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Mobile Feedback for NFC/RFID-based Applications

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Motivation: Increasing number of NFC-based applications, complex interfaces with a lot of tags
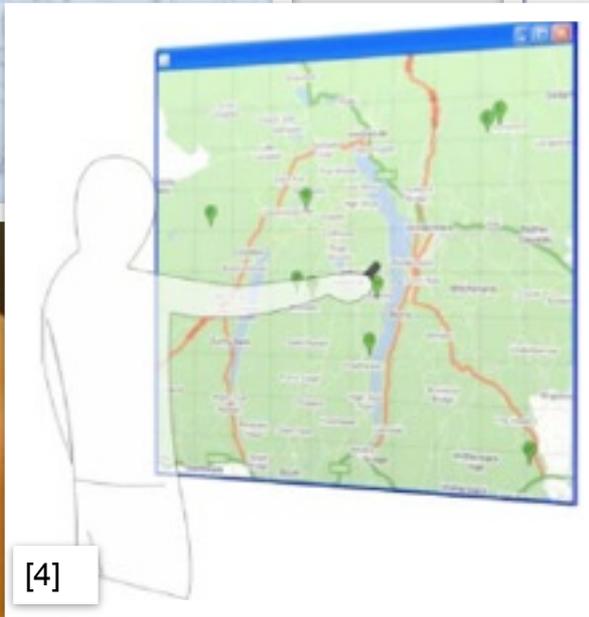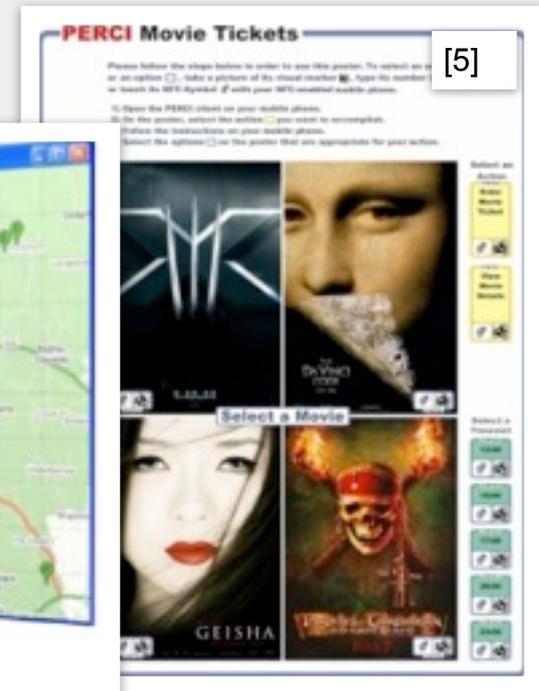

[1] [2] [3] [4] [5]

Goal: Comparison of different feedback methods for NFC-based applications
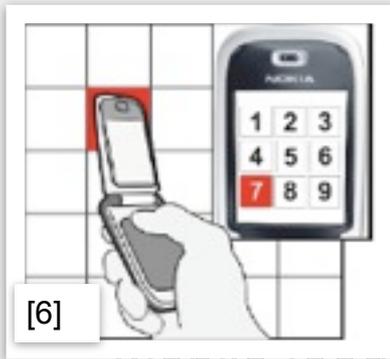
Agenda

1. Related Work
2. First User Study
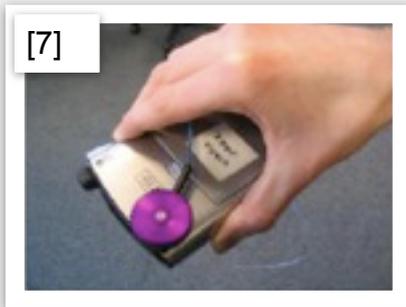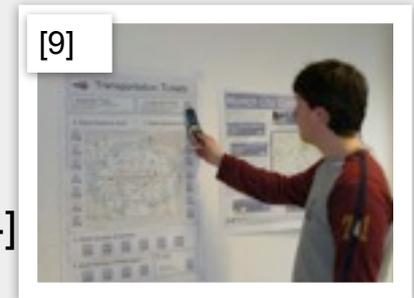3. Second User Study
4. Conclusion & Outlook

