HERMES – Cognitive Care and Guidance for Active Aging
FP7-ICT 216709
Specific Targeted Research or Innovation Project

Start date of project: January 1, 2008
Duration: 39 months

D7.3 - User Evaluation Report Trial 2

Mari Feli González (INGEMA)
Ana Navarro (INGEMA)
David Facal (INGEMA)
Sebastian Prost (CURE)

Abstract

This deliverable covers the procedure and results of the second user trials of the HERMES system. In particular it describes the conditions of the trials in Austria and Spain, how users were recruited and the three different evaluations carried out. In the concept evaluation the users were presented with the HERMES scenarios and asked to rate them. In the user experience evaluation the participants tested the HERMES Home System, HERMES Mobile and Cognitive Games by performing several tasks. In the home trials, the participants tried out the minimal system at home, with learnability as the main focus of the evaluation.

Results of the evaluation concentrate on the following aspects:

- User acceptance of the technology
- Quantitative and qualitative evaluation of system acceptance and problems while performing the tasks
- Qualitative usability evaluation through think-aloud protocols and observation
- Learnability evaluation with users at home.

The results for each of the components of the HERMES system are summarized and several conclusions about the performance of the system are drawn. In general the system was well accepted in the different evaluations, being the Calendar, the Shopping Lists and the Cognitive Games the applications better accepted. Few usability problems were identified and were mostly related with the nature of the devices (e.g. small size of the PDA). Regarding learnability, even no differences between the time needed for completing the required tasks between first and second session, less errors were observed in the second session. HERMES system has been designed following a User Centred Design and that is why different evaluations have been carried out. In the first user trial the participants identified several usability problems that were improved after this evaluation. In the second evaluation the users have been presented with an improved version of the first prototype. The results obtained in this second evaluation have been more positive than in the first one.

TABLE OF CONTENTS

1. Introduction

1.1 Background

User centred design is the concept that refers not only to the methodology used for designing the easy-to-use products and systems but also to a philosophy whereby the user is at the centre of the process (Rubin, 1994). It is the process of development in which the needs, desires, and limitations of the final users are reviewed at each stage of the design. According to this approach, it is important to evaluate not only the possible end users' performance, but also their acceptance. The HERMES project has adopted this methodology. A first prototype was tested at the end of 2009 and with the feedback gathered from the end users a second prototype was designed and implemented. This second prototype was tested at the end of the project. The focus of this evaluation was not only to obtain information about the usability and usefulness of the system but also about the acceptance of it in a lab environment in two different countries and, hence, in two different cultures. This final prototype was also tested in a home environment where the learnability of the system was the main outcome of the evaluation.

1.2 Scope of this deliverable

This document contains the information regarding the second user trial evaluation. Specifically, it collects the information regarding the methodology followed in this second trial as well as the evaluation instruments. The main results and main conclusions in terms of the usability, acceptance and learnability of the system are also detailed in this deliverable.

The basis of this deliverable is deliverable D7.1, in which the general evaluation framework can be found as well as D7.2, in which the results in the first user trial are detailed.

This deliverable is structured as follows: sections 2 aims to give a general overview of the components of the system tested in each type of evaluation. Section 3 provides information about the trials procedure (recruitment of the users and methodology of the concept, user experience and home evaluations). Section 4 is more exhaustive and tries to reflect the results found in the three evaluations. The aim of the section 5 is to summarize how the ethical issues have been address in the second trial as well as information exchange between the HERMES end-user partners and the external ethics advisors. After this section the main conclusions drawn are summarized in section 6.

2. Components tested

In the second user trial, five types of evaluations were carried out.

- Heuristic evaluation of the mobile and home system, carried out by user experience professionals at CURE
- User experience evaluation, carried out in both Austria and Spain.
- Performance evaluation of the underlying HERMES components, carried out in Austria.
- Home evaluation, carried out only in Spain
- Concept evaluation, carried out in both Austria and Spain. The methodology followed in this evaluation was the presentation of the HERMES scenarios in different groups of people and, after that, the administration of some questionnaires related to their acceptance. Since no components were tested, this evaluation is detailed in section 3.3 and not in this section.

2.1 Type of evaluation

2.1.1 Heuristic evaluation

A heuristic evaluation of the mobile and home system has been performed prior to the start of the trials to identify and consecutively correct existing usability problems. The HERMES prototype has been assessed by usability professionals at CURE. Assessment was based on several guidelines, targeting both general user interaction and specific requirements of elderly people and touch interaction. The following tables list the heuristics used:

Information Input

	Guidline
1	Information input should be as simple as possible, only one input at a time. A sequence of inputs/promps is preferred compared to a form-filling style of input.
2	Clearly highlight the input position or focus on the screen.
3	There should be a “Backspace”/”Delete” button to correct entered text and/or a “Clear” button to clear the whole input.
4	Try to avoid requiring long textual inputs to the system.

User Feedback

	Guideline
5	Brief feedback to show that a screen button has been pressed (auditory tone, change of color, inverse video, or a 3D pressed-in effect).
6	Audio feedback for lengthy inputs can be annoying to the user.
7	If audio feedback is used, modify the sound frequency characteristics (should not be lower than 120Hz).
8	If the system response to user input takes more than 2 or 3 seconds, users may start to feel that a fault has occurred. Show a progress indication.

User Cognitive Design

	Guideline
9	Provide ample time to read information.
10	Reduce the demand on working memory by supporting recognition rather than recall and provide fewer choices to the user

11	Focus on learnability and memorability. Addresses greater difficulty in learning new concepts and helps with declining short term memory.
12	For designing an interface rely on familiar aspects of manipulating a physical object or use metaphors. A familiar interface can also help against techno-phobia.
13	Minimise the number of interface elements, based on common user interface goal of simplicity.
14	Strive for predictability by maximising consistency. Use new objects with new appearances for new interface behaviours. This avoids clashes with the user's existing knowledge.
15	Support user in reducing clutter. This is especially important if many user interface elements need to be large. In general, reduce distraction from the current focus.
16	Reduce functionalities which require a conceptual background as far as possible.
17	Write the text in simple language. Avoid using technical and computer related terms.

Interaction and Navigation

	Guideline
18	Do not use a deep hierarchy and group information into meaningful categories. Use a one-level-navigation instead of using menu structures.
19	Provide location of the current page/screen and provide extra and bolder navigation cues (basic controls for navigating through the system: Start, Finish, Restart, Step back/Go back, Next page, Previous page, Enter/OK, Cancel/Exit).
20	Users may choose system functions by mistake: Provide a clearly marked emergency exit button to leave the unwanted screen.
21	Provide (redundant) visual guidance to support the flow of interaction (e.g. a graphical hint to help encoring the end users to touch the next button).
22	Avoid complex control techniques - due to the limitation of the orderly's upper limbs, the elderly finds hard to perform sliding and rotating touch screen controls.
23	Use familiar (multi-touch) gestures. If they are familiar to gestures of the real world, they reduce the error rate compared to standard touch-interaction.
24	Avoid pull down menus.
25	Avoid scroll bars.
26	Avoid double tapping.
27	Provide only one open window.
28	Align all interface elements in a horizontal and vertical grid.
29	Arrange the buttons on the bottom of the interface, so the input-hand would not hide the screen.
30	Display headlines the top of each screen as the major information.
31	Information should be concentrated mainly in the center. Important information should be highlighted. Avoid irrelevant information on the screen.
32	Consider that the screen/tabletop may be large so users may be unable to reach the whole screen easily.

Target Design

	Guideline
33	Provide larger targets, at least 20-26mm per side.
34	Provide clear and meaningful target capture.
35	Ensure the user can easily make interface elements larger.

Use of Color and Graphics

	Guideline
36	Graphics should be relevant and not for decoration. No meaningless animation should be present.
37	Icons should be simple and meaningful. Test out, if they are understandable.
38	Add labels to icons.
39	Touch areas or screen buttons should be easily distinguishable from other graphics.
40	Icons need to be large, to be identifiable by older people with reduced eyesight.
41	Colors should be used conservatively. The number of colors should be kept within reasonable limits (4 or 5).
42	Combinations of blue/green, red/green and red/blue tones should be avoided.
43	Provide color-neutral displays for visual impaired users.
44	There should be hight constrast between foreground and background.
45	Background screens should not be pure white or change rapidly in brightness between screens.
46	Use colours to structure the display and group categories of data, and to help identification (labels, entry fields, prompts).
47	Do not use color (other than black) for permanent elements such as long lines of text.

Text Design

	Guideline
48	Use large font size (up to 48pt) and let the font size to be adjustable.
49	Avoid moving text.
50	Text should be left justified and text lines should be short in length.
51	There should be spacing between the lines.
52	Main body of the text should be in sentence case and not all capital letters.
53	Text should have clear large headings.
54	Use san serif type font. Avoid fancy font types.
55	A font with a serif may be used to help distinguish between system messages and user entry.
56	Inputted characters should be clearly distinguished from the system prompt in color, font (e.g. serif of typewriter font), case, or inverse video.

For each guideline the usability professionals assessed on a scale between 0 and 3 how well both the home and the mobile system fulfil it. Additionally they gave comments and recommendations on how to improve the user interaction. In general results were very positive, those areas that have been criticised were corrected prior to the start of the user evaluation to enable better performance of the system.

2.1.2 User experience evaluation

The user experience evaluation (UX) refers to the assessment carried out with the participants in the lab in which the users were faced with the second prototype and required to perform some tasks with it. In the same evaluation the participants also answered some questions related with the usability and acceptance of the system.

The improved feature technologies already tested in the first prototype were tested again together with other new features (e.g. shopping lists, people browsing, and locations). The most significant visible change was the full integration of the various desktop applications, accessible from a home screen: “main application”. The system tested in the lab was the “full system” which differs from the “minimal system” (used for the home evaluation) because it contains all

the functionalities and also the sensing environment. Specifically, the functionalities tested in the UX evaluation are as follows:

- HERMES Main Application: this is the launcher application for all HERMES sub-applications: MyPast, Calendar, People, Locations, Shopping Lists, and Cognitive Games. Furthermore it presents so-called daily summaries, which provide concise information about the current day (i.e. the next scheduled appointments) and the last 24 hours of MyPast recordings in textual (a list of the last threads recognised) in a visual form (a kind of photo slide showing video stills based on video summarisation).
- MyPast: The following filters were available:
    - People
    - Hour Range
    - Weekdays
    - Months
    - Speech (this filter was only tested in the Spanish evaluation)
- HERMES Calendar Application: It supports the participants' prospective memory allowing him or her to record the future appointments and enabling alerts for the appointments.
- HERMES People Application: The HERMES People application allows the users to browse existing faces in the database. The user is able to change the name, birthday and person reminder for any entry.
- HERMES Locations Application: it allows the user to browse GPS locations created on the PDA. It will be possible to rename location names and to change reminders attached to any location.
- HERMES Shopping List Application: it serves as an equivalent to the shopping lists on the PDA.
- HERMES Cognitive Games: Cognitive Games are fully integrated with the HERMES system. Three cognitive games are implemented:

    - Maze
    - Puzzle
    - Who's who

- HERMES Mobile: It runs on a PDA and supports the following functionalities:
    - Management of Appointments
    - Recording of conversations
    - Setting GPS-based location reminder
    - Browsing of personal contacts (possibility of taking photos of people)
    - Management of multiple shopping lists
    - Synchronization with the HERMES system

While from a user perspective the integrated system as a whole was tested, table 1 lists the different components that have been involved in the second user trial.

Sensing Environment and A/V Processing

Component	Description	Main Partner(s) involved
People counting	Counts People within the room. This is a part of the person tracker.	AIT

Visual Person Tracking	Tracks people's movement within the HERMES space (in-door)	AIT
Data logging and mining for reminder generation	Logs XMLs from perceptual components into the common data structure	AIT
Audio speaker recognition	Recognises the speaker identity based on voice	IBM
Image/Video Tagging and Retrieval	Stores images/video with appropriate tags / Retrieves video segments based on queries	AIT
Offline speech-to-text	Transcription of spoken conversations (Spanish only) Spoken notes, e.g. associated with calendar appointments are transcribed and available for display in textual form and for contents based search (on home system) Any speech-to-text is done on home system	IBM
Speech Info indexing	The speech transcripts are stored in indexed form for fast search	IBM
Content based search in speech	Returns relevant segments of audio in response to a textual query. Uses indexed speech info.	IBM
Text-to-speech (TTS)		IBM
Situation ID	Room occupancy, motion activity and time of day are used to reason about possible activities	AIT
Improved offline speech analyser	Built-in speaker tracker unit Speaker identity tag in the output XML transcript Enhanced ASR accuracy due to use of speaker-specific acoustic module Upgrade of ASR acoustic and language models	IBM
Fingertips tracking for the multi-touch surface	Track users' fingertips to enable multi-touch surface interface	AIT

Semantic and Reasoning

Component	Description	Main Partner(s) involved
MyPast Backend	Supports CURE's UI to process threads, overview threads and markers. Allows users to filter information based on various criteria.	UniBrad
Video summarization	Summarisation of videos through frame analysis Long user videos are summarised to produce shorter versions that capture the most important frame sequences	UniBrad
NMF-based clustering	Groups semantically similar documents together facilitating more advanced processing Users can be presented with semantically similar documents while browsing to facilitate memory triggering through human-like semantic document links.	UniBrad
NMF-based summarization	Provides summaries of long transcripts summarising the most semantically important sentences Users will be able to see the content of a transcript more quickly and easily through the summarised version	UniBrad
NMF-based multi document summarization	Provides multi-document summaries to describe general topics and themes in collections of documents Works with NMF-clustered documents	UniBrad

Front-End

Component	Description	Main Partner(s) involved
Main Application	Presents a user interface to launch applications (MyPast, Calendar, People Browser, Locations and Shopping Lists). Shows information screen presenting daily summary of current day and last activities (generated from Calendar and MyPast data)	CURE
Calendar	Presents the user interface functionalities in a GUI to the user and allows the user to set appointments with reminders store voice notes as addition to appointments edit appointments synchronization with HERMES PDA imports appointments from the PDA and exports appointments to PDA (within a defined time interval)	CURE
MyPast	Presents the user interface functionalities in a GUI to the user and allows the user to retrieve and edit information that has been captured by the input processing components (as described in the deliverable D.5.1)	CURE
People Browser	Browse existing people	CURE
People Naming	Name unknown/new people Resolve mismatches	CURE
Locations	Browse existing locations Possibility to add /change reminders for given locations	CURE
Shopping List	Allows the user to manage shopping lists	CURE

Mobile Application

Component	Description	Main Partner(s) involved
Mobile Calendar	insert/delete/edit/browse/notify appointments (including information like date, time, description, reminder), attach audio notes to appointments	TXT
Mobile Audio recording	The mobile application allows the user to record the audio note and attach it to a chosen event (Appointment Dictation) The mobile application allows also to record a discussion (Conversation Support) It displays post processed speech transcriptions	TXT
Location reminder	GPS integration Possibility to add locations basing on the current location Possibility to add /change reminders for given locations	TXT
People Browser	browse HERMES-registered people profiles take pictures	TXT
Shopping List	Enables the user to manage shopping lists	TXT
Mobile device synchronization	Synchronisation with the home-based workstation with focus on: Available audio transcriptions related to audio notes attached to appointments Audio recordings for Conversation Support. New/Updated stored POIs (using the “locate mode”) Appointments (to and from the PDA and the home-based workstation) Audio notes attached to the appointments and location reminders	TXT

Cognitive Games

Component	Description	Main Partner(s) involved
Maze	Game about matching appointments with times, by coordinating dual-finger motion within a maze	AIT
Who-is-who	Game about remembering peoples' names via matching textual clues and pictures	AIT
Puzzle	Game about solving a jigsaw puzzle depicting scenes from user's everyday life	AIT

Table 1: Overview and description of technologies available in the second prototype

2.1.3 Home evaluation

In the home evaluation the users were required to take the minimal system home for several days (depending on the availability and willingness of the users). The aim of this evaluation was to check whether it is possible to learn how to operate with the system using it at home for a period of time. Since some time is needed to learn how to use a new system, it is not possible to obtain this information in a lab context evaluation where the user only spent about 1.5-2 hours.

The home evaluation was carried out in Spain only, with 8 participants.

