Design Guidelines and Design Recommendations of Multi-touch Interfaces for Elders

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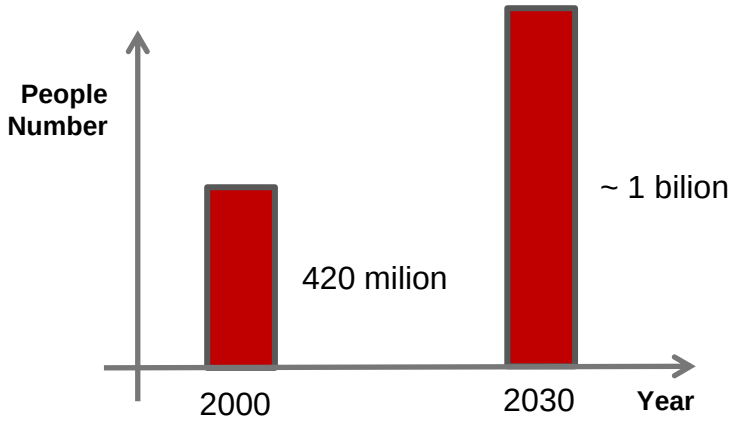
Overview

- Worlwide population is aging. **(Farage et al., 2012)**
- The number of people over 65 years in the world. **(Ribeiro et al.,2010)**

Year	People Number
2030	~1 billion
2000	420 million



- In 2030, one habitant out of four will have over the age of 65. **(Zaphiris et al.,2005)**

- Aging brings age-related changes, e.g., physical and cognitive changes, that influences the interaction. **(Loureiro and Rodrigues, 2011)**
- Elders have difficulties handling traditional input devices, e.g., keyboard and mouse. **(Boustani,2010)**

Overview

- An alternative are NUI (Natural User Interfaces), in particular Multi-Touch Interfaces.
- Many lists of design guidelines are proposed in the literature for elders, e.g., websites, TV user interfaces, etc.
- Lack of set of design guidelines and design recommendations of multi-touch interfaces for elders.
- This paper proposes a set of design guidelines and design recommendations of multi-touch interfaces for elders.
- Useful resource for designers, application developers, usability specialists and researchers.

Background

Aged-Related Changes

Aged-Related Changes

Physical Changes

Cognitive Changes

Visual

Main Changes:
- Visual acuity;
- Peripheral vision;
- Dark adaptation.

(Fisk et al.,2009)

Hearing

Main Changes:
- Hearing loss;
- Detection of tones in all the frequencies in special high-pitched sounds.

(Caprani et al., 2012)

Motor

Main Changes:
- Gait disturbances;
- Balance difficulties;
- Motor control problems.

(Schut,1998)

Memory

Main Changes:
- Short-term memory;
- Long-term memory.

(Hawthorn,2000)

Attention

Main Changes:
- Difficulty in complex tasks;
- Maintaining attention (long periods of time).

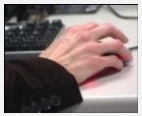
(Comodori and Guarnera,2008)

Background

Suitable Input Devices For Elders

- Human-computer interaction is possible using a wide range of input devices, e.g., keyboard, mouse, touchpad, touchscreen, etc.
- The input devices can be classified in indirect and direct input devices. **(Wood et al., 2005)**

Indirect Input Devices



- Coordenation of spatial information;
- Hand-eye coordination;
- Difficult to use by elder users.

Direct Input Devices

- Direct user input on a display;
- Reduced cognitive and coordenation demands;
- Easy to use by elder users.

- The interaction modes in touchscreens can be classified in single-touch and multi-touch interaction. **(Lepicard and Vigouroux, 2013)**

Single-Touch Interaction

- A only a point of contact is recognized, e.g. using a finger;
- Performing of basic operations, e.g., open and close programs or pushing buttons.

Multi-Touch Interaction

- Detection of multiple simultaneous touch points, e.g., using the fingers of a single hand or the both hands;
- Gestures on surface, enables a diversity of operations.

