AMBIENT ASSISTED LIVING, AAL

JOINT PROGRAMME

ICT-BASED SOLUTIONS FOR ADVANCEMENT OF OLDER PERSONS' INDEPENDENCE AND PARTICIPATION IN THE "SELF-SERVE SOCIETY"

D2.1

User Requirements

Project acronym:	**Entrance**
Project full title:	**ENabling elderly people TRAvel and iNternet acCEss**
Contract no.:	**2010-3-108**
Author:	PLUS

TABLE OF CONTENTS

TERMINOLOGY & ABBREVIATIONS

50plus	50Plus GmbH, Austria
ALab	Autonom'Lab, France
CEA	Commissariat à L'Energie Atomique, Laboratoire d'Intégration des Systèmes et des Technologies, France (Project Coordinator)
F	F-value
GPS	Global positioning system
ICT	Information and communication technologies
IT	Information technologies
N	Sample size
p	p-value
PLUS	Paris Lodron University Salzburg, Austria
RQ	Research question
SD	Standard deviation
SPSS	Statistical Package for the Social Sciences
U	Test statistics "U" of the Mann-Whitney-U-Test
UCD	User centered design
χ^2	CHI-Square

1 EXECUTIVE SUMMARY

1.1 Link with the objectives of the project

Access to information is shifted steadily to online platforms, but older adults are often less likely to use digital services such as purchasing e-tickets or booking vacation packages. Within the Entrance project a platform (home platform and mobile platform) will be developed that supports older adults in trip planning as well as indoor and outdoor navigation. Navigation in this context means to plan and organize the itinerary to a certain destination. It also encompassed the actions undertaken to actually reach the destination (with or without technology). Furthermore, a self-paced tutorial on the home platform is planned to be implemented, which supports older adults in using the computer and the Internet services. It will comprise a glossary and simple step-by-step instructions on the use of menus, toolbars, search engines, and Internet services. These developments will be inspired by different theoretical frameworks such as design for all, value-base design and capability-based design.

Different methods were applied to investigate the respective user needs. At the beginning, narrative interviews with older adults aged between 60 and 75 years were performed. Thereby, we asked for strategies they have when navigating indoor and outdoor, situations in which they need help, problems they face and what kind of technology they use for navigation. Furthermore, interviews regarding epistemic values (learning, curiosity, serious gaming) with older adults aged between 60 and 75 years old were conducted. We explored learning strategies, motivations for learning, interest in and curiosity about technologies, as well as experiences with tutorials and serious games. Experts (e.g., trainers of computer classes for older adults) were also interviewed in order to find out how older adults learn to use technology. Afterwards, workshops were conducted, which aimed at deepening the results of the interviews and finding creative solutions for tutorials and navigation aids. While the interviews and workshops gathered qualitative data in order to explore our end users' characteristics regarding learning and navigation, a quantitative survey was also conducted, which aimed at gathering representative data.

The concepts, guides and materials for the studies were provided by PLUS, and adapted according to the project partners' feedback. The studies were then conducted by 50plus in Austria, and ALab/CEA in France. Afterwards, PLUS analyzed the results and provided the analysis reports.

Finally, on basis of the results of the requirements analysis, personas were developed, which aim at communicating the users' needs within the project team.

The results of the requirements analysis will be the basis for the development of the ENTRANCE prototypes, i.e. the home platform, the mobile platform, the serious game and the haptic feedback device. In the evaluation phase we will later on assess whether the users' requirements have been met. Therefore, an evaluation framework will be defined. The evaluation itself will be iterative, i.e. there will be separate evaluations for different activities, as they are developed consecutively (from mock-ups and design sketches to prototypes). This evaluation will also be complemented by technology and HCI development and evaluation guidelines, inspired by the capability theory. A brief presentation of the basic ideas of the capability approach and a preliminary collection of associated guidelines are exposed in this deliverable.

1.2 State of the art

All research efforts in the project are following a user-centered design (UCD) approach. User-centered design (UCD) is a multidisciplinary design approach, which is based on the

active involvement of users and refers mainly to the usefulness and usability of a product [Mao et al. 2001]. Thus, we are including end users into the requirements analysis and later on in the evaluation phase. The aim is to develop an application, which meets the users' needs at best.

The state of the art regarding the methods and content of the requirements analysis will be presented in the respective chapters of this report, i.e. sections 2.1 to 2.5.

1.3 Research questions

The following research questions were defined for the user requirements analysis. Each study addressed one or several research questions, which are indicated in the respective chapters.

RQ1: What characterizes the end users of the system?

- Age (chronological/subjectively perceived)
- Impairments
- Time to/since formal retirement
- Current autonomy level
- Trendsetting behavior

RQ2: How do end users cope with technology? (here: computers and mobile phones)

- Which technology experience do they have? (novice/familiar/occasional users …)
- Which technologies do they use?
- To what extent do they accept those technologies?
- For which purposes do they use those technologies?
- Which problems do they have when using those technologies?
- What do end users fear when using technologies in general?
- How playful do they use technologies general?

RQ3: Which role do epistemic values play?

- Regarding Learning:
    - Which strategies do they have for learning how to use technologies?
    - Which experiences do they have with tutorials?
    - How supportive do they appraise tutorials?
    - Who is involved in learning?
    - Why are they motivated to learn using technologies?
- Regarding Curiosity:
    - How interested in/curious about technologies are end users?
- Regarding serious gaming:
    - How supportive do they appraise serious games for learning?
    - Which experiences do they have with serious gaming?

RQ4: How do end users plan/organize/conduct their travels?

- Which kinds of travels are end users interested in?
- Which routines do they have for traveling?
- How do they organize their travels?
- Which technologies do they use for organizing travels?
- Which problems/barriers do they have when organizing travels?

- What kind of activities do users especially enjoy when organizing travels?
- How do they plan/organize events during traveling?
- How do they use technology during travels?

RQ5: How do end users navigate indoor and outdoor?

- Which strategies do they have for navigating outdoor and indoor?
- In which situations/locations do they need help in terms of navigation?
- Which problems do occur regarding outdoor and indoor navigation?
- How do they use technology for navigation?

RQ6: In how far are end users willing to pay for a system like Entrance?

1.4 Mapping between Research Questions and Methods

The following table (Table 1) shows the mapping of the research questions to the methods, which were applied. As we made satisfying experiences with a mixed-method approach to use the data for a persona creation (see Moser et al. 2012), we decided to assess both quantitative and qualitative data in the requirements analysis. The quantitative data from the survey was considered appropriate for clustering the target users for the personas, and enrich them afterwards with qualitative data from interviews and workshops. More details, as well as the creation process of the personas can be found in chapter 4.

	(Narrative) Interviews with end users	Expert Interviews	Workshops	Survey
RQ1: What characterizes the end users of the system?				X
RQ2: How do end users cope with technology?		X		X
RQ3: Which role do epistemic values play?	X		X	X
RQ4: How do end users plan/organize/conduct their travels?	X		X	X
RQ5: How do end users navigate indoor and outdoor?	X		X	X
RQ6: In how far are end users willing to pay for a system like Entrance?				X

Table 1: Research questions and applicable methods

Besides, a secondary literature review was conducted to build the studies upon the available literature.

Research question one was not addressed in the workshops and end user interviews in form of a separate research question, as it primarily consists of the description of the sample in those cases. However, in the survey we explicitly addressed RQ1 and thus will also provide the respective answers in chapter 2.4.3.

2 APPROACH

In the following the respective studies will be presented, including the research questions addressed, the study setup, and the summarized results. Separate detailed study concepts and reports are also available for all studies, which include also the sub-research questions for the studies, as well as the detailed results. This deliverable thus provides an overview of the main findings in each study.

2.1 End User Interviews

In order to assess the older adults' experiences regarding navigation and learning, we conducted interviews. We performed episodic interviews, which are a form of narrative interviews. The interview technique derives its label from the Latin word "narrare" (i.e. to report, to tell a story). The central aim of the method is to stimulate the so-called "informant" (i.e. interviewee) to narrate on a specific topic. Additionally, the interviewer asks a number of specific questions on the topic. According to this, an episodic interview includes semantic and episodic questions. Semantic questions focus on gathering knowledge on certain topics (e.g., How would you define the term technology? What do you understand by the term "navigation"?). Narrative questions aim at stimulating the interviewee to narrate on a certain topic. Thereby, experiences from certain situations play a central role (e.g., Think of a situation when you navigated to a new/unknown destination. Please tell me about a situation that illustrates how you proceed in order to find the right way.).

Beforehand, an interview guide was established in order to keep the focus on the central areas of one topic. For all research areas narration requests and questions were defined [Flick 2011, Kvale 2007]. As the interview should not overchallenge the particpants, the research questions were split up. Thus, we performed interviews solely focusing on learning strategies and interviews focusing on navigation and travelling.

The interviews about learning focused on strategies, experiences and motivations older adults have when learning how to use technologies (e.g., mobile phone, computer). Thereby, we were also interested in what kind of tutorials they use and how supportive these tutorials are perceived, as well as their experiences with educational (i.e. serious) games.

Within the interviews about traveling/navigation we were interested in how older adults plan, organize and conduct their journeys and what kinds of mobile technologies they use when traveling. Moreover, we focused on outdoor and indoor navigation strategies, problems that might occur and possible solutions for these problems.

All interviews also included questions on the mobile phone usage of older adults in general.

2.1.1 Research Questions

The research goal of the end user interviews was to explore strategies older adults might have for learning how to use technologies (e.g., mobile phones, computers) and to find out how they plan, organize and conduct their travels with and without technology. Moreover, we focused on navigation strategies indoor and outdoor and investigated older adults' mobile phone usage in general (e.g., cell phone and smart phone usage).

Consequently, the following research questions were addressed (numbering according to the definition of all research questions in chapter 1.3):

- RQ2: How do end users cope with mobile phones?
- RQ3: Which role do epistemic values play?
- RQ4: How do end users plan/organize/conduct their travels?
- RQ5: How do end users navigate indoor and outdoor?