- **NFC-based applications**

  - **Perci (PERvasive ServiCe Interaction) project,** NTT DoCoMo Euro-Labs [10]
  - **Improving the Accessibility of NFC/RFID-based Mobile Interaction through Learnability and Guidance** [11]
  - **Touch & Interact project** [12**]**


[6]

Mobile feedback

  - **Tactons, Earcons** [13]
  - **Tactile Feedback for Mobile Interactions** [14]
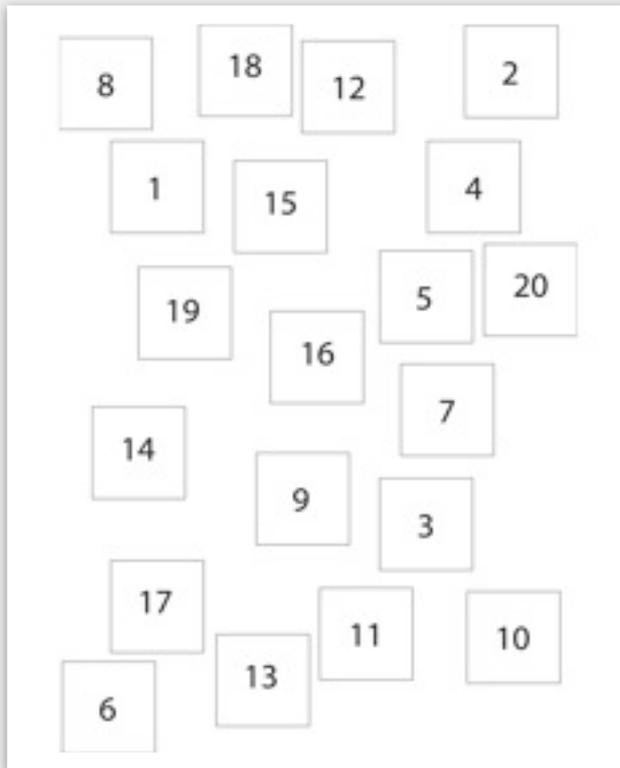
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How do users perform simple tasks with different feedback technologies?

