walk test. The outcomes demonstrated a significant improvement of all parameters. However, the follow up after two weeks demonstrated that functional improvement could be possible on a long term, if the subjects continue with targeted tasks for extended period of time. Besides, the balance training could be continued on subject's home instead of the hospital, which would decrease the number of outpatients' visits and reduce related costs.

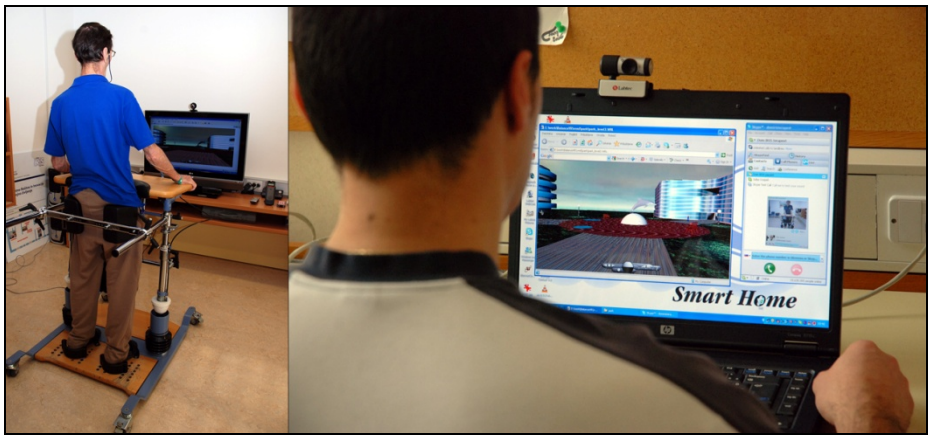

Figure 1. *Balance training with task in virtual environment could be continued on subject's home (left). Therapist (right) supervised and advised the subject through the videoconference and followed the task performance in the Internet Explorer.*

I Cikajlo, M Rudolf, N Goljar, Z Matjacic, Continuation of balance training for stroke subjects in home environment using virtual reality, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 235–240, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Audio-visual biofeedback system for postural control

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ABSTRACT

This study presents an application of biofeedback in balance training, in particular an audio-visual balance rehabilitation system designed for training of the elderly. Motivated by the need to provide portable, cost-effective and accessible training devices, the system implements a MEMS accelerometer to quantify the balance board movements during a balancing task and use them to provide a real-time, synchronous audio-visual biofeedback. The visual feedback displays the offset and the overall performance of the balance board. The audio feedback is based on the sound localization cues that indicate the direction of the balance board movements using stereo sound. Initial results indicate a significant improvement in the postural stability when the audio-visual biofeedback is provided. The pilot study found significant improvements in maintenance and recovery of dynamic balance manifested through decreased variability of complex, lateral and front-to-back movements during a balancing task.

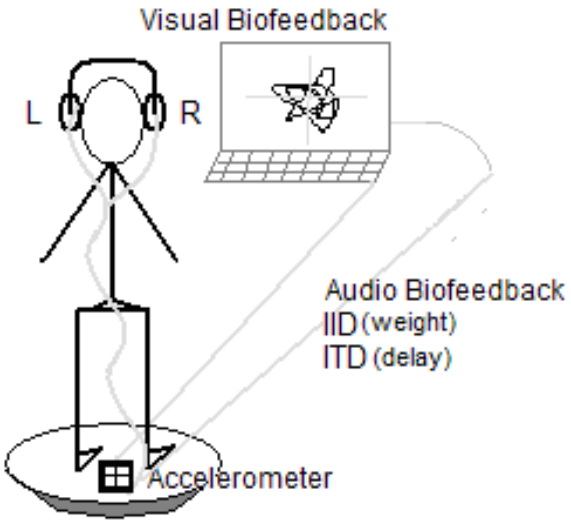

Figure 2. *System implementation for the audio-visual biofeedback. The subject is watching the visual display screen and at the same time receiving the stereo sound with the sound localization algorithm on the headphones.*

M Milosevic, K M V McConville, Audio-visual biofeedback system for postural control, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 241–247, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Development of an interactive rehabilitation game using the Nintendo® WiiFit™ Balance Board for people with neurological injury