2.1.2 Study Setup

Overall, 17 participants took part in the study, nine from Austria and eight from France. All participants were already retired except for one.

Interviews, focusing on the topic "Learning": Eight people participated in the interviews about learning, four from Austria and four from France (four male, four female). They were between 56 and 76 years old.

Interviews, focusing on the topic "Traveling/Navigation": Nine older adults participated in the interviews focusing on travelling and navigation, five from Austria and four from France (four male, five female). They were between 64 and 72 years old.

2.1.3 Summarized Results

In the following, the summarized results will be presented along the four research questions, which were addressed in the end user interviews.

2.1.3.1 RQ2: How do end users cope with mobile phones?

RQ2 aimed at investigating the target groups' mobile phone usage in general. Thereby, we were interested in the experiences older adults have with their mobile phones and for what kinds of purposes they use it.

When asking for the purpose of the mobile phone usage, the interviews revealed that it was used for emergencies/safety reasons, in order to be reachable, to be mobile and independent and also for professional reasons, besides the basic functions like making a call and communicating with others. Regularly used functions were making calls, writing text messages, scheduling, administering addresses/saving numbers and accessing the Internet. Moreover, the calculator and the alarm clock were identified as functions that are regularly used. Most participants had a cell phone, only a few participants had a Smart Phone (e.g., Blackberry or iPhone). The vibrotactile feedback was considered as useful in order to avoid disturbing others. Positive experiences with the mobile phone were mentioned regarding being reachable, especially in case of emergencies. The interviewees made negative experiences when they had no reception, if the battery was empty or when the mobile phone broke.

2.1.3.2 RQ3: Which role do epistemic values play?

The central aim of this research question was to identify strategies and experiences when learning how to use technology and what kind of tutorials they use.

In general the participants were motivated to learn how to use technologies, which can be traced back to e.g., a personal interest in technologies in order to be "up to date". Besides, they experienced a personal comfort when using technology and were convinced of the importance of technology in everyday life. In order to learn how to use technologies a variety of different strategies were identified. Learning together with others by e.g., attending a training course, using training DVDs or CDs and books were mentioned. Most important seems to be the strategy "learning by doing", to just try out the technology and find out how it works. The interviews revealed that tutorials played a marginal role for the interviewees. They had hardly any experiences with tutorials and rarely used them. Similar results were found regarding the use of educational games for learning. The participants had difficulties to define the term "educational game" and associated educational games with board games such as Monopoly or other games (Solitaire).

2.1.3.3 RQ4: How do end users plan/organize/conduct their travels?

RQ4 aimed at investigating interests of the target group in terms of travelling and explore strategies and routines when travelling. Moreover, we were interested in what kinds of technologies the participants use when travelling and wanted to identify problems and barriers that might occur.

In general, we identified a variety of different travels the participants were interested in, e.g., culture trips, city trips, senior travels as well as adventure trips (e.g., camping, taking a cruise or travelling as a backpacker). The main motivation when travelling was to get away, to experience new things (getting to know new cultures) and to extend the personal horizon. Only a few routines were identified when travelling: Going to the same place or the same hotel, using the same travelling guide or using the mobile phone in order to be in contact with family and friends at home.

When organizing the travels, the participants relied on a travel agency, a Senior Club they are travelling with, or plan their journey on their own, by reading books or watching movies beforehand and looking up information in a travelling guide or on the Internet. According to this, only a few technologies were used when organizing travels: the TV, the computer (Internet) and the (mobile) phone. Only a few technologies were used during the journeys, e.g., the mobile phone in order to be in contact with family and friends or to activate the alarm clock and audio guides when visiting museums. Events during the journey (e.g., buying a ticket) are either organized on-site (e.g., buying a ticket at the office or at a ticket machine) or in advance (e.g., buying a ticket on the Internet or reserve a ticket in advance).

2.1.3.4 RQ5: How do end users navigate indoor and outdoor?

RQ5 aimed at identifying strategies when navigating indoor and outdoor. Thereby, we focused on tools that might be used when navigating. Moreover, we were interested in problems that might occur, and identified situations in which help in terms of navigation might be required.

The interviews revealed a variety of different strategies when navigating outdoor and thereby different tools were used, e.g., maps, navigation systems, signs, the Internet or smart phones. It has to be emphasized that the applied strategies might vary according to the transportation mode, e.g., going by car requires different strategies than walking. Moreover, the place where one has to navigate (at the countryside, in the city) seems to be decisive for the navigation strategy. In terms of the outdoor navigation almost exclusively ego-centered strategies were identified. When navigating/orientating indoor, also allo-centered strategies were mentioned, e.g., trying to memorize “goal points”, e.g., at the underground car park. Besides, participants were looking for landmarks or ask other people in order to find the right way. Problematic situations were identified when being in an unfamiliar city or at the underground car park. When using indoor maps especially colors and a logical and simple visualization were pointed out to be helpful.

For more details about the analysis and the results there is a separate report available (“End User Interviews Results”).

2.2 Expert Interviews

The expert interviews were conducted in order to find out how older people use new technologies. They aimed at identifying older adults’ motivations, barriers, and learning experiences through an external assessment.

The expert interviews were conducted with people, who are concerned with older adults in a professional or educational way, e.g., teachers in computer classes for seniors, etc. The goal

was also to identify older adults' needs for serious gaming and tutorials on and for computers.

Like in the end user interviews, also episodic interviews [Flick 2011, Kvale 2007] were conducted (for a the description of episodic interviews see chapter 2.1) on basis of a guide, which was developed for these interviews.

2.2.1 Research Questions

The following research question was addressed (numbering according to the definition of all research questions in chapter 1.3):

- RQ2: How do end users cope with technology?

As mentioned above, computers and mobile phones are the relevant technologies in the ENTRANCE project. Thus, the interviews focus on those devices.

2.2.2 Study Setup

In total, 14 experts took part in the interviews, 6 of them in Austria and 8 of them in France. They were between 33 and 73 years old (2 female, 12 male). The professional backgrounds were various:

- Trainers of computer classes for older adults
- IT counselors, sellers and service providers
- Computer scientists
- Managers
- Doctors
- Etc.

All of them were working with older adults in a professional way through training or supporting them in computer usage, e.g., as professional trainers, in voluntary work supporting older adults in using computers or the creation of intuitive Internet tools for older people.

2.2.3 Summarized Results

In the following, the summarized results for the research question are presented.

2.2.3.1 RQ2: How do end users cope with technology?

The heterogeneity of the target group has been confirmed by the experts. The older adults vary regarding skills, experiences, fears and problems they have in using computers. Although a tendency is visible to the experts that the older adults are more open to computers than in the past, there are still many problems the older adults face. As long as the system or software remains the same, the older adults do not have many problems, as they memorize steps and develop habitual paths, which they follow. However, in case of system or software changes, the older adults seem to be over-challenged. Furthermore, they seem to have problems with the mouse, and complex menus and structures, which are increased by a lack of understanding the basic functions. Another problem is losing files or icons, which cannot be found any more. They are discouraged and frustrated, if something does not work immediately. Also the perception of being too old to use computers is influencing the usage negatively. They are sometimes not managing the variety of information, both from e.g., grandchildren about functions and possibilities of computers as

well as on the Internet itself. Besides the problems, which the older adults experience, also fears inhibit the computer usage, regarding e.g., destroying, breaking or deleting something, dangers on the Internet like misuse of private data, or not managing the computer and causing errors.

Concerning playful approaches the experts only referred to playful content, like editing pictures or playing games on the computer, but they did not mention creative or flexible approaches in terms of usage. In terms of support, the older adults need when learning to use a computer, the experts indicated that time and practice are essential. They need clear instructions regarding the steps they have to perform for achieving their individual goals, and appreciate additional materials like paper documents or videos. Furthermore, hands-on approaches are important, as well as immediate coaching and help. In order to still fears and overcome problems, older adults need reassurance and encouragement. Computer classes should be fun, convivial and playful to be educational, i.e. unobvious learning is appreciated. Furthermore, it is essential that the older people have the impression that someone cares about what they are doing. If the older adults seek advice, they refer to materials, like notes and books, or to experts or family and friends. However, support functions on the computer or support hotlines are rarely used.

According to the experts, older adults use the computer mainly for communication, e.g., emails and Skype, as well as for working with digital pictures and surfing on the Internet. Furthermore, computers are used for passing time and getting away from routines. The possibilities for having contact via the computer are motivating them to use the computer, as well as seeing others using it or hearing them talk about it. Some feel a need, are curious or interested, while others want to be autonomous and up to date. Nevertheless, not only such “intrinsic motivation” is crucial for using computers, also “extrinsic motivation” like obligations, forces and persuasions from work or family are decisive. Finally, they buy computers to “remain young”, to have one before the class starts in order to have the possibility to practice then, as well as interest, curiosity and fun. The experts furthermore referred to gender differences, e.g., women seem to be more interested, while men stick to learning it more consequently.

For more details about the analysis and the results there is a separate report available (“Expert Interviews Results”).

2.3 Workshops

In order to extend the insights, which were gathered in the interviews, workshops were conducted with older adults between 60 and 75 years. The workshops focused on the one hand on older adults’ navigation behavior and on the other hand on their needs regarding tutorials. Again, in order not to overchallenge the participants, the topics for the workshops were split. Finally, two workshops (one in Austria and one in France) referred to older adults’ strategies when navigating indoor and outdoor and to problems that occurred. Moreover, it was intended to develop ideas for technology supported indoor and outdoor navigation aids. Another two workshops (one in Austria and one in France) were conducted for assessing further insights about older adults’ needs for tutorials (epistemic values) in order to support them in learning to use computers.

In general, a workshop is a data collection method of the social sciences. Thereby, a group of participants discusses issues, based on a semi-structured guide, which is developed by the researchers. This qualitative approach aims at gathering perceptions, needs, problems, beliefs, etc. from a target audience and enables to gain deeper insights into a topic. Therefore, workshops are not only used to gather representative data but also to explore relevant issues that have to be considered by giving participants small tasks. Following the instant card technique [Beck et al. 2008], activity cards are provided. These cards aim at

capturing intentions and opinions of participants and should also encourage and support design ideas.

