Second Lives for the Third Age:
Motivating Rehabilitation in Virtual Environments

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Global Context – Ageing Population

- UK Office for National Statistics
- By 2034, 23% of the population expected to be over 65
- Similar or worse problems affecting other countries e.g.
  - There are currently 167 million Chinese over 60.
  - By 2050, that figure is projected to increase to almost 400 million - a quarter of the population.
The Chief Medical Officer states:

A growing body of evidence suggests that diseases and conditions which are the primary cause of loss of function and independence in later life are preventable and physical activity can play an important part. Preventive effects arising from regular physical activity in older age are at least as strong as those found in middle age for all-cause mortality, cardiovascular disease, and type 2 diabetes.
Barriers to participation

- Health issues
- Environmental conditions
- Financial hardship
- Lack of social support
- Poor provision for specific cultural needs (e.g. single-sex sessions)
- Consequently, only a minority of older people meet recommended levels of physical activity (Department of Health Better Health in Old Age 2004)
Global Context - Falls

• Increased likelihood of falling with age
• Affects not just frail, but also independent ‘well’ elderly
• Leading cause of injury-related hospitalisation in this population
• Fear of falling leads to reduced activity
Falls Rehabilitation

• **Targeted** rehabilitation through **active participation** and **engagement** in **contextually-appropriate repetitive and intensive** movements (e.g. Otago programme) shown to promote recovery

• Exercises completed individually at home, can be tedious => problem with motivation.

• Only effective with good compliance
Balance Training Exercises

- 12 exercises
Falls Rehabilitation II

• Computer games can provide a controlled, safe and challenging stimulus for rehabilitation.

• Most computer games not suited to an older clientele.
Dance

- Dance is an age and culture-appropriate, single or multiple participant activity that has significant rehabilitation benefits.
- Virtual dance applications have used pre-programmed movement sequences triggered by keyboard, or motion capture.
- We suggest sensing appropriate rehabilitation movements to trigger dance sequences, NON ONE-TO-ONE MAPPING.
Pilot study

• Investigate usability for older people
• Proof of principle virtual environment developed
• Two modified weighing scales per participant were used to collect centre of pressure (COP).
Pilot work II

• ‘Texas Line Dance’ style dance movements were motion captured
• Participants’s balance rehabilitation movements were mapped on to the Avatar’s dance movements
• Piloted with 6 women (ages 80-91) undertaking exercise classes for balance rehabilitation
• Cohort had no previous computer experience
• Only few minutes of prior exposure before testing
• Series of tasks to perform [VIDEO]
## Results

<table>
<thead>
<tr>
<th>Participant Age</th>
<th>seconds to complete simple task</th>
<th>seconds to complete complex task</th>
<th>jump</th>
<th>spin</th>
<th>kick</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80</td>
<td>318</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>91</td>
<td>117</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<tr>
<td>3</td>
<td>88</td>
<td>225</td>
<td>2</td>
<td>1</td>
<td>1</td>
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<tr>
<td>4</td>
<td>82</td>
<td>328</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>85</td>
<td>163</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>91</td>
<td>170</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>mean</strong></td>
<td><strong>86.2</strong></td>
<td><strong>220.2</strong></td>
<td><strong>2.0</strong></td>
<td><strong>1.0</strong></td>
<td><strong>1.5</strong></td>
</tr>
</tbody>
</table>

For jump, spin and kick a score of 2 means task completed without assistance, 1 = assistance was required, 0 = task could not be completed.
Discussion

• All able to control basic avatar movements
• Some able to control complex dance movements
• The ‘jump’ seemed especially intuitive
• All enjoyed the experience
• MOVE TO RICHER VIRTUAL WORLD
Virtual Worlds/ Metaverses

Combination of computerised balance rehabilitation with virtual worlds\(^1\) provides possibility of rich age-appropriate scenarios and socialisation.

\(^1\)A **virtual world** is a computer-based simulated environment intended for its users to inhabit and interact via **avatars**. Some, but not all, virtual worlds allow for multiple users. Well-known virtual worlds include Second Life (Linden Labs) and World of Warcraft (Blizzard).
Second Life - Fantasy

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Second Life - Music

Music Island

Smithsonian Latino Music

Blues Museum

mosh-pit friendly punk-rock club

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Second Life - Education

Goethe Institut

First World War Poetry Digital Archive

Open University

Instituto Espanol
Second Life - Animals

Zoo by’s Pet Store

Turing Isle

Zoo Neunkirchen

sionChicken
Second Life Usage Statistics I

Monthly Unique Users with Repeat Logins (Thousands)

July '10

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Second Life Usage Statistics II

About L$400 to one Pound.
Second Life Usage Statistics III

Italia 4 Milano - 58
Cidade do Medo - 56
Sexy Islands - 56
Franks Place 2 - 48
A Lesbian Paradise - 44
Hy Brazil - 44
Midnight Reflections - 43
escort oasis - 43
Sweethearts - 42
Lu Dongbin - 41

Average number of unique avatars in the sim at any given moment:
Convergence

Virtual worlds → Sensor Technology → Movement-Mapped Avatars → Second Lives for the Third Age → Dance/Exercise Therapy

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Engineering For Life Pilot Study

Pilot funding to:

• Explore older peoples’ opinions and expectations of virtual worlds.