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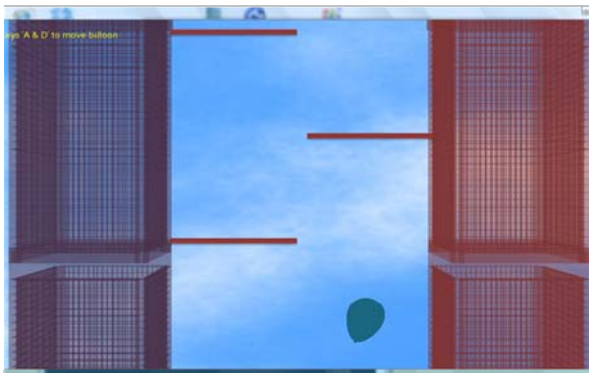
ABSTRACT

Visual biofeedback and force plate systems are often used for treatment of balance and mobility disorders following neurological injury. Conventional Physical Therapy techniques have been shown to improve balance, mobility and gait. The training program encourages patients to transfer weight onto the impaired limb in order to improve weight shift in standing and during gait. Researchers and therapists have been exploring the use of video game consoles such as the Nintendo® WiiFit™ as rehabilitation tools. Initial case studies have demonstrated that the use of video games has some promise for balance rehabilitation. However, initial usability studies and anecdotal evidence has indicated that the commercial games that are currently available are not necessarily suitable for the controlled, specific exercise required for therapy. Based on focus group data and observations with patients, a game has been developed to specifically target weight shift training using an open source game engine and the WiiFit balance board. The prototype underwent initial usability testing with a sample of four Physical Therapists and four patients with neurological injury or disease. Overall, feedback was positive and areas for improvement were identified. This preliminary research provides support for the development of a game that caters specifically to the key requirements of balance rehabilitation.



Figures 3 & 4. *Screenshots of second and third iterations of game.*

B S Lange, S M Flynn, C Y Chang, A Ahmed, Y Geng, K Utsav, M Xu, D Seok, S Cheng, A A Rizzo, Development of an interactive rehabilitation game using the Nintendo® WiiFit™ Balance Board for people with neurological injury, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 249–254, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Development of a voice-based rhythm game for training speech motor skills of children with speech disorders

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ABSTRACT

In this project, we deal with the development and evaluation of a new tool for conducting speech rhythm exercises. A training methodology is proposed, based on a schedule of exercises, each presenting a sequence of syllables arranged in a specific rhythmic pattern. In order to assist the therapists with conducting speech rhythm exercises with children, we have developed a computer game prototype which implements the training, by providing the exercises, visual feedback and evaluation of performance. The game prototype was further evaluated in a usability study involving children with various speech disorders. We discuss the limitations of the current system and propose improvements for further development.

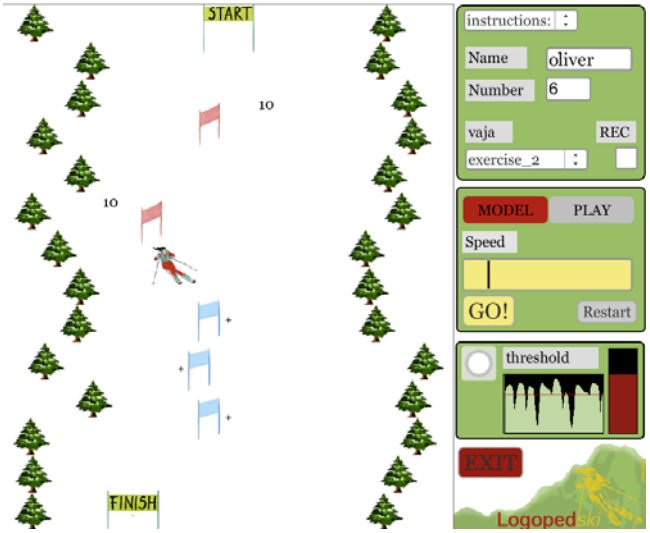

Figure 2. *A screenshot from the rhythm game prototype.*

D Umanski, D Kogovšek, M Ozbič, N O Schiller, Development of a voice-based rhythm game for training speech motor skills of children with speech motor disorders, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 255–262, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Robotic vocalization training system for the auditory-impaired