Background

Multi-Touch Interfaces

- Natural User Interfaces use natural interactions of humans to interact with user interface elements, using:

Multi-Touch

Gestures/Movements

Speech

Facial Expressions/ Body language

Eye-gazing

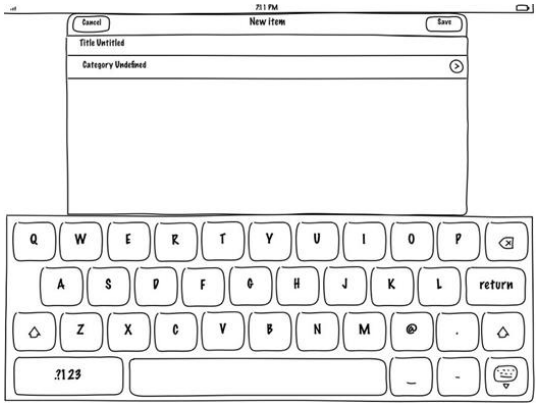
- There are a diversity of devices that supports multi-touch and gestural input, an interesting device for elders is tabletop, due to:
  - Large interaction area;
  - Multi-user support;
  - Great potential in face-to-face social interaction (e.g. playing games).

A pair of elderly using a multi-touch tabletop.

(Apted et al. 2006)

Background

Designing Multi-Touch Interfaces for Elders



- The design of a multi-touch user interface should suit elder's needs to be easily used. **(Leonardi et al.,2010)**
- Lists of design guidelines of multi-touch interfaces are scarce in the literature.
- **(Boustani,2010)** presented a list, but some aspects are missing, e.g., gestures desirable and avoidable and guidelines to help the interface testing.

- Design recommendations to attenuate aged-related changes:

Visual

- Appropriate size of interface elements and text;
- Make use of high contrast colors.

(Caprani et al. 2012)

Hearing

- Presence of a control to adjust audio is crucial.

(Nunes, 2010)

Motor

- Large targets for accurate selections;
- Avoid the use of scrolling.

(Boustani,2010)

Memory

- Use of appropriate feedback;
- Include the current system location.

(Nunes et al.,2012)

Attention

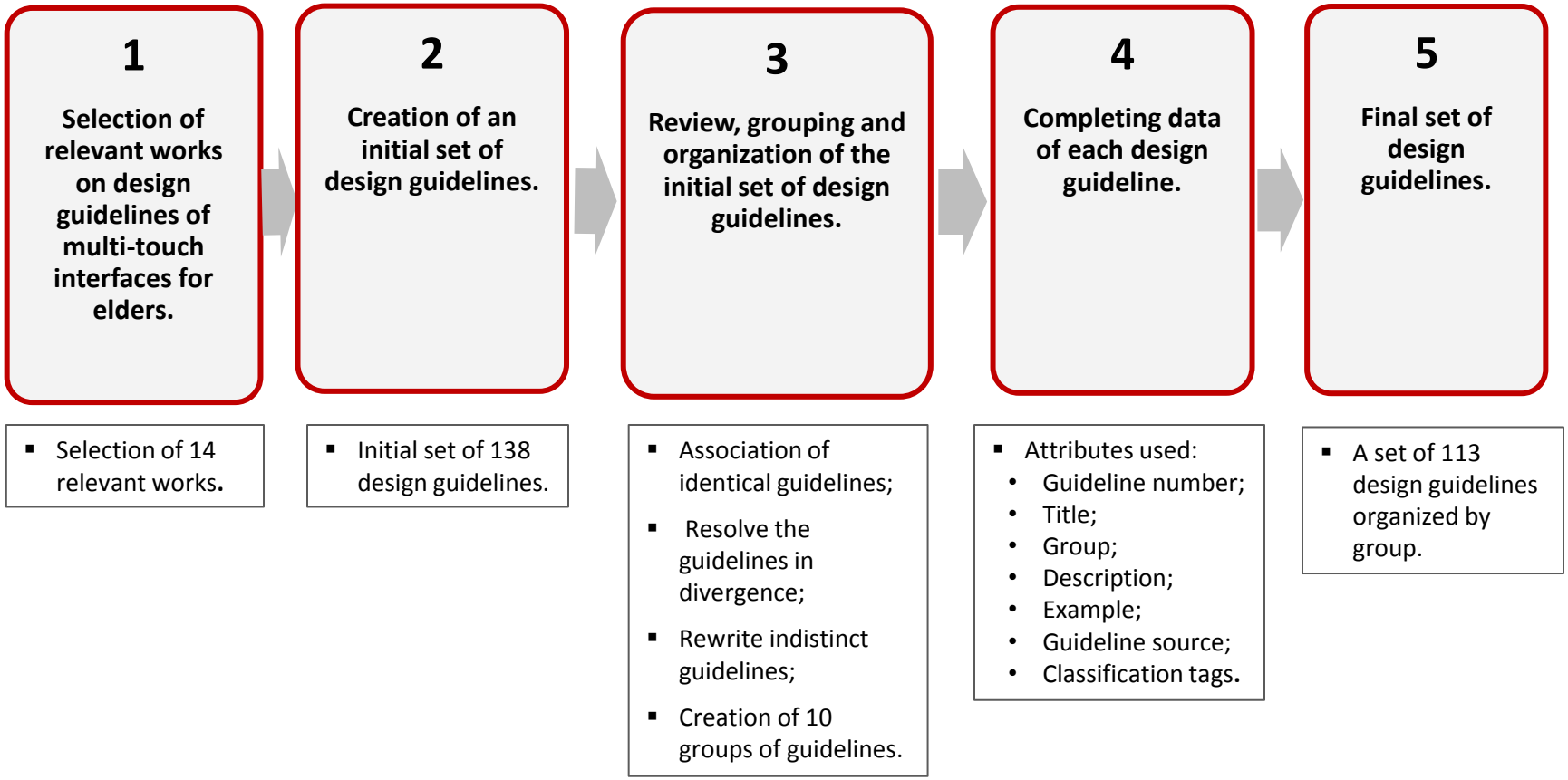
- Avoid animations;
- Avoid irrelevant information.