2.3.1 Research Questions

The following research questions (each in separate workshops) were addressed (numbering according to the definition of all research questions in chapter 1.3):

- RQ3: Which role do epistemic values play?
- RQ5: How do end users navigate indoor and outdoor?

2.3.2 Study Setup

In the navigation workshops, 13 older adults participated (7 in France and 6 in Austria). They were between 54 and 71 years old (average age = 64,46, SD = 4,81). 9 participants were female and 4 were male. 9 participants indicated to be married, 2 to be widowed, 1 to be divorced and 1 to be single. All of the participants were already retired.

- **Austria**: Four participants already used digital navigation aids, like smart phones or navigation systems in cars. One participant was completely inexperienced with digital navigation aids.
- **France**: Three French participants mentioned to not use a navigation system, two indicated to use GPS.

In total, 16 older adults took part in the learning workshops (10 in Austria and 6 in France). They were between 64 and 72 years old (average age = 67,50 years, SD = 3,18). 9 participants were female and 7 male. 11 participants were married, 2 indicated to be divorced, 1 was single and 1 was widowed. The majority of the participants indicated to be retired (n = 15), one stated to be unemployed.

- **Austria**: Three participants started using a computer after retirement, the other ones had used at least specific programs at work. However, those, who had to use computers at work, did not necessarily proceed with using computers immediately after retirement. The main purposes of using computers for the participants were to archive their pictures, being available for friends and family worldwide (e.g., email, Skype), using online-banking, learning languages, playing card games, looking up information on the Internet (e.g., about journeys) or a general interest in technology. Two participants mentioned that not having an email address would have excluded them. One of the participants was an IT expert, another one indicated to be an advanced user, one appraised her-/himself as between casual and advanced user, and one explicitly defined her-/himself as non-user or beginner. The others did not indicate how they would appraise themselves.
- **France**: One participant mentioned to be an occasional user, two stated to be beginners, whereof one regretted to be beginner. One participant indicated to have some IT skills, one had to use technology at work, and another participant thought to be unable to keep up, as the technology would overtake her/him. One participant indicated to have learned to use a computer by her-/himself, and one participant refused computers at all (as they do not appeal to her/him and do not have priority for her/him). The main purposes for using computers were the work with personal stuff (e.g., own folders, pictures), searches, emails, personal curiosity, pictures and videos from family, purchases, and games (card as well as lottery games). One participant pointed out that computers were a great invention, but would be complicated to use. Two participants mentioned to be fascinated by new technology. One thought that computers were good, but their usage depends on the individual. In one case, the partner uses a computer and takes over the associated tasks. One participant expressed fears of being disconnected and no longer being able to keep up.

2.3.3 Summarized Results

The summarized results for the two research questions are presented in the following.

2.3.3.1 RQ3: Which role do epistemic values play?

The participants emphasized that personalization is necessary (e.g., the most used sites on the Internet should automatically appear), and they are convinced that there is no universal approach, especially as the settings on individual computers differ to a large extent. Also the knowledge of computer-related icons and symbols differed highly.

For learning how to use a computer some participants already used books or manuals, however, they are not always perceived as helpful. Moreover, participants expressed the need for step-by-step instructions, without the necessity of reading too much text. The tutorial could offer pictures and speech output, and should present the best way to proceed according to individual needs (e.g., the simplest or fastest way). The input could be done by typing in questions (similar to Google), and there could be command lines for quick help.

Although the participants expressed many wishes for the graphical layout of tutorials (e.g., bigger buttons), some also emphasized that it needs not be reduced, as simplifying might also lead to a loss of information.

2.3.3.2 RQ5: How do end users navigate indoor and outdoor?

Although some participants already used navigation systems, there were a few references to a lack of trust in the information, which is provided. In general, the participants used maps, asked others, or concentrated on the signage on-site. In order to plan trips, the participants looked for the way on maps (both on printed maps and on the Internet).

The participants referred also to many problems in outdoor navigation, e.g., finding the direction, finding cars in car parks, coping with inappropriate signs, or lacking information points. They indicated to navigate or orientate themselves by streets and places, landmarks, environmental situations, and streetscape. Indoor, they referred to missing staff to ask, unclear signs or bulletin boards and therefore required detailed information on-site. They orientate themselves by references points, such as elevators, pictures or wardrobes.

The navigation aids should provide the above-mentioned information step by step, with the help of pictures, symbols and signs. The information could be written, as long as there are big letters used, or oral (voice in- and output).

One participant indicated to already use a navigation system on his/her smart phone. Another two would buy a mobile phone if it met their needs. One participant was not sure about this. One refused navigation systems on smart phones, as it would be too complicated (no overview possible on the small display). Instead, s/he preferred to use a printed map. Another participant did not want to have a navigation system on a smart phone, as talking to people was appreciated more.

For more details about the analysis and the results there is a separate report available (“Workshop Results”).

2.4 Survey

While the interviews and workshops gathered qualitative data in order to explore our end users’ characteristics regarding learning and navigation, the survey aimed at gathering representative data. Furthermore, the survey provided the possibility to integrate further aspects, which will be important in the ENTRANCE project, i.e. financial matters.

The survey was distributed both offline and online in France as well and in Austria. All partners of the project distributed the link to the online survey via their homepages, magazines, emails or newsletter. 34 completely filled out questionnaires were gathered through the online distribution (9 French/25 German). The offline version was a paper-pencil questionnaire that was distributed by the end user organizations 50plus and ALab. Overall, 82 offline questionnaires were returned (56 French/26 German). In summary, 116 filled out questionnaires were used for the analysis.

2.4.1 Research Questions

The following research questions were addressed (numbering according to the definition of all research questions in chapter 1.3):

- RQ1: What characterizes the end users of the system?
- RQ2: How do end users cope with technology (i.e. computers and mobile phones?)
- RQ3: Which role do epistemic values play?
- RQ4: How do end users plan/organize/conduct their travels?
- RQ5: How do end users navigate indoor and outdoor?
- RQ6: In how far are end users willing to pay for a system like Entrance?

2.4.2 Study Setup

The questionnaire was developed on basis of the qualitative results of the workshops (see chapter 2.3) and interviews (see chapters 2.1 and 2.2), which were conducted to explore older adults' technology usage, learning strategies, travelling behavior and strategies they have when navigating indoor and outdoor. Furthermore, the secondary research was also taken into consideration (see chapter 2.5). The respective findings were used to phrase survey items in order proof whether the qualitative insights are valid for a larger sample. Furthermore, with the input from the project partners further questions were defined to ensure the assessment of all relevant facets of the topics.

After the items were phrased, we conducted a workshop to pretest (in cooperation with 50plus) with six older adults in order to find out whether the phrasings were appropriate for the target group.

2.4.3 Summarized Results

In the following, the summarized results for all research questions will be presented. The analysis was performed in SPSS 20.0.0, a statistical analysis tool[1].

2.4.3.1 RQ1: What characterizes the end users of the system?

Age & Gender. The participants were between 50 and 83 years old (average age = 68.64, SD = 5.89, N = 116) (see Figure 1). 43,93% of the participants were female, 56,07% male (see Figure 2).

[1] http://www-01.ibm.com/software/analytics/spss/

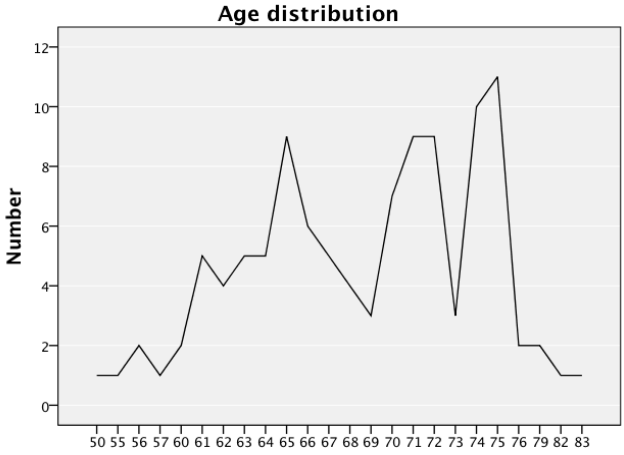

Figure 1: Participants' age

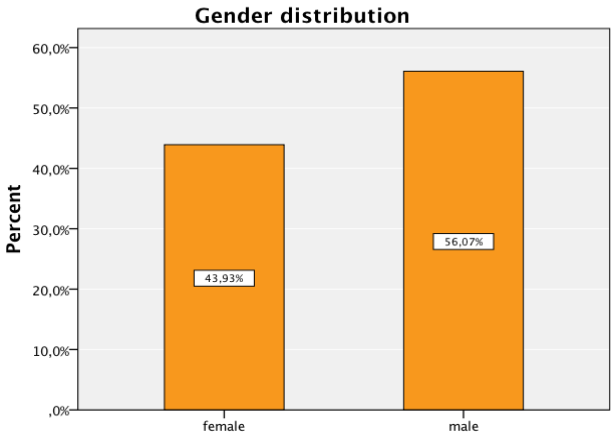

Figure 2: Participants' gender

Family status. In terms of the family status, the data represents relative frequencies as the respondents could choose multiple answers. That means that the percentages concern the share of participants, who respectively agreed to the certain categories. The majority, 66,1% indicated to be married, 14,7% were widowed, 11% were living in a partnership, 8,3% were divorced and 4,6% indicated to live alone (N = 114).

Educational level. Regarding the participants' educational level (N = 109) 38,5 % indicated to have completed high school, 27,5 % compulsory education, 26,6 % a graduate degree and 7,3 % indicated to have no educational attainment.

Time to/since formal retirement. The majority of the respondents (94,8%) was already retired or will retire within 2012, only 5,2% will retire in the future, until 2027.