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ABSTRACT

The authors are developing a vocalization training system for the auditory-impaired using a talking robot. The training system mainly consists of a talking robot which has mechanical organs like a human. With an adaptive learning strategy using an auditory feedback control, the robot autonomously learns the vocalization, and then reproduces the speech articulation from inputted sounds. By employing the talking robot, the training is realized by two different approaches. One is a training based on the hardware demonstration, which shows the speech articulation by the robotic motions, and the other is a software-based training, which shows the phonetic characteristics of generated voices. Training experiments are being conducted in Kagawa Prefectural School for the Deaf, and significant results have been obtained. In the previous system, the speech learning algorithm of the robot was constructed by using a Self-organizing Neural Network (SONN), which consists of the combination of a Self-organizing Map (SOM) and a Neural Network (NN). However, improper maps were found in the results of the speech articulation learning. In this study, a new algorithm using two SOMs, called a dual-SOM, is introduced for the autonomous learning of the robotic articulations. Firstly, the construction of the training system is described together with the autonomous learning of robotic vocalization using the dual-SOM algorithm, and then the analysis of the speech training progress is presented based on the phoneme characteristics and the mechanical vocal articulations.

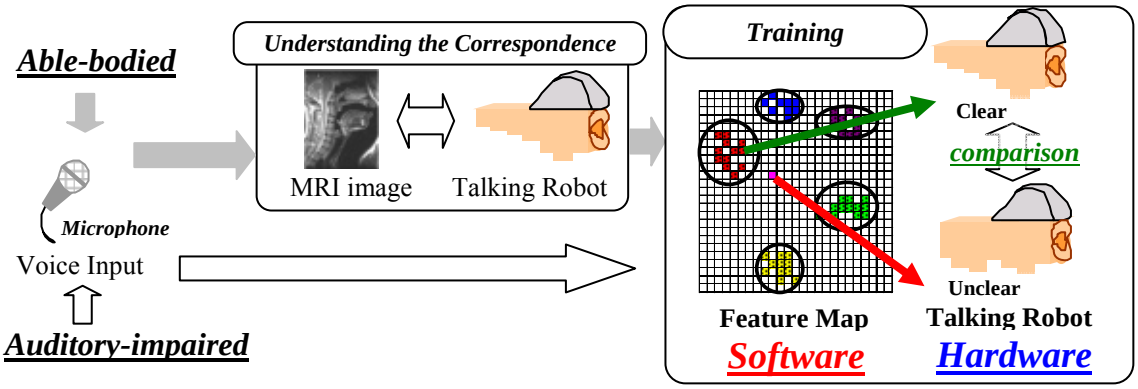

Figure 2. *Scheme of speech training system.*

M Kitani, T Hara, H Hanada, H Sawada, Robotic vocalization training system for the auditory-impaired, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 263–272, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Session IX:
Speech & Audio

Automatic speech recognition for assistive technology devices

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ABSTRACT

Speech offers great potential as a mode of interaction with devices to control our environment, support our work or assist us with tasks of daily living, however, to date the level to which this has been universally achieved and exploited has not matched its potential. Automatic Speech Recognition (ASR) is the process of interpretation of human speech by a machine. This may take two forms; continuous speech, as with human to human interaction or dictation, and discrete speech, such as commands issued to a device. ASR in the 'ENABLE' project uses discrete utterances to allow navigation of the user interface on a wrist worn device, control of the associated ECS (Environmental Control System) components as well as the ability to provide feedback for long term conditions using speech alone; features widely requested by users with a range of disabilities as well as by others for general ease of use. The aim of this paper is to explain the rationale and process behind the development of the ASR for the ENABLE device.

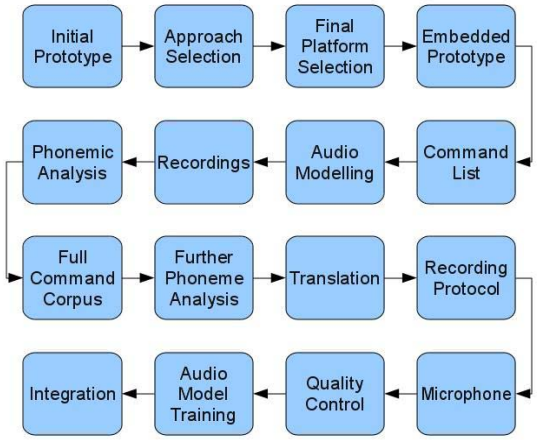

Figure 1. *Development Stages for the ENABLE ASR System.*

A P Harvey, R J McCrindle, K Lundqvist, P Parslow, Automatic speech recognition for assistive technology devices, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 273–282, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Session IX:
Speech & Audio

Basic study toward automatic generation of glove-type command input device with optimal number of sensors

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ABSTRACT

Data-gloves are one of the most essential devices for VR systems. Although most of conventional data-gloves are designed to capture "analogue" hand postures, most of information systems require just "digital" hand postures corresponding to commands. This paper proposed a method to calculate a data-glove with optimal number of sensors to obtain given set of "digital" hand postures. The authors applied the proposed method to JSL. The result tells that a data-glove with just eight sensors can obtain all hand postures given in JSL.

