A Subjective Evaluation of Multimodal Notifications

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What is the MMH Project?

• Improve home reminder systems, allowing for independent living
• Consider the user’s needs
• Consider the home environment
• Multimodal Interaction
Sensory Impairment

“As well as chronic illness, older people are also more likely to have a disability. Nearly half of disabled people are aged 65 or older. The most common problems relate to movement and to vision and hearing. Sensory impairments become increasingly common as people age: around 80% of people over 60 have a visual impairment, 75% of people over 60 have a hearing impairment, and 22% have both a visual and hearing impairment.”

-Department of Health

Multimodal Notifications

- Notifications typically Visual/Audio
- Tactile Notifications increasingly in popularity, but limited to phones
- Olfactory notifications extremely rare, but some basic ones do exist
Changing Attitudes to Technology

- Playstation Eye
- Released 2003
- Sold 10.5 Million Units in 5 years

Penny Arcade - 2007

If you want to play Eye of Judgement, we need the Playstation Eye. I don’t know. There’s just something weird about it.

Statement:

That’s weird.

Does it need to be on all the time?

It’s not actually plugged in.
Kinect

- Microsoft Kinect
- Released 2010
- Sold 10 Million Units in 6 months

Penny Arcade - 2010
Multimodal Notifications

- Multiple Modalities can provide flexibility in the face of Sensory Impairment and Changing Requirements
- Also provides options for delivering delicate information privately
- But not being used...

Two Experiments

- Subjectively evaluate a range of notification modalities over 2 experiments
- Used NASA TLX
- 8 Interaction Modalities tested
Notification Modalities

- Considered Visual, Auditory, Tactile and Olfactory (smell) notifications
- Visual represented by Text, Pictogram and Abstract Visual methods
- Auditory represented by Speech, Earcons and Auditory Icons
- Totalling 8 Notification Modalities

Experiment Method

- Card matching game is primary task
- Pressing buttons secondary task
Experiment Hardware

Experiment 1 - Hypothesis

With *interrupting* notifications, the notifications (grouped by sensory apparatus) will have different subjective workload ratings measured by NASA-TLX.
Experiment 1 - Design

- Notifications grouped by Visual, Auditory, Tactile and Olfactory
- 3 Notifications per game
- 5 Games per Condition
- TLX questionnaire after each condition
- Included Control condition without notifications

Experiment 1 - Participants

- 27 Participants
- 14 Male, 13 Female
- 20 Aged 18-30, 4 Aged 31-45, 3 Aged 46-60
Results

Experiment 2 - Hypothesis

With *distracting* notifications, the notifications will have different subjective workload ratings measured by NASA-TLX.
Experiment 2 - Design

- 8 Conditions, one per Notification Modality
- Plus Control condition without notifications
- 3 Notifications per game
- Notifications may or may not require a response
- 4 Games per Condition
- TLX questionnaire after each condition

Experiment 2 - Participants

- 18 Participants
- 12 Male, 6 Female
- 17 Aged 18-30, 1 Aged 31-45
Results

- Speech and Auditory Icons well received
- Earcons performed well
- Tactile memory lapse
- Scepticism about Olfaction
- Olfaction had practical issues
Other Interesting Findings

• Lack of Significant Differences between Control and Experimental conditions
• Subjective performance correlated with primary task performance

In Conclusion

• Even ‘gimmick’ modalities like smell could have a use in the home
• Can be done without much cost
• Guidelines and Models needed to help developers include additional modalities
• More work needed
Questions?

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