Usability study (II).
Usability test results according to ISO9241-9

Deliverable 3.2. (II)

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Version	Comments	Authors
V1	This document summarizes the most important aspects worked on basic usability according to ISO9241-9 standard. The work presented in this report has been coordinated by Ricard Barberà and Nadia Campos (IBV). All members involved in WP3 have made important contributions to this deliverable summarized as follows: • Definition of ISO 9241-9 protocols (UniBwM) • Development of the application ISO9241-9 (UniBwM) • Performance of the ISO 9241-9 test (VIOS, IM, ST, IBV) • Review of the report (all WP3 Partners)	Ricard Barberà (IBV) Nadia Campos (IBV) Steffi Erdt (IM) Ute Vidal (VIOS) Martin Burkhard (UniBwM) Gustavo Monleón (ST)

Deliverable Nº: D 3.2. Usability Study (II)
Title: Usability test results according to ISO9241-9 standard.
WP: 3 User requirements and context analysis

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Main focus and objectives:
This document presents the results of the usability test according to ISO 9241-9:2000, used to select the most adequate screen to implement the Elisa System.

Integration into Project work plan:
This document is integrated between WP5, valuation, and WP4, development.

Deviation from description of the work (if it is necessary):

Main results and use value for project:
The results of this validation will be used to select the hardware in which integrate ELISA.

Main conclusions and consequences:
The ISO 9241-9:2000 test allows selecting the best option to implement the ELISA system, the SAMSUNG 10.1 tablet.

Content

1   Introduction

This report is part of the WP 3 "User requirements & Context analysis" of the project "SI-Screen/Elisa" whose purpose is to create a new user oriented social interaction tool that enables elderly people to stay or to get in touch with family, friends and neighbourhood, and which helps them to find local activity, health and wellbeing offers.

This report presents the results of the usability test performed according to ISO9241-9 over different devices. This test was used to support the selection of the device.

2   ISO 9541-9 Validation

2.1   Objectives and methodology

We have used the ISO 9241-9:2000, Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 9: Requirements for non-keyboard input devices:

- To measure ideal element size for users when using touch screens
- To compare the hit rate and accuracy

The test to be performed was based on Fitts' law: http://en.wikipedia.org/wiki/Fitts's_law, and consisted in touching a circle spot within a circular figure in a predetermined order. In this test the key parameters were:

- ID   = difficulty of a test
- D   = distance between two elements, given by the display size oft he tablet
- W   = width of an element, calculated out of the difficulty and display size
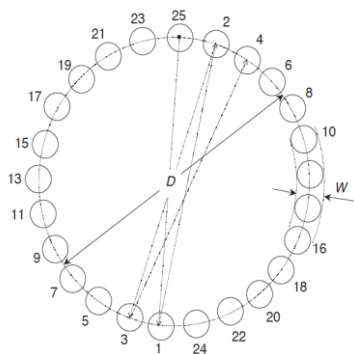
$$ID = \log_2\left(\frac{D}{W} + 1\right).$$

The test was programmed in English, Spanish and German with the following characteristics:
- 12 tests in total, executed in random order (prevent learning)
- tests with difficulty ID = 2.5 (easy) with 11 circle elements
- tests with difficulty ID = 3.0 (normal) with 11 circle elements
- 3 tests with difficulty ID = 3.5 (moderate) with 11 circle elements
- 3 tests with difficulty ID = 4.0 (hard) with 11 circle elements
- After each complete test the results are stored in an excel file (+ csv backup)

Annex I contains more information about the methodology used during this validation.

2.2 Results of the ISO 9541-9 validation

The test was performed by 30 older persons (15 in Germany and other 15 in Spain, 23 women and 7 men), with an average age of 65.7 years (from 57 to 91 years old). The participants involved in this test included all main typologies of users.

The key data used for the selection and classification of the different devices were the users' preference and the number of errors. Taking into account this data we obtain the following table relating the preferences of the users and the number of errors.

Device	First+Second	Third+Fourth	Error
Samsung 10	19	11	547
Sony P	17	13	1346
Sony S	14	16	1471
Samsung 7	10	20	2750

The first column represents the device.The second column represents the number of times that the devices was selected by older persons as the most preferred or second option. The third column represents the number of times that the devices were selected as less preferred or third option. The last column shows the number of errors for all users when performing the test in each of the devices.

As a conclusion, we can say that **bigger devices are preferred to small devices** and **the number of errors is related to the perception of the users**. Older persons preferred the bigger devices producing less errors.

The results of this test have been published in:

Burkhard, M. & Koch, M., (2012). Evaluating Touchscreen Interfaces of Tablet Computers for Elderly People. In: Reiterer, H. & Deussen, O. (Hrsg.), Mensch & Computer 2012 – Workshopband: interaktiv informiert – allgegenwärtig und allumfassend!?. München: Oldenbourg Verlag. (S. 53-59).