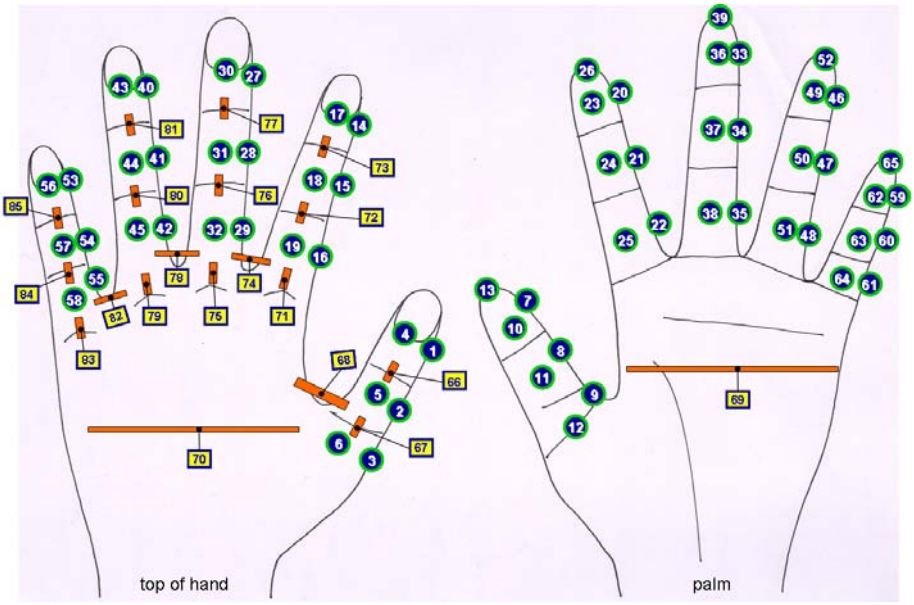

Figure 2. *Sensor Arrangement of Fully Furnished Data-glove*

Y Tabata, T Kuroda, K Okamoto, Basic study toward automatic generation of glove-type command input device with optimal number of sensors, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 283–289, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Poster Abstracts

Virtual environments for exposure in obsessive-compulsive disorder, **G Cárdenas López**, **S Muñoz**, Universidad Nacional Autónoma de México, MÉXICO

Obsessive Compulsive Disorder (OCD) affects 2.6% of the population in Mexico, severely affecting the quality of life of the people who suffer it. The World Health Organization (WHO) ranks OCD as the tenth leading cause of disability in the world, representing a health issue that requires attention, especially from health professionals. Several studies on the different treatments developed for this disorder have been carried, including: exposure, response prevention and cognitive therapy. We developed a treatment based on virtual reality (VR) technologies to expose patients with OCD to controlled virtual environments. The treatment includes sessions of psychoeducation, breathing training, cognitive restructuring and exposure, using a Head Mounted Display (HMD). VR increases the sense of immersion and presence in the environment, and evokes the same reactions and emotions that are experienced in real situations.

G Cárdenas López, S Muñoz, Virtual environments for exposure in obsessive-compulsive disorder, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 291–293, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Integrative approach for designing collaborative technologies for social competence training in children with autism spectrum conditions, **S V Cobb**, **L Millen**, **T Glover**, **S Parsons**, **S Garib-Penna**, **P L Weiss**, **E Gal**, **N Bauminger**, **S Eden**, University of Nottingham/University of Birmingham, UK and University of Haifa, Bar Ilan University, ISRAEL

The COSPATIAL project is exploring the use of two collaborative interaction technologies, Collaborative Virtual Environments (CVEs) and Shared Active Surfaces (SASs), as suitable media to support learning of social competence skills for typically developing children and those with Autism Spectrum Conditions (ASC)s. This paper describes the integrated approach used to design and develop learning scenarios in each technology.