(Boustani,2010)

List of Design Guidelines

Methodology

- The list of design guidelines was reached using the following methodology:



List of Design Guidelines

- Examples of selected works:

Title	Author(s)
"An Exploratory Study of a Touch-based Gestural Interface for Elderly."	(Leonardi et al.,2010)
"Tabletop sharing of Digital Photographs for the Elderly."	(Apted et al., 2006)
"Determining the Benefits of Direct-touch, Bimanual, and Multifinger Input on a Multitouch Workstation."	(Kin et al., 2009)
"Exploring the Accessibility and Appeal of Surface Computing for Older Adult Health Care Support."	(Piper et al.,2010)
"Touch Screens for the Older User."	(Caprani et al., 2012)
"Designing Touch-based Interfaces for the Elderly."	(Boustani, 2010)
"Design Recommendations for TV User Interfaces for Older Adults: Findings from the eCAALYX Project."	(Nunes et al., 2012)

List of Design Guidelines

- Guidelines Organization

- Examples of Guidelines

G1 - Target Design

- Ensure the user can easily make interface elements larger (adjustable);
- Different physical properties have to be considered while designing the interface (e.g. size of buttons).

G2 - Use of Graphics

- Use icons along with labels;
- Use high contrast between the elements of the user interface;
- Blue and yellow or red and green tones should be avoided.

G3 - Navigation and Errors

- Provide a good navigation;
- Design error messages that make it clear that the user is not the cause of the error;
- Make it easy for user to correct input errors.

List of Design Guidelines

Final Design Guidelines

G4 - Content Layout Design

- Concentrate information on the center of the screen;
- Maintain consistency in the user interface;
- Remove user interface elements calling attention.

G5 - User Cognitive Design

- Be prepared for older adults that refuse to learn;
- Make use of behaviors developed by older adults to cope with memory loss.

G6 - Audio

- Increase duration of sound signals;
- Use male voices for delivering auditory information;
- Remove sound distractions.

G7 - Text Design

- Use a very large font type;
- Use left-aligned text;
- Use an easy to read font family, e.g., Helvetica, Arial.

G8 - User Feedback and Support

- There is lack of tactile user feedback;
- Use supporting peripherals if needed.

G9 - Multi-Touch Interaction

- Tap gestures (when applied to well recognized objects) are the easiest ones to understand and remember;
- Iconic gestures are very engaging;
- Natural affordances of screens are needed.