As previously pointed out, the difference between the lab (full system) and the home (minimal system) evaluation was the sensing environment present in the lab evaluation, but not in the home evaluation (cameras and microphones were not installed at the users' home). The reasons for the no installation of the full system at the elderly homes are that the elderly are not willing to install cameras and microphones at home and possible problems in the maintenance of the system.

The components tested in the home evaluation are basically the same as in the lab evaluation (see table 1 for more information) with the difference that in the home evaluation the following components (related with the sensing environment) were not tested:

Person/Face Identification
People counting
Visual Person Tracking
Face Diarisation
Data logging and mining for reminder generation
Audio speaker tracking
Audio speaker recognition
Multimodal person tracker
Voice activity detection
Situation ID
Video summarization

Table 2. Components not tested in the home evaluation

Regarding the functionalities, all the functionalities tested in the lab evaluation were also tested in the home evaluation.

3. Procedure of user trials

3.1 User recruitment

To be included in the user trials the following inclusion criteria have to be met by potential HERMES end users:

- users over 60 years of age,
- without cognitive impairment or diagnosed with AAMI or MCI,
- not suffering from any severe sensorial and/or motor problems and
- living independently in their own homes.

3.1.1 Recruitment in the user experience evaluation and home evaluation

The users were recruited from the previous pool of users. In spring 2010 there were different focus groups both in CURE and INGEMA. The possible participants in the second trials were invited to these focus groups where different situations were simulated (e.g. birthday, in the doctor's surgery, playing cards, etc). The aim of collecting this information was to have real information in order to populate the system (especially MyPast and People applications) with the information of these participants. In this way, it was possible to build a personalized system which contains the users' data and that provides meaningful information when the participants are carrying out the trials. People who attended the focus groups in Austria had no prior experience with the system.

Technical issues with the recordings of the focus groups at INGEMA rendered them unusable for the second trials. Therefore the databases of the home system were populated with the data from the users who participated in the first trials and the databases of the lab user experience evaluations were populated with the information of the people who participated in the audio and video collection task under WP2 (T2.4 carried out in summer 2008) in 2008. However, it was not possible to get all 16 participants from the existing pool of users to carry out the second trials, so new people were invited to the second trial. As these participants were completely new and they did not have previous recordings, the databases of these people were populated with video recordings from the focus groups recorded at CURE. In this way, participants could have some previous information in their past application in the system, though the information was not personalized.

In Spain the users' recruitment started in July 2010. We tried to reach the number of participants as planned for both user experience evaluation and home evaluation by calling the users who already participated in any HERMES study. However, since the trials were delayed, some users were not available when they were contacted again. Some new users were contacted but due to this situation, it was not possible to recruit 16 users in Spain for the user experience evaluation, as planned. Finally, 13 elderly people carried out the second trials in Spain.

3.1.2 Recruitment in the concept evaluation

There were two types of concept evaluation:

- Concept evaluation carried out following a group presentation approach: In both places (INGEMA and CURE) new people were recruited for this kind of evaluation. Since we

wanted to obtain sincere information when we compared HERMES and SOPRANO scenarios, we contacted new people since the people from the pool of users were already involved in HERMES so there was a risk of a biased evaluation.

- Concept evaluation at home: Also, a concept evaluation was carried out at home. In this part of the concept evaluation, the same participants as in the home evaluation participated.

The number of people recruited as well as their socio-demographics information (gender, age) is shown in table 3.

Type of evaluation	Gender (females)	Average Age	Number of people involved in Spain	Number of people involved in Austria	Number of total of people involved
User Experience evaluation	29%	66.45	13	18	31
Home Evaluation	50%	71.13	8	N/A	8
Concept Evaluation[1]	50%	68.92	4	24	28

[1]The numbers shown in this table refer to the concept evaluation carried out with the methodology of the group. For the concept evaluation at home, the participants were the same as the ones who participated in home and lab evaluations.

Table 3. Characteristics of the sample in Spain and Austria according to the type of evaluation.

3.2 Performance evaluation

Performance evaluation aims at identifying if rejection of technology is due to too error-prone/under-performing technical components of the system. Two key components of HERMES have been identified as the ones with most potential effect on the user: Both are related with the MyPast application and its filtering capacities.

The first one deals with the accuracy of the face detection, tracking and identification. The accuracy of these algorithms is visible to the user as the accuracy of the people filter in MyPast. It influences how correct a given person filter represents the actual events that have been recorded, i.e. are there events missing where given person was present (false negatives) or are there events included where the sought person was not present (false positives).

The second one covers the accuracy of the speech transcription module. For the user, this is visible through the speech search interface of MyPast. When a keyword is entered, are there conversations missing, where a certain keyword is actually contained (false negatives) or are there conversations included that in reality do not contain the keyword sought after (false positives).

For that purpose, benchmarking values of these key components need to be assessed to identify potential rejection of the system based on low performance in these areas of HERMES.

3.3 Concept evaluation

The general aim of the concept evaluation was to know whether the final idea and functionalities of the HERMES system were appreciated by the users. One of the open questions after the first user trial was administered to find out to what extent the results (good or bad) of the user's evaluations were due to the accessibility issues or to the level of acceptance of the technology.

That means that the participants can make a negative assessment of the system even if this is well designed and it is accessible, but one of the main reasons could be that they do not accept the functionalities offered by the system (either because they do not need them, they do not fully understand the aim of the functionalities, etc.)

3.3.1 Concept Evaluation – group approach

For this concept evaluation, participants were confronted with two different scenarios: the HERMES scenario and a scenario of another similar technology, including ambient assisted living technologies, especially ICTs in order to support independent living. The SOPRANO Project (www.soprano-ip.org) was the one selected for the comparison of the scenarios. SOPRANO aimed at designing and developing highly innovative, context-aware, smart services with natural and comfortable interfaces for older people at affordable cost, meeting requirements of users, family and care providers and significantly extending the time they can live independently in their homes.

The reason why this project was chosen was because it meets the requirements for the evaluation: similar technology with the aim of supporting independent living. Another reason was that INGEMA was also working on this project so it was very easy to obtain detailed information of the scenarios.

In the both groups the followed methodology was:

1. Welcome to the group, session presentation, staff and participants presentation, explanation about consent forms and administration of the usage of technology questionnaire (Appendix 1). The aim of this questionnaire is to know the level of familiarity of the users with both technologies and memory aids and to get a general idea about the acceptance of the technologies as an aid in the daily life.
2. Presentation of the HERMES scenarios. The four scenarios of the HERMES system were presented to the group in a power point presentation.
    a. Scenario 1: Memory of Past Experiences
    b. Scenario 2: Reminder of Activities
    c. Scenario 3: Cognitive Training
    d. Scenario 4: Mobile Support

   The presentation was focused on the functionalities of the system without giving details about the technology itself or the interface.
3. After the presentation of the HERMES Scenarios the moderator of the group gave the participants the AmI Technology Acceptance Questionnaire (AmI TA). This questionnaire (Appendix 1) is based on the model of Allouch et al, and address the following dimensions:
    a. Perceived benefits (enjoyment, ease of use, convenience, personalization, usefulness)
    b. Perceived disadvantages (privacy and loss of control)
    c. Attitude (good/bad, wise/unwise, beneficial/harmful, pleasant/unpleasant, valuable/worthless, enjoyable/unenjoyable)
    d. Outcome Expectancies (monetary, activity, social, self-reactive, novelty and fashion/status outcomes)
    e. Intention (intention to use in the future)

In this model perceived benefits and disadvantages are expected to strongly correlate with attitudes towards the HERMES system. The more specific outcome expectations

will have a direct influence on the intention to adopt HERMES system. The variables in the model are interdependent and a reciprocal relationship is expected between the perceived benefits and the perceived disadvantages concerning attitudes towards HERMES. For a more detailed discussion see D7.1 User Evaluation Plan.

4. Presentation of the SOPRANO scenarios.
    a. Scenario 1: Automatic tablet dosage
    b. Scenario 2: Fall Detection
    c. Scenario 3: Against forgetfulness
    d. Scenario 4: Against loneliness
    e. Scenario 5: Bed Monitoring
    f. Scenario 6: Stay Mobile
    g. Scenario 7: Save Home during Travel
    h. Scenario 8: Visits Management

The approach taken was the same as in the HERMES scenarios: information regarding the functionalities and not about the technology and the interface.

5. After the presentation of the SOPRANO scenarios the participants in the focus group were required to fill in the AmI TA questionnaire again, but this time thinking on the SOPRANO scenarios.
6. At the end of the session two extra questionnaires were administered to the participants where they were asked to rate the HERMES (Appendix 3) and SOPRANO (Appendix 4) functionalities shown in the scenarios using a 5 Likert scale.
7. Summary of more important ideas, farewell,

Each one of the group sessions was about 90 minutes long.

3.3.2 Concept Evaluation at Home

The concept of the HERMES system was also assessed comparing:

1. The results in the acceptance of those people who participated in the user experience evaluation carried out in the lab and those who took the system home for some days. The hypothesis behind this is that the elderly who took the system home for a period of time would show a better acceptance of the system in comparison that those who tested the system in the lab since they did not had much time to get familiar with the system (two sessions of about 1.5 hours each of them) and they have a more realistic vision of the functionalities of the system.
2. The results of the acceptance of the participants in the user experience in the first session (after being presented with the HERMES scenarios), and in the second one (after finishing the tasks with the HERMES system). The hypothesis is that after having a real experience with the system the acceptance of it would be better.
3. The participants who took the system at home before and after having the system at home. This is an intra-subject comparison (the same subject before and after having the system at home) and the hypothesis was that having the system at home for a period of time gives the users a possibility to get familiar with it, better understand the functionalities and the aim of the system and to be more skilful with it. The expected result is that the acceptance evaluation would be better after having the system at home.

In these two hypotheses of the concept evaluation at home, the acceptance of the system was also measured with the AmI Technology Acceptance Questionnaire (Appendix 1).

3.4 User experience evaluation

The user experience evaluation (UX) was conducted in the lab and its aim was to obtain information regarding:

- interface complexity,
- information visualisation,
- game experience
- acceptability

The lab evaluation itself was performed in a similar way as during the first trials. As in these first trials the UX evaluation was divided in two different sessions. In the next sections the methodology followed in the two sessions is detailed.

3.4.1 First session

The goal of the first session was to evaluate (1) the acceptance of the HERMES scenarios; (2) HERMES Mobile Application; (3) HERMES Cognitive Games.

In table 4 the steps of the first session are summarized

Welcome and informed consent
Questionnaire about the use of the ICT and attitudes towards new technologies
Presentation of the HERMES scenarios AmI TA Technology questionnaire about the HERMES scenarios
HERMES Mobile Tasks with HERMES Mobile (post-questionnaire after each task) EmoCards General Questions UTAUT
HERMES Cognitive Games Tasks with HERMES Cognitive Games (post-questionnaire after each task) EmoCards (after each Cognitive Game) General Questions UTAUT
Cognitive assessment Prospective memory questions MAC Questionnaire

Table 4: Steps followed in the first session of the user experience evaluation

First of all the user was welcomed and introduced to the system and the evaluation procedure. After that, the informed consent was explained and the user was asked to sign it. Before starting with the evaluation of the HERMES system itself some general information regarding the technology usage and the attitudes towards technology was collected (see Appendix 2). This questionnaire aims to obtain information about: (1) ICT-products or services you use and how frequently you use them; (2) memory support tools you use and how frequently you use them; (3) opinion towards the usefulness of several devices (e.g. I find it good that when I want to know something, I can also get that information via technical appliances). The aim of including this questionnaire is that we can know whether the people who show lower acceptance of HERMES system also perceive less usefulness of the technological systems.

After these questionnaires the acceptance of the HERMES scenarios was tested.

3.4.1.1 Acceptance of the HERMES scenarios

As already commented in section 3.3.2, the concept evaluation was also carried out in the lab setting with the aim of comparing the acceptance of the participants in lab and in home evaluation.

For this evaluation, the HERMES scenarios were presented using the same power point slides as in the group sessions. After this presentation the AmI TA Questionnaire was administered to the users (Appendix 1).

3.4.1.2 HERMES Mobile Application

The first application showed to the user was the HERMES Mobile. First of all the interviewer explained the HERMES Mobile application to the user and s/he was required to do several tasks with this application covering the HERMES scenarios and use cases. These tasks were:

Starting Exercise: Please take HERMES Mobile and browse through the applications for 3 minutes and try to understand what you can do with it. Think out loud while doing it.

Creating a New Appointment: You meet David, a friend of yours. You begin to talk, but then you decide that you could meet on the weekend because now you have something to do.
Task: Please enter this new appointment.

Changing an Appointment: Your friend calls you to change the weekend's appointment. You will see next week, on Tuesday at 3 p.m.
Task: Please modify the appointment to the new date.

Recording a Conversation: While you are at the doctor, the doctor tells you some information about the medication you need to take. In order not to forget any important details, you record the conversation.
Task: Please use HERMES Mobile to record some seconds of conversation.

Setting a Location Reminder[1]: You are looking for a present for your friend David. You see something nice, but you don't have any time because you have a doctor's appointment. You decide to add this location and a reminder associated with it in your HERMES Mobile. When you pass by this location, the device will remind you.
Task: Please go to an outdoor position. Then use the system to introduce this location ("book shop") and a reminder ("buy present for David").

Viewing and Taking Photos of People: Your doctor has a new receptionist. In order not to mix her up, you decide to store her name and a picture of her on your HERMES Mobile.
Task: Use HERMES Mobile to save name ("Anna – receptionist") and a photo of her. Browse the other persons. Who else is already on your list?

Creating a Shopping List: Your friends will come to visit you so you need to buy coffee, tea, milk and some cookies.
Task: Please use HERMES Mobile to introduce these items into your shopping list.

[1] This task could not be done in all the evaluations because of the GPS of the PDA was not fully working in the lab. That is the reason why the results about this task are not detailed in the results section.

While the users performed the tasks, they were observed by the interviewer and they were asked to think out loud, comment or ask any doubt they had. After performing each task a specific questionnaire collecting opinions about how the user experienced the system during the task, how well the system supported the user and what can be improved were administered. This questionnaire can be found in Appendix 3.

Just after the realization of the tasks with the HERMES Mobile application the EmoCards were presented to the users. Emotions involved in the user experience have become a major topic in usability research, including the self-report measurement of the nature of emotions elicited by the system (Desmet, Hekkert & Jacobs, 2000). When we test emotional reactions to technological experience in elderly people, emotional measurement is a critical issue, not only according to the lack of expertise of the elderly persons, but also because of the age-related changes in the emotional experience (Lochenhoff & Cartensen, 2007).

The EmoCards (Appendix 4) are 14 different cards, 7 of them are faces who express positive emotions and the other 7 are faces who express negative emotions. The cards are presented on the table into two different groups: positive and negative emotions. Within each group, the cards are presented in random order. Also, the two groups (left or right) are switched randomly. In this moment of the evaluation the user was required to choose the card which best expresses the users' emotions after performing the HERMES Mobile tasks.

In this evaluation the close questions were also combined with the open questions. Some general questions about HERMES Mobile (Appendix 5) were asked.

Finally, in order to assess the acceptance of the HERMES Mobile application the Mobile UTAUT (Appendix 6) were administered to the user. This questionnaire, also used in the first user trials, was adapted from the Unified Theory of Acceptance and Use of Technology (UTAUT) study of Venkatesh et al. (2003). For an in-depth description see Section 2.1.1 in the deliverable D.7.1.

3.4.1.3 HERMES Cognitive Games

To assess the user experience of HERMES cognitive games we have used the following methods:

- Game heuristics (see D6.1 for more information about the results of the game heuristics evaluation)
- Questionnaires to assess game experience (e.g. the Game Experience Questionnaire, GEQ)

Furthermore, it was planned to use psycho-physiological methods, mainly Electromyogram (EMG) and Galvanic Skin Response (GSR) to evaluate the games with users. However, due to the nature of the games only little arousal was to be expected that hardly could be interpreted in a meaningful way. Therefore, this evaluation method was omitted in favour of the abovementioned measures.

In the evaluation of the HERMES Cognitive Games the users were required to carry out the following tasks:

***Starting exercise*:** HERMES Cognitive Games allow the elderly to train through games with material that have been captured previously. Please open the application "Cognitive Games" and browse through the application, trying to understand what you can do with this application. Think out loud while doing it.