- Abstract use cases (as abstract as possible)
- Two prototypes with different feedback situations
  - Simple and strong confirmation
  - Simple and critical error
- Haptic, auditory and visual feedback
- Measurement of time and attention shifts
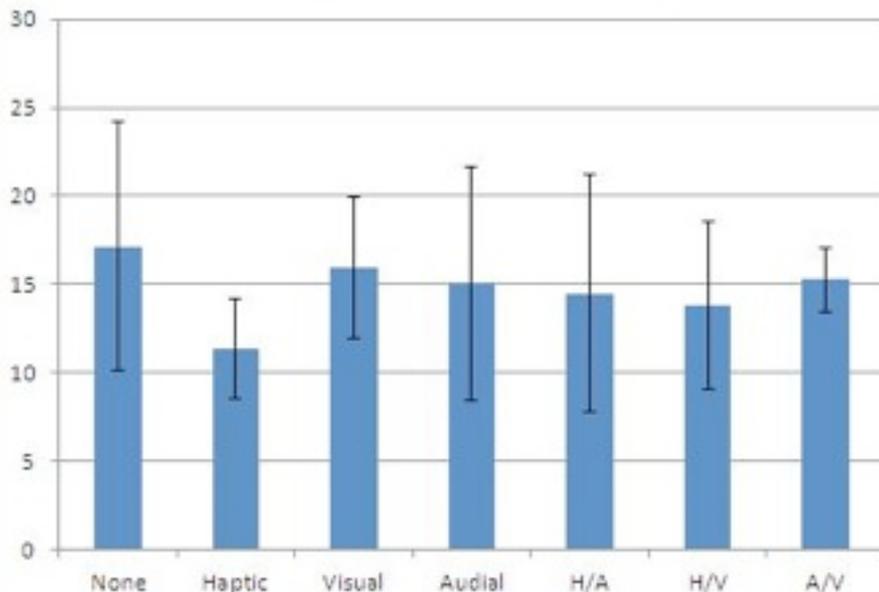- 14 participants, latin square design
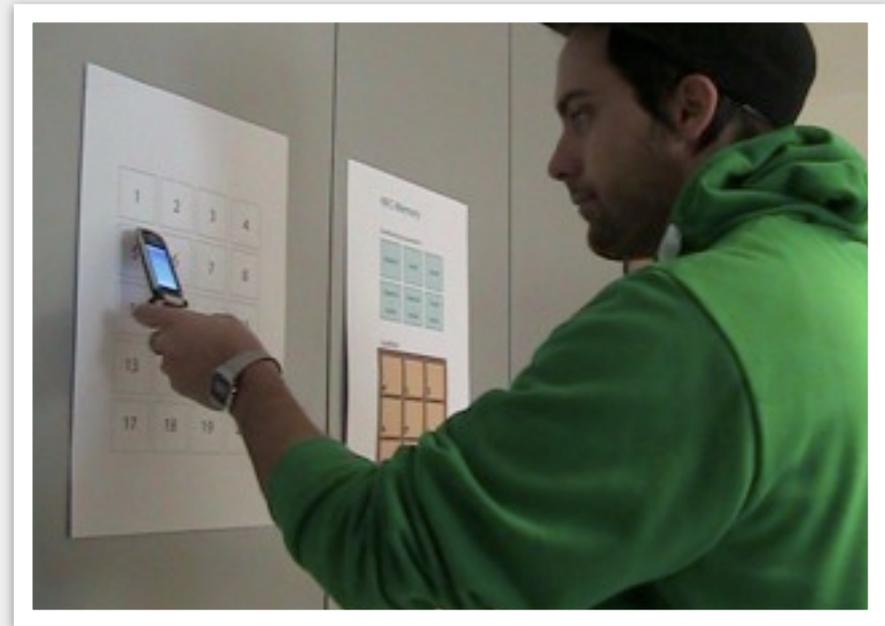
First Prototype:
Task 1: Touch all uneven numbers
Measured: Time and attention shifts