S V Cobb, L Millen, T Glover, S Parsons, S Garib-Penna, P L Weiss, E Gal, N Bauminger, S Eden, M Zancanaro, L Giusti, Integrative approach for designing collaborative technologies for social competence training in children with autism spectrum conditions, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 295–298, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

Videogame for improving orientation and mobility in blind children, **J Sánchez**, **J P Rodríguez**, *Universidad de Chile*, *CHILE*

This work presents an evaluative study on the usability of a haptic device together with a sound-based videogame for the development and use of orientation and mobility (O&M) skills in closed, unfamiliar spaces by blind, school-aged children. A usability evaluation was implemented for a haptic device especially designed for this study (Digital Clock Carpet) and a 3D videogame (MOVA3D) in order to determine the degree to which the user accepted the device, and the level of the user's satisfaction regarding her interaction with these products for O&M purposes. In addition, a preliminary cognitive evaluation was administered. Usability results show that both the haptic device and the videogame are usable, accepted and considered to be pleasant for use by blind children. The results also show that they are ready to be used for cognitive learning purposes. Results from the preliminary cognitive study demonstrated significant gains in the development of tempo-spatial orientation skills of blind children when navigating in unfamiliar spaces.

J Sánchez, J P Rodríguez, Videogame for improving orientation and mobility in blind children, *Proc. 8th Intl Conf. on Disability, Virtual Reality and Assoc. Technologies*, P M Sharkey, J Sánchez (Eds), pp. 299–303, Viña del Mar/Valparaíso, Chile, 31 Aug. – 2 Sept. 2010.

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Author Index

	Paper	Abstract
Adamovich, S V	131	*xxxiii*
Ahmed, A	249	*xlvii*
Baptista, A	79	*xxvi*
Barrett, J	17	*xix*
Battersby, S	139	*xxxiv*
Bauminger, N	295	*lii*
Biswas, P	203	*xli*
Broeren, J	115	*xxxi*
Brown, D J	139	*xxxiv*
Brown, S H	147	*xxxv*
Buckwalter, J G	213	*xlii*
Budziszewski, P	27	*xx*
Burke, J W	195	*xl*
Cao, X	71	*xxv*
Cárdenas-López, G	103, 291	*xxix, lii*
Cassinelli, A	157	*xxxvi*
Chance, E	165	*xxxvii*
Chang, C Y	223, 249	*xliii, xlvii*
Charles, D K	195	*xl*
Cheng, S	249	*xlvii*
Cherni, H	85	*xxvii*
Chieng, C L	223	*xliii*
Chihara, K	61	*xxiv*
Cikajlo, I	235	*xlv*
Cobb, S V	93, 295	*xxviii, lii*
Connell, L	139	*xxxiv*
Costa,, R M E M	1	*xvii*
Crosbie, J H	195	*xl*
Crucian, G P	7	*xviii*
Dalrymple-Alford, J C	7	*xviii*
De la Rosa-Gómez, A	103	*xxix*
Dietz, A	123	*xxxii*
Difede, J	213	*xlii*
Douguet, A-S	71	*xxv*
Dünser, A	7	*xviii*
Dzwiarek, M	27	*xx*
Edelmayer, G	17	*xix*
Eden, S	295	*lii*
Floratos, N	17	*xix*
Fluet, G G	131	*xxxiii*
Flynn, S M	185, 223, 249	*xxxix, xliii, xlvii*
Forbell, E	213	*xlii*
Gal, E	295	*lii*
Gamito, L	79	*xxvi*
Gamito, P	79	*xxvi*
Garib-Penna, S	295	*lii*
Geng, Y	249	*xlvii*
Giusti, L	295	*lii*
Glover, T	295	*lii*
Goljar, N	235	*xlv*
Gonzalez, M F	203	*xli*
Grabowski, A	27	*xx*
Hanada, H	263	*xlix*
Hara, T	263	*xlix*
Harvey, A P	17, 273	*xix, l*
Haynes, K	165	*xxxvii*
Helmer, R J N	157, 175	*xxxvi, xxxviii*
Hickey, S	61	*xxiv*
Hogarth, H	17	*xix*
Hurvitz, E A	147	*xxxv*
Hyry, J	61	*xxiv*
Ishikawa, M	157	*xxxvi*
Johansson, B	115	*xxxi*
Jankowski, J	27	*xx*
Joseph, P-A	85	*xxvii*
Kadri, A	85	*xxvii*
Kenny, P	213	*xlii*
Kern, K L	147	*xxxv*
Kim, J	213	*xlii*
Kirner, C	41	*xxii*
Kirner, T G	41	*xxii*
Kitani, M	263	*xlix*
Kizony, R	123	*xxxii*
Klinger, E	71, 85	*xxv, xxvii*
Koenig, S T	7	*xviii*
Kogovšek, D	255	*xlviii*
Kruger, S E	229	*xliv*
Kurkus-Rozowska, B	27	*xx*
Kuroda, T	61, 283	*xxiv, li*
Lacerda, R	79	*xxvi*
Lafond, I	131	*xxxiii*
Lahav, O	33	*xxi*
Langan, J	147	*xxxv*
Langdon, P	203	*xli*