Play the Maze Game: Please, imagine that you arrive home and sit in your sofa. You start using HERMES, and the system suggests you to play a Cognitive Game.
Task: Please, try to play the Maze game.

Play the Who-Is-Who Game: Please, imagine that you have played the Puzzle game for quite a time and the system suggests you to play the Who is Who game. It explains you that this game consists of matching names and personal traits of your friends and relatives, so you decide to play it.
Task: Please, try to play the Who is Who game.

Play the Puzzle Game: Please, imagine that you do not want to play the Maze game anymore and select another game in the game menu of the system.
Task: Please, try to play the Puzzle game.

After each one of these tasks the post-task questionnaire (Appendix 3) and the EmoCards were administered to the user (Appendix 4).

In the Cognitive Games evaluation another questionnaire was included: the Game Experience Questionnaire (GEQ) (Appendix 7). As already explained in D6.1, the Game Experience Questionnaire (GEC) (IJsselsteijn, de Kort, Poels, Jurgelionis, & Bellotti, 2007), is a tool developed within the FUGA – Fun of Gaming project – to assess the subjective experience of the players during and after playing the games. This questionnaire was developed by the Technology University Eindhoven, Netherlands and adapted for Spanish users by INGEMA. The core part of the questionnaire modules focuses on seven components: immersion, flow, competence, positive and negative affects, tension and challenge.

After the assessment with the GEQ some general questions about HERMES Cognitive Games were asked to the user (Appendix 5).

The last questionnaire in this first UX session was the Game UTAUT (Appendix 6).

3.4.1.4 Cognitive assessment

With the aim of finding out the participants' general cognitive status, two different questionnaires were administered:

- Questions for the evaluation of the prospective memory (Appendix 8). While users were performing different activities, we assessed prospective memory with four tasks (two of them for the evaluation of the prospective memory based on time, and two of them for the evaluation of the prospective memory based on events):
    - Please, in 15 minutes tell me that we have to make a rest (time-based question).

- When I give you a pen, please sign in this paper *(give the participant the pen in 20 minutes)* (event-based question).
- Please ask me in 2 minutes when we are going to finish the session (time-based question).
- When I give you a piece of paper, please write there your address (event-based question) *(give the participant the paper in 5 minutes)*

These questions were taken from the Memory for Intentions Screening Test (MIST) (Raskin and Buckheit, 1998) which aims to assess the prospective memory. According to this test, the general rules for the prospective evaluation are: (1) there must be a delay between the encoding of the intention and the execution of the intention; (2) this delay must be filled with a secondary ongoing task; (3) there cannot be an obvious external reminder by another person, rather the person must be aware of cues or prompts from the environment. MIST has good pshychometric characteristics.

- Memory Assessment Questionnaire (MAC-Q) (Crook, Feher & Larrabee, 1992; Montorio & Izal, 2002, for the Spanish version). (Appendix 9). MAC-Q is a self-report questionnaire of 5 questions addressing daily activities, three questions addressing overall memory functioning comparing present moment to when the person was 18 to 20 years old, 1 question addressing the sense of worry about one's memory and 4 questions about the perceived frequency of specific types of forgetfulness typically associated to old age. Some of the items of this scale ask about the frequency of forgetfulness related with episodic memory. That is the reason why we chose this scale as an indication of the episodic memory state of the users.

To know the participants' cognitive status allows the end-users partners to establish comparisons between the acceptance of the technology and the cognitive status. Two hypotheses are established in this sense:

- Those people with worse prospective memory will better accept the Calendar application.
- Those people with worse episodic memory will better accept the MyPast application.

3.4.2 Second session

In the first evaluation session the user was giving an appointment for the second session. The aim of the second session was to evaluate the HERMES Home System.

In table 5 the steps of the second session are summarized

HERMES - Calendar Tasks with HERMES Calendar (post-questionnaire after each task) EmoCards General Questions UTAUT
HERMES - MyPast Tasks with HERMES MyPast (post-questionnaire after each task) EmoCards General Questions UTAUT
HERMES – Locations / People / Shopping Lists Tasks with HERMES Locations / People / Shopping Lists (post-questionnaire after each task) EmoCards

General Questions
AmI TA Technology questionnaire

Table 5: Steps followed in the second session of the user experience evaluation

3.4.2.1 HERMES Home System

The Cognitive Games (part of the HERMES Home System) were already tested in the first session so, in this second session, the other applications were tested:

- Calendar
- MyPast
- Locations
- People
- Shopping Lists

The two sessions of the UX evaluation were recorded in audio and video. The aim of leaving MyPast application evaluation for the second session was to have the possibility to watch the videos recorded in the first session and, hence, to have more meaningful data for the users.

In the same way of the first session, the participant was asked to perform the following tasks with this application:

Task with HERMES Main Screen
***Starting exercise*:** Please browse through the application for 3 minutes and try to understand what you can do. Think out loud while doing it.

Tasks with HERMES Calendar
Starting Exercise: Please open the application "Calendar" and browse through the application for 1 minute and try to understand what you can do with this application. Think out loud while doing it.

Create New Entry: Please, imagine that you have to see the doctor next Monday at 11:30 for a check-up. You do not want to be late / forget it anyway, and a good way to be sure of that it is introducing the appointment in HERMES.
Task: Try to enter this appointment in HERMES Calendar. If you want, you can also record a voice note with additional details.

Browse and View Appointments: Imagine now that later on you are at home and you want to look up the time of the medical check-up you introduced in the system before.
Task: Please, browse the entries in Calendar and view the details of the appointment. Apart from the medical check appointment, can you see other entries in the calendar? Is any entry associated with an audio note? Can you hear it? What is it about? Can you re-record it?

Synchronisation: The system includes a synchronisation process. All things you enter on your HERMES Mobile device can be synchronised with the HERMES system in your home.
Task: Please synchronize HERMES Mobile with the home system by attaching it to the connection cable.

Change Entry: The doctor calls you to change your appointment on Monday at 11:30. The new time for the doctor's appointment will be on Friday at 12 noon.

***Task*:** Please change the time and date of the appointment with the doctor.

After each task the participant was required to answer the post-task questionnaire (Appendix 3), as they did in the first session after each task with HERMES Mobile and HERMES Cognitive Games.

After the last task, the user was presented with the EmoCards (Appendix 4) and required to choose one, based on the emotion experimented while she or he was carrying out the HERMES Calendar tasks.

The last two questionnaires administered about HERMES Calendar were:

- General Questions about HERMES Calendar (Appendix 5).
- Calendar UTAUT (Appendix 6).

Tasks with HERMES MyPast

Starting Exercise: Please open the application "Calendar" and browse through the application for 1 minute and try to understand what you can do with this application. Think out loud while doing it.

Time Search:

Austria: Last June, several activities were conducted in the laboratory. Some people were celebrating a birthday, drinking coffee, playing cards, reading, eating and visiting the doctor.

Spain: In November and December 2009, we evaluated the system the first time. The sessions back then where recorded by HERMES.

Task: Please use the system to find entries that took place during this period of time.

People Search: Jose's birthday was last June. He met all his friends in the laboratory to celebrate. Teresa, his wife, was there. Also, they were playing cards and drinking coffee.

Task: Please find entries between May and July where your friend Teresa and Jose are involved. How many entries do you find? Play back one video.

As it was done in the HERMES Calendar application, after each task the user was requested to answer the post-task questionnaire (Appendix 3). After the last task the user was also asked to complete these questionnaires:

- MyPast Emocards (Appendix 4)
- General Questions about HERMES MyPast (Appendix 5)
- MyPast UTAUT (Appendix 6)

Locations, People and Shopping List ("Other Apps")

Viewing Locations [2]

Task: Browse the locations. Which places are on your list? Set a reminder for "Flower shop". The next time you come by there, you want to be reminded to guy flowers for Rosie.

Viewing Photos of People

Task: Browse the pictures of people. Who is on your list? Set a reminder for "Peter". The next time he visits you, you want to remind him to give him back a book you lent.

[2] This task could not be done in all the evaluations because of the GPS of the PDA was not fully working in the lab. That is the reason why the results about this task are not detailed in the results section.

Managing Shopping Lists
Task: Browse the shopping lists. Which items are on your shopping lists so far? Add a new item: "Bread".

Again the post-task questionnaire (Appendix 3) was completed after each task and, at the end, these questionnaires were administered:

- EmoCards (Appendix 4)
- General Questions about HERMES Locations, People and Shopping Lists (Appendix 5)

The last questionnaire of this second session was the AmI TA Questionnaire (Appendix 1). This questionnaire was again administered at the end of the last session with the aim of checking whether there are differences in the acceptance of the system before and after using the HERMES system.

3.5 Evaluation at home

Within the HERMES project we are interested in finding out how is the interaction of older adults with the developed personal system not only in the lab, but rather in their natural context, that means, at some potential users' homes. The procedure of this evaluation is described in the following sections.

The focus of this evaluation was the learnability of the HERMES system. The term *Learnability* can be used to describe the ease or difficulty of learning how to use a technological device (Linja-aho, 2005). Learnability refers to the experience of a new user when he is starting to use the system. It should be possible to learn efficient and error-free interaction quickly.

Since we wanted to observe the differences in the users between the first visit (when they saw the second prototype for the first time and they tried to carried out some tasks with it) and the second visit (when they gave us back the system after a period of time experimenting with it at home) we assessed to key variables to evaluate the learning curve of the system:

- Time
- Errors

The hypothesis behind is that the participants in the home evaluation would need less time in the second visit to carry out the tasks, and also they made less numbers of errors.

3.5.1 First visit

The goal of the first visit was to explain the users the HERMES System before taking the system at home for a period of time (depending on the availability of the users and their willingness) and prepare them to use it. The other aim of this first visit was to observe the users while they interacted with the system for the first time in order to compare this first interaction with the second one (after some time learning how to use it).

The different parts of this first visit are detailed in the following sections.

3.5.1.1 Pre-evaluation

The users were asked about their experience with computers and if they have some kind of technological devices or memory aids in their homes. Also, the users were asked questions

regarding their general attitudes towards ICT. For this aim, we used the same questionnaire as we did in the lab evaluation (Appendix 2).

3.5.1.2 Task with HERMES Home System

Basically, the functionalities tested in the home evaluation were the same as in the lab evaluation. HERMES Home System was explained and tested by giving users several tasks (see section 3.4.1.2 (for tasks with HERMES Mobile), 3.4.1.3 (for tasks with HERMES Cognitive Games), 3.4.2.1 (for tasks with HERMES Home System) for the description of the tasks required to the participants to complete with HERMES Home System). The users were encouraged to think out loud while doing the tasks and the interviewer took notes while the users performed the tasks.

For each one of the tasks with HERMES Home System, HERMES Cognitive Games and HERMES Mobile the interviewer recorded:

1. The time needed for completing the tasks
2. The type of mistakes:
    a. Mistype
    b. wrong key
    c. take a long time
    d. skip a step
    e. no answer
    f. other

Also the prospective memory was assessed using the same tasks as in the lab evaluation (see section 8).

Before leaving the lab with the HERMES minimal system, the interviewer gave two manuals to the users, one for the HERMES Home System (the applications supported in the multi-touch laptop), and other for the HERMES Mobile (the PDA). Also the interviewer gave the participant a telephone number where s/he can call if s/he has doubts or problems while s/he has the system at home. Besides, each user was telephoned by the interviewer during the period s/he has the system at home to ask for possible problems, doubts, etc.

3.5.2 Second visit to the lab

On the second visit to the lab, the users were asked to perform the same tasks they did in the first visit as described in the previous section of this deliverable. Again, the interviewer recorded both the time and the mistakes made by the participant in this second session to compare them with the time and the errors found in the first session.

In the second visit, another two questionnaires were administered:

- Memory Assessment Questionnaire (MAC-Q) (Appendix 9)
- Learnability Questionnaire: this is an ad-hoc questionnaire created for the learnability evaluation of the HERMES system in which the participants are required to indicate their level of agreement in a 5-point Likert scale in different sentences which refers to variables related with the learnability (Appendix 10).

4. Results

In the following sections the results found in the second trial are presented. The quantitative data for the concept, user experience and home evaluation have been entered in an SPSS database. Non-parametric tests have been carried out due to the sample did not fulfil the criteria for parametric tests. The level of significance selected has been $p< 0.05$.

4.1 Concept evaluation

4.1.1 Concept evaluation – group approach

A total of 24 elderly people participated in the groups where HERMES and SOPRANO scenarios were presented. The age average was 68.92 (age range: 60-87), and the proportion males-females was 50%-50%.

The descriptive data (mean and standard deviation of each of the items) of this evaluation can be shown in Appendix 11, including

- AmI TA Questionnaire about the HERMES scenarios
- AmI TA Questionnaire about the SOPRANO scenarios
- HERMES Features Questionnaire
- SOPRANO Features Questionnaire

For the study of the differences between the acceptance in HERMES and SOPRANO scenarios, Wilcoxon tests have been carried out for each of the items of the AmI TA Questionnaire. We have found significant differences in the following items:

- AmI TA Question 26 ($p=0.043$), showing that the users perceived that they would use HERMES for maintaining valuable contact with others more likely than SOPRANO.
- AmI TA Question 35 ($p=0.007$), showing that the users perceived that they would use HERMES because it is something new more likely than SOPRANO.
- AmI TA Question 38 ($p=0.007$), showing, in a similar way, that the users perceived that they would use HERMES because the appliances are modern more likely than SOPRANO.

These results point that, according to those dimensions measured with the AmI TA, the main differences in the users' perception are linked to social dimension and novelty and modern of the HERMES system when compared to SOPRANO.

Although not directly comparable, results collected about HERMES and SOPRANO features showed similar trends. In general, we can see that the most appreciated features of HERMES scenarios are: reminder of appointments, the three cognitive games and the shopping list application. When participants were asked to express their level of satisfaction with the SOPRANO features, the most appreciated applications were: fall detection, safe home during travel, automatic pill dispenser and against forgetfulness – check if something was forgotten. As it can be concluded from these results, people really liked the HERMES support for the prospective memory (reminder of appointments and shopping lists) as well as to keep their brain active thanks to the cognitive games. The support to the episodic memory (HERMES MyPast) was not so well perceived by the participants. In SOPRANO project, those applications related with the security (safe detection and safe home during travel), were the best rated, as well as those related with memory support (automatic pill dispenser and against forgetfulness).

4.1.2 Concept evaluation at home

4.1.2.1 Differences between user experience evaluation and home trials

The hypothesis supporting this analysis is that people in the home trials would have a better perception of the HERMES scenarios since they have been testing the system for a period of time in their houses and, because of that, they would have a more realistic vision of the functionalities of the system and, hence, a better acceptance of the system.

In order to test this hypothesis we have carried out Mann-Whitney tests comparing the second session of the participants for home and user experience evaluation in Spain. The reason why we have only carried out this statistical analysis with the Spain participants is that if we compare the home evaluation (only carried out in Spain) with the results found in the user experience evaluation (carried out in both Spain and Austria, and with a larger number of participants than in the home evaluation) we are introducing a bias of confusion in the results, since we cannot be sure that the results found are due to the differences between home and user experience evaluation itself or due to cultural differences.

Significant differences were only found in question 11b ("I think HERMES is unwise / wise") ($p= 0.008$) and question 24 ("I would use HERMES to strengthen my relationship with family and friends") ($p=0.043$). The average obtained in these two questions (see Appendix 12 for the descriptive data) was higher for those people participating in the user experience evaluation. One of the reasons why the system has obtained a better acceptance in the second session of the user experience evaluation, in comparison with the second session of the home evaluation, could be that the system was not fully working in some of the cases of the home evaluation (see section 4.4 for more details). That is why people participating in the home evaluation did not show a better acceptance of the system after having it at home, as it was hypothesized.

4.1.2.2 Differences between first and second session in the home trials

The second hypothesis about the concept evaluation at home was that people in the home trials would better evaluate the features and would have a higher intention of use it after having it for a period of time. Results of the AmI TA questionnaire for the first and second home evaluations are showed in Appendix 12.

Mann-Whitney tests were carried out with the following significant differences in the AmI TA Questionnaire, this time between first and second evaluation in those participants who installed HERMES at home. Significant differences were again found in responses to questions 11b ($p=0.046$) and 24 ($p=0.041$), and also in responses to question 26 ("I would use HERMES to maintain valuable contact with others") ($p=0.034$), question 28 ("…to have something to talk about with others") ($p=0.059$), and question 33 ("… to feel less lonely").