Impairments. In order to find out potential impairments of the target users, participants were asked to indicate their visual, hearing and physical capabilities and to state, if they use any visual, hearing or mobility aids (see Figure 3).

7,5% stated that their visual capabilities were very good, 74,5% good, 17% bad and 0,9% pointed out that their visual capabilities were very bad (N = 106). 89% used glasses or contact lenses (N = 109) and 18,6% other visual aids, for example a loupe (N = 102).

Regarding the hearing capabilities, 17,3% indicated to have very good hearing capabilities, 61,5% good, 20,2% bad and only 1,0% stated to have very bad hearing capabilities (N = 104). Only 10% were using a hearing aid (N = 100). More than half of the respondents (55,5%), who used a hearing aid (N = 10, 1 missing), indicated that it meets their requirements, 44,4% pointed out that their hearing aid did not meet their requirements.

22% of the participants rated their physical capabilities (mobility) as very good, 65,7% as good, 10,5% as bad and only 1% stated that the physical capabilities were very bad (N = 105). Only 5,8% indicated to use a mobility aid, e.g., crutches or a walking stick.

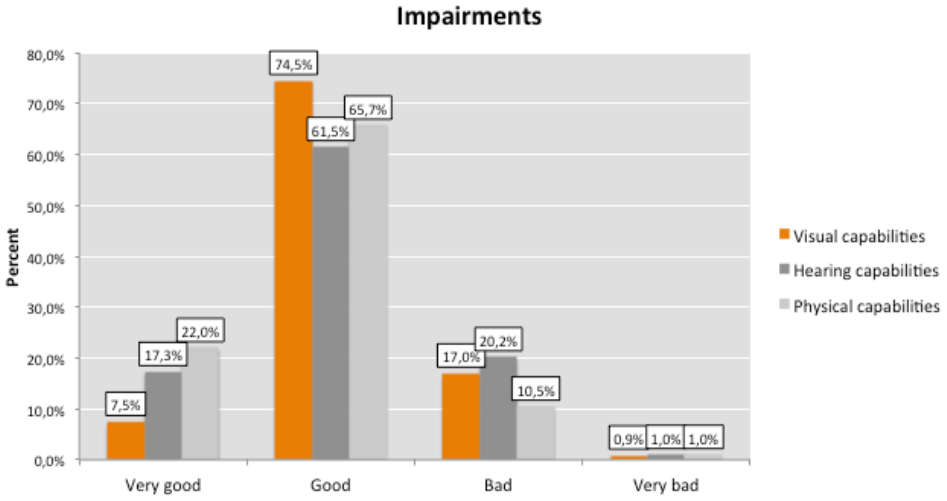

Figure 3: Participants' visual, hearing and physical capabilities

To summarize, the end users, who took part in the survey, were between 50 and 83 years old, were mainly married, having a high school degree, and already having retired. Regarding impairments and capabilities, the majority indicated to have rather good visual, hearing and physical capabilities, some indicated very good and some very bad. Only a very small proportion indicated to have very bad visual, hearing or physical capabilities.

2.4.3.2 RQ2: How do end users cope with technology?

Regarding technology usage, the participants were asked to indicate whether they use a **mobile phone**, a **computer** or a **navigation system**.

Mobile Phone. The majority of participants (78,4%) used a mobile phone. One fifth (21,6%) indicated that they don't use any mobile phone (N = 116). 48,3% use/used a mobile phone at work and the rest do/did not use a mobile phone at work.

In order to identify the reason, why the participants did not use any mobile phone or used it less than once a month they were asked to indicate a reason. However, not all respondents answered the question. Some participants indicated that they have a landline phone (4 participants) and therefore do not need a mobile phone, or their partner has got one and so they do not need an extra mobile phone (1). Moreover, it was not experienced as useful (1) or as too expensive (1). Two respondents pointed out that they only use their mobile phone for security reasons, when for example having troubles on the road.

78,2% used a cell phone and 21,8% a smart phone (N = 87). Regarding the frequency of use it is remarkable that only half of the participants (54,4%) used their mobile phone on a daily basis, 27,8% used it many times a week, 3,3 % about once a week, 10% once or twice a month and only 2,2% indicated to use their mobile phone only several times a year (N = 90).

Computer. Three quarters (73,9%) used a computer, the rest did not use any computer (N = 116). Three quarters (75,3) use/used a computer at work and one quarter (24,7%) do not/did not use a computer at work.

68,7% (N = 83, 2 missing) of those respondents, who indicated that they used a computer, did this on a daily basis, 26,5% used it many times a week and 3,6% about once a week. We could identify a variety of different reasons, why the respondents did not use any computer or used it less than once a month (not all respondents indicated a reason). Some experienced that there is no need to have a computer, as it is not useful (3). Other reasons were the fear to get addicted (1), no interest (1), lack of knowledge how to use it (1), no time (1), no passion to learn how to use it (1) and costs. Two participants of the survey pointed out that they regret that they do not have one.

Navigation system. 50% of the participants used a navigation system and the others did not use any navigation system (N = 110). 72% of those, who indicated to have one and who answered the question, indicated to use a portable navigation system, 29,4% used a navigation system that was integrated in their car and 15,7% a navigation system on their mobile phone (N = 53) (see Figure 4).

Some additional systems were mentioned such as a navigation system on the bike (1), a navigation system integrated on the computer (1) or in one's plane (1). Thereby, the majority (41,5%) used it once or twice a month, 22,6% several times a year, 20,8% many times a week and 15,1% used it about once a week.

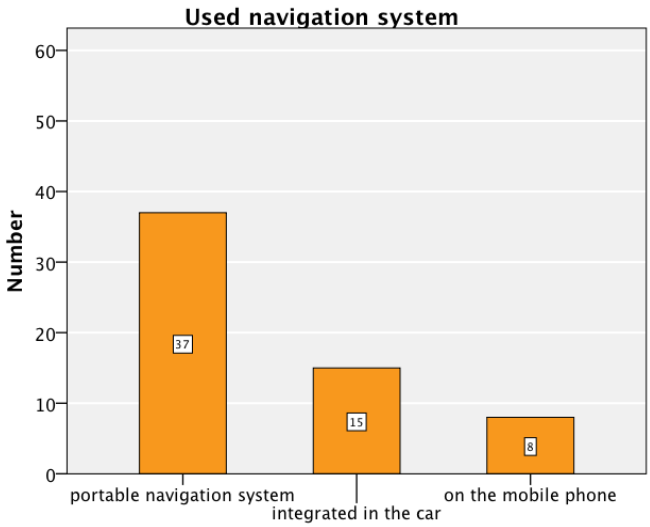

Figure 4: Used navigation system

The participants indicated a variety of different reasons for not using a navigation system or only using it several times a year: It is not needed more often (13), because it is only used for long trips (4), for journeys where the destination is unknown (3), or only when going on holidays (2). Others indicated that they experience no need to use a navigation system (4), or even have no interest in using one (2), are not used to it (1), do not drive (1), or the care is not equipped with one (1). Other respondents stated that they use maps (4) and that they want to challenge themselves by reading maps (1), or using their mind (1) when navigating.

Differences between Austria and France

In Austria, significantly more participants used a mobile phone ($\chi^2 = 12.57$, $p < 0.001$)[2]: While only 6,0% of the Austrian participants indicated to not use a mobile phone, 33,30% of the French participants did not use a mobile phone. Furthermore, the Austrian participants indicated to use their mobile phone more often than the French participants ($U = 724.5$, $p < 0.05$)[3].

Regarding the purpose for which the different technologies are used, the participants were asked to indicate which functions they regularly use on their mobile phone, their computer and their navigation system. The data represents relative frequencies. The percentages concern the share of participants, who respectively agreed to the certain statements.

Regularly used functions on the mobile phone. In order to investigate participants' mobile phone usage in general, they were asked to indicate what kind of functions they regularly used on their phone. The data represents relative frequencies. The percentages concern the share of participants, who respectively agreed to the certain statements.

Regarding the function "calls", 100% of the respondents, who answered the question, indicated that they use their mobile phone for calls. 64% used it for writing and reading text messages, 51,7% for administering contacts, 18% for writing and reading emails, 14,6% to surf in the Internet, 13,5% for route planning with mobile maps and 12,4% for scheduling activities (see Figure 5).

Furthermore, the participants mentioned that they would use the following functions on the mobile phone: alarm clock (2), games (1), MMS (1), pictures (1) and look up information about films in the cinema (1).

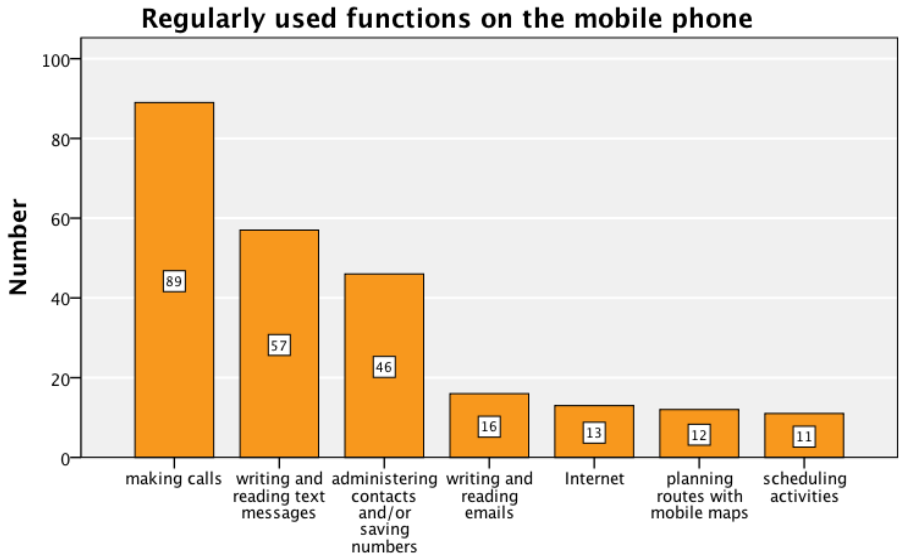

Figure 5: Used functions on the mobile phone

[2] Crosstabs with Chi-Square (χ^2) Tests were used in order to identify differences. A significance level of 5% was chosen.

