Closer to Nature: Interactive Installation Design with a Therapeutic Robot for Enhancing Engagement in Seniors with Dementia

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Future Everyday- Industrial Design

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Seniors with Dementia in LTC are reported often: spend most of time alone and with limited stimulations of the senses, empty conversations or little engagement in meaningful activities, which can further lead to loneliness, sensory deprivation, social isolation or challenging behaviours.

• Deficits come with dementia
  • Diminished Cognitive Abilities of dementia
  • Increased difficulties in mobility
  • Lack of inner motivation (lose of interest, concentration)

• Lack of engagement in Long-term Care
  Seniors with Dementia in LTC are reported often: spend most of time alone and with limited stimulations of the senses, empty conversations or little engagement in meaningful activities, which can further lead to loneliness, sensory deprivation, social isolation or challenging behaviours.

Design Approaches for Enhanced Engagement

- **Social Robots** are designed to provide **companionship**, promote therapeutic interactions by encouraging people to actively engage in **social interactions**.

- **Multi-sensory stimulation** provides **senses stimulation** (visual, audio, tactile, olfaction and taste) without the need for complex reasoning, therefore are ideally for any stages of people with dementia.

- **Ambient Displays** provide continuing displayed information that naturally blends in to the environment, therefore enable **continued access** to a wider spectrum of users and perfect for use in public/shared spaces.

Installation Closer to Nature in Vitalis

• Design and Implementation

We utilize a novel combined approach of:
• Social Robot
• Multi-sensory stimulations
• Ambient Display

Expected to:
• Provide companionship, increase social bonding;
• Engage, delight users, stimulate reactions, encourage communications;
• Offer long-term access to residents with dementia, create a use context for facilitation of the social robot use;
• Reduce agitation, anxiety, increase autonomy and create a purposeful feeling.

Design and Implementation

• The self-built ambient display unit

Old-fashioned Water Pump
Infrared Sensor
SHARP, 2D120XF95

Water Trough
Metal plated with water proof, safety proof

Water Circulation System
Electrical water pump, Easy Tpy 513-0214
Water filter, Philips InstantTrust

Arduino Board
Custom-made Arduino enclosure
Connected to computer, infrared sensor, electrical water pump

Display
BenQ, 87"

Computer
MSI Nightblade MI B089
Connects to Arduino board and display

• The interactive robotic sheep through re-programming a Pleo robot

Design and Implementation

Explorative user evaluation including observational rating scales and semi-structured interviews to research on:

1) how participated residents responds to the interactive system design in general;
2) the effectiveness in engagement, affection, restore attentiveness, connectedness, and communication;
3) user experience and reflections from the perspective of staff and family members.
User Evaluation Study

• The evaluation study followed a repeated measurement design with two study settings: the Ambient Display unit-based interaction (setting 1) and the combination of an Ambient Display unit and a Social Robot based interaction (setting 2).
• 20 Participants were recruited including 9 residents of Vitalis, 5 family members (2 spouse/wife, 2 daughters and a son), 2 caregivers (one male and one female) and 4 volunteers (all female).

Results from Observational Measurement of Engagement (OME) and Observed Emotion Rating Scale (OERS).

<table>
<thead>
<tr>
<th>Rating items</th>
<th>Without IRS M (SD)</th>
<th>With IRS M (SD)</th>
<th>Z value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement (OME)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>498.00 (234.17)</td>
<td>678.39 (244.99)</td>
<td>-2.77</td>
<td>.006</td>
</tr>
<tr>
<td>Attention</td>
<td>4.89 (1.28)</td>
<td>5.67 (0.84)</td>
<td>-2.49</td>
<td>.013</td>
</tr>
<tr>
<td>Attitude</td>
<td>5.17 (0.78)</td>
<td>5.39 (1.20)</td>
<td>-1.07</td>
<td>.285</td>
</tr>
<tr>
<td>Affect (OERS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pleasure</td>
<td>2.17 (0.62)</td>
<td>2.50 (0.86)</td>
<td>-1.90</td>
<td>.058</td>
</tr>
<tr>
<td>General Alertness</td>
<td>3.72 (0.96)</td>
<td>4.39 (0.92)</td>
<td>-2.97</td>
<td>.003</td>
</tr>
</tbody>
</table>

Table. Results of Wilcoxon Signed Rank test of OME and OERS rating scales. IRS is abbreviation for Interactive Robotic Sheep.

Figure. Differences in Pleasure and General alertness in two settings. CTN for setting without IRS. LN for setting with IRS.

Implications

• Design for a holistic sensory enrichment.
• Design strategies toward active engagement.
• Reminiscent objects for a new experience.
• User-centered vs. family perceived.
• Empirical field study and co-creation with stakeholders.

Ethical Reflections

1) Such empirical field research with PWD should consider protecting user autonomy, privacy, and dignity. Therefore, a clear protocol for signing informed consent and data collection, storage, and access was set up.

2) “The nature of care is still human care”. Concerns of the employment of robots in dementia care is often raised, as it tends to replace the human relationship with technology. Closer to Nature performs as a bridge for social connectedness.

1. Turkle Sherry. 2017. Alone together: Why we expect more from technology and less from ourselves. Hachette UK.
Thank you!

Please contact Yuan Feng (Y.Feng@tue.nl) if you have any further questions.