Navigation for People with Mild Dementia

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Dementia

- a progressive disease affecting cognitive functions
- most commonly known symptom is the loss of memory
- also: loss spatial and topographic orientation
- interpreting a map is not feasible
- hence: an informal carer has to accompany the person with dementia (PwD)
Overall research question:

Can GPS route navigation assist people with mild dementia in finding their way?

Three small scale exploratory studies:

1. pre-study
2. study on preferred audio conditions
3. study on safety
Pre-study: methods

- literature study
- interviews with 23 people with mild dementia and their informal carers
- small experiment with 2 participants using Wizard of Oz method
Pre-study: main outcomes

- patients (16/23) and carers have a need for navigation support
- patients have a preference for a visual interface with landmarks (11/23)
- patients seemed able to operate the navigation support (2/2)
- patients reached their destination (2/2)

NB: outcomes are indicative due to the small scale exploratory nature of study
Pre-study: indications for follow-up research

Question:
Which type of audio support is most beneficial?

Concern:
How safe is it for people with mild dementia to operate a mobile device while participating walking along the street?
Audio study - Main Research Question

Which type of audio guidance is most beneficial to persons with mild dementia using navigation support?

- familiar voice (e.g. of informal carer) versus unfamiliar (default) voice
- with versus without a warning sound before a spoken instruction
Audio study - Design

- 4 participants (MMSE 17-25) each walked 4 pre-defined routes with randomly assigned audio conditions

- Observation of errors and assistance requests by participants

- After each route: questionnaire on satisfaction and experienced workload (NASA Task Load Index)

- Used technology: PDA’s with TomTom 6, adapted for maximum simplicity

<table>
<thead>
<tr>
<th>Voice only</th>
<th>Voice + warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfamiliar voice</td>
<td>U (CONTROL)</td>
</tr>
<tr>
<td>Familiar voice</td>
<td>F</td>
</tr>
</tbody>
</table>
Audio study - Results on Effectiveness

<table>
<thead>
<tr>
<th>variable</th>
<th>unfamiliar voice</th>
<th>familiar voice</th>
<th>without warning sound</th>
<th>with warning sound</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effectiveness</strong></td>
<td>16:53</td>
<td>16:27</td>
<td>15:53</td>
<td>16:58</td>
</tr>
<tr>
<td>Task duration [min:sec]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Errors</td>
<td>1.00</td>
<td>0.67</td>
<td>0.43</td>
<td>1.29</td>
</tr>
<tr>
<td>number of route deviations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>number of repeated instructions</td>
<td></td>
<td>1.50</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Requested assistance</td>
<td>1.67</td>
<td>1.33</td>
<td>2.14</td>
<td>1.00</td>
</tr>
<tr>
<td>number of asked questions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

indicative conclusions:

- familiar voice is more effective than unfamiliar voice
- the use of warning sounds has a negative influence on effectiveness
Audio study - Results on Cognitive Load

<table>
<thead>
<tr>
<th>variable</th>
<th>results per audio condition per route (14 routes by 4 participants)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>unfamiliar voice</td>
</tr>
<tr>
<td>Load on working memory</td>
<td>TLX score [5–25 points]</td>
</tr>
</tbody>
</table>

indicative conclusion:

- audio condition has no effect on Cognitive Load
Audio study -
Results on User Satisfaction

<table>
<thead>
<tr>
<th>variable</th>
<th>results per audio condition per route (14 routes by 4 participants)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>unfamiliar voice</td>
</tr>
<tr>
<td>User satisfaction</td>
<td>average preferences [1–5 points: from very negative to very positive]</td>
</tr>
</tbody>
</table>

indicative conclusions:
- no preference for familiar voice or unfamiliar voice
- small preference for warning sounds
Safety study

Research Goals:
- Develop an exploratory understanding of safety risks for our target audience in using a navigation device in a residential neighborhood.

Research methods:
- Literature review
- Observational research study (experiment):
  - data collected by observation and video-analysis (2h 36 min) during the Audio Study
  - 3 people with mild dementia walked in total 4 different routes of approximately 1 km
  - two observers: one to guarantee the safety of the participants
Safety study - outcomes literature study

- unable to find: scientific studies on safety issues of using portable navigation devices by people with mild dementia or elderly

- new focus: cognitive impact of dividing attention between two tasks (operating device, walking, paying attention to traffic)

- conclusion: senior citizens – and especially senior citizens with cognitive impairments – suffer diminished task performance in dual-task scenarios

- expectation: participants may experience “cognitive overload” symptoms when operating the navigation device and simultaneously paying attention to traffic and pavement
Safety study -
outcomes experiment

- at no time it was necessary to interfere to guarantee the safety of the participant

- dual task implications:
  - stopping during device use: after 17% (21/123) of the voice prompts
  - difficulties in walking: only one observation, not during device use
  - navigation instruction while crossing: no stopping, no slowing down
  - looking before crossing: in 84% (41/49) participants explicitly looked before crossing (control group without navigation device: 79% (15/19))

- conclusions:
  - no evidence of unsafe walking behaviour with navigation support
  - operationalising the concept of Safety is quite complex

NB:
outcomes are indicative due to the small scale exploratory nature of study
What is next?

• large scale experiments on safety

• research project on Social Navigation Support
Social navigation support

Person with dementia
(+ smartphone, GPS, Social Navigation)
- Taps emergency button
- Outgoing call
- Talks with carer, normal phone screen
- Arrives home
- Ends conversation
- Returns to main screen of phone

Carer
(+smartphone, Social Navigation, TomTom)
- Incoming call ringing, from PwD
- Accepts call, switches to handsfree
  talks PwD home, PwD position updated real-time in 3D/map view
- Ends conversation
- Returns to main screen of phone
Social navigation support
Project approach Social Navigation

Goal:
- design, develop, and test Social Navigation for people with mild dementia

How: in a user-centered design project
- involving users from the start
- experiments in lab setting
- field studies

Special attention to bridging the gap between project and practice
- involvement of stakeholders like a call center
- following a business model approach
- anticipating on structural financing

Current hurdle to take: project financing…
Thank you!