[3] For variables, which were not nominal, but also not normally distributed, a Mann-Whitney Test (U) was used in order to identify differences. A significance level of 5% was chosen.

Regularly used functions on the computer. The most used functions on the computer are Emails (96,4%) the Internet (86,7%) and office applications such as word or excel (75,9%). 68,7% used it for uploading, editing or sharing photos and 34,9% for playing games (see Figure 6). Additional functions that were identified are cutting or editing videos (2), administering photos (1), or listening to music (1).

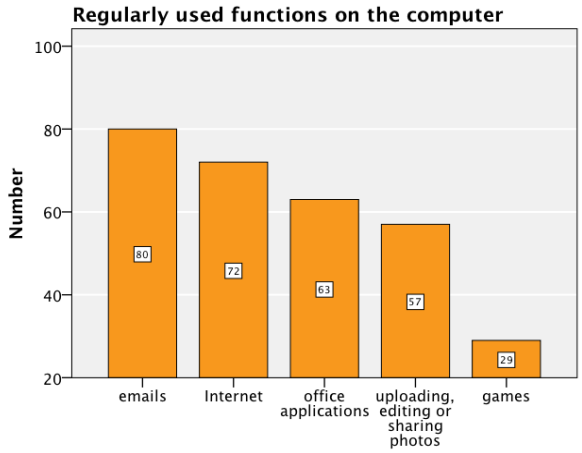

Figure 6: Used functions on the computer

Regularly used functions on the navigation system. The majority of participants used the navigation system for navigation in the car (92,5%) and route planning (73,6%). 28,3% used the speech output, almost one quarter (24,5%) used the navigation system for localizing points of interest, 13,2% to be informed regarding the traffic situation (traffic motion control) and 1,9% used speech input (see Figure 7). Additional functions that were mentioned are the Asfinag (i.e. an Austrian company, which plans, finances and tolls the entire motorway and expressway network) web cams (1), navigation when going with the bicycle (1), searching for a gas station (1), and radar detection (1).

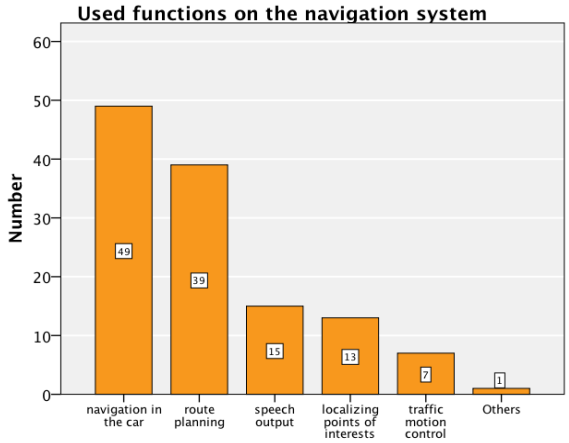

Figure 7: Used functions on the navigation system

Differences between Austria and France

In Austria, significantly more participants used their mobile phone for making calls (χ^2 = 14.69, p < 0.001): While only 6,0% of those Austrian participants, did not use a mobile phone for making calls, 36,40% of the French participants did not make calls with their mobile phone. However, this might be due to the fact that less French participants have a mobile phone, than Austrian participants.

Furthermore, there were significant differences between the Austrian and French participants in the computer usage: The Austrian indicated to use emails more often (86,0 %agreed) than the French participants (56,1%) (χ^2 = 11.91, p < 0.01), to use the Internet more often (78,0% versus 50,0%) (χ^2 = 9.47, p < 0.01) and to use the computer more often to upload, edit or share photos (70,0% versus 33,3%) (χ^2 = 15.30, p < 0.001).

Computer playfulness. In order to assess how playful participants interact with computer they were asked to indicate their agreement/disagreement (I agree, I rather agree, neither/nor, I rather disagree, I disagree) to four statements regarding their spontaneity and creativity when interacting with technology. The following statements were used:

- When I am interacting with the computer, I do not think a lot before I do something.
- When I am interacting with the computer, I have creative ideas how to proceed.
- When I am interacting with the compute, I do this informally.
- When I am interacting with the computer, I always proceed the same way.

Regarding the first statement more than half of the respondents (57,9%) indicated to agree or rather agree to act spontaneously when interacting with the computer. 14,5% indicated to neither agree nor disagree to the statement and 27,7% indicated that they disagree or rather disagree to act spontaneously (N = 67).

The majority of the respondents (59,7%) stated that they have creative ideas how to proceed when interacting with the computer, 22,2% indicated that they neither agree nor disagree to the statement and 18,0% pointed out that they disagree or rather disagree to have creative ideas when interacting with the computer (N = 72).

Regarding the informality when interacting with the computer three quarters (75,3%) indicated to agree or rather agree to the statements, 7,8% neither agree nor disagree and only 16,9% said that they did not agree or rather disagree to interact informally with the computer (N = 77).

Regarding the statement “When I am interacting with the computer, I always proceed the same way” 75,9% stated that they agree or rather agree, 7,6% indicated to neither agree nor disagree and 16,4% pointed out that they do not or rather do not agree to the statement (N = 79).

2.4.3.3 RQ3: Which role do epistemic values play?

In order to find out what kind of strategies the participants had, they were asked to indicate how they normally proceed in order to learn how to use technologies. The data represents relative frequencies. The percentages concern the share of participants, who respectively agreed to the certain statements.

69,3% of participants, who responded to the question, indicated that they asked somebody, 55,4% just tried it out, 33,7% used written step-by-step instructions with pictures, 20,8% attended a training course in a group, 9,9% used written step-by-step instructions without pictures and only 5,9% used video instructions in order to learn how to use technologies (see Figure 8).

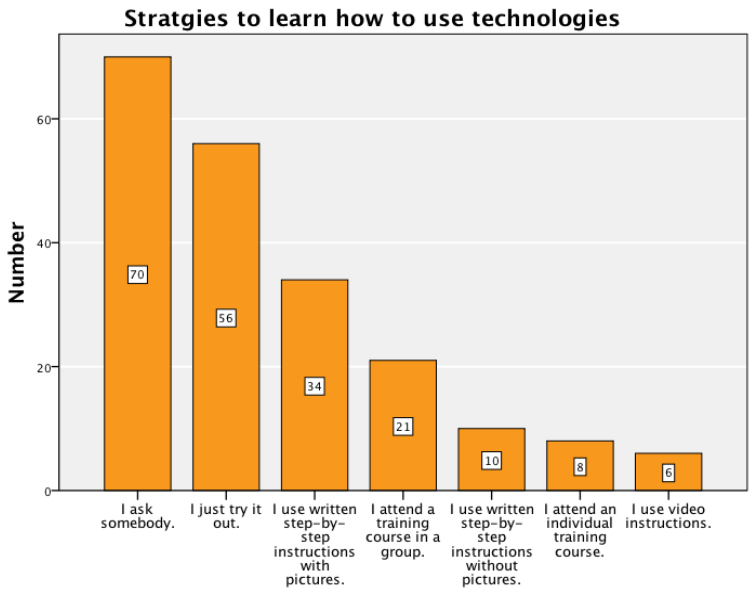

Figure 8: Learning strategies

Differences between Austria and France

In France, significantly less participants indicated to attend a training course in a group (χ^2 = 23.47, $p < 0.001$): While in Austria 38,0% of the participants indicated to attend a training course in a group, only 3,0% of the French participants indicated the same.

Regarding the supportiveness of different tutorials participants of the survey were asked to indicate, how supportive they appraise step-by-step instructions without pictures, step-by-step instructions with pictures, and video instructions.

Step-by-step-instructions without pictures. They are considered as very or rather supportive by the majority of the respondents (48,6%, N = 72), by 38,9% as not supportive or hardly supportive and 12,5% indicated that they consider this kind of tutorials as neither supportive nor not supportive.

Step-by-step instructions with pictures. 93% (N = 72) stated that they consider step-by-step instructions with pictures as very or rather supportive, only 4,2% as not supportive or hardly supportive and 2,8% neither supportive nor not supportive.

Video instructions. More than half of the respondents (56,5%, N = 46) indicated that they appraise video instructions as very supportive or rather supportive, 17,4% considered this kind of tutorial as not supportive or hardy supportive and 26,1% indicated “neither/nor”.

In order to find out who is involved in supporting participants regarding learning participants were asked to indicate, who was important for them. The data represents relative frequencies. The percentages concern the share of participants, who respectively agreed to the certain statements.

65,1% indicated to ask their children for support, 31,1% asked their friends, 29,2% got support from their grandchildren, 24,5% from their partner, 13,2% from other experts, 12,3%

from trainers from a computer class, 7,5% from former work colleagues and 3,8% from participants from a computer class (see Figure 9).

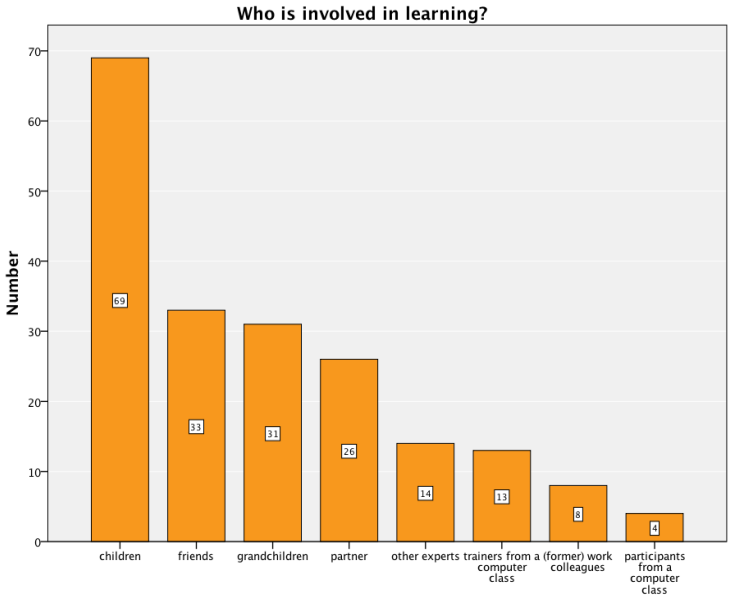

Figure 9: Learning support

Differences between Austria and France

In France, significantly fewer participants indicated to ask trainers form a computer class to support them (3,0%) than in Austria (22,0%) (χ^2 = 10.29, p < 0.01). Also for asking other experts, there was a significant difference: In Austria, 24,0% indicated to ask other experts for support, in France only 3,0% indicated to do so (χ^2 = 11.79, p < 0.01).

