One toy, many games: *Whiz*Toys for combined physical activity and cognitive training

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3G’s for the aged society: Gerontology, Geriatrics, Gerontechnology

- It is only natural to consider applying technologies for the care of older adults…

- First International Congress on Gerontechnology, 1991
- International Society for Gerontechnology, 1997

“Design technology and environment for independent living and social participation of older persons in good health, comfort and safety”

- Scope of Gerontechnology: Health, Housing, Mobility, Communication, Leisure, Work
Gerontechnology is only valuable if we can bring research to daily applications

A design approach to gerontechnology:
Creativity ➔ Prototype ➔ Products ➔ Sales

Mission: To carry out a successful industrial and educational experiment
One day when Zeng was out cutting wood among the mountains, there came a visitor to his house. After awaiting her son’s return in vein, his mother bit her finger.

Zeng felt heartache all of a sudden and knew there was an emergency. He rushed back home with a burden of wood, and on arrival, knelt down to asked his mother what happened. His mother replied, “Here is a visitor who needs you urgently. So I bit my finger to awake you to come back…”

From the “24 stories of filial piety” Zeng was a disciple of Confucius 2,500 years ago…

THE BEGINNING OF TELEHEALTH…
ARE YOU USING TELEHEALTH SYSTEMS TO CARE THE OLDER ADULTS?

Wearable devices or, leap beads？

Why are technological products not used for caring the older adults?

Companion robots?

Smart home, smart wheelchair, smart anything?
Persuasive technology: How technology is designed to change behaviors of the users

- A new behavior was created in 2007
- User Centered Design: Need ≠ Motivation

More fun than functions…
If telehealth systems connect older adults with family members

The son is the trigger... Care, interaction, connection, in addition to health monitoring
Non-pharmacological intervention for preventing cognitive decline in older adults

- Physical activity (PA) is known to improve cognitive function at older age.
- In a meta analysis of 41 studies, combined PA + CA (cognitive activity) intervention showed significantly larger gains in cognition relative to the control group (Gheysen et al, 2018).

What is the trigger for older adults?

<table>
<thead>
<tr>
<th>Cognitive</th>
<th>ADL</th>
<th>BPSD</th>
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</thead>
<tbody>
<tr>
<td>Cognitive training</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Cognitive rehabilitation</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Cognitive stimulation therapy</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Snoezelen/multisensory</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Reality orientation</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Reminiscence therapy</td>
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<td>-</td>
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<tr>
<td>Validation therapy</td>
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<tr>
<td>Physical activity</td>
<td>+</td>
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<tr>
<td>Music therapy</td>
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<td>-</td>
</tr>
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<td>Aromatherapy</td>
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<td>-</td>
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<tr>
<td>Animal-assisted therapy</td>
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</table>
Play comes first: Serious game design

• Use technology to combine multimedia, entertainment, and experience (Laamarti et al., 2014), to design “games that do not have entertainment, enjoyment, or fun as their primary purpose” (Michael et al., 2006)

• Recommendations for serious games for people with dementia [Dietlein et al, 2018] :
  - Interventions should be supervised to support people with dementia to help them understand the instructions and the technology of the games
  - Serious games should be well adapted to the target population and their individual impairments, capacities, and interests
  - Interventions should be played in groups in order to guarantee enjoyment and commitment to the games and to foster social behavior and interaction
What are the values brought by technologies?

(1) Combining physical exercise, cognitive training, and multi-sensory stimulation
(2) Caregivers can choose and design games suitable for older adults

Chasing game

Mahjong matching
(3) Generate and record data that are helpful to elderly care

- Timed up and go (TUG)
- Time (sec), step length (cm), cadence (steps /min), difference in left and right steps (%)
Validation of TUG data from WhizToys