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	Paper	Abstract
Lange, B S	123, 185, 213, 223, 249	*xxxii, xxxix, xlii, xliii, xlvii*
Levene, P	17	*xix*
Levy, S T	33	*xxi*
Liang, W	223	*xliii*
Ljungberg, C	115	*xxxi*
Lundqvist, K	273	*l*
Geng, Y	249	*xlvii*
Giusti, L	295	*lii*
Glover, T	295	*lii*
Goljar, N	235	*xlv*
Gonzalez, M F	203	*xli*
Grabowski, A	27	*xx*
Matjacic, Z	235	*xlv*
Mayer, P	17	*xix*
McConville, K M V	241	*xlvi*
McCrindle, R J	17, 273	*xix, l*
McDonough, S M	195	*xl*
McNeill, M D J	195	*xl*
Mendonça, I	1	*xvii*
Merians, A S	131	*xxxiii*
Miles, M	175	*xxxviii*
Millen, L	93, 295	*xxviii, lii*
Milosevic, M	241	*xlvi*
Morais, D	79	*xxvi*
Morie, J F	165	*xxxvii*
Morrow, P J	195	*xl*
Muñoz, S	291	*lii*
Nanavati, C	223	*xliii*
Needham, P	17	*xix*
Nyman, S R	17	*xix*
Okamoto, K	283	*li*
Oliveira, J	79	*xxvi*
Ozbič, M	255	*xlviii*
Pacheco, J	79	*xxvi*
Panek, P	17	*xix*
Pareto, L	115	*xxxi*
Parslow, P	273	*l*
Parsons, R	213	*xlii*
Parsons, S	295	*lii*
Patel, H	93	*xxviii*
Plaza Torres, M	109	*xxx*
Qiu, Q	131	*xxxiii*
Ratzon, N	123	*xxxii*
Reger, G	213	*xlii*
Richardson, A	139	*xxxiv*
Rizzo, A A	123, 213, 223, 249	*xxxii, xlii, xliii, xlvii*
Rodríguez, J P	299	*lii*
Rosa, P	79	*xxvi*
Rothbaum, B	213	*xlii*
Rydmark, M	115	*xxxi*
Rudolf, M	235	*xlv*
Sagae, K	213	*xlii*
Saleh, S	131	*xxxiii*
Sánchez, J	51, 299	*xxiii, lii*
Santos, N	79	*xxvi*
Saraiva, T	79	*xxvi*
Sawada, H	263	*xlix*
Schiller, N O	255	*xlviii*
Seok, D	249	*xlvii*
Shefer Eini, D	123	*xxxii*
Si, Y	223	*xliii*
Smith, R	17	*xix*
Soares, F	79	*xxvi*
Souza, D S	1	*xvii*
Standen, P J	139	*xxxiv*
Tabata, Y	283	*li*
Tarruella, A	85	*xxvii*
Tadres, A	51	*xxiii*
Tokarski, T	27	*xx*
Umanski, D	255	*xlviii*
Utsav, K	249	*xlvii*
Valente, J A	41	*xxii*
Victor, C R	17	*xix*
Walker, M	139	*xxxiv*
Wataya, R S	41	*xxii*
Weiss, P L	123, 295	*xxxii, lii*
Wilde, D	157, 175	*xxxvi, xxxviii*
Williams, J	213	*xlii*
Williams, V M	17	*xix*
Xu, M	249	*xlvii*
Yafa, B	123	*xxxii*
Yamamoto, G	61	*xxiv*
Yeh, S-C	123	*xxxii*
Yoshitake, D	61	*xxiv*
Zancanaro, M	295	*lii*
Zerroug, A	157	*xxxvi*

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