Interest in technology. The majority of the respondents (67,3%, N = 110) stated that they are very or rather interested in technology, 16,4% were neither interested nor not interested and only 16,4% indicated to be not or only hardly interested in (new) technologies.

Attitude towards technologies. In order to identify the attitudes towards technologies in general, the participants of the survey were asked to indicate to what extent they agreed to the statement “New technologies enrich my everyday life” and “I am critical of new technology in my everyday life”. They could express their extent of agreement on a five-point scale (I agree, I rather agree, neither/nor, I rather disagree, I disagree). Almost three quarters (71,4%) of the participants agreed or rather agreed to the statement “New technologies enrich my everyday life”, 17,9% indicated that they neither agree nor disagree and only 10,7% pointed out that they disagreed or rather disagreed to the statement (N = 112). We can therefore conclude that the majority of the respondents experienced technologies as an enrichment in their everyday life.

However, almost half (45,8%, N = 107) of the participants were critical of new technologies, 18,7% indicated that they neither agreed nor disagreed to the statement and 35,5% pointed out that they disagreed or rather disagreed to the statement and therefore were not critical of new technologies in their everyday life.

Trendsetting. The participants were asked four questions about their trendsetting behavior, i.e. “There are areas of interest where it is important for me to be up to date.”, “I am a person

who is interested in new things.", "I always like to try out new things.", and "For me it is important to be up to date in terms of new ideas, trends and developments". The participants were on average rather trendsetters (5 = disagree, 1 = agree; mean = 3.8, SD = .89).

Differences between Austria and France

The French participants indicated to be less interested in (new) technologies than the Austrian participants (U = 899.0, p < 0.001). The Austrian participants were significantly more convinced that technologies would enrich their lives (U = 938.5, p < 0.001). Furthermore, the Austrian participants were significantly more trendsetters, than the French one (F = 6.37, p < 0.05)[4].

Educational games. Almost two thirds of the participants (67,6%, N = 111) have never played an educational game and almost one third (32,4%) has played an educational game once. Out of those respondents, who answered to the question about the supportiveness of educational games for learning (N = 69), more than half (53,6%) stated that they find educational games very supportive or rather supportive. 34,8% indicated "neither/nor" and 11,6% of the participants said that they appraise educational games as not or hardly supportive.

2.4.3.4 RQ4: How do end users plan/organize/conduct their travels?

In order to investigate the travelling behavior of the target group, participants of the survey were asked to indicate, which kinds of travels they are interested in. They could select multiple responses, thus, the data represents relative frequencies. The percentages concern the share of participants, who respectively agreed to the certain statements.

Almost two thirds of the respondents (74,5%) are interested in culture trips, 35,3% in wellness trips, 25,5% in combined travels and 22,5% in adventure trips, Besides, 17,6% indicated to be interested in pilgrimages, 11,8% in gourmet trips and 3,9% in business trips (see Figure 10).

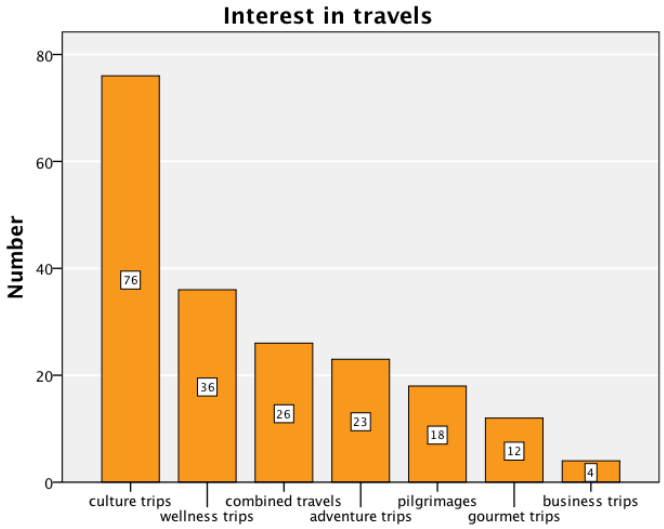

Figure 10: Interest in travels

[4] A T-Test for independent samples was used, and a significance level of 5% was chosen.

Besides the predefined categories, the respondents indicated a variety of other different interests regarding travelling such as sport trips (3), camping trips (2), senior travels (2), sailing trips (1), beach vacations (1), short trips for only 3 to 5 days (1), and relaxing trips (1).

Differences between Austria and France

In France, significantly fewer participants indicated to be interested in culture trips (56,1%) than in Austria (78,0%) (χ^2 = 6.06, p < 0.05), in adventure trips (12,1% versus 30,0%) (χ^2 = 5.72, p < 0.05), and in combined trips (7,6% versus 42,0%) (χ^2 = 19.39, p < 0.001).

Routines. In order to find out whether there are certain routines when travelling, the participants of the survey were asked to indicate, how they usually book their journeys. The data represents relative frequencies. The percentages concern the share of participants, who respectively agreed to the certain statements.

More than half of the respondents (55,6%) stated to usually book their journey via a local travelling agency, 39,4% indicated to book via the Internet, more than one quarter (26,3%) via the telephone and 14,1% stated that they do not book anything in advance (see Figure 11).

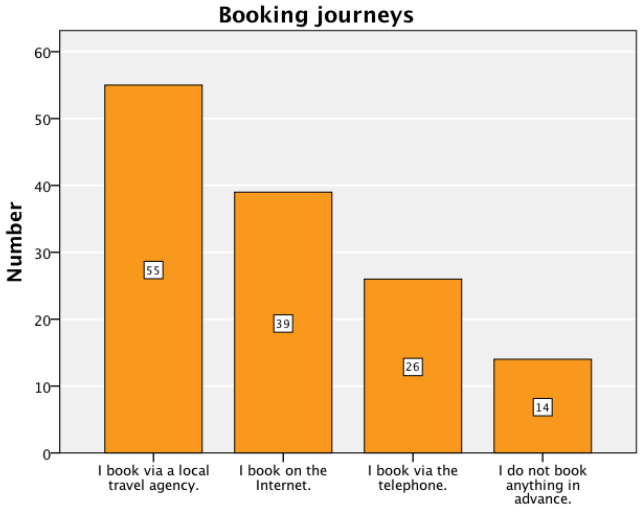

Figure 11: Usual way of booking journeys

Differences between Austria and France

In France, significantly fewer participants indicated to usually book via a local travel agency (27,3%) than in Austria (74,0%) (χ^2 = 24.91, p < 0.001).

2.4.3.5 RQ5: How do end users navigate indoor and outdoor?

Regarding the strategies for navigating outdoor the participants were asked to indicate, how they usually navigate when going by car or when walking. The data represents relative frequencies. The percentages concern the share of participants, who respectively agreed to the certain statements.

Car. When going by car, almost three quarters (71,2%) indicated to usually use a street map, 44,2% a navigation system, 31,7% print-outs of maps they had looked up before on the Internet, 15,4% said that they ask other people and 13,5% to navigate by means of landmarks. Additionally, one respondent mentioned to be supported by the co-driver (see Figure 12).

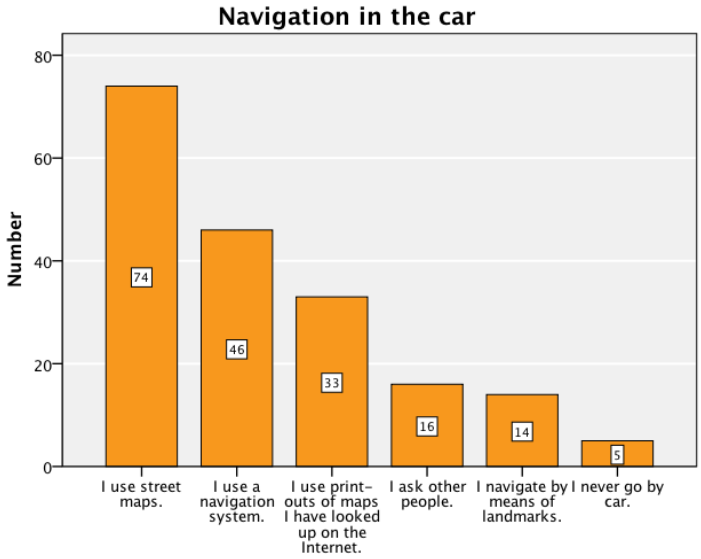

Figure 12: Usual navigation in the car

Walking. Regarding usual navigation aids when walking 59,6% indicated to use maps, 54,8% to ask other people, 38,5% to navigate by means of landmarks, 18,3% to use print-outs of maps they had looked up on the Internet and 13,5% stated to use a navigation system (see Figure 13).