Contrary to our expectations, perceptions of the users were worse after the home experiences regarding how wise the system is and their social possibilities. Although users scored social possibilities of HERMES high compared to other systems (see section 4.1.1), the real experience at home showed some limitations of these possibilities. As it was argued in section 4.1.2.1., the technological problems found in the home evaluation could result in a worse acceptance of it.

4.1.2.3 Differences between first and second visit at lab

The same analysis as the ones did in the section 4.1.2.2. were also carried out taking into account the participants (both in Spain and Austria) in the user experience evaluation and

comparing the results found in the first session and in the second one. We assessed the differences between the AmI TA questionnaire administered first time (after the participants were presented with the HERMES scenarios) and at the end of the second session (after the participants completed all the tasks with HERMES Mobile and Home System). The hypothesis was that the level of acceptance would be higher at the end of the second session (after having a real experience with the system). This hypothesis was confirmed since after carrying out Wilconxon tests we find significant differences (always obtaining higher scores in the second session, as it can be seen in Appendix 12) in the following variables:

- Question 1 "I would use the HERMES system when it becomes available" (p=0.022)
- Question 2: "Does HERMES make the use of a memory support tool more or less fun? (p=0.022)
- Question 11c: "I think HERMES is harmful/beneficial" (p=0.013)
- Question 11d: "I think HERMES is unpleasant/pleasant" (p=0.005)
- Question 13: "I would use HERMES because it offers me more freedom" (p=0.032)
- Question 16: "I would use HERMES because I like to use such appliances" (p=0.018)
- Question 17 "I would use HERMES to be entertained" (p=0.005)
- Question 23: "I would use HERMES to save time" (p=0.034)
- Question 36: "I would use HERMES to be able to support my own memory" (p=0.043)
- Question 37: "I would use HERMES to discover new possibilities" (p=0.007)
- Question 38: "I would use HERMES because these appliances are modern" (p=0.031)
- Question 39: "I would use HERMES to keep up with the newest technology" (p=0.037)

4.2 User experience evaluation

4.2.1 Previous Technology usage and attitudes towards technologies

The aim of this questionnaire was to know the technological profile of our participants in each country and their attitudes towards new technologies. Tables showing the percentages of use of ICT products and memory support tools are included in Appendix 13, and also a table showing the average obtained in the six questions aiming at knowing the attitudes towards technology in each country.

Percentage of use of technological and memory support products show discrete but quite diverse results, showing different degrees of use. Comparing countries, the Austrian sample seems to be more used to technology and responses varied more widely between response options and between products.

Regarding attitudes towards technology, Mann-Whitney test were carried out to know whether this variable shows significant differences in the two countries. Results show differences in these questions:

- I find it good that I can keep in touch with people I care via technical appliances (such as mobile phone and Internet).
- The disadvantages which some technical appliances can cause just belong to this kind of appliance.
- With the arrival of the Internet, the possibility for everyone to participate in society has grown.
- I find it good that when I want to know something, I can also get that information via technical appliances.

In these four questions, the averages were higher in the Austrian sample which means that they were more agree with these sentences. This is an important result which should be taken into account when the differences between Austria and Spain in the acceptance of HERMES system

are discussed in the following sections, since the Austrian sample seems to be more familiar with the technology and also to show a better acceptance and more positive attitudes towards the technology in general. Taking into account the Austrian sample profile, it would be possible that they also show a better acceptance of the HERMES system in comparison with the Spanish sample (less familiar and more reluctant to technologies in general).

4.2.2 Acceptance

In the following sections the results about the acceptance of the HERMES system in the user experience evaluation are described.

4.2.2.1 Acceptance of the HERMES Scenarios

The acceptance of the HERMES Scenarios was evaluated in the first session of the lab evaluation using the AmI TA questionnaire (see sections 4.1.1 and 4.1.2.2). The mean and average of these items are shown in Appendix 14. Whereas results showed in sections 4.1.1 and 4.1.2.2 are from those participants in Spain in different moments and environments, in this section we show and compare results obtained in the user experience evaluation in Spain and Austria.

In Appendix 14, the table shows the results found in general in the two countries. Mean differences tests have been carried out. We have found significant differences between countries in question number 4 (“In your opinion, in how far would you have more or less control over the use of your current memory support tool compared with the HERMES system?”) (p=0.043), question number 7 (“To what extent do you find the combination of a memory support tool with all kind of information and communication technology useful?”) (p=0.046), question number 14 (“HERMES would be used because it makes task in the home more pleasant”) (p=0.001), question number 15 (“To make daily domestic activities more pleasant”) (p=0.034), question number 17 (“To be entertained”) (p=0.008), question number 39 (“ To keep up with the newest technology) (p=0.016) and, finally, question number 41 (“Because it increases my status”) (p=0.000).

In general, these results show a better acceptance of the HERMES scenarios in the Austrian sample. This trend can be explained because of the differences in previous technology usage and attitudes towards technologies (see section 4.2.1).

4.2.2.2 Acceptance of the different applications

4.2.2.2.1 EmoCards

As the EmoCards were administered after each of the applications in the lab evaluation, the following figures show the percentages of the EmoCards in each one of the applications and after each one of the cognitive games.

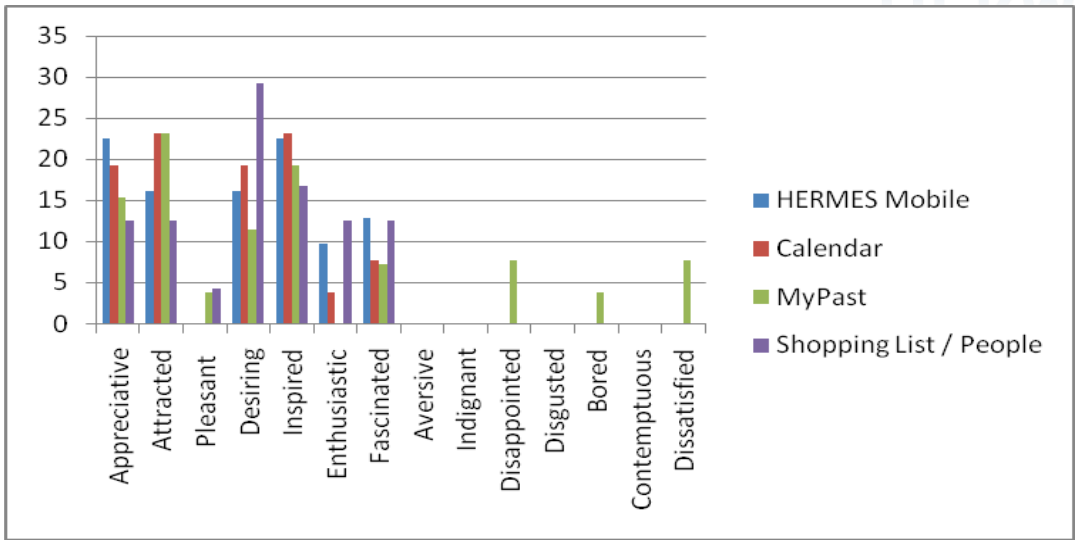

Figure 1. Emotions, selected in the EmoCards test, to represent emotional state after using different HERMES applications

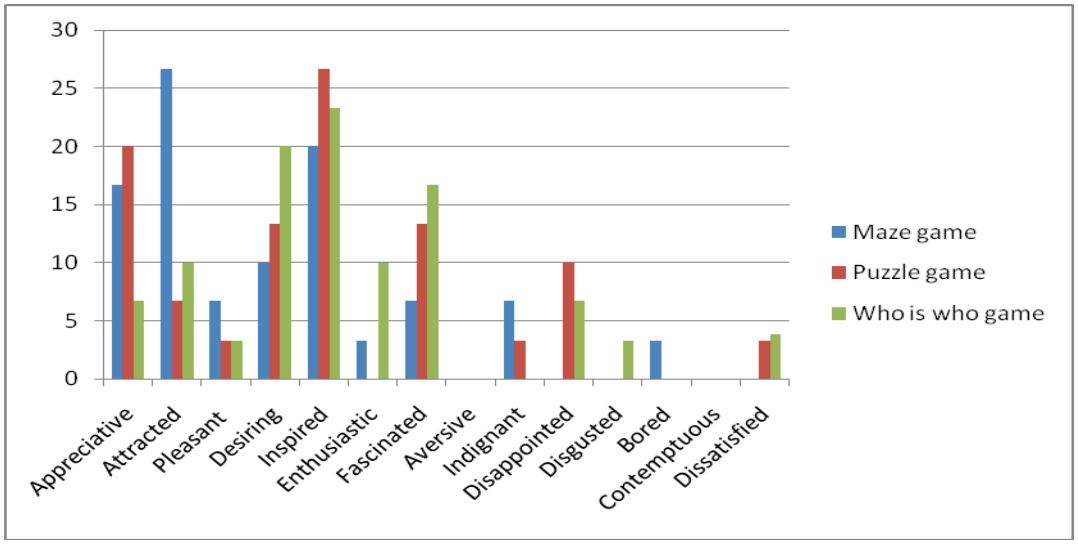

Figure 2. Emotions, selected through Emocards, to represent emotional state after using HERMES cognitive games.

As we can see in figure number 1, all the participants in the trials chose EmoCards showing positive emotions when they were asked to select one for the HERMES Mobile, Calendar and shopping lists applications. On the contrary, MyPast and Who is Who game were the applications which accumulated the highest percentage of EmoCards showing negative emotions (19.2% and 13.8% respectively). The other two games (Maze and Puzzle games), also were scored with negative EmoCards (10% and 6.6% respectively), but less than MyPast and Who is Who game.

4.2.2.2.2 UTAUT

This questionnaire was administered after testing HERMES Mobile, HERMES Calendar, HERMES MyPast and HERMES cognitive games applications. The average obtained in each application as well as in each of the two countries are shown in Appendix 15. Mann-Whitney tests indicate significant differences ($p<0.005$) in the following items:

HERMES Mobile, in items "PE2: Using HERMES Mobile enables me to accomplish tasks more quickly" ($p=0.039$) and "FC3: HERMES Mobile is not compatible with other systems I use"

(p=0.031). The Austrian Sample obtained a higher score on PE2 question which means that a better performance expectancy of the HERMES Mobile. They also obtained a higher average on question FC3 pointed out that they probably use another technology-based system to help them to remember their appointments, and they perceive that the two systems are not compatible.

HERMES Calendar, in items "PE1: I find HERMES Calendar useful in my life" (p=0.012), "EE1: My interaction with HERMES Calendar is clear and understandable" (p=0.002), "EE3: I find HERMES Calendar easy to use" (p=0.009), "EE4: Learning to operate HERMES Calendar is easy for me" (p=0.001), "AT1: Using HERMES Calendar is a good idea" (p=0.014), "AT2: HERMES Calendar makes life more interesting" (p=0.020), "AT3: Living with HERMES Calendar is fun" (p=0.005), "AT4: I like living with HERMES Calendar" (p=0.005), "FC2: I have the knowledge necessary to use HERMES Calendar" (p=0.000), "AX1: I feel apprehensive about using HERMES Calendar" (p=0.012), "AX2: It scares me to think that I could lose a lot of information using HERMES Mobile by hitting the wrong key" (p=0.012), "AX3: I hesitate to use HERMES Calendar for fear of making mistakes I cannot correct" (p=0.036), and "AX4: HERMES Calendar is somewhat intimidating to me" (p=0.020). This is the application where more differences were found.
To sum up, differences were found in questions related to Performance Expectancy, Effort Expectancy, Attitude Toward Using Technology, Facilitating conditions, in the sense that Austrian participants obtained higher scores on these variables indicating that they consider the application more useful in their lives, they think that they are able to use it without a lot of effort, they have a better attitude towards the application (according to the results found in section 4.2.1, they also showed a better attitude to technology in general), and they have the necessary resources for using it. Also, significant differences were found in the four items belonging to the Anxiety sub-scale, indicating a higher anxiety in the Spanish sample. This result can be explained because of the Spanish sample perceivedthat they did not have the personal resources for using the system and they were not familiar with technology (as it can be shown in section 4.2.1). Also, the Spanish sample show a worse prospective memory (see section 4.2.4.1. for more information), and that could be one of the reasons why they are afraid of losing information.

HERMES MyPast, in items "EE4: Learning to operate HERMES MyPast is easy for me" (p=0,004), "FC2: I have the knowledge necessary to use HERMES MyPast" (p=0.010), "AX2: It scares me to think that I could lose a lot of information using HERMES MyPast by hitting the wrong key" (p=0.031), "AX3: I hesitate to use HERMES MyPast for fear of making mistakes I cannot correct" (p=0.007). Again, higher scores were found for the Austrian sample indicating a better perception of the personal resources they have for interacting with MyPast application, and lower scores on the anxiety items were found in this sample as indirect evidence that they perceive they have better resources for using the system.

HERMES cognitive games, the only difference was found in "PE3: Using HERMES games increases my productivity" (p=0.024). The scores found in this variable pointed out that the Austrian sample perceived that this improvement in their productivity can be possible while the scores obtained by the Spanish sample are lower.

Taking into account the general results in the different dimensions of the UTAUT we found that:

- All the applications obtained high scores for the Performance Expectancy (PE), Effort Expectancy (EE), Attitude toward Using Technology (AT), Facilitating Conditions (FC), Behavioural Intention to Use the System (BI) and lower scores for Anxiety (AX) sub-scales.

- The application which obtains better scores in Performance Expectancy (PE) sub-scale is Calendar, while the one with lower scores is HERMES Mobile. However, there is not a huge difference between these two applications.
- The same pattern as in the PE sub-scale is found in the Effort Expectancy (EE) and Attitude toward Using Technology (AT) sub-scales, showing the highest scores in Calendar application (participants perceived that Calendar is the easiest application and also they showed more positive attitudes towards it) and the lowest in HERMES Mobile.
- The results found in the Facilitating Conditions (FC) sub-scale show that HERMES Mobile is the application with highest values and Cognitive Games is the one with the lowest.
- In the Anxiety (AX) sub-scale, we find the highest results (indicating a higher level of anxiety) in HERMES Mobile application and the lowest scores (indicating a low level of anxiety) in Cognitive Games application.
- Regarding the Behavioural Intention to Use the System (BI) sub-scale, the results are in the same direction as the ones found in the Performance Expectancy, Effort Expectancy and Attitude toward Using Technology, showing that Calendar is the application with highest scores (the intention of use of this application is high), while HERMES Mobile is the one with the lowest scores.

4.2.3 Game Experience Questionnaire

The Game Experience Questionnaire has two options of answers: "Yes" and "No". The next table shows percentages of Yes responses per each country and in general:

		Spain	Austria	Total
1	I was interested in the game's story	91,7%	76.5%	82.8%
2	I felt successful	66.7%	83.3%	75.0%
3	I felt bored	8.3%	5.6%	6.7%
4	I found it impressive	66.7%	58.3%	62.5%
5	I forgot everything around me	75.0%	41.7%	58.3%
6	I felt frustrated	8.3%	11.1%	10.0%
7	I felt irritable	0%	13.3%	7.4%
8	I felt skilful	66.7%	50%	58.3%
9	I felt content	90.9%	69.2%	79.2%
10	I felt challenged	33.3%	81.3%	60.7%
11	I had to put a lot of effort into it	41.7%	25.0%	33.3%
12	I felt good	100%	85.7%	92.3%
13	I found it a waste of time	8.3%	13.3%	11.1%
14	I felt energized	91.7%	63.6%	78.3%
15	I felt satisfied	91.7%	78.6%	84.6%
16	I felt weary	0%	6.7%	3.7%

Table 6. Percentages of "Yes" responses in the items of the GEQ

Results collected from the GEQ showed a good perception of the HERMES games in elderly participants, highlighting feelings of arousal, satisfaction and interest. Nevertheless, percentages of those items regarding feelings of flow (i.e. "I forgot everything around me") are relatively low. In this regards, improvement of those conditions promoting flow in these kinds of games might be one possible aim of future investigations.

4.2.4 Cognitive evaluation

4.2.4.1 Prospective memory

Taking into account the total sample of the user experience evaluation, we have found that the 7.4% of the participants answered correctly 1 of the prospective memory items, 29,6% answered correctly 2 items, 22.2% answered correctly 3 items and 40.7% answered correctly 4 items.