Feedback: Simple confirmation
       Haptic: Short vibration
       Audio: Simple tone
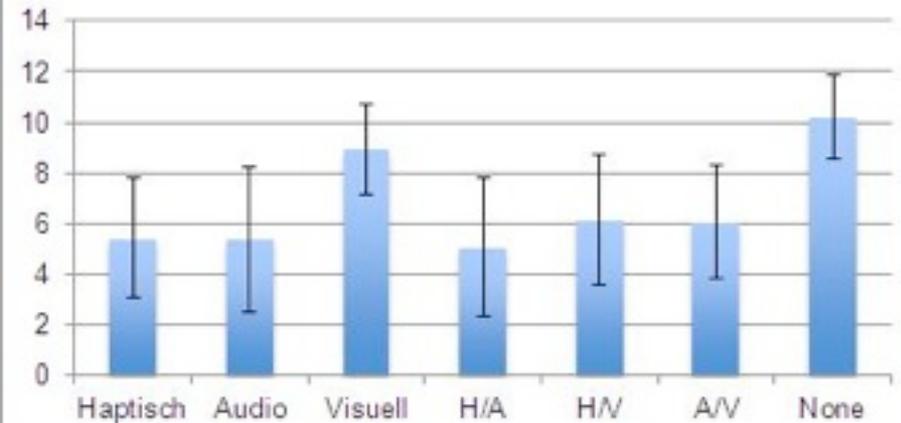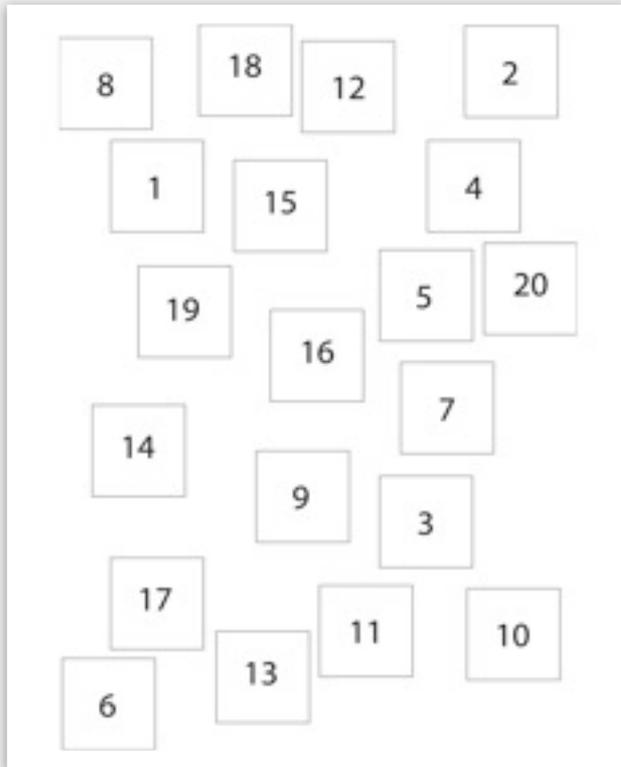   **Visual**: Text-alert with number
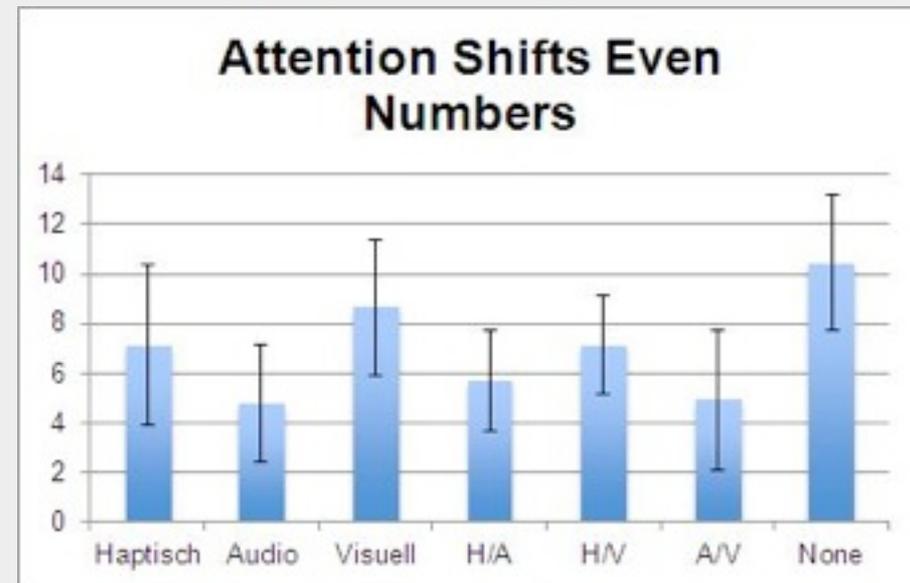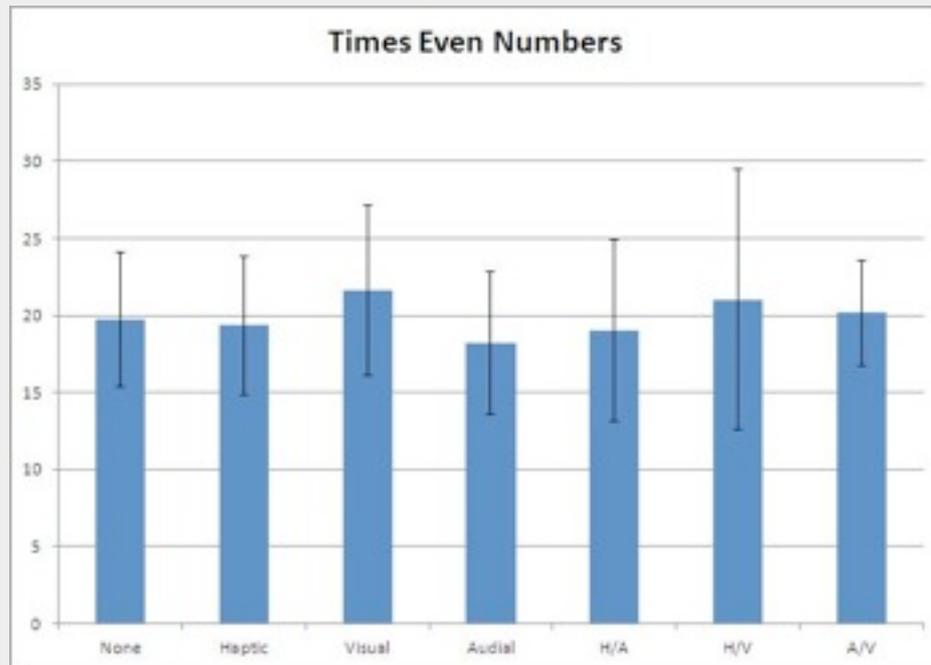
Results:

First Prototype:
Task 2: Touch all even numbers (three damaged tags simulated) and identify the three damaged tags
Measured: Time and attention shifts

Feedback: Simple confirmation and critical error
      Haptic: Short Vibration/Long Vibration
      Audio: Simple tone/broken tritone
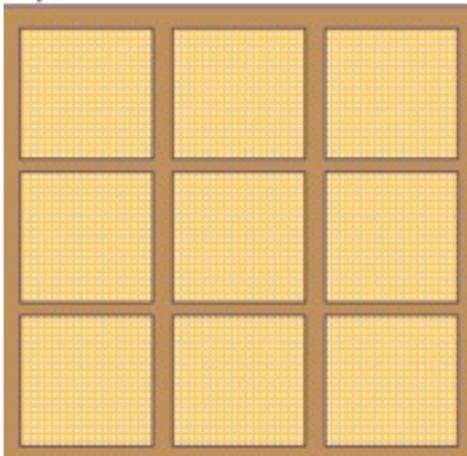   Visual: Text-alerts

Results:

NFC-Memory

Feedbacktyp auswählen:

Haptisch	Audio	Visuell
Haptisch + Audio	Haptisch + Visuell	Visuell + Audio

Spielfeld:

Second Prototype:
Task: Find the four pairs
Measured: Time and Attention shifts

Feedback: Simple and strong confirmation, simple and critical error

Haptic:
• Short vibration/Two short vibrations
• Long vibration/Two long vibrations

Audio:
• Simple tone/Broken major triad
• Broken tritone/"Alarming" sound
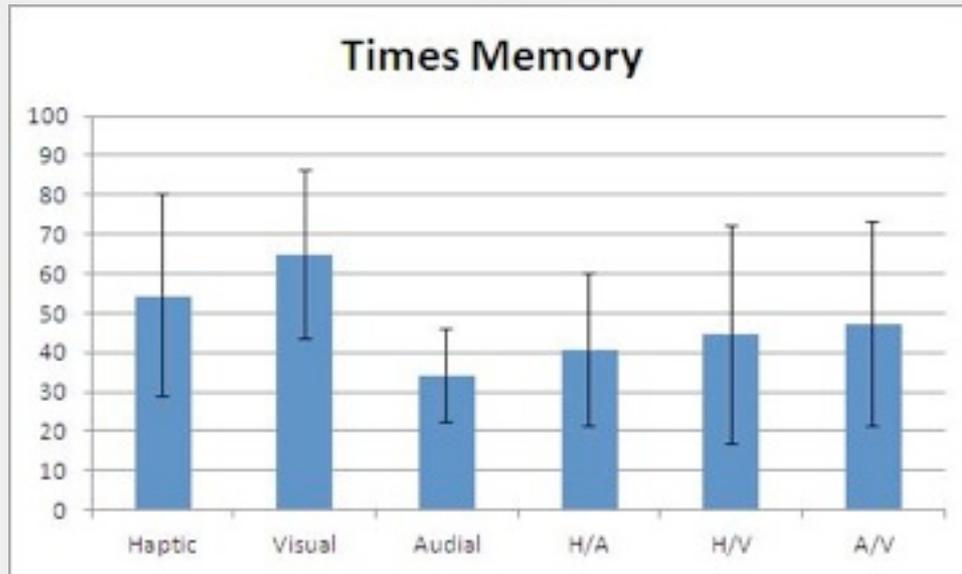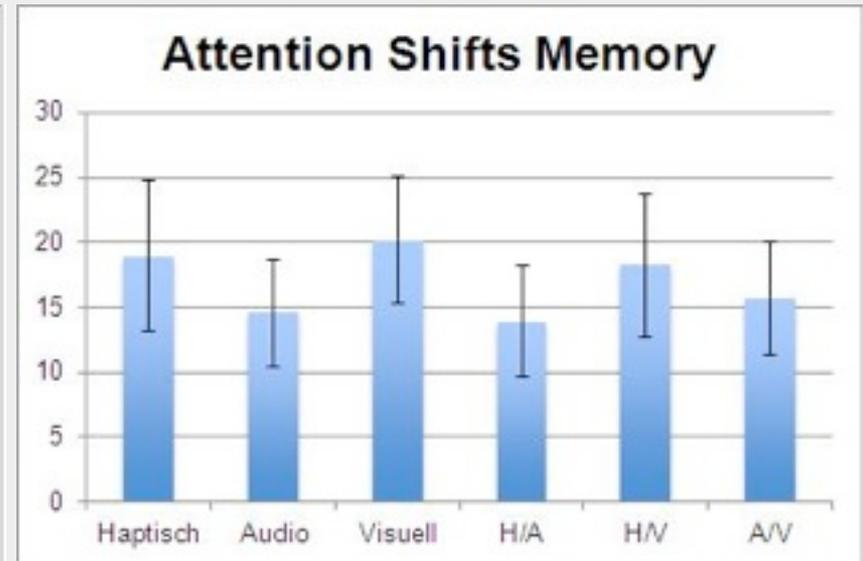
Visual:
• Text-alerts and picture-alerts

