Virtual Assistive Companions for Older Adults: Qualitative Field Study & Design Implications

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**Embodied Conversational Agents (ECAs)**

- Computer animated characters
- Typically humanlike
- Use natural ways of communication
- Perceive & express emotions
- Exhibit distinctive personality
- Learn/recognize models of others
- Learn/develop social competencies
- Establish/maintain social relationships

(a) Real estate Agent REA from MIT  
(b) Pedagogical agent Steve from University of Southern California  
(c) Greta from University of Paris  
(d) Multimodal assembly expert MAX from University of Bielfield  
(e) IVH from MIRALab, University of Geneva

ECAs for Older Adults

Reduce loneliness by means of empathic feedback

» Vardoulakis et al. 2012 [3]
Social companion for support & wellness counselling

» Abby King et al. 2013 [4]
Encourage more active lives & reduce prevalence of chronic disease

Coach for health education & behaviour change

Virtual Assistive Companion

- Natural dialogue interaction
- Emotion recognition
- Context & Behavior Interpretation
- Practical, psychological, social support
- 3D human-like virtual agent
- Long lasting beneficial relationship

Older Adults

Practical, psychological, social support
Long lasting beneficial relationship
3D human-like virtual agent
Emotion recognition
Context & Behavior Interpretation
Natural dialogue interaction

Pervasive Health
Qualitative Field Study

**Acceptance**
- Attitude, expectations, concerns, constraints

**Usefulness**
- Tasks to support older adults accomplish routine daily activities

**Social Intelligence**
- Communication skills & character traits for believable, comfortable, acceptable interaction

**Appearance**
- Humanlike vs. cartoonlike, formal vs. informal, gender, age, etc.
## Participants

### 20 Older Adults

<table>
<thead>
<tr>
<th>Living environment</th>
<th>Nursing home</th>
<th>Care apartments</th>
<th>Independent household</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology experience</td>
<td>Low</td>
<td>Medium - High</td>
<td>Medium- High</td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Age</td>
<td>65-85</td>
<td></td>
<td>65-92</td>
</tr>
</tbody>
</table>

### 12 Formal Caregivers & 2 Psychologists

<table>
<thead>
<tr>
<th>Working Environment</th>
<th>Nursing home</th>
<th>Care apartments</th>
<th>Elderly association</th>
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<tbody>
<tr>
<td>Participants</td>
<td>9</td>
<td>3</td>
<td>2</td>
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<tr>
<td>Expertise</td>
<td></td>
<td></td>
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<tr>
<td>Occupational therapist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Care coordinator</td>
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<tr>
<td>Qualified caregiver</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Neuropsychologist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gerontopsychologist</td>
<td></td>
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</tbody>
</table>
Methods

Qualitative Data

» Content Analysis
  > Interview transcripts
  > Reflective notes
  > Field notes

» Inductive Coding
  > Theme → Categories
  “The constellation of words or statements that relate to the same central meaning”

» Reduce Subjectivity
  > Independent researcher validation

Focus Group Interviews

Paper Mock-ups

Individual Interviews

Direct Observation

Methods

- **Paper Mock-ups**
  - Different gender & age groups
  - Humanlike look vs. Cartoonlike look
  - Informal vs. Formal look

- **7 point Likert Scale**
  - “Not attractive” - “Very attractive”

Models from “WorldViz Vizard” and “Mixamo” collections
INTRODUCTION

METHODS

RESULTS

DESIGN IMPLICATIONS
Results

- ACCEPTANCE
- USEFULNESS
- SOCIAL INTELLIGENCE
- APPEARANCE
Acceptance

- **Personalized attention**
  - Unlimited time to attend to needs of users

- **Autonomous**
  - Family, friends, caregivers not available at all times

- **Conversational**
  - Comfortable interaction format

- **Relational**
  - Designed for companionship & long-term use

- **Undermine Independence**
  - “I want to ask for help using my own mouth!” [Older adult, NL]
  - “Older adults need to think and act for themselves as much as possible” [Care professional, NL]

- **Privacy Intrusion**
  - “A system able to ‘see’ what I am doing is intrusive!” [Older adult, CH]

- **Replace Human Care**
  - “When there is something wrong caregivers come in, sit next to you on the bed and talk..” [Older adult, NL]
Usefulness

» Daily Schedule Management
“Some elderly need more reminders than others” [Care professional, NL]

» Dietary Planning
“Using the ingredients I have in the fridge, what could I prepare?” [Older adult, NL]

» Notifications
“When I get out, remind me that I have to think about buying milk” [Older adult, NL]

» Safeguarding
“Safety matters require high accuracy and reliability...” [Care professional, NL]

» Physical & Mental Wellbeing
“The virtual partner can encourage me to do physical activity...” [Older adult, CH]

» Socialization
“It gets quite lonely downstairs in the evening hours” [Older adult, NL]
Social Intelligence

» “Smooth” Communicative Skills

“Natural voice, smooth and continuous movement” [Care professional, NL]

» Express Pleasant Emotions

“It must definitely be a smiling, friendly face” [Care professional, NL]

» Emotion Recognition

“If the companion detects I am feeling sad or anxious it could propose going for a walk calling a friend.” [Older adult, CH]

» Guiding vs. Directing

“Focus should be on ‘Reminding’ instead of ‘Doing’...” [Gerontopsychologist, CH]
**Appearance**

- Female vs. Male
- Adult vs. Child
- Informal vs. Formal look
- Humanlike vs. Cartoonlike

“I want to be able to look the avatar in the eyes” [Older adult, NL]

“Humanlike avatars are too impersonal, too serious, maybe depressing after a while” [Older adult, CH]
Appearance

Average Ranking (n=9)

Attractiveness

Smiley | Female 1 | Child 2 | Male 1 | Child 1 | Female 2 | Male 2

0 0 0 0 0 0 0
Appearance

Average Ranking (n=15)

Attractiveness

- Smiley
- Female 1
- Female 2
- Child 2
- Male 1
- Child 1
- Male 2
Design Implications

Acceptance

» Privacy Considerations
  > User autonomy to interact & follow recommendations
  > Process multimodal data streams “on-the-fly”
  > Automatic decisions only in safety situations

Long-Term Interaction

» Relationship of trust
» “Working Alliance” [7]
  > Maximize outcomes in long-term helping situations

» “Episodic memory” [8]
  > Key past interactions
  > Learning from past experiences
  > Respond more adequately
  > Adapt to specific needs

Design Implications

Supplementing Vs. Replacing Care

► Machine vs. Human
  > Support for those who don’t have it
  > Trivial time consuming care tasks

► Avoid making user overly reliant
  > Self-confidence
  > Independence

Agent Personalization & Behaviour Variability

► Personalization
  > Care requirements
  > Living conditions
  > Likes & Dislikes
  > Social & Physical context

► Adaptation
  > Verbal & Non-verbal behaviour
Design Implications

Humanlike Behaviour & Appearance

» Balanced Realism

“People expect virtual characters to have a behaviour fitting their appearance”

» Uncanny Valley [6]

“Large difference between visual & behavioral realism”

> Repulsive response
> Danger of interaction break down

Thank you

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Find out more:
www.cameli.eu