We have conducted Pearson bivariate correlations between the sum of the number of items of prospective memory items correctly answered and the items of the UTAUT scale for the HERMES Calendar, which is the HERMES application more strongly related with prospective memory, as it has been described before in this document. Correlations showed significant relations between the sum of correct responses in the prospective memory items and UTAUT "EE1: My interaction with HERMES calendar is clear and understandable" (r=.545), "EE3: I find HERMES calendar easy to use" (r=.530), "EE4: Learning to operate HERMES calendar is easy for me" (r=.505), "AX2: It scares me to think that I could lose a lot of information using HERMES calendar by hitting the wrong key" (r=.448) and "FC3: HERMES calendar is not compatible with other systems I use" (r=-.432).

These moderate correlations point to a relation between having a relatively good prospective memory and the intention of using a memory aid supporting a good memory fit. The hypothesis was that those people with a worse prospective memory capacity would have a better acceptance of the HERMES Calendar application, since they perceive that this tool can support their memory loss. But contrary to what it was hypothesised; those people with better prospective memory also showed a higher intention of use this application. This result can be indicating that those people with better memory are the ones who also show a higher intention of use of this application, maybe because they perceive that they have the personal resources needed for using this application.

4.2.4.2 Episodic memory

As reported before, subjective episodic memory has been measured in these trials using the MAC-Q scale. In the following table the average of the sum of the three factors assessed by this scale are shown.

	Spain	Austria	Total
Daily activities	17.67	18.69	18,25
Overall memory functioning	10,17	10.38	10,29
Sense of concern about one's own memory	10.09	10.25	10,19

Table 7. Results in MAC-Q

We have conducted Pearson bivariate correlations between these score and the UTAUT results for the HERMES MyPast, which is the HERMES application more strongly related to episodic memory, as it has been described before in this document. Correlations showed significant relations between the first of the MAC-Q factors and items "EE1: My interaction with HERMES MyPast is clear and understable" (r=.483), "EE2: It is easy for me to become skillful at HERMES MyPast" (r=.501), "EE4: Learning to operate HERMES MyPast is easy for me" (r=.470), "FC2:I have the knowledge necessary to use HERMES MyPast" (r=.506), and "FC4: A specific person is available" (r=-.468). The third factor correlate significantly with item "FC1: I have the resources necessary to use HERMES MyPast" (r=-.434). The second factor, which is more related to metacognitive process, did not correlate with any UTAUT item.

These moderate correlations point to a relation between perceiving a relatively good episodic memory, especially for concrete situations, and the intention of using a memory aid to support this memory. Again it seems that instead of being the people with worse memory perception who better accept and evaluate the support of the HERMES applications, are those with better memory performance who show a stronger intention of use of the system.

4.2.5 Open questions

This last section includes three types of results:

- Usability issues
- Open questions dealing with ethical issues, directly asked to the participants
- Other open questions

4.2.5.1 Usability issues

In the user experience evaluation the user was requested to perform some tasks with the system and to answer a post-task questionnaire after that. The post-task questionnaire included a 5 points Likert-scale question: *"How well did the system support you in solving the task?"* In table number 7, the responses obtained in this question for each one of the task requested the user to perform (see section 3.4 for more information about these questions) are shown.

	THE SYSTEM HAS NOT SUPPORTED ME AT ALL	THE SYSTEM HAS SUPPORTED ME ONLY IN SOME PARTS OF THE TASK	UNDECIDED	THE SYSTEM HAS SUPPORTED ME IN ALMOST ALL THE TASKS	THE SYSTEM HAS SUPPORTED ME AT EVERY MOMENT
PDA_NEW_APPOINTMENT	3.2%	6.5%	16.1%	41.9%	32.3%
PDA CHANGE APPOINTMENT	0%	12.9%	19.4%	48.4%	19.4%
PDA RECORD CONVERSATION	0%	3.2%	16.1%	41.9%	38.7%
PDA_TAKING PHOTO	0%	6.7%	20%	26.6%	46.7%
PDA SHOPPING LIST	0%	0%	6.5%	38.7%	54.8%

MAZE GAME	0%	8%	12%	44%	36%
PUZZLE GAME	0%	11.5%	3.8%	50%	34.6%
WHO IS WHO GAME	4.2%	4.2%	4.2%	41.7%	45.8%
CALENDAR – BROWSE APPOINTMENT	0%	0%	7.4%	33.3%	59.3%
CALENDAR – CREATE NEW APPOINTMENT	0%	15.4%	7.7%	42.3%	34.6%
CALENDAR – SYNCHRONIZATION	0%	7.1%	0%	14.3%	78.6%
CALENDAR – CHANGE APPOINTMENT	0%	4.2%	4.2%	58.3%	33.3%
MYPAST – TIME SEARCH	3.8%	7.7%	3.8%	46.3%	38.5%
MYPAST – PEOPLE SEARCH	0%	4%	4%	52%	40%
PEOPLE	0%	0%	7.7%	46.2%	46.2%
SHOPPING LIST	0%	3.8%	3.8%	23.1%	69.2%

Table 7. How well did the system support you in solving the task?

As it can be seen in this table in all the tasks the highest percentage of answers is found in options: *"The system has supported me in almost all the tasks"* and *"The system has supported me at every moment"*. This percentage (the sum of the people who have rated this question with options: *"The system has supported me in almost all the tasks"* and *"The system has supported me at every moment"*) varies between 67.8% in task Change Appointment in HERMES Mobile and 93.5 in task Create Shopping List in HERMES Mobile.

Those people who gave answers: *"The system has not supported me at all", "The system has supported me only in some part of the tasks";* were required to identify the specific difficulties by completing the task (icons, text, colours, following the changes on the screen, problems understanding which action / response is expected, etc). Also the interviewer was observing at every time the difficulties that the user had by completing the tasks. These usability problems (the ones identified by the users and the ones observed by the interviewer) are collected in the following table (table 8). In the second column some comments about the possible solution of these usability problems are described.

	USABILITY PROBLEMS
Tasks with HERMES Mobile	Incorporate the option of showing different calendar views (week, month, day, etc).
	More information about next step: What do I have to do?
	For changing an appointment a button with the label change would be easier to understand
	Keyboard size

	Letters and icons are too small
	Sometimes it takes a long time to find the correct button
	Required more time than taking notes
	Option for closing the keyboard
	For the task of taking photos, it should be easier to start the camera application
	When people were required to change an appointment most of them did not change appointment, but created a new one (deleting old one)
	When they wanted to stop a recording they pressed "Done" instead of pressing "Stop recording"
	Not easy to know how to return from camera mode
Tasks with Cognitive Games	Maze game: the notebook icon in the middle of the screen (indicating the reaching point) is confusing
	In order to move the cursor, it is needed to press too hard
	Who is Who game: elements were difficult to move
Calendar	Setting the time was not clear To switch between capitals and lower case letters
	'+/- (setting time) was confusing Deletes old entry and creates new one, instead of changing it
	Participants did not understand "Done" button as confirmation
MyPast	System did not show the weekdays
	Difference between date functions and time functions not clear
People/Locations/Shopping Lists	Changing of reminder confusing

Table 8. Usability issues in the user experience evaluation

It is needed to mention that Synchronisation task was not always possible to complete due to technical problems.

In general the usability problems are less than the ones found in the first user trial and also are less serious than them. Most of the usability issues found now can be solved by means of allowing the participants to practice with the system (e.g. now they are not familiar with the action of pressing "Done" after finishing a task, but this action can be easily learnt after a time practising with the system). Other usability problems are due to the nature of the devices (e.g. the small size of the screen and buttons of the PDA). Some of the comments should be carefully taken into account since they are more personal opinions than general findings.

4.2.5.2 Open questions dealing with ethical issues

After each one of the applications, participants were required to answer four questions aiming at knowing the type of information they would record / save in the application or the information they would not record / save, and also whether they would show the application to other people or would use it together with others.

- Which information would you record with the device?

HERMES MOBILE: They said that they would record appointments, sales talk, theatre, cinema, events, and conversations in general. Also they would record the things they have to do in a distant future, since they think that they are able to remember what they have to do in the next days and they would not record this information.

COGNITIVE GAMES: Participants suggested playing games with personal pictures and their own contacts pictures and also with pictures from actors and celebrities.

CALENDAR: In general, participants pointed out that the information they would record in the Calendar would be the most important information for them: medical appointments, important calls, etc. However, some of the people in the trials would record all the information they need to remember: appointments in general, upcoming events, leisure activities, meeting with friends.

MYPAST: Participants would record visits, information from the HERMES Mobile, family celebrations (in order to be able to remember them some time after) and conversations.

PEOPLE/LOCATIONS/SHOPPING LISTS: In people application a participant suggested to include preferences of people regarding eating habits, and two participants would include telephone numbers and addresses. Between these three applications, shopping list was the preferred one.

- Which information would you NOT store in such a system? Why?

HERMES MOBILE: The participants would not record intimate and private conversations, and irrelevant things.

COGNITIVE GAMES: Information they would not use for playing games were information about private details, especially the information including their friends, and boring information.

CALENDAR: Participants were reluctant to record personal experiences and things that can be private to other people and secret information (codes, passwords, etc).

MYPAST: This is the application where people were more reluctant to record conversations. Some of the situations they avoided to record were: intimate and private moments, when they receive visits (because of visitors' privacy), when they are in a bad mood, when they are alone with his wife or her husband, family life in general, personal conversations and daily routine.

PEOPLE/LOCATIONS/SHOPPING LISTS: In general, people would record all type of information here (except the photos and details of those people who do not want to appear in the system), since they perceived that the information included in Locations and Shopping Lists is not sensitive and private.

- If you would own such a system, would you show it to other people? Why or why not?

HERMES MOBILE: In general participants would show the system to other people for different reasons: because it is useful and user-friendly, it is helpful and they thought that other people should get to know it. However, in this point there are some people who would not show it to other people because of privacy concerns.

COGNITIVE GAMES: Some of the participants were willing to show the system to other people if the others are interested and they can play in a competitive way. However, other participants did not agree with showing the games to other people since they thought that it is something private.

CALENDAR: Opinions in this point are again divided between those people who would show the system to other people interested on it because they thought that could be interesting and helpful for them, and those participants who would not show it since contains personal information they did not share with others.

MYPAST: People who would show the system to others argued that they can reminisce together, they would show if they need a proof of something (e.g. a proof that something happened in their homes), and because it is new. Very few people would not show it to other people or would only show some part of this application (e.g. some recordings).

PEOPLE/LOCATIONS/SHOPPING LISTS: As in the previous question, participants did not perceived these three applications as the most private ones, so they did not have privacy concerns.

- Would you use the system together with other people? Why or why not?

HERMES MOBILE: In general, people said that they would not show the system to other people since it is too private.

COGNITIVE GAMES: As in the previous questions, there were some participants interested in playing games in a competitive way together with other people, while other preferred to play alone. Some of them would like to play the cognitive games with their grandchildren.

CALENDAR: Again, people who in the previous question said they would show the system to other people, they also would use the system together with them, and people who did not show the system to others would not use it together.

MYPAST: In general participants would reduce the shared use of this application to those people present in the recordings (e.g. if a participant record an event where his friend Ana appears, he would use the system for viewing that recording with his friend).

PEOPLE/LOCATIONS/SHOPPING LISTS: Some of the participants would not use the applications together with other people because they did not perceive the necessity of using it with other people. The other people would use it together with others, since they thought that this could be useful for the others.

4.2.5.3 Other open questions

After each one of the applications (HERMES Mobile, Cognitive Games, Calendar, MyPast and Locations, people and shopping lists, the participants were also asked:

- Was it fun using the system? Why or why not?

HERMES MOBILE: All the people in both Austria and Spain thought that this was a funny system for several reasons: because it is new, interesting, useful, easy, it is a challenge, useful if somebody is forgetful. However, some people pointed out that even fun and useful they did not have the need to use it now (because they are able to remember things by themselves), but they can imagine some people older than them, and also themselves in the future, using the system.

COGNITIVE GAMES: Participants considered that games are funny and they perceived the potential value they have, since they improve the intellectual power and they mentioned that it is a fun way of passing time. Puzzle game was the one preferred by the participants.

CALENDAR: All the participants thought that this was a funny application. Some of the reasons of this positive evaluation were: (1) better overview than in small paper calendar; (2) it is helpful; (3) it is well-arranged; (4) they had the feeling of success; (5) it is user-friendly.

MYPAST: People thought that it was a funny, exciting and new application.

PEOPLE/LOCATIONS/SHOPPING LISTS: In general, the participants considered this application funny because it is easy to work with, eases the life and it is useful.

- What part of the system would you improve? Why or why not?

HERMES MOBILE: The participants pointed out that some possible improvements could be: larger letters and icons, improve the keyboard, typing should be easier, move the "Done" button to a more visible place, include audio messages about how to do in every moment.

COGNITIVE GAMES: Some o the issues the participants would improve were: symbols/blocks should be easier to move, they would increase the difficulty level of the games.

CALENDAR: The major improvement mentioned by the participant was that they preferred to type numbers for setting up the time of the appointment instead of pressing plus and minus buttons on the screen.

MYPAST: Some of the users would include a help function and others would only like to see the days with events recorded.

PEOPLE/LOCATIONS/SHOPPING LISTS: Most of them did not have any improvement to do, but they would include information in People application about who people do not want to be recorded.

4.3 Home evaluation

4.3.1 Attitudes towards technologies

As reported in 4.3.1, the aim of this questionnaire was to know the technological profile of our participants, in this case of those persons participating in the home trials. Mean results are presented in the following table:

	Spain
1. Technical appliances (such as mobile phone and Internet) help to better organize my personal life.	3.00
2. I find it good that I can keep in touch with people I care via technical appliances (such as mobile phone and Internet).	4.13
3. The disadvantages which some technical appliances can cause just belong to this kind of appliance.	2.75
4. It is good that all kind of administrative forms are available via Internet (for example a change of address form).	3.63
5. I find it good that when I want to know something, I can also get that information via technical appliances.	3.88

Table 9. Average of the items in the attitudes towards technologies questionnaire for the home evaluation

4.3.2 Learnability evaluation

The main variable to be assessed in home evaluation was the learnability of the system. Since the procedure followed in this evaluation allowing the users to have the system at home for a period of time, it allows us to obtain information about the learnability of it. The main measures of the learnability were: time and errors.

The average of the days the participants had the system at home was 7 days ranging from 4 days until 12 days. At the beginning it was thought that the participants had the system for two weeks, but finally this was not possible. Some of the participants did not want to have the system at home for 2 weeks, and others who agreed in the first session (when they took the system) having it for that period of time, after some days they called and asked us to give us back the system before, argued that they had some problems with it. Of course, for ethical reasons, in these cases we offered our help for solving the problems (going to the users' home for solving the problems), but they preferred to give us back the system so we scheduled the second visit before than the expected.

4.3.2.1 Time differences between first and second session

One of the hypotheses we wanted to test in the home evaluation was that the users in the second session would need less time for completing the same tasks they completed in the first session with both HERMES Mobile and HERMES Home System. Table 10 shows the average of the time needed for each one of the tasks in both the first and the second session.

	FIRST SESSION	SECOND SESSION
HERMES Main Screen Calendar – New appointment	166.75	191.00
HERMES Main Screen Calendar – Browse	36.13	80.50
HERMES Main Screen Calendar – Change appointment	101.25	69.00
HERMES Main Screen MyPast – Time search	34.14	50.50
HERMES Main Screen MyPast – People Search	47.29	37.75
HERMES Main Screen MyPast – Event Search	58.43	51.50
HERMES Main Screen People – Viewing Photos	92.13	110.00
HERMES Main Screen Shopping Lists – Add item	69.75	53.80
HERMES Main Screen Shopping Lists – Delete item	33.71	16.75
HERMES Cognitive Games - Maze	96.88	65.75
HERMES Cognitive Games - Puzzle	104.50	69.00
HERMES Cognitive Games – Who is Who	30.50	29.50
HERMES Mobile Calendar – New appointment	189.00	182.80
HERMES Mobile Calendar – Change appointment	90.25	113.00
HERMES Mobile Conversations – Record Conversation	72.75	110.00
HERMES Mobile People – Viewing and taking photos	179.00	138.20
HERMES Mobile Shopping Lists – Add item	50.13	41.33

Table 10: Time (in seconds) needed for completing the tasks in home evaluation

Mann-Whitney test were carried out in order to find possible differences. These analyses, contrary to our hypothesis, did not show significant differences. This lack of differences can be

due to some people did not use the system at home (for the technical problems) for the time needed in order to really learn how to operate with the system.