ABSTRACT

The AAL project SI-Screen focuses on providing an innovative user interface for elderly people enhancing their access to awareness streams of Social Networking Services by using tablet computers. As part of our attempt to investigate the acceptance of the newly developed user interface, we assessed the display size and touch input accuracy of multi-touch tablet computers in a multi-directional tapping task as proposed by the ISO 9241-9 standard. In this paper we present our methodology for evaluating touchscreen interfaces with elderly people and discuss our initial findings obtained in Germany and Spain.

Lux, P.; Mueller, T.; Burkhard, M. Android Tablet-Computer im Pilottest mit Senioren [full available at: http://www.soziotech.org/tablet-pilottest-mit-senioren/]

ABSTRACT

Interaction with the Elderly & Service Assistant (Elisa) in the EU research project SI Screen. A tablet computer that is tailored to the individual needs of older people. To measure the touching accuracy of the older generation on tablets, a test application for a multi-directional tapping task was made according to ISO 9241-9 standard and evaluated in a pilot test with four seniors. In this paper, we present the first application and test results of the pilot test before with four different Android tablet computers. Accompanying interviews over the technical knowledge of the participants and the claim of display size, shape and material properties were recorded in questionnaires.

REFERENCES

ISO 9241-9:2000 Ergonomic requirements for office work with visual display terminals (VDTs)-Part 9:
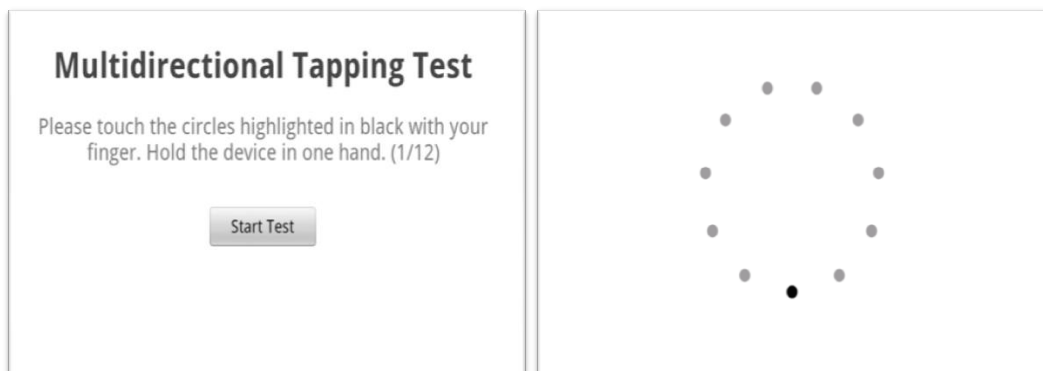Requirements fo non-keyboard input devices

ANNEX I. Main aspects of the software developed for the ISO 9541-9 test.

The tablet is given to the user and the evaluator notes the start time of the test. As soon as the user enters into the main screen a unique identifier is created internally for each test candidate. This identifier is used for storing the test data. When you cancel a test or restart the application a new unique identifier is created

Tablet Evaluation

Welcome to the ISO 9241–9 input device test.

Launch
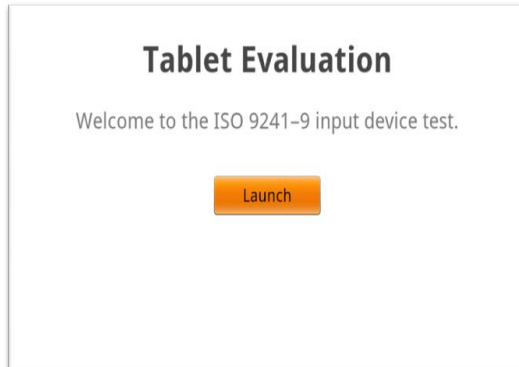
One out of the 12 multidirectional tests is randomly selected
- Every time a user touches a highlighted circle the next circle will be highlighted
- After each test the test results are stored into an excel file. If the test is cancelled before the test is finished the test data is lost.

Multidirectional Tapping Test

Please touch the circles highlighted in black with your finger. Hold the device in one hand. (1/12)

Start Test

After all 12 tests have been performed the end screen is shown and then the application can now be closed

The End

Thank you for your time and your support!
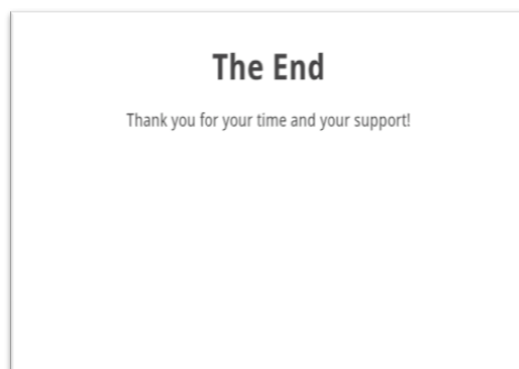
Summary of program management:
- Data is stored on external SD card
- Storage location is: /mnt/sdcard/CSCM.TabletEvaluation
- Older tablet devices (Samsung Galaxy Tab) require an external SD Card
- Modern tablet devices (Sony S, Sony P, Galaxy Tab 10.1N) have a built-in SD Card
- In case an external SD card is missing, the app will present an error message