- WhizToys resolution in length is 12.5cm
- 15 participants, 3 tests/person

<table>
<thead>
<tr>
<th></th>
<th>WhizToys average</th>
<th>Video average</th>
<th>Max. difference</th>
<th>Avg. diff. (SD)</th>
<th>percentage error</th>
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</thead>
<tbody>
<tr>
<td>Average time (sec)</td>
<td>10.3</td>
<td>10.1</td>
<td>0.5</td>
<td>0.29 (0.14)</td>
<td>2.82%</td>
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<tr>
<td>Average step length (cm)</td>
<td>52.8</td>
<td>50.5</td>
<td>8.9</td>
<td>2.66 (1.70)</td>
<td>5.04%</td>
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<tr>
<td>Left Step length (%)</td>
<td>49.0</td>
<td>49.2</td>
<td>8.0</td>
<td>2.22 (1.98)</td>
<td>4.53%</td>
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<tr>
<td>Right Step length (%)</td>
<td>51.0</td>
<td>50.8</td>
<td>8.0</td>
<td>2.22 (1.98)</td>
<td>4.35%</td>
</tr>
<tr>
<td>Cadence (step/min)</td>
<td>111.8</td>
<td>111.5</td>
<td>13.6</td>
<td>3.30 (3.16)</td>
<td>2.95%</td>
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<tr>
<td>Steps</td>
<td>11.1</td>
<td>11.4</td>
<td>1.0</td>
<td>0.40 (0.50)</td>
<td>3.60%</td>
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</table>
TUG data simulating different conditions on WhizToys

• Normal walking
• Wearing aging simulation suit
• Heavy load on one leg

For exercise prescription

<table>
<thead>
<tr>
<th></th>
<th>normal walking</th>
<th>aging simulation</th>
<th>P-value</th>
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<tbody>
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<td>Average time (s)</td>
<td>8.8</td>
<td>11.2</td>
<td>&lt;0.05</td>
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<tr>
<td>Step length (cm)</td>
<td>61.2</td>
<td>48.8</td>
<td>&lt;0.001</td>
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<tr>
<td>Cadence (steps/min)</td>
<td>118.3</td>
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<tr>
<td></td>
<td>steps</td>
<td>10</td>
<td>12</td>
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<th>Load on one leg</th>
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<tr>
<td>Left step length (%)</td>
<td>49.1</td>
<td>51.2</td>
<td>45.6</td>
<td>&lt;0.05</td>
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<tr>
<td>Right step length (%)</td>
<td>50.9</td>
<td>48.8</td>
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Make some sense out of the performance in … Whack-a-Roach

- Whacking 11 roaches in 39 seconds: 79%

29 older adults in a community, average 72.3 years old. Plays WhizToys once a week for 1.5 hours, 8 weeks.

From TUG data, average gate speed increases 14.7%.

Exercise makes a difference…
Similar technological products: MOTO Tiles, Stampede, TREAX pads…

Is “play” a good enough trigger for older adults?
“Pillow Fight”, 3rd Place in Stanford Center on Longevity Design Challenge

• Intergeneration game: Changed video game controllers to familiar household items - pillows, enabling older adults and children to play together by punching the pillow.
We are designers!
UX: User Experience Design

Find that Trigger—Caregivers are the best designers!

iPad Project by Anchor in UK

- iPads were introduced to all of Anchor’s care homes (63) in two years, to be used in activity sessions for residents with dementia.
- Use of iPads with residents: 42% using the iPad less than a few times a week, 44% a few times a week and 13% more than a few times a week.
- Playing music or songs (94%), playing film clips (60%), games (58%), drawing and art (48%), use of Skype (45%).
- iPads were helping to enhance activities and further enrich residents’ lives by providing an extra dimension to an activity.

Do we really need any hi-tech products like, WhizToys?
Bringing research to daily applications: More DESIGN THINKING!

- Empathy: User centered, persona…
- Define the right problem: What, how, **Why**
- Think like a boss… (not like a professor…)

Proud to be a designer!
PhD 1992, Stanford, ME, Design Division
We are designers: The future world needs transdisciplinary talent

“Design” is our common language!

Design starts with a problem. Design ends with a solution.

DESIGN IS A PROBLEM SOLVING PROCESS.

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Thank you

Transdisciplinary learning
Real world problem and experience

CELEBRATING THE GENIUS OF LEONARDO DA VINCI, 500TH ANNIVERSARY

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Gerontotechnology

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