4.3.2.2 Errors differences between first and second session

Besides timing the tasks, the interviewer observed the participants while performing the tasks in the first and second session.
In the following table the errors found in these two sessions are shown.

	PROBLEMS FOUND IN THE FIRST SESSION	PROBLEMS FOUND IN THE SECOND SESSION
Tasks with HERMES Mobile	Problems finding the icon "Create a new entry"	Continue in the second session
	Find the button for setting up the time	Not continue in the second session
	Introduce the time for the appointment with letters in the description box	Not continue in the second session
	Do not press "Done" button after finishing a task	Continue in the second session in some cases
	Do not find the place where writing the topic of the appointment	Not continue in the second session
	Problems taking the photo	Continue in the second session
Tasks with Cognitive Games	Problems about action required after selecting the photo for playing Puzzle Game	Not continue in second session
Calendar	Problems finding the button for entering a new appointment	Not continue in the second session
	Problems setting up the time for the appointment	Continue in the second session in some cases
MyPast	Problems with the filters	Not continue in the second session
	Confusion about what should be search in MyPast and in Calendar	Not continue in the second session
People/Locations/Shopping Lists	Enter the appointment description in People application	Not continue in second session
	Find the keyboard	Not continue in second session

Table 11. Comparison between errors found in first and second session in the home evaluation

While some of the errors found in the first session were not made again in the second one, there were some errors which still continue in the second session after the practice period at home. Some of the reasons why these problems continued can be due to:

- Some of the users did not practice the time needed at home. There was not an objective measure of the time the users spent practicing at home, and also some of them had technical problems and that is why they did not practice too much.

- Some of the users would need not only time for learning how to operate with the system, but also formal teaching and practicing with a person who guide them and who correct his/her errors.

In general the applications where the elderly made less error were Cognitive Games and People/Locations/Shopping Lists, while HERMES Mobile showed the highest number of errors. This can be due to some of the participants were familiar with the PC (so it was not difficult to complete some of the tasks), but they were not familiar with PDA and they were to face with a novel application in a novel device.

Due to the different problems in the home evaluation (people reluctant to take the system home for several days; technical problems while they had the system at home; impossibility of carrying out the second session in 1 case for technical problems – when the user came to the lab for the second session it was not possible to switch on the laptop - one of their relatives was changing the configuration and the password while she had the system at home - and when we solved the problem and called again the user for completing the second session she did not want), it is convenient to be careful with the conclusions drawn.

4.3.2.3 Learnability Questionnaire

The last questionnaire administer to the users in the home evaluation was an ad-hoc 5-points Likert scale including questions regarding the learnability process. This subjective information is presented (percentage of responses) in the following table:

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
1 - These instructions and prompts are helpful	0%	16.7%	16.7%	66.7%	0%
2 - Learning to operate this software initially is full of problems	16.7%	33.3%	50%	0%	0%
3 - It takes too long to learn the software commands	33.3%	16.7%	33.3%	16.7%	0%
4 - Working with this software is mentally stimulating	0%	33.3%	16.7%	50%	0%
5 - I can understand and act on the information provided by this software	16.7%	16.7%	16.7%	50%	0%
6 - Learning of use new functions is difficult	16.7%	33.3%	16.7%	33.3%	0%
7 - It is easy to make the software do exactly what you want	0%	33.3%	33.3%	33.3%	0%
8 - I will never learn to use all that is offered in this software	50%	33.3%	0%	0%	16.7%
9 - Have to look for the assistance most times when I use this software	50%	0%	0%	16.7%	33.3%
10 - It is easy to forget how to do thing with this software	33.3%	33.3%	0%	33.3%	0%

Table 12. Results in the Learnability Questionnaire

At least half of the participants considered that learning how to use the system is mentally stimulating (item 4), easy to understand (item 5), possible to learn (item 8) and no need the help of others (item 9). Nevertheless, and due to the fact that no differences between the time needed in the first and second session for completing the task, it makes necessary further complementary data to study learning possibilities related to a system like the one presented.

5. Ethical issues

According to the different types of evaluations (user experience evaluation, concept evaluation and home evaluation) it is possible to distinguish different privacy levels and different actions to guarantee the privacy and safety of the participants.

- Concept evaluation: People participating in these trials were just requested to attend one time to the lab. They were presented with HERMES and SOPRANO scenarios and asked to fulfil the acceptance questionnaire about them. There was not any special privacy risk in these tests. Regarding the actions taken (e.g. informed consent, storage and handling of the data, etc), can be found in deliverable D8.3: Ethical Guide and Manual including relevant legislation guidelines

- User experience evaluation: The procedure of the second user trial was very similar to the first one so the ethical issues were addressed in a similar way. No major ethical risks were identified. For more information about the measures use for the guarantee of the ethical issues see D7.2 User Evaluation Report Trial 1 and D8.3.

- Home evaluation: This has been the new evaluation in this second trial and also the one which could be risky from the ethical point of view. The elderly who wanted to participate in these trials were provided with the minimal system (a multi-touch laptop in which the HERMES Home System was installed and a PDA in which the HERMES Mobile application was installed). Their houses were not equipped with the sensing environment (microphones and cameras) so there were not privacy risks in this sense. However, several specific actions were carried out to guarantee that participants could not access to the other participants' data previously stored in the laptop and in the PDA. That means, there were two laptops and two PDAs for the home evaluation, so the users shared these devices, when one user finished the trial, the laptop and the PDA were given to other participant. Both PDA and laptop for the home evaluation contained the Switch User Application where the staff from INGEMA chose the code of the participants before giving him/her the laptop, in order to give them a system where they can seen their previous videos in MyPast, their photos in the cognitive games, etc. In order to not allow the users to enter in these applications and to hence to be able to watch the other participants' videos, these applications were password protected, or directly it was not possible for them to enter in these applications. It was not necessary to save the information in a hard disk and delete it in the computer and in the PDA each time a participant gave us back the devices; it was enough protecting the databases.

Also, especial emphasis was put on the fact of not recording with the PDA other people not participating in the project, and especially without their knowledge and permission. None of the participants recorded other people.

At the beginning it was planned to give the participants an internet cable in order to solve the possible technological problems. Finally this cable was not given to the users because some users did not have internet at home and because it would be really difficult to remotely solve the problems if some action from the participants would be needed.

Finally, in this third period of the project, two meetings with the ethical advisory board have been held. The first one was held in February 2010 in Vienna and the ethics advisors gave the user partners feedback about how to carry out the second user trial as well as they approved the way in which the ethical issues were addressed in the first trial. In the second meeting, held in March 2010 in San Sebastian, the progress made in the project was presented to the ethics

advisors. They again agreed with the way the ethical issues were addressed. During these two meetings one of the main questions which arose was the lack of ethical committees, both in Austria and Spain, specialized in the review of projects related with technologies. In fact, this is a situation that also happens in other European countries. The attendances to the meeting talk about develop a draft of guidelines that can help the ethical committees to know the concrete points they should evaluate in these projects. This first draft can be found in Appendix 16.

6. Overall conclusions

In the second HERMES user trial the improved version of the HERMES system was tested with elderly people in Austria and Spain. The applications tested were:

- HERMES Mobile
- Calendar
- MyPast
- Locations/People/Shopping Lists
- Cognitive Games

These applications were mainly tested in two different ways:

(1) User experience evaluation: The applications were tested by facing the elderly with the system and asking them to complete some tasks with it. After completing the tasks, several questionnaires aiming at knowing the acceptance of the system, usability issues, and user's perceptions and opinions were administered.

(2) Home evaluation: The participants were asked to take the system home in order to compare the time needed and the errors made in different tasks with the system before and after having the system at home. Time and errors were taken as indirect measures of the learnability of the system.

Additionally, a concept evaluation, where HERMES and SOPRANO scenarios were presented to the participants who rated their level of acceptance, was carried out.

In the **user experience evaluation** we found that all the applications of the HERMES scenarios were well perceived and evoked positive emotions in the elderly, as results found in EmoCards and UTAUT Questionnaires pointed out. The preferred and the best evaluated application was the Calendar and, on the other hand, the less accepted application was the HERMES Mobile. It is important to say at this point that HERMES Mobile application was well perceived and assessed, that means, even it was the one which obtained the lowest scores in comparison with the others, it obtained good acceptability rates.

Cognitive Games were also very well assessed, especially the Puzzle Game. Results collected from the Game Experience Questionnaire (GEQ) showed a good perception of the HERMES games, highlighting feelings of arousal, satisfaction and interest. However, the participants wanted to have more games and more difficult games.

A short cognitive evaluation was made to the participants in order to test two hypotheses:

- People with a worse prospective memory capacity would better assess the Calendar application (developed for the support of prospective memory).
- People with a worse episodic memory capacity would better assess the MyPast application (developed for the support of episodic memory).

We found contrary results to our hypothesis; better scores in prospective and episodic memory are related with a better acceptance of the Calendar and MyPast application.

Regarding the usability issues, almost all the participants thought that the system supported them (partially or fully) in all the tasks carried out with the several applications. Less usability problems have been found in this second trial in comparison with the first one. The majority of the usability problems found in the second user trial were related with:

- Those features which are inherent to the devices. For instance, most of the people complaint about the small size of the letters and icons in the PDA (HERMES Mobile), but this cannot be changed.
- Personals opinions about some possible improvements. However, these are opinions should be carefully considered since they are not shared by everyone.
- Typical problems that can be made by anyone who have not been practiced with a new system.

In general, people were worried about the privacy risks of their visitors and some of them were reluctant to the idea of recording other people at their homes. However, they really acknowledged having a system able to record some events at their homes, when no visitors appear in those recordings.

When we analyzed the results obtained in the user experience evaluation comparing the scores obtained in Spain and Austria, we found that, in general, the Austrian sample showed a better acceptance of the system as well as a better intention of use of it. This result can be due to the fact that the Austrian sample was more familiar with technology in general, and also they had more positive attitudes towards technology.

In the **home evaluation** we hypothesized that time differences would be find between the time needed for completing the tasks in the first and in the second session (less time needed in the second session). However, this hypothesis was not supported by the results found. One of the reasons why we did not find this reduction in the time needed for completing the tasks can be the technological problems the participants had while they had the system at their homes. This situation did not allow them to practise a lot of time with the application. But when we analyzed the type of errors made (observed by the interviewer) we found that some errors disappeared in the second session. Besides, as it can be perceived in the results found in the learnability questionnaire that most of them considered the HERMES system as easy to understand and possible to learn and they did not think that it would be necessary the other people's help to use it.

Finally, in the **concept evaluation** we found that the participants would user HERMES system, in comparison with SOPRANO system, because it is more probably use for maintaining valuable contact with others and it is something new and modern. Also, the HERMES scenarios were better evaluated, especially those related with reminder of appointments, the three cognitive games and the shopping list application.

We found support to the hypothesis: People in the second session of the user experience evaluation would better accept the system in comparison with their level of acceptance after being presented with the scenarios". In fact, we found a higher level of acceptance in several of the items of the AmI Questionnaire after the users completed the tasks with it. However, we failed finding support for these two hypotheses,

- People in the home trials would have a better perception of the HERMES scenarios since they have been testing the system for a period of time in their houses and, because of that; they would have a more realistic vision of the functionalities of the system.
- People in the home trials would better evaluate the HERMES features and would have a higher intention of use after having it for a period of time.

The reason why we did not find support to these hypotheses could be that participants in the home evaluation found several technological problems with the system, and these problems motivated a bad assessment of the HERMES system.

Since the evaluation tools used in first and second trials were different (only UTAUT was administered in the two trials for Calendar and MyPast applications), it is not easy to analyze the differences between first and second prototype. Another reason why this comparison is not easy to do is because people who participated in first and second trials are not the same (only some people from the Spanish sample are the same). That means, if we compare the results in these two trials and we find significant differences we cannot be 100% sure that the differences are due to the improvements made in the system. In this case, the differences can also be consequence that the people are different. However, in the second trials in comparison with the first ones we have found less usability problems and not so serious problems and higher acceptance of the system.

7. References

Allouch SB, van Dijk JAGM, & Peters O, The acceptance of domestic ambient intelligence appliances by prospective users, in: LNCS 5538, pp.77-94, 2009.

Charter of Fundamental Rights of The European Union. 2000/C364/01. Official Journal of the European Communities 18 December 2000.

Crook, T.H., Feher, E.P. & Larrabee, G.J. (1992). Assessment of memory complaint in age-associated memory impairment: The MAC-Q. *International Psychogeriatrics*, 4, 165-176.

Desmet, P.M.A., Hekkert, P., Jacobs, J.J. (2000). When a car makes you smile: Development and application of an instrument to measure product emotions. In: S.J. Hoch and R.J. Meyer (Eds.), Advances in Consumer Research, 27, 111-117.

IJsselsteijn, W., de Kort, Y., Poels, K., Jurgelionis, A., & Bellotti, F. (2007). Characterising and measuring user experiences in digital games. Paper presented at the ACE Conference´07, Salzburg, Austria.

Ley Orgánica 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal.

Löckenhoff, C.E. & Carstensen, L.L. (2007). Aging, emotion and health-related decision strategies: Motivational manipulations can reduce age differences. *Psychology and Aging*, 22, 134-146.

Raskin, S., & Buckheit, C. (1998, March). Prospective memory in traumatic brain injury. Poster presented at the Cognitive Neuroscience Society, San Francisco, CA.

Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D. 2003. User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly Vol. 27 No. 3,* 425-478

8. APPENDIXES

8.1 Appendix 1 – AmI Technology Acceptance Questionnaire (AmI TA)

We would like to ask you some questions about the HERMES system.

Question number 1 - Would you use the HERMES system when it becomes available?

- ☐ Definitely not
- ☐ Probably not
- ☐ I don't know
- ☐ Probably yes
- ☐ Definitely

Question number 2 - Does HERMES make the use of a memory support tool more or less fun?

- ☐ Definitely less fun
- ☐ Less fun
- ☐ Neither more nor less fun
- ☐ More fun
- ☐ Much more fun

Question number 3 - What do you think; does HERMES make the use of a memory support tool easier or more difficult?

- ☐ Definitely more difficult
- ☐ More difficult
- ☐ No difference to others
- ☐ Easier
- ☐ A lot easier

Question number 4 - In your opinion, in how far would you have more or less control over the use of your current memory support tool compared with the HERMES system?

- ☐ Definitely less control
- ☐ Less control
- ☐ No difference to others
- ☐ More control
- ☐ Much more control

Question number 5 - Do you expect that HERMES offers you more or less convenience in using a memory support tool?

- ☐ Definitely less convenience
- ☐ Less convenience
- ☐ No difference to others
- ☐ More convenience

- ☐ Much more convenience

Question number 6 - With the HERMES system an attempt is made to increase personalisation of a memory support tool. How appealing do you find this?

- ☐ The personalisation possibilities are not at all appealing
- ☐ The personalisation possibilities are not very appealing
- ☐ The personalisation possibilities don't bother me
- ☐ The personalisation possibilities are appealing
- ☐ The personalisation possibilities are very appealing

Question number 7 - To what extent do you find the combination of a memory support tool with all kind of information and communication technology useful?

- ☐ Not useful at all
- ☐ Not useful
- ☐ This combination doesn't bother me
- ☐ Useful
- ☐ Very useful

Question number 8 - Could you indicate in how far you are planning to buy the HERMES system when it becomes available?

- ☐ I definitely won't buy it
- ☐ I don't plan to buy it
- ☐ I don't know
- ☐ I plan to buy it
- ☐ I definitely plan to buy it

Question number 9 - If you give permission, HERMES can record any activity in your living room, in order to allow you to retrieve videos afterwards, if you don't remember what happened. How attractive do you find this possibility?

- ☐ Very unattractive
- ☐ Unattractive
- ☐ Neither unattractive nor attractive
- ☐ Attractive
- ☐ Very attractive

Please motivate your rating: _____

Question number 10 - If you give permission, the HERMES system identifies all faces detected by its cameras, so you can easily search for certain persons in your video archive. Thus you can see who was visiting you at home and when. How attractive do you find this possibility?

