Methodology for designing, implementing and evaluating assistive mobility technology to enable the social inclusion and independence needs of an ageing population

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Larger project on social inclusion, navigation and Mild Cognitive Impairment (MCI)

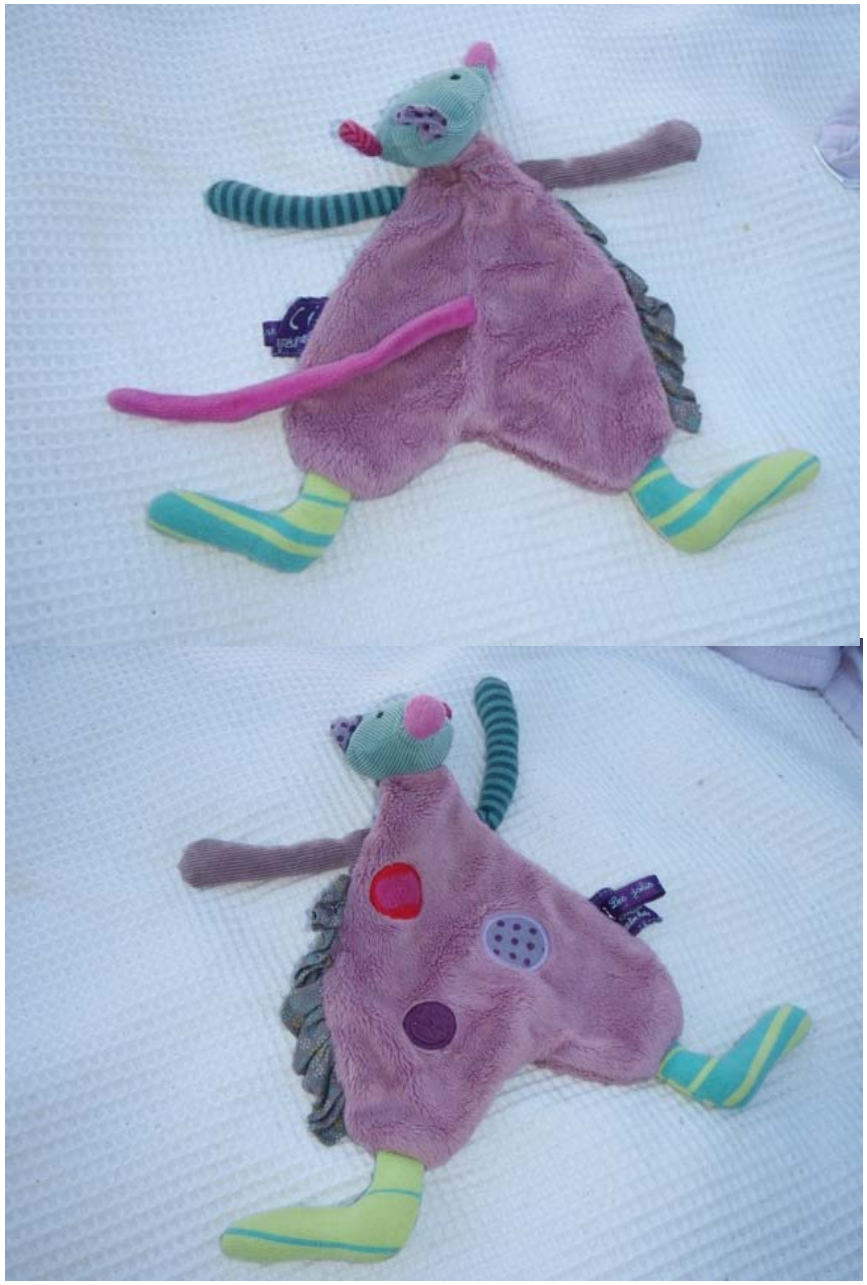
- Social inclusion; the right and possibility for every person to be member of a group, community, or society as a whole.
- Proves to be an important factor for self-esteem and quality of life.
- To be able to be mobile is a major prerequisite for social inclusion.

Early prototype: Project urban vibrations

- Wearable vibration belt
  - Component in a wearable system to assist with navigation in a larger longer term development.
- Field evaluation requires participants to feed back their experience through pressing three activity points in the belt when
  - they notice a vibration
  - vibration becomes uncomfortable
  - vibration becomes too uncomfortable (stop vibrations)

Material inspiration

- We looked generally at softer wearable solutions, and notice the impact of different textures and shapes for tactile interactivity
- We found baby-friendly (good) designs a valid place to start with many subtle different textures and actions with pulling stretchy parts and tags and ruffles, circling around round shapes etc.