[14]

Results:

Results:

- Performance of users with visual feedback worse than with haptic or auditory feedback

- For more complicated tasks involving different feedback situations the audio feedback leads to best performance

- The users like the haptic feedback but have difficulties to recognize and learn patters

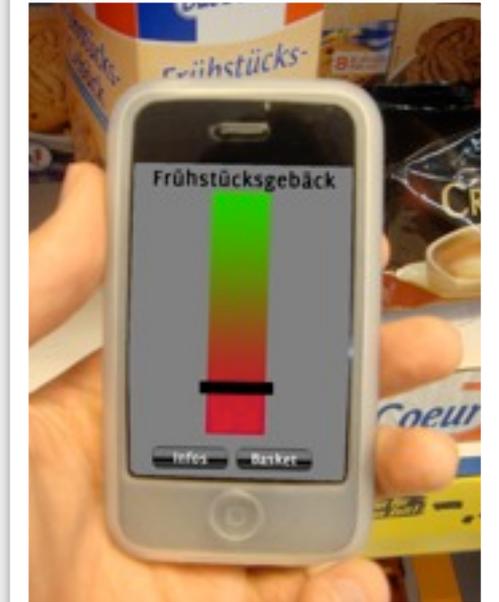- The users are concerned about privacy with audio feedback
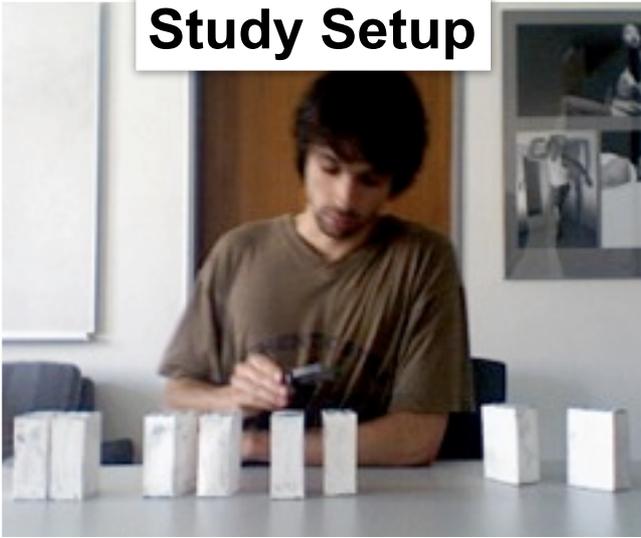
Original idea: Diabetes type 2 use case

[14]

Online Health Profile

Study Setup

The Feedback:
Haptic/Visual: A short vibration to confirm the touch of the tag, a diagram with a green-red scale to show the sugar content and text alerts to warn about allergies.