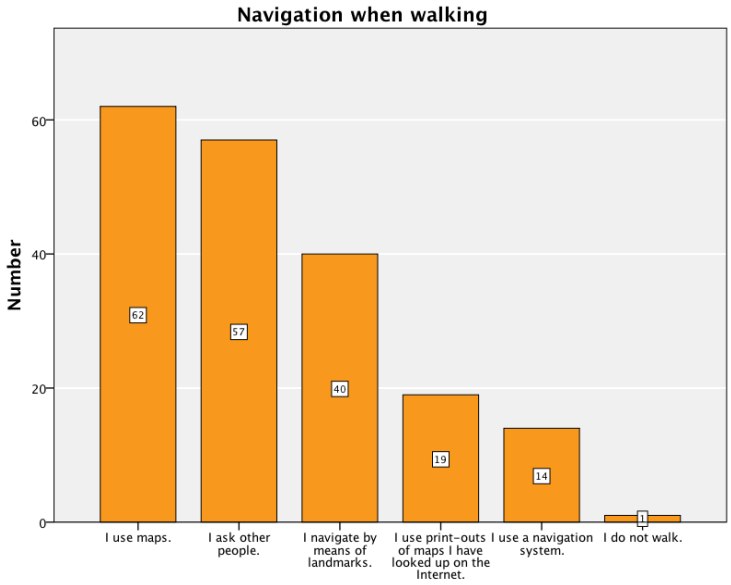

Figure 13: Usual navigation when walking

Additionally, participants were asked to indicate the most important kinds of navigation support when navigating in familiar and unfamiliar indoor and outdoor environments (multiple choices were possible). The data again represents relative frequencies and percentages concern the share of participants, who respectively agree d to the certain statements.

Navigation support in familiar outdoor environments. 55,1% stated that landmarks were important for them in familiar outdoor environments (e.g., their home town), 46,9% indicated to use street maps, 30,6% to ask other people, 19,4% to use a navigation system and 18,4% pointed out to use print-outs of online maps (see Figure 14).

Navigation support in unfamiliar outdoor environments. 74,8% stated that they use street maps, 36,4% to use a navigation system, 35,5% to ask other people, 33,6% to use landmarks and 22,4% said that they use print-outs of online maps (see Figure 14).

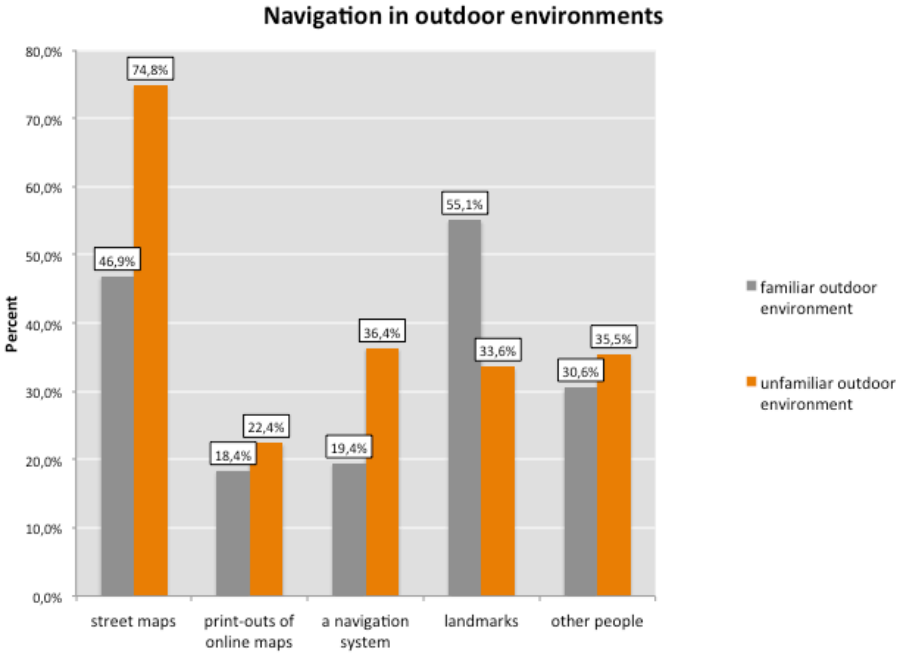

Figure 14: Navigation in outdoor environments

Differences between Austria and France

Regarding the *navigation in the car* there were some significant differences between the French and the Austrian participants. In Austria no participant indicated to never use a car, whereas in France 7,6% of the participants indicated to never use one ($\chi^2 = 3.96$, $p < 0.05$). The Austrian participants more frequently used street maps (82,0% versus 50,0%) ($\chi^2 = 12.61$, $p < 0.001$), and print-outs of online maps (44,0% versus 16,7%) ($\chi^2 = 10.44$, $p < 0.01$). Furthermore, the Austrian participants indicated more often to ask other people for help (26,0% versus 4,5%) ($\chi^2 = 11.01$, $p < 0.05$).

Regarding *navigation when walking* there is a similar tendency: More Austrian participants indicated to use maps (64,0% versus 45,5%) ($\chi^2 = 3.93$, $p < 0.05$), to use print-outs of online maps (32,0% versus 4,5%) ($\chi^2 = 15.66$, $p < 0.001$), and to navigate by means of landmarks (46,0% versus 25,8%) ($\chi^2 = 5.16$, $p < 0.05$).

Regarding *outdoor navigation* there were some additional significant differences between the French and the Austrian participants. In familiar outdoor environments, the Austrian participants rather used print-outs of online maps (34,0%) than the French participants (1,5%) ($\chi^2 = 22.90$, $p < 0.001$. The same is true for navigating by means of landmarks in familiar outdoor environments (58,0% versus 37,9%) ($\chi^2 = 4.63$, $p < 0.05$). In unfamiliar outdoor environments, more Austrian participants indicated to use print-outs of online maps (38,0% versus 7,6%) ($\chi^2 = 16.05$, $p < 0.001$) and to navigate by means of landmarks (54,0% versus 13,6%) ($\chi^2 = 21.66$, $p < 0.001$).

Usual indoor navigation. The majority of the respondents (85,5%) indicated to usually use information boards, 70,0% to pay attention to signs, 46,4% to ask other people, 30,0% to pay attention to reference points and 7,3% to use maps.

Navigation support in familiar indoor environments. 67,9% of the respondents said that they use information boards, 67,9% signs, 35,8% reference points, 32,1% to ask other people and 4,7% indicated to use maps (see Figure 15).

Navigation support in unfamiliar indoor environments. 81,5% pointed out to use information boards, 69,4% signs, 42,6% to ask other people, 29,6% to use maps and 28,7% said that they use reference points (see Figure 15).

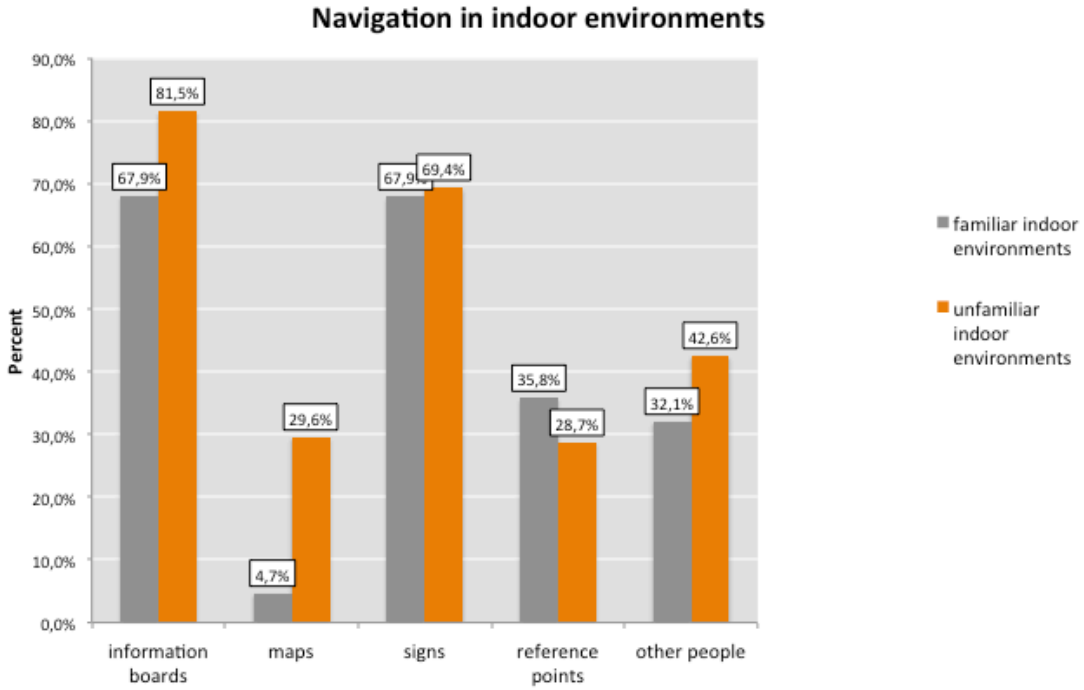

Figure 15: Navigation in indoor environments

Differences between Austria and France

Regarding *usual indoor navigation*, there were also many significant differences between France and Austria. The Austrian participants more often indicated to use information boards (94,0% versus 71,2% (χ^2 = 9.61, p < 0.01), to pay attention to signs (82,0% versus 54,5%) (χ^2 = 9.61, p < 0.01), or to reference points (44,0% versus 16,7%) (χ^2 = 10.44, p < 0.01).

Regarding *indoor navigation in familiar environments*, the Austrian participants more frequently indicated to use information boards (88,0% versus 42,4%) (χ^2 = 25.10, p < 0.001), to pay attention to signs (78,0% versus 50,0%) (χ^2 = 9.47, p < 0.01), and to reference points (50,0% versus 19,7%) (χ^2 = 11.86, p < 0.01).

In *unfamiliar environments*, the Austrian participants indicated to use information boards more often than the French participants (96,0% versus 60,6%) (χ^2 = 19.46, p < 0.001), as well as signs (80,0% versus 53,0%) (χ^2 = 9.06, p < 0.01), reference points (46,0% versus 12,1%) (χ^2 = 16.67, p < 0.001) and asking other people (52,0% versus 30,3%) (χ^2 = 5.60, p < 0.05). However, the French participants indicated more frequently to use maps (40,9%) than the Austrian participants (10,0%) (χ^2 = 13.61, p < 0.001),

2.4.3.6 RQ6: In how far are end users willing to pay for a system like Entrance?

In order to find out whether participants could imagine to use a smart phone in order to be supported in terms of travelling, they were asked to indicate, if they could imagine to be provided with navigation advice, booking events, receiving additional information regarding points of interests or saving GPS data of pictures. They could state their agreement/disagreement with respect to four different statements (agree/rather agree/neither-nor/rather disagree/disagree).