Testing

low and high end sensitivity range and effects of interruption/distraction

- One hour urban evaluation
- Study sensitivity range with participants 9 to 75 years, of both genders, variation of experience with ICT.
- Vibration signals range from un-noticeable to slightly more powerful than that of a vibrating mobile phone.
- Training with the belt, interviews, demonstrations and questionnaires to gain insight into participants' experience in interacting with the belt.
- First training in a lab scenario.
- Later evaluation take place doing small tasks in everyday environments.
- Long term goal is to develop a wearable solution that will eventually assist elders with navigation.

Tasks:

Mixture of calm, multi-task and unaware task

- Task 1: Calm task
  - participants move in public space and pay attention and focus on own body movement and count while in a busy space
  - respond to vibrations
- Task 2: Busy/multi-focus task
  - participants move around in public space and pay attention and focus on urban environment, read buildings
  - in another example, take a photo of a building, concentrate through small camera keyhole (hands are bound up with camera)
  - need to adjust to responding to vibrations.

- Task 3: Unaware task

Cross here and count the number of white lines on the crossing to Bispensgade

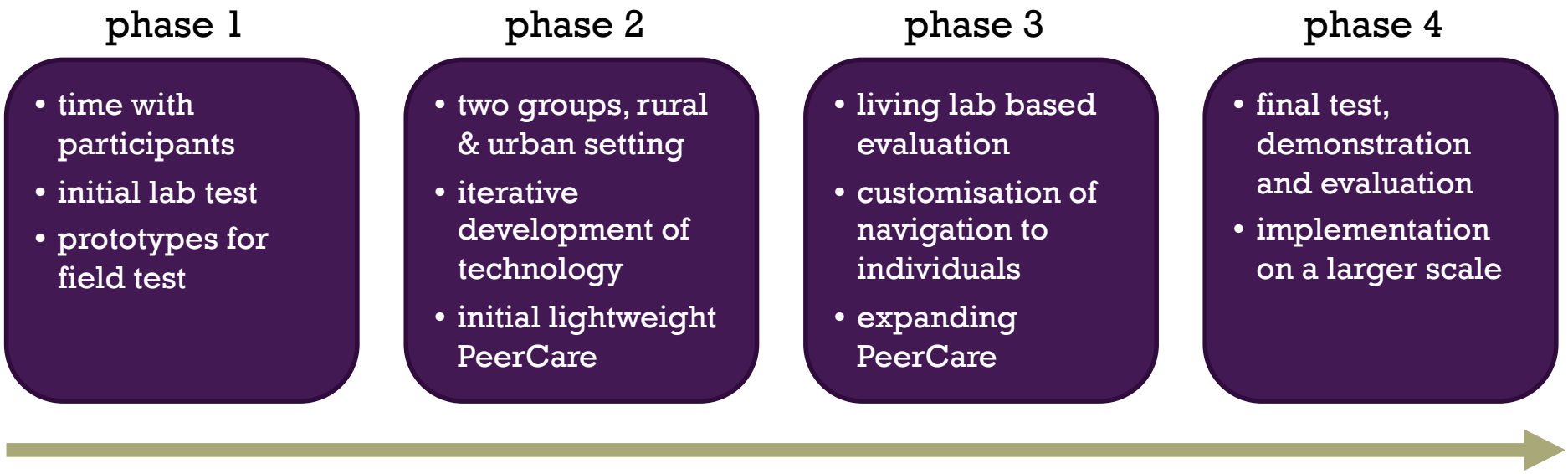
Sketching and prototyping

- Prototype still in redesign so we don't just get obvious feedback that we already know, e.g., the buttons were hard to find/press.
- Longer term goal to develop companion navigators, vibration is one component.
- Add modular components of what the individuals feel comfortable using, e.g., tablet, mobile phone, speech input and output, as the participant finds natural-enough already to use.

Methods to configure prototypes to participants' everyday life

- PeerCare as developed by Riche & MacKay (2010) in order to create a system that enhances the ability of elderly peers to communicate with and care for each other (Hutchinson et al, 2003).
- Methods for observing participants operating in their homes and usual habitats in order to design for their specific needs and to build a scalable living lab method (Winthereik et al, 2009) for urban and rural environments.
- As the prototypes become more robust, the repertoire expands and the user group is enlarged meaning a multitude of design and evaluation methods is required.
- Scaling up of product and user group sizes as we go.

Four phases



Four phases of iterative design, integration, test and evaluation methodology

Phase One

- In the first phase we work directly with a small group of people with MCI to get direct and specific input in the early plan, design and experiment phases.
- This small group and their everyday situations will form the focus of the kinds of navigation activities that we develop support for.
- Understanding everyday challenges of this group will inform the design of components.