Audio/Haptic: A short sound to confirm the touch of the tag, 1-5 short vibrations to express the sugar content and a long vibration to warn about allergies.

- 12 participants
- 8 tagged products (white boxes)
- Every product has an assigned sugar content
- The user scans the products an orders them according to the sugar content
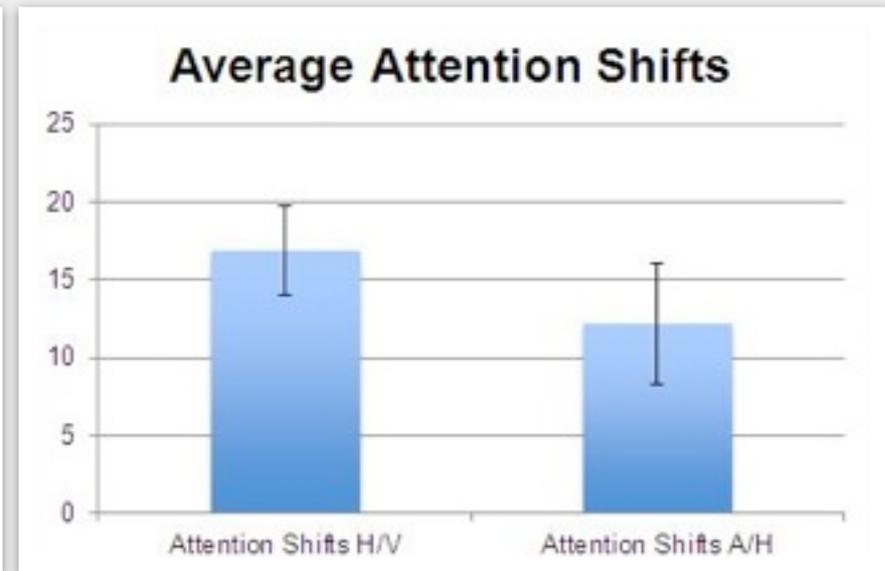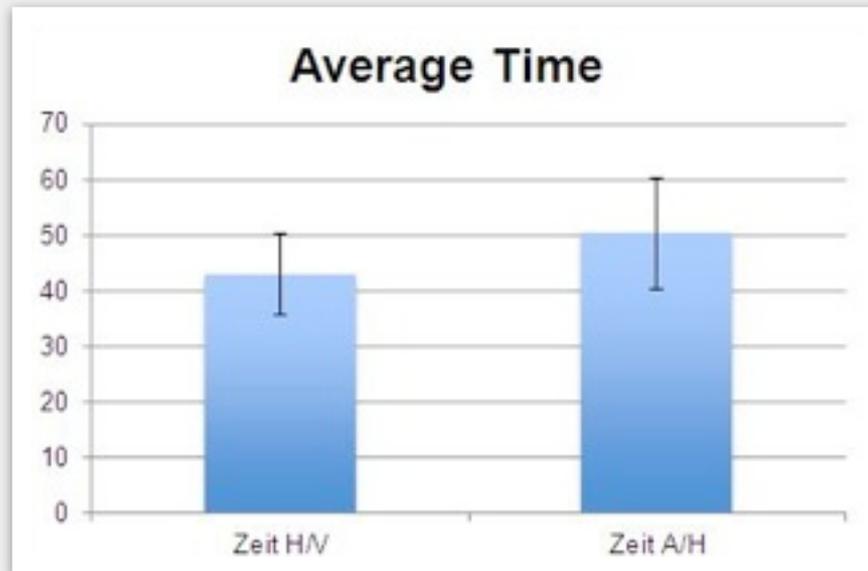- Identification of the two products he is allergic to and two products with the same sugar content

Results:

- Users prefer the visual feedback although it produces more attention shifts
- The haptic feedback is considered useful, but needs too much attention

Conclusions

- People like haptic feedback and see the benefits
- Current vibration capabilities of mobile devices not sufficient to deliver complex feedback
- Auditory feedback is easy to learn and leads to good performances in a lot of situations, but users are concerned with privacy issues

Future Work

- Build a "library" of feedback patterns
- Build advanced prototypes with capable vibration motors

Thank you for your attention!