- ☐ Very unattractive
- ☐ Unattractive
- ☐ Neither unattractive nor attractive
- ☐ Attractive
- ☐ Very attractive

Please motivate your rating: _____

Question number 11 - Please rate the following statements: I think HERMES is …

				neutral			
a)	bad	☐	☐	☐	☐	☐	good
b)	unwise	☐	☐	☐	☐	☐	wise
c)	harmful	☐	☐	☐	☐	☐	beneficial
d)	undpleasant	☐	☐	☐	☐	☐	pleasant
e)	worthless	☐	☐	☐	☐	☐	valuable
f)	joyless	☐	☐	☐	☐	☐	enjoyable

How likely are the following reasons for you to use HERMES?

Question number 12 - To make remembering things easier for me.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 13 - Because it offers me more freedom.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 14 - Because it makes task in the home more pleasant.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 15 - To make daily domestic activities more pleasant.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 16 - Because I like to use such appliances.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 17 - To be entertained.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 18 - To be able to do different things at once.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 19 - To have more control over my daily life.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 20 - Not to have to do everything by myself.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 21 - To make my everyday life easier.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 22 - Because it is convenient that I do not have to carry out certain tasks myself.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 23 - To save time.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

(social outcomes)
Question number 24 - To strengthen my relationship with family and friends.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 25 - To be able to communicate with family and friends.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 26 - To maintain valuable contact with others
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 27 - To belong to a particular group.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 28 - To have something to talk about with others.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 29 - To have something to do.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 30 - When I am bored.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 31 - To relax.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 32 - When I don't have anything else to do.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 33 - To feel less lonely.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 34 - As a way to pass time.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 35 - Because it is something new.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 36 - To be able to support my own memory.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 37 - To discover new possibilities.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

(fashion/status)
Question number 38 - Because these appliances are modern.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 39 - To keep up with the newest technology.

very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 40 - Because it belongs to my lifestyle.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 41 - Because it increases my status.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Question number 42 - When HERMES becomes available, I will use it.
very unlikely ☐ ☐ ☐ ☐ ☐ very likely

Note: The following two questionnaires: Rating the features of the HERMES and SOPRANO Scenarios were also assessed in the concept evaluation – group approach. They were not administered to the participants in the user experience and home evaluations.

Rating the features of the HERMES Scenarios

Please rate the presented scenarios. Would you use the functionalities? Please mark the respective box.

1. Memory of Past Experiences

a. Remembering visits and conversations

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

b. Remembering where objects (e.g. keys) have been put

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

c. Remembering conversations with the doctor

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

2. Reminder of Activities

a. Reminder of appointments

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

b. Reminder of person related data

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

3. Cognitive Training

a. Maze

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

b. Who is Who?

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

c. Puzzle

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

4. Mobile Support

a. Shopping lists

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

b. Location-aware reminders

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

Rating of the presented SOPRANO Scenarios

Please rate the presented scenarios. Would you use the functionalities? Please mark the respective box.

Automatic pill dispenser

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

Fall detection

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

Against forgetfulness – Check if something was forgotten

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

Against loneliness – Suggestions for activities

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

Bed Monitoring

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

Stay Mobile – Gymnastics in front of the TV

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

Save Home during Travel

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

Visits Management

☐	☐	☐	☐	☐
Definitely yes	Rather yes	Maybe	Rather not	Definitely not

8.2 Appendix 2 - Questionnaire on Usage of Technology

Please indicate which ICT-products or services you use and how frequently you use them.

Product:	**Usage:**				
	Never	at least 1x a day	at least 1x a week	at least 1x a month	more rarely
PC or Laptop	☐	☐	☐	☐	☐
Mobile phone	☐	☐	☐	☐	☐
Digital Picture Frame	☐	☐	☐	☐	☐
TV	☐	☐	☐	☐	☐

Please indicate which memory support tools you use and how frequently you use them (create or look at entries).

Tool:	Usage:				
	Never	at least 1x a day	at least 1x a week	at least 1x a month	more rarely
Notepad	☐	☐	☐	☐	☐
Post Its	☐	☐	☐	☐	☐
Diary	☐	☐	☐	☐	☐
Blog	☐	☐	☐	☐	☐
Calendar	☐	☐	☐	☐	☐
Digital calendar	☐	☐	☐	☐	☐
Photo albums	☐	☐	☐	☐	☐
Online photo albums	☐	☐	☐	☐	☐
Video recordings	☐	☐	☐	☐	☐
Online videos	☐	☐	☐	☐	☐

What is your opinion towards the following statements?

Technical appliances (such as mobile phone and Internet) help to better organize my personal life.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

I find it good that I can keep in touch with people I care via technical appliances (such as mobile phone and Internet).

Disagree ☐ ☐ ☐ ☐ ☐ Agree

The disadvantages which some technical appliances can cause just belong to this kind of appliance.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

It is good that all kind of administrative forms are available via Internet (for example a change of address form).

Disagree ☐ ☐ ☐ ☐ ☐ Agree

With the arrival of the Internet, the possibility for everyone to participate in society has grown.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

I find it good that when I want to know something, I can also get that information via technical appliances.

Disagree ☐ ☐ ☐ ☐ ☐ Agree

8.3 Appendix 3 – Post task questionnaire

How well did the system support you in solving the task?

☐	☐	☐	☐	☐
1: The system has not supported me at all	2: The system has supported me only in some parts of the task	3: Undecided	4: The system has supported me in almost all the tasks	5: The system has supported me at every moment

If you think the system should provide a better support (mainly responses 1 and 2), please think of the technologies you are currently using in your daily life and write down / tell us how it could be improved:

_____

_____

_____

Have you identified specific difficulties by completing this task? ☐ Yes ☐ No

If Yes, please specify:

a. Problems understanding the icons on the screen? ☐ Yes ☐ No

b. Problems reading text on the screen? ☐ Yes ☐ No

c. Problems with colours of the screen? ☐ Yes ☐ No

d. Problems following the changes on the screen easily after tapping it? ☐ Yes ☐ No

e. Problems understanding which action / response is expected from you? ☐ Yes ☐ No

f. Other: _____

8.4 Appendix 4 – EmoCards

8.5 Appendix 5 - General Questions about HERMES Applications

- Was it fun using the system? Why or why not?
- What part of the system would you improve? Why or why not?
- Which information would you record with the device?
- Which information would you NOT store in such a system? Why?
- If you would own such a system, would you show it to other people? Why or why not?
- Would you use the system together with other people? Why or why not?

8.6 Appendix 6 – UTAUT

All items are measured on a seven point Likert scale, where
1 = completely disagree
2 = moderately disagree
3 = somewhat disagree
4 = neutral (neither disagree nor agree)
5 = somewhat agree
6 = moderately agree
7 = completely agree

Scales / Items
Performance Expectancy (PE)
PE1: I find HERMES Mobile useful in my life.
PE2: Using HERMES Mobile enables me to accomplish tasks more quickly.
PE3: Using HERMES Mobile increases my productivity.
PE4: Using HERMES Mobile increases my chances of leading an active lifestyle.
Effort Expectancy (EE)
EE1: My interaction with HERMES Mobile is clear and understandable.
EE2: It is easy for me to become skilful at using HERMES Mobile.
EE3: I find HERMES Mobile easy to use.
EE4: Learning to operate HERMES Mobile is easy for me.
Attitude toward Using Technology (AT)
AT1: Using HERMES Mobile is a good idea.
AT2: HERMES Mobile makes life more interesting.
AT3: Living with HERMES Mobile is fun.
AT4: I like living with HERMES Mobile.
Facilitating Conditions (FC)
FC1: I have the resources necessary to use HERMES Mobile.
FC2: I have the knowledge necessary to use HERMES Mobile.
FC3: HERMES Mobile is not compatible with other systems I use.*
FC4: A specific person (or group) is available for assistance with HERMES Mobile difficulties.
Anxiety (AX)
AX1: I feel apprehensive about using HERMES Mobile.
AX2: It scares me to think that I could lose a lot of information using HERMES Mobile by hitting the wrong key.
AX3: I hesitate to use HERMES Mobile for fear of making mistakes I cannot correct.
AX4: HERMES Mobile is somewhat intimidating to me.
Behavioural Intention to Use the System (BI)
BI1: I intend to use HERMES Mobile in the next semesters if I would have access to it.
BI2: I predict I would use HERMES Mobile in the next semesters if I would have access to it.
BI3: I plan to use HERMES Mobile in the next semesters if I would have access to it

*Note: * indicates reversed scale.*

8.7 Appendix 7 - General Questions about HERMES Game Experience

Please indicate how you felt **while playing** the game for each of the items,

		1	2	3	4	5
		Strongly disagree	Disagree	Undecided	Agree	Strongly agree
1	I was interested in the game's story					
2	I felt successful					
3	I felt bored					
4	I found it impressive					
5	I forgot everything around me					
6	I felt frustrated					
7	I felt irritable					
8	I felt skilful					
9	I felt content					
10	I felt challenged					
11	I had to put a lot of effort into it					
12	I felt good					

Please indicate how you felt **after you finished playing** the game for each of the items,

		1	2	3	4	5
		Strongly disagree	Disagree	Undecided	Agree	Strongly agree
13	I found it a waste of time					
14	I felt energised					
15	I felt satisfied					
16	I felt weary					

8.8 Appendix 8 - Questions for the evaluation of the prospective memory

EPISODIC MEMORY 1: Please, in 15 minutes tell me that we have to make a rest.

Result: _____

EPISODIC MEMORY 2: When I give you a pen, please sign in this paper *(give the participant the pen in 20 minutes).*

Result: _____

EPISODIC MEMORY 3: Please ask me in 2 minutes when we are going to finish the session.

Result: _____

EPISODIC MEMORY 4: When I give you a piece of paper, please write there your address.

Result: _____

8.9 Appendix 9 – Memory Assessment Questionnaire (MAC-Q)

How would you describe your capacity to remembering the next activities?

	1	2	3	4	5
	Very poor	Poor	Average	Good	Very good
The name of a person it has just been introduced to you					
Specific data from an article or newspaper you have recently read					
Switch off the lights, unplug the electronic devices and lock the door of your house when you go out					
Intend to take something with you (for example, an umbrella or a letter), before leaving a room or going out					
Remember something as a house address that you were told a few minutes before					

Please indicate the answers that suit you better:

	1	2	3	4	5
	Much worse	Worse	Same	Better	Much better
How would you describe your memory capacity comparing to the rest of the society?					
How would you describe your actual memory capacity if you compare it with the highest capacity you got in the past?					
	Much slower	Slower	Same	Faster	Much Faster
Think about the moment your memory was at the highest level, how would you describe your speed ability now to process new information?					
	Never	Rarely	Sometimes	Quite often	Very often
How often do you get upset or frustrated due to your actual memory capacity?					

The following questions are about minor memory mistakes that everyone makes from time to time, but some of them happen more often than others. We would like you to tell us how often in your opinion these things happen to you.

	1	2	3	4	5
	Never	Rarely	Sometimes	Quite often	Very often
How often do you feel you are again in this situation?					
Repeat the same story to the same person on different occasions.					
Have often do you have difficulty remembering a word that you want to use?					
Have often do you have difficulty remembering a word that it is on the tip of your tongue?					
How often do you come up with familiar faces without knowing why do you know them?					

8.10 Appendix 10. Learnability Questionnaire

Indicate your level of agreement with each of the following phrases. On a scale of 1 to 5.

1. The instructions and prompts are helpful.
2. Learning to operate this software initially is full of problems.
3. It takes too long to learn the software commands.
4. Working with this software is mentally stimulating.
5. I can understand and act on the information provided by this software.
6. Learning how to use new functions is difficult.
7. It is easy to make the software do exactly what you want.
8. I will never learn to use all that is offered in this software.
9. I have to look for assistance most times when I use this software.
10. It is easy to forget how to do things with this software.

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

8.11 Apendix 11. Concept evaluation – group approach

Mean results of the AmI-TA questionnaire for both HERMES and SOPRANO scenarios

	HERMES SCENARIOS	SOPRANO SCENARIOS
Question number 1	3.29	3.46
Question number 2	3.50	3.42
Question number 3	3.57	3.78
Question number 4	3.92	3.63
Question number 5	3.83	3.78
Question number 6	3.43	3.60
Question number 7	3.96	3.96
Question number 8	2.79	2.88
Question number 9	2.71	3.17
Question number 10	3.13	3.35
Question number 11a	3.65	3.76
Question number 11b	3.65	4.06
Question number 11c	3.94	3.89
Question number 11d	3.63	3.47
Question number 11e	3.69	3.75
Question number 11f	3.50	3.44
Question number 12	3.33	3.52
Question number 13	2.54	2.50
Question number 14	3.58	3.45
Question number 15	2.78	3.25
Question number 16	2.54	2.64
Question number 17	2.83	2.45
Question number 18	2.50	2.48
Question number 19	3.39	3.17
Question number 20	3.13	3.09
Question number 21	3.46	3.64
Question number 22	3.04	3.04
Question number 23	3.17	2.63
Question number 24	3.21	3.09
Question number 25	3.25	2.86
Question number 26	3.46	2.78
Question number 27	2.13	2.00
Question number 28	2.17	2.04
Question number 29	1.88	1.92
Question number 30	1.88	1.54
Question number 31	1.83	1.63
Question number 32	1.71	1.55
Question number 33	1.88	1.91
Question number 34	2.70	1.95
Question number 35	2.75	1.90
Question number 36	3.75	3.61
Question number 37	3.38	2.91
Question number 38	2.38	1.83
Question number 39	2.55	2.13
Question number 40	1.83	1.91
Question number 41	1.50	1.41
Question number 42	2.67	3.00

Complementarily, mean results of the HERMES Features Questionnaire results are presented also for both projects in the following table, showing firstly HERMES features followed by Soprano's features:

	HERMES SCENARIOS
Memory of Past Experiences	
Remembering visits and conversations	**2.70**
Remembering where objects (e.g. keys) have been put	**2.54**
Remembering conversations with the doctor	**2.58**
Reminder of Activities	
Reminder of appointments	**1.67**
Reminder of person related data	**2.38**
Cognitive Training	
Maze	**1.92**
Who is Who?	**1.96**
Puzzle	**2.17**
Mobile Support	
Shopping lists	**2.17**
Location-aware reminders	**2,63**
	SOPRANO SCENARIOS
Automatic pill dispenser	**2.13**
Fall detection	**1.83**
Against forgetfulness – Check if something was forgotten	**2.00**
Against loneliness – Suggestions for activities	**3.08**
Bed Monitoring	**2.79**
Stay Mobile – Gymnastics in front of the TV	**2.83**
Save Home during Travel	**1.88**
Visits Management	**2.71**

8.12 Appendix 12. Concept evaluation at home

Mean results of the AMI-TA questionnaire for laboratory evaluation and first and second home evaluations are showed in the following table:

	EXPERIENCE EVALUATION – 1st SESSION (AUSTRIA AND SPAIN)	EXPERIENCE EVALUATION - 2ND SESSION (AUSTRIA AND SPAIN)	USER EXPERIENCE EVALUATION - 2ND SESSION	HOME EVALUATION – 1ST SESSION	HOME EVALUATION – 2ND SESSION
Question number 1	3.55	3.96	3.90	3.88	3.29
Question number 2	3.71	4.23	4.20	3.88	3.86
Question number 3	3.68	3.92	3.50	3.50	3.71
Question number 4	3.60	3.80	3.11	3.75	2.83
Question number 5	3,90	4.04	3.80	3.75	3.71
Question number 6	4.03	4.08	4.10	3.88	3.43
Question number 7	4.06	4.38	4.20	4.00	3.43
Question number 8	3.16	3.35	2.90	3.13	3.14