• Develop an age-appropriate, safe environment in the virtual world

• Develop a whole-body physical interface to allow rich interaction without requiring mouse or computer skills.
Team

- Ben Heller – project management and Physical Interface
- Breda Beban – Creative direction
- Kerry McSevery – analysis of user behaviour
- Katarzyna (Kasia) Machaczek – motivation
- Ricard Gras (Interactiva) Second Life implementation, *machinima*
- Ismail Mubarak – assistance and recruitment
- Ann Light
Things you miss or would like to do

- Walking around streets of city (Glasgow) – lacks stamina to do that now – visiting parks, churches, galleries along the way
- Going dancing at the local ballroom – getting dressed up to go out – tango, waltz etc., leave shoes at the cloakroom and put on "dancing shoes", silver ball, big band – meet boys!
- Swimming
- Sailing
- Horse riding
- Fishing (very popular sport for men)
- Running downhill really fast like kids do
- Sex
- Climbing trees
- Gardening – suggested possibility of "virtual garden" (to include pruning, weeding hoeing, planting, watering, nurturing)
- Running a marathon
Travel

• Visit space (or sites associated with "space race", Cape Kennedy, Russia etc.)
• Visit periods from history, e.g. 1920s and 30s – music, Art Deco etc., Victorian era
• Shopping (perhaps real shopping via internet, actual gain)
• Visit virtual museums
• Flying an aeroplane (was in Air Force when younger, but had to do ground job due to colour blindness)
• Travel (came up a lot) – problems with getting insurance to travel abroad when older – would like to revisit places, or see new ones – 18th Century "grand tour" of Europe, Grand Canyon
• Cycling through Staffordshire countryside (where she grew up – would like to feel ‘free as a bird’)
• Cycling or driving through interesting environments, go to meet people
Miscellaneous

• **Role play** - Play the leading role in an opera

• **Socialisation**
  – Being with friends
  – Touching and being touched by another human being
  – Pets (virtual dog to take for walks)

• **Famous people** - Meet Elvis
Concerns

• Other characters shouldn’t be ‘agents’, they must be driven by real people.

• Not interested in imaginary scenarios, want versions of reality, things that they can no longer do (e.g. museums, shopping). “wouldn’t be interested in anything that isn’t real” was heard on more than one occasion.
Walled-garden
Features

• Rest + socialisation area
• Lake with fish
• Trees (climbable)
• Gardening activity
• Animals (birds, butterflies, peacock)
• Walled to prevent incursion/ users getting lost
Physical User Interface

Use Polhemus 6 dof electromagnetic tracking system

- Infer desired movements
- Send key-presses to Second Life viewer to trigger appropriate movements and animations
Evaluation

• 4 older users - two women, two men (Somali)
• Used both conventional and physical user interfaces
• Opinions sought by interview
• VIDEO
Results

- Users had difficulty with speed of movement in Second Life, particularly turning.
- This was compounded for the physical interface (rotation angle of user corresponds to rotation rate of avatar)
- The simplest, most directly mapped movements were preferred (jump, wave, punch)
- The link between physical movement and avatar movement wasn’t always understood
Comments

• Which bits did you enjoy the most?
• I think the flying bit
• The flying, why do you think that is?
• I just sort of feel as if I was flying as well
• Is there anything that you'd like to have been able to do in the garden that you couldn't?
• I can't think of anything no, I mean I walked round the garden, I flew round the garden, and I danced in the garden you know, um... well I suppose if I could pick some of the flowers, you know, and as I said before if you'd got an allotment in the garden to grow vegetables.
So if you were to meet your grandchildren in Second Life, what kind of things do you think you'd like to do?

Well I'd still like to hear __ play his clarinet, and perhaps we could have a bandstand. And __ a football pitch, he'd like that. And __ a netball pitch, you know. And you could just go and watch quite easily.

You could even join in if you wanted to

Yeah, that's right, you could couldn't you. Yeah, I hadn't thought of that

Do you think you'd enjoy that?

Oh I'm sure I would, yes. Netball, I used to play when I was younger, and that would be good.

You can even do concerts and things in Second Life

You could play in the concert in the orchestra!
Way forward

• Find a more natural metaphor for turning.
• Slow-down movements for novice users.
• Create training scenarios.
• Improve social aspects.
• Explore a larger range of content (+ a larger physical range – ‘park’ not garden)
• Make environment more interactive and more fun!
• Further funding…
Microsoft Kinect

(Project Natal) Microsoft’s 3D motion tracking add-on for Xbox. Scheduled for November 2010 release £130 (!!!)

Depth tracking camera, so produces a 3D ‘point cloud’ at 30 fps.

‘State of the art’ computer vision human tracking algorithms.

‘Learns’ postures from a giant database!

Accuracy???
Thank you!