- Data from built-in SD Cards can be read via USB, depending on the manufacturer for Samsung install Kies Software first: http://www.samsung.com/us/kies/ another option is to install a File Manager / Explorer via Android Play Store

Android Test Data Access. Test Data Description

- participant ID   = unique identifier
- tablet device   = name of the tablet device
- date time   = date and time when the user pressed on the screen
- test nr.   = name of the test ranging from „Test1" to „Test12"
- circle nr.   = numbre of the circle element ranging from „1" to „11"
- centre X-coord   = X position of the circle element on the tablet in pixel
- centre Y-coord   = Y position of the circle element on the tablet in pixel
- centre deviation   = distance from the centre of the circle in pixel
- ISO ID   = difficulty of the test
- ISO W in Px   = width of the circle element in pixel
- ISO D in Px   = distance of two circle elements in pixel
- screen width   = width of the tablet display in pixel
- screen height   = height of the tablet display in pixel
- XDPI   = exact physical pixels per inch of the screen (X dimension)
- YDPI   = exact physical pixels per inch of the screen (Y dimension)

Android Test Data Access.Test Protocol

- All test candidates where asked to hold the tablets in their hands to cause fatigue
- The following steps were performed in the pilot tests:
  - Introduction
  - Begin with the initial questions of the questionnaire
  - Perform 1 to 4 tablet test in randomised order of the tablets
    - perform ISO 9241-9 test on device
    - make notes about your observations
    - ask elderly person fill in results in questionnaire
  - Let elderly person rate the tablets they used
  - Optional feedback

References

- Overview: http://www.cse.yorku.ca/course_archive/2004-05/F/4441/ISO9241-9.pdf
- Official Standard: http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=30030

ANNEX II. Summary of the questionnaire used during the ISO 9241-9:2000 validation

Consent sheet template

ParticipantID:_____

Dear Sir or Madam,

In the european project SI-Screen / elisa we evaluate the usability of tablet devices for elderly people. The following questions help us to analyse your comfort when using touch or speech input on tablet computers. From results of our tests we derive the design guidelines for the graphical layout of elisa and usuability improvements that reflect your personal needs.

<data privacy statement>

This evaluation and interview is performed by <organisation>

In case of any questions feel free to contact us.

Thank you very much for your support
Best regards

<Person Responsible

address

Thank you for your participation!

Question for the characterisation of the users

Do you agree with the following statements?

I am very interested in new and innovative technology	Totally disagree	☐	☐	☐	☐	☐	Totally agree
I find computer programs adapting to my personal needs very useful.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
In case I have to contact technical support I usually feel like everyone knows more than I do.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
In case of technical issues friends and relatives usualy ask me for assistance.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
Usually, I am the first one to try latest technology	Totally disagree	☐	☐	☐	☐	☐	Totally agree
Even for complex techinical devices,I do not require any assistence.by others	Totally disagree	☐	☐	☐	☐	☐	Totally agree

How often have you used the following devices with touch screens in the past month?

Ticket machine, e.g. for train tickets	Never	☐	☐	☐	☐	☐	Daily
Car navigation device	Never	☐	☐	☐	☐	☐	Daily
Mobile phone with touch display (Smartphone)	Never	☐	☐	☐	☐	☐	Daily
Tablet computer with touch display	Never	☐	☐	☐	☐	☐	Daily

For each of teh four devices the users had to answer to the folowing topics:

Test 1 Samsumg Galaxy 10	
Do you agree with the following statements?	

I had fun using this tablet device.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
The recognized touch input was very accurate.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
I feel phyically exhausted after using this device.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
The screen display is too small.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
The exterior frame of the tablet is of excellent quality.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
Touching the display with my fingers was very comfortable.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
During the test I had to concentrate.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
The tablet was to heavy.	Totally disagree	☐	☐	☐	☐	☐	Totally agree
All in all, the tablet was very easy to use.	Totally disagree	☐	☐	☐	☐	☐	Totally agree

Additionally the users were asked to rank from place 1 (best) to 4 (worst), according to your overall impression of their usabilty

PLACE:	**Samsung Galaxy 10**
PLACE:	**Sony Tablet P**
PLACE:	**HTC Flyer**
PLACE:	**Sony Tablet S**

To complete the feedback some open space were given to the users.

ANNEX III.