- Integrated prototypes robust enough for field evaluations with a small group of people with MCI

Inspirational concept: MarkerClock

(Riche and Mackay 2007)

- MarkerClock is designed to be paired to another markerClock via a dedicated channel.
- Enhance a ubiquitous, familiar object, with information about the *peer's* activity.
- MarkerClock is both a standard clock and a window into the *peer's* household.
- MarkerClocks are symmetric: each *peer* provides and receives the same information.
- Activity information is turned into a simple, abstract representation - can be ignored or interpreted by a knowledgeable user.
- Balance between privacy and supporting shared awareness of each other's rhythms and routines, leading to both social and care exchanges.

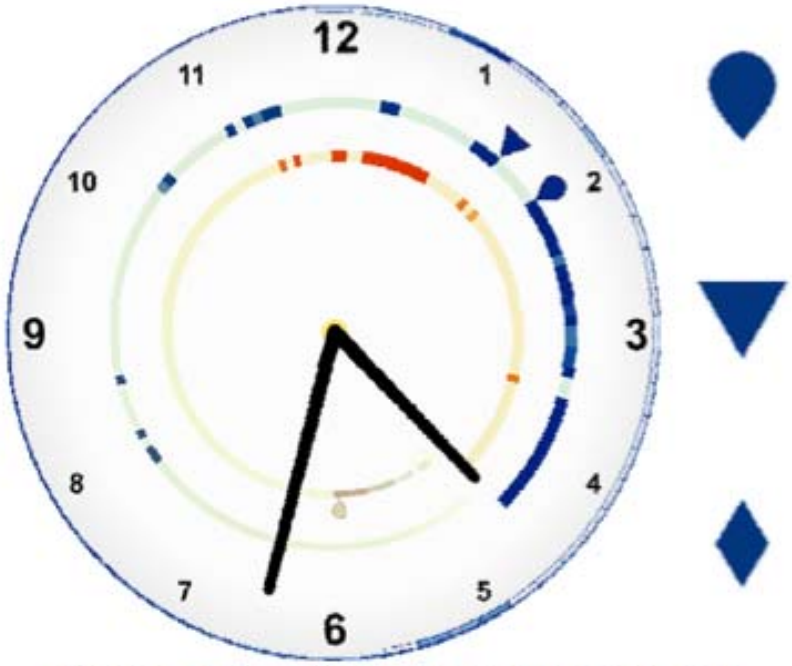


Figure 2. MarkerClock connects two users, each represented by a concentric colored ring.

Phase two

- Two groups of participants with MCI in urban and rural settings; everyday activities
- Field evaluations: relevant activities are identified by the participants (Riche & MacKay, 2010).
- Improve underlying technology and interaction design
- Iterative development of prototypes adding more complex tasks to the repertoire of navigational activities.
- Low-fi awareness prototypes, e.g. MarkerClock, Riche & MacKay (2010) into peer participants' houses (friends)
- Integration with assistive navigation devices.
- Establish PeerCare networks within an ageing community: safety issues and PeerCare emphasises reciprocal social relationships
- Practical support.

Phase three

- Living lab based (Winthereik et al, 2009) evaluations. Participants do mundane tasks in their home and daily life environments using the prototype for week-long periods.
- Involves iterative development of the prototype in order to allow appropriation of navigational concepts to the individuals' everyday activities.
- PeerCare, where elderly neighbors develop small networks Riche & MacKay (2010), Malmborg et al. (2010).
- Adds a more socially mediated element with low-fi concepts becoming integrated as an information stream both in the home and as vibrotactile information on the wearable devices.
- This component added to create a system that enhances independence with surety about mobility and navigation, and also integrates and extends the ability of elderly peers to strengthen social ties.

Phase Four

- In phase four user evaluations from phases two and three are added to technological results from the development of mobile computer vision, the decentralised backbone structure, and seamless navigation support and are integrated into a robust prototype which can be tested on a larger group of participants from both rural and urban areas.

- Both quantitative logging methods and qualitative observation and interview methods will be applied to evaluate use qualities of the navigational support in the final evaluation phases (MacKay, 1998).

Conclusion

- The methodology ensures that
  - the individual needs are taken into account,
  - small care networks are developed and
  - independence through mobility is supported.
- The design and evaluation methods ensure
  - the prototypes are appropriated to individual needs and wishes for a good everyday life through use of the prototypes at each stage
- The technology is designed so that it can be
  - incrementally scaled up to include customising for incoming individuals needs and
  - to support and initiate small and larger social groupings