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References

[1], [2], [3], [5], [10]: http://www.hcilab.org/projects/perci/index.htm

[4]: Hardy, Rukzio, Wagner, Paolucci: Exploring Expressive NFC-based Mobile Phone Interaction with Large Dynamic Displays.

[6]: Hardy, Rukzio: Touch & Interact: Touch-based Interaction of Mobile Phones with Displays.

[7], [8], [14]: Brewster: Tactile Feedback for Mobile Interactions.

[9], [11]: Broll, Keck, Holleis, Butz: Improving the Accessibility of NFC/RFID-based Mobile Interaction through Learnability and Guidance.
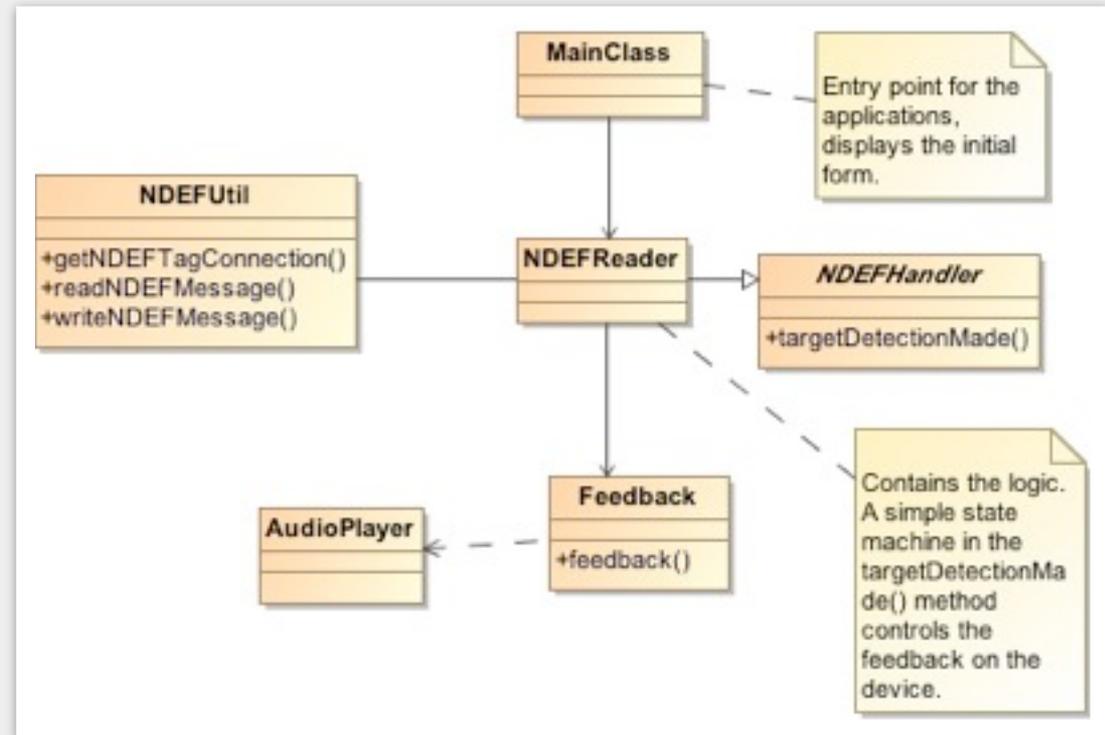
[12]: http://www.comp.lancs.ac.uk/~rukzio/projects.shtml

[13]: http://www.dcs.gla.ac.uk/~stephen/publications.shtml

[14]: http://www.iconfinder.net

• Based on Nokia 6131 NFC SDK

Results: Qualitative Results