G10 - Interface Testing

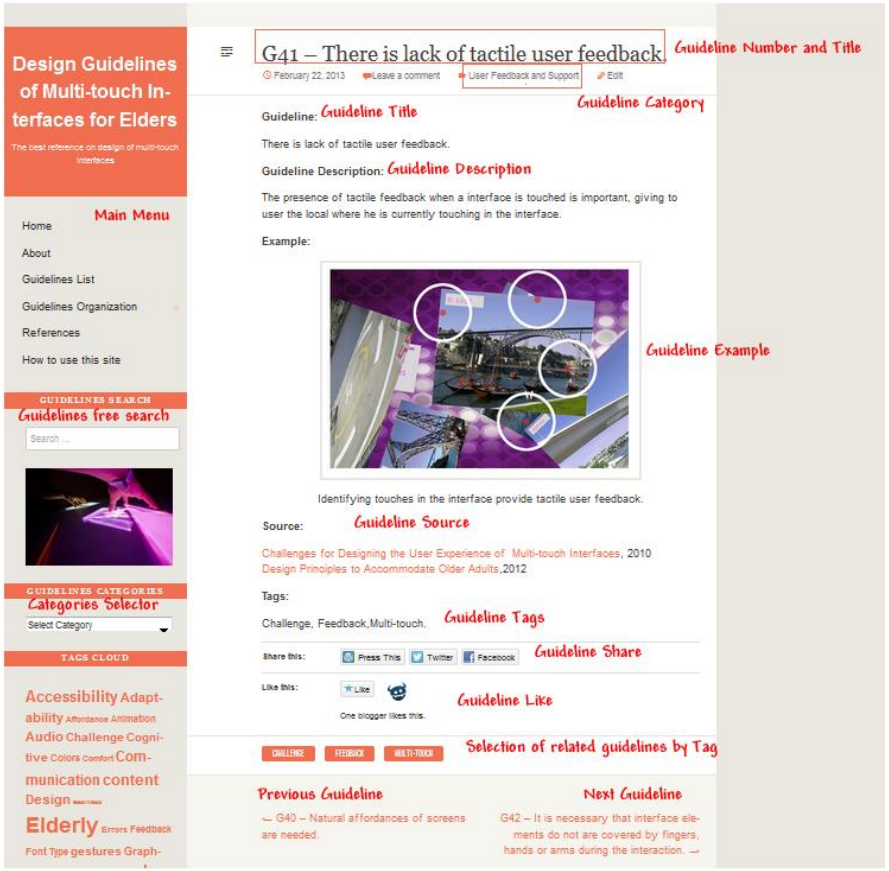
- Inform the older adult of the goal of the project beforehand;
- Keep the test short and make use of breaks;
- Respect the opinions of the test participants.

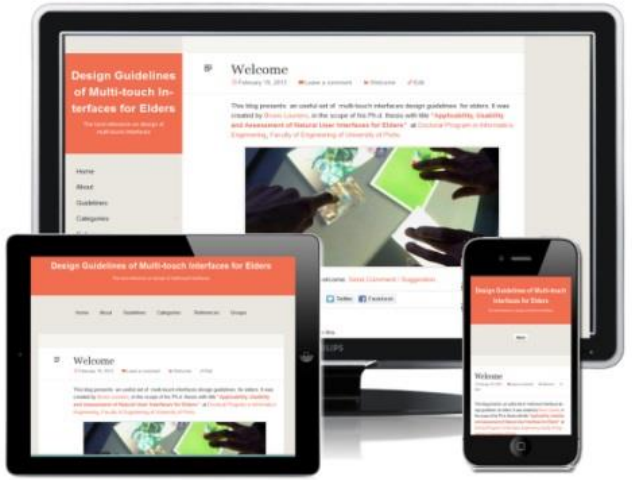
List of Design Guidelines

Final Design Guidelines

- On-line Version

http://eldermultitouchguidelines.wordpress.com





Main Features

- Responsive design;
- Quick access to guidelines list;
- Search of guidelines;
- Visualization of guidelines by group;
- etc.

Conclusion and Future Work

- An organized set of design guidelines of multi-touch interfaces for elders was proposed;
- List of design guidelines structured in a very detailed and comprehensive way;
- Useful resource for designers, application developers, usability specialists and researchers;
- Possible extensions of this work:
  - Use of the design guidelines in an automatic detection system;
  - Inclusion of other design guidelines in the list;
  - Review and rating of the design guidelines by experts;
  - Design of a multi-touch interface with and without the use of proposed guidelines.

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Thank You!

Questions?

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