Question number 9	3.29	3.27	2.90	3.38	2.71
Question number 10	3.23	3.73	3.70	3.00	2.43
Question number 11a	4.24	4.44	4.22	4.00	3.86
Question number 11b	4.32	4.52	4.67	4.25	3.71
Question number 11c	4.10	4.60	4.56	4.25	3.71
Question number 11d	3.83	4.44	4.56	4.00	3.71
Question number 11e	4.14	4.48	4.44	4.38	3.86
Question number 11f	4.07	4.32	4.22	3.88	3.71
Question number 12	3.94	4.19	3.80	3.38	3.57
Question number 13	3.13	3.54	3.00	3.50	3.29
Question number 14	3.16	3.62	3.00	3.50	3.43
Question number 15	3.03	3.50	3.10	3.38	3.14
Question number 16	3.32	3.77	3.50	3.38	3.14
Question number 17	3.06	3.58	2.80	3.63	2.86
Question number 18	3.23	3.62	3.50	3.50	3.29
Question number 19	3.48	3.77	3.30	4.00	3.29
Question number 20	3.19	3.38	3.40	3.50	3.14
Question number 21	3.81	3.73	3.20	3.63	3.57
Question number 22	3.52	3.27	3.30	3.63	2.86
Question number 23	3.29	3.77	3.30	3.63	2.57
Question number 24	3.48	3.54	3.60	3.25	2.14
Question number 25	3.55	3.42	3.30	3.25	2.43
Question number 26	3.32	3.42	3.30	3.00	2.29
Question number 27	2.42	2.65	2.80	2.63	2.29
Question number 28	2.81	3.23	3.50	3.00	2.71
Question number 29	2.48	2.27	2.70	3.13	2.43

Question number 30	2.48	2.54	3.20	3.13	2.71
Question number 31	2.74	2.56	3.00	3.13	2.71
Question number 32	2.26	2.38	3.00	3.00	3.29
Question number 33	2.48	2.35	2.90	3.75	1.86
Question number 34	2.23	2.35	2.70	3.50	2.86
Question number 35	3.23	3.58	3.20	3.63	3.14
Question number 36	3.87	4.19	3.70	4.00	3.43
Question number 37	3.87	4.23	4.00	3.88	3.00
Question number 38	3.00	3.69	3.80	3.50	3.43
Question number 39	3.39	4.00	3.60	3.50	3.43
Question number 40	2.45	2.96	2.60	3.25	2.86
Question number 41	2.13	2.27	2.00	2.75	2.00
Question number 42	3.32	3.65	3.40	3.88	3.43

8.13 Appendix 13. Previous Technology usage and attitudes towards technologies

Frequency of use (percentage) of ICT products and memory supports tools in the Spanish sample are showed in the following table:

	Never	Once a day	Once a week	Once a month	Almost never
PC or laptop	61.5%	23.1%	15.4%	0%	0%
Mobile phone	7.7%	46.2%	23.1%	0%	23.1%
Digital picture frame	84.6%	0%	7.7%	7.7%	0%
TV	0%	100%	0%	0%	0%
Notepad	69.2%	7.7%	15.4%	0%	7.7%
Post It	69.2%	23.1%	0%	7.7%	0%
Diary	92.3%	0%	0%	7.7%	0%
Blog	44.0%	0%	0%	4.0%	4.0%
Calendar	30.8%	46.2%	7.7%	0%	15.4%
Digital calendar	92.3%	0%	7.7%	0%	0%
Photo albums	7.7%	7.7%	0%	30.8%	53.8%
Online photo albums	76.9%	0%	0%	23.1%	0%
Video - recordings	69.2%	0%	7.7%	0%	7.7%
Online videos	84.6%	0%	7.7%	0%	7.7%

Frequency of use (percentage) of ICT products and memory supports tools in the Austrian sample are showed in the following table:

	Never	Once a day	Once a	Once a	Almost

			week	month	never
PC or laptop	5.6%	83.3%	11.1%	0%	0%
Mobile phone	0%	94.4%	0%	0%	5.6%
Digital picture frame	88.9%	0%	5.6%	0%	5.6%
TV	0%	94.4%	5.6%	0%	0%
Notepad	16.7%	33.3%	16.7%	5.6%	27.8%
Post It	27.8%	27.8%	11.1%	5.6%	27.8%
Diary	70.6%	5.9%	5.9%	0%	17.6%
Blog	88.2%	0%	5.9%	5.9%	0%
Calendar	5.6%	77.8%	0%	0%	16.7%
Digital calendar	61.1%	22.2%	0%	11.1%	5.6%
Photo albums	22.2%	0%	33.3%	27.8%	16.7%
Online photo albums	38.9%	5.6%	16.7%	22.2%	16.7%
Videorecordings	55.6%	0%	16.7%	5.6%	22.2%
Online videos	50%	0%	22.2%	11.1%	16.7%

Complementarily to frequency of use of ICT products and memory supports showed in the former tables, some questions regarding attitudes towards technology were applied in both countries. The range of responses goes from 1 (completely disagree) to 5 (completely agree).

	Mean results in Spain	**Mean results in Austria**
Technical appliances (such as mobile phone and Internet) help to better organize my personal life.	2.86	2.33
I find it good that I can keep in touch with people I care via technical appliances (such as mobile phone and Internet).	3.76	2.17
The disadvantages which some technical appliances can cause just belong to this kind of appliance.	3.24	2.72
It is good that all kind of administrative forms are available via Internet (for example a change of address form).	3.33	2.44
With the arrival of the Internet, the possibility for everyone to participate in society has grown.	3.85	2.44
I find it good that when I want to know something, I can also get that information via technical appliances.	3.76	2.22

8.14 Appendix 14. Acceptance of the HERMES Scenarios

Mean results of the AmI-TA questionnaire about HERMES scenarios in Spain and Austria are showed in the following table:

	MEAN RESULTS IN SPAIN	MEAN RESULTS IN AUSTRIA
Question number 1	3.23	3.78
Question number 2	3.23	4.06
Question number 3	3.46	3.83
Question number 4	3.08	3.94
Question number 5	3.54	4.17
Question number 6	4.00	4.06
Question number 7	3.54	4.44
Question number 8	3.15	3.17
Question number 9	3.46	3.17
Question number 10	3.08	3.33
Question number 11a	4.15	4.31
Question number 11b	4.31	4.33
Question number 11c	4	4.18

Question number 11d	3.85	3.82
Question number 11e	4.23	4.06
Question number 11f	3.77	4.29
Question number 12	3.46	4.28
Question number 13	3.08	3.17
Question number 14	2.23	3.83
Question number 15	2.38	3.50
Question number 16	3.08	3.50
Question number 17	2.38	3.56
Question number 18	2.69	3.61
Question number 19	2.92	3.89
Question number 20	3.31	3.11
Question number 21	3.54	4.00
Question number 22	3.23	3.72
Question number 23	2.85	3.61
Question number 24	3.38	3.56
Question number 25	3.54	3.56
Question number 26	2.85	3.67
Question number 27	2.23	2.56
Question number 28	2.77	2.83
Question number 29	2.69	2.33
Question number 30	2.77	2.28
Question number 31	2.85	2.67
Question number 32	2.69	1.94
Question number 33	2.69	2.33
Question number 34	2.23	2.22
Question number 35	2.85	3.50
Question number 36	3.46	4.17
Question number 37	3.46	4.17
Question number 38	2.54	3.33
Question number 39	2.62	3.94
Question number 40	1.54	3.11
Question number 41	1.69	2.44
Question number 42	2.85	3.67

8.15 Appendix 15. Acceptance of the HERMES applications: UTAUT results

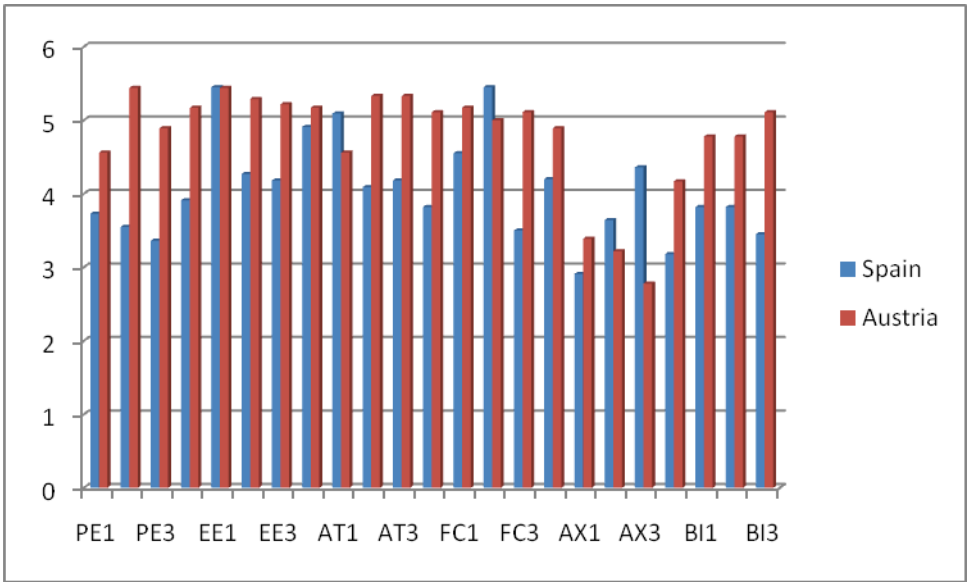

Figure 3. UTAUT results for HERMES mobile application

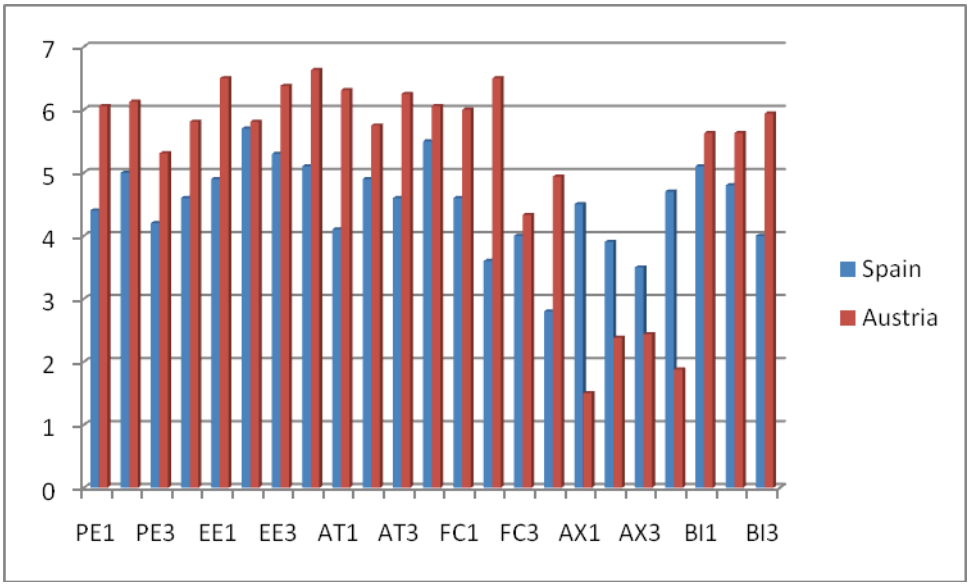

Figure 4. UTAUT results for HERMES calendar application

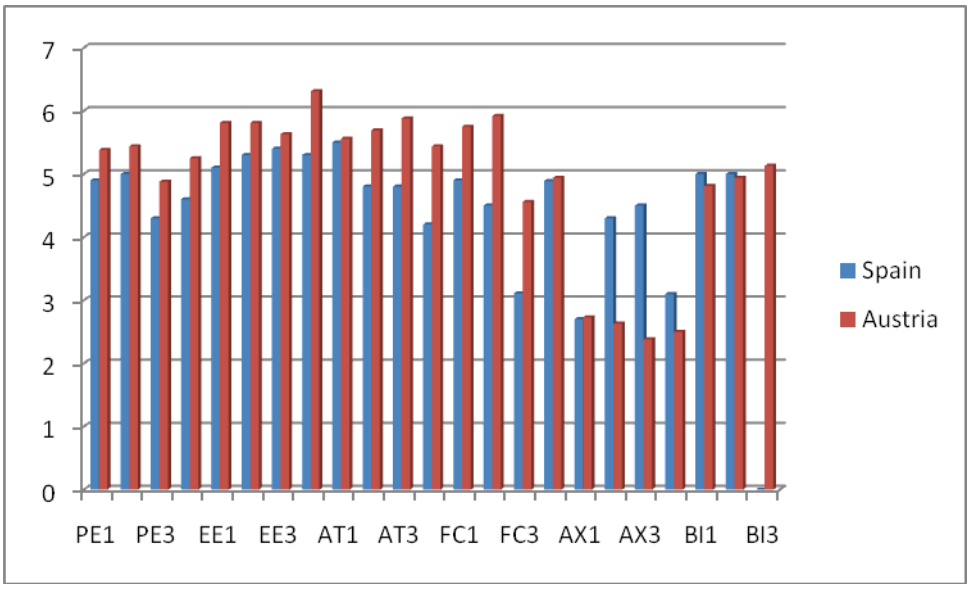

Figure 5. UTAUT results for HERMES MyPast application

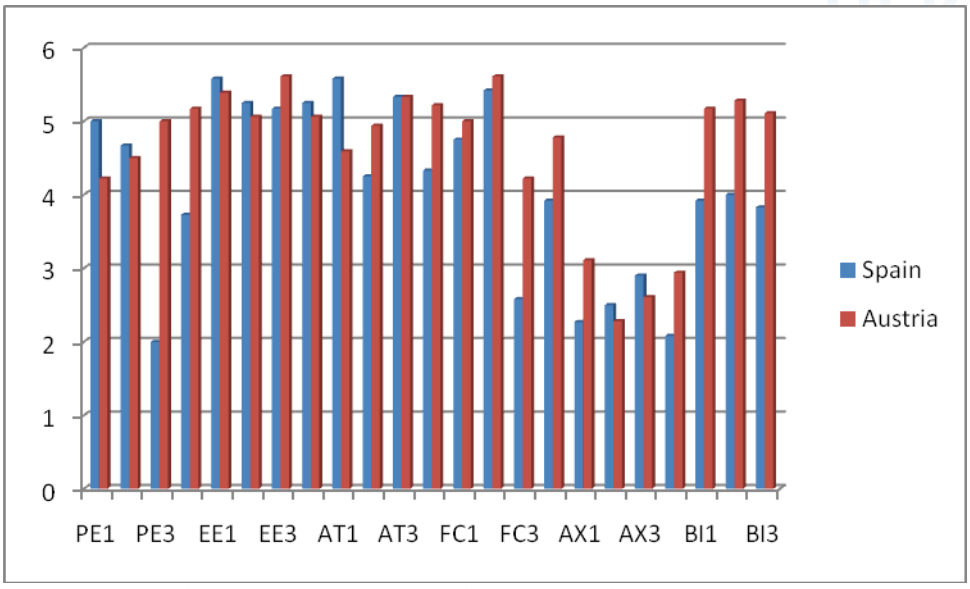

Figure 6. UTAUT results for HERMES cognitive games

8.16 Appendix 16. Ethical check-list for the ethical committees

Usually when a technological project similar as HERMES needs to be ethically reviewed there are some problems finding an Ethical Committee able and willing to evaluate it. This situation is common in several European countries. One of the reasons because it is not easy to find an appropriate Ethical Committee could be that these committees are familiar with clinical projects but not with the technological ones. This check-list tries to create awareness of this situation and, at the same time, to define some general principles that can help the ethics reviewers in the review process of a technological project.

The end-user partners of the HERMES project and the external ethics advisors considered that the ethical reviewers of the technical project should pay attention to the following points when they are evaluating a project. The final approval of the project should depend on the level of accomplishment with these points.

- European legislation
    - European Charter of Fundamental Rights
- National legislation
    - Organic Law on Protection of Personal Data (LOPD 15/1999)
- Data protection
    - Informed Consent
        - Easy to understand
        - Sections that must be included: (a) aim of the study; (b) study participants and procedures; (3) voluntary nature/wwithdrawal; (4) risks/benefits; (5) how the information is stored; (6) how the information is encoded; (7) qquestions; (8) confirmation
    - Data collection process
        - Data fairly and lawfully processed.
        - Processed for limited purposes.

        - Adequate, relevant and not excessive.
        - Accurate.
        - Processed in accordance with the data subject's rights.
    - Data storage and handling processes
        - Data not kept longer than necessary.
    - Process of encoding or anonymization
        - Information should be anonymized so that individual identities cannot be revealed.
    - Security measures for storage and handling
        - Data stored in a locked server, and all identification data will be stored separately
    - Dissemination of the results
        - Not transferred to countries without adequate protection.
        - Not listing individual cases

- Provide equal opportunities to
    - People of different age groups (e.g. old people and very old people)
    - People from different cultures
    - People of different genders

- Preparation of the users before the trials