Regarding the statement “I would be interested in being provided with navigation advice on a smart phone” more than half of the respondents (54,5%) indicated that they (rather) agree, almost one quarter (23,9%) (rather) disagree and 21,6% stated “neither/nor” (N = 88). Regarding the interest in booking events on a smart phone, only 37,7% stated that they (rather) agree to be interested in booking events on a smart phone, 34,1% stated to (rather) disagree and 28,2% stated that they neither agree nor disagree (N = 85).

Regarding the statement “I would be interested in receiving additional information regarding points of interests on a smart phone” more than half of the respondents (59,8%) agree or rather agree to the statement, 19,5% disagree or rather disagree to the statement and 20,7% stated to neither agree nor disagree to the statement (N = 92). In terms of the interest in saving GPS data of taken pictures on a smart phone 54% said that they agree or rather agree to be interested, 21,4% to disagree or rather disagree and 24,7% indicated that they neither agree nor disagree (N = 89).

Willingness to spend for a trip assistance application on a smartphone. In total, 39 participants answered to the question about how much they would be willing to spend. Thereby, one quarter (10) indicated that they do not have any idea how much money they would spend on the service, seven stated that they won't be willing to spend any money and two persons pointed out that they would only pay a minimum prize but did not indicate an amount. Half of the respondents (20) would be willing to spend money in a service and indicated different amounts ranging from 0,20€ per information request up to 50,00€ at the most per month.

Preferred paying method. The participants were asked what their preferred paying method for trip assistance was. Almost half of the respondents (48,5%) said that they prefer a free service, augmented with advertisements, 32% indicated “neither/nor” and 19,6% stated that they would prefer paying by themselves (N = 97) (exact percentages see Figure 16).

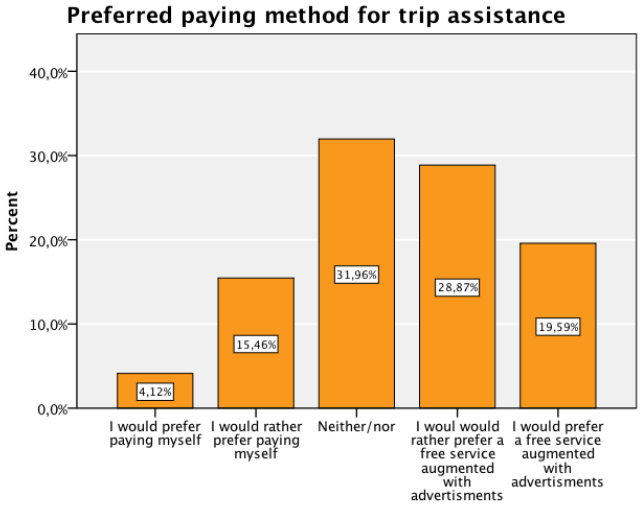

Figure 16: Preferred paying method

The survey revealed many insights regarding the older adults' technology usage, their travelling behavior and navigation strategies. The two end user organizations Autonom'lab and 50plus recruited 116 older adults in Austria and France to take part in the 59-item questionnaire. It is remarkable that the participants were primarily technology affine, as indicated by the high usage rates of computer and mobile phones. Only regarding navigation systems the participants seem to be rather reluctant. Although the participants again (similar to the workshops and interviews) did rarely use serious games, they indicated to be curious and interested in various features of technologies. Within the survey also details about learning strategies were found, emphasizing the role of other people in supporting the learning process, and the importance of written materials (e.g., step-by-step instructions with pictures) and training classes. Regarding travelling and navigation the participants expressed various preferences and strategies. For navigation the use of maps was mentioned most frequently, but the participants also indicated to be interested in navigation support on a mobile phone.

For more details about the analysis and the results there is a separate report available ("Survey Results").

2.5 Secondary Research

The secondary research was conducted by PLUS and CEA to summarize the findings and state of the art regarding

- older adults' technology (i.e. computer and mobile phone) usage,
- their epistemic values and behaviors (i.e. learning and serious games for older adults),
- their travelling behavior, and
- indoor and outdoor navigation.

2.5.1 Summarized Results

In the following, the related work will be presented briefly along the respective research questions. Also for the secondary research a detailed report is available.

2.5.1.1 RQ2: How do end users cope with technology?

57 % of people aged 50+ had a computer in 2008, whereof 47 % had access to the Internet. The number of older users and the technology skills are increasing, especially regarding "technologically open minded" users. Having a computer at home does not necessarily mean that the computer is actually used. The term "lapsed users" describes those, who used a computer at earlier times, but gave up to. The main purposes of the Internet for older adults are gaining information about goods and services, emails in order to stay in contact with the family and to send pictures, or reading the news. Mobile phones are used widely among older people, who not only have it for security reasons and for communicating with friends and family, but also e.g., for sending and receiving text messages [Empirica 2008].

The ICT usage is influenced by the social status of the older adults, i.e. the higher the social status of the older adults (i.e. occupational and educational status), the more likely they are using ICTs. Furthermore, attitudes and motivation influence older people's ICT usage, e.g., by not recognizing benefits. Older adults also tend to use only those technologies, which they are familiar with. Different forms of impairments, which might occur in older ages, can additionally influence the ICT usage, e.g., motor skills affect the mouse usage, visual impairments impede perceiving small elements on the screen etc. Thus, also the probability of using ICTs might be affected negatively [Empirica 2008].

2.5.1.2 RQ3: Which role do epistemic values play?

Adult learning is an important issue as it might have a positive influence on satisfaction and psychological wellbeing [Jenkins 2011]. Learning is influenced by several factors, e.g., the material that is used or the applied methodological approach. Furthermore, it depends on the people's motivation (intrinsic interest) to learn, which in turns depends also on the need to learn something. Learning is an intrinsic process that is influenced by different situations we face in life and with which we have to cope with. There are two conditions for learning: disjuncture and social interaction. Learning depends on the world, the person lives in, which changes and gives input. The learning person uses relevant input, adapts and transforms it in order to become more experienced [Jarvis 2010]. Regarding older adults, cognitive and motivational aspects are interdependent, thus a decline in cognitive abilities might lead to a decline in motivation as well and vice versa [Hasselhorn et al. 2009].

Although ICTs (especially computers) would provide opportunities for everyone to participate in learning, the people's decision to learn is not merely depending on how convenient it is via ICTs. Those, who are not motivated to learn, will also conduct learning activities if the computer offers the possibility to [Selwyn et al. 2004]. Furthermore, computers can evoke negative feelings like fear, suspicion, resentment and downright hostility, which need to be addressed especially when teaching computer shy people [Selwyn 1997].

Serious games, which are not only for entertainment, but also for learning and information, might be valuable for older adults by improving social, physical and psychological well-being. Serious games, which aim at supporting training and physical activity, are called "Exergames", e.g., the game application "DanceAlong" [Keyani et al. 2005] focuses on exercise for older adults. It is a valuable application to maintain people's status of health and mobility. However, the social aspect is supported merely in case of conducting the game in a group. The "Walk 2 Win" game [Mubin et al. 2008] is a combination of memory and physical activity. The older adults play it with mobile devices and try to find pairs of cards through turning them over. This turn is related to specific hotspots in a game room, which the older adults have to walk to. "Age Invaders" [Khoo et al. 2006] is an interactive game that allows older adults to play together in a physical space with grandchildren, while the children's parents can participate on the Internet. The game application focuses on improving social contacts, especially among family members and addresses also on physical, cognitive and psychological aspects. Furthermore, there are games, which try to foster memory and maintain cognitive abilities, like "Brain Age" and "Brain Age2", also known as Dr. Kawashima's Brain Training. Although they were not especially developed for older adults, they might be beneficial for them as well.

2.5.1.3 RQ4: How do end users plan/organize/conduct their travels?

Older adults' travel behavior is influenced by a variety of factors, such as education, income or gender [Jang and Ham 2009]. However, traveling might increase the quality of life and create new interest in life, or stop life from becoming boring [Lee and Tideswell 2005]. Long-distance journeys are primarily made for pleasure purposes (e.g., vacations, sightseeing excursions, for rest and relaxation, visiting friends and family or outdoor recreation), personal reasons or family businesses (e.g., shopping trips, medical visits, providing rides for others), or business reasons [Jang and Ham 2009]. The mainly used mode of transportation is the car, followed by the airplane and bus [Collia et al. 2003]. The tourism market recognized the target group of the older adults, which is steadily increasing. However, when focusing on older adults the great heterogeneity within this group has to be taken into consideration [Sniadek 2006].

2.5.1.4 RQ5: How do end users navigate indoor and outdoor?

Regarding outdoor navigation, which is finding one's way in an outdoor environment by foot, car or another means of transportation [Hagethorn 2008], many findings refer to pedestrian navigation. Thereby, wayfinding depends on the shortness of the route and the costs (e.g., avoiding dangerous situations) [Hoogendoorn and Bovy 201]. When designing for outdoor navigation different user groups and their special needs should be taken into account. Older adults for example face different physical restrictions with increasing age, such as visual impairments [Xu et al. 2010] or restrictions regarding their auditory acuity [Hagethorn 2008]. Furthermore, older adults' cognitive capabilities need to be considered, e.g., by providing a simple operation of navigation aids [Blackman et al. 2007].

A number of studies have documented an age-related decline in the human ability to orient and navigate in the environment (Driscoll et al., 2005; Kirasic, 1991; Kirasic, Allen & Haggerty, 1992; Liu et al., 2011; Moffat, Zonderman & Resnick, 2001; Wilkiniss et al., 1997). These studies consistently report that:

- Older people take longer to reach a target location and make more errors than younger individuals.
- Compared to young adults, older adults seem to require more time to form a cognitive map of the environment (Iaria et al., 2009).
- They also seem less efficient in using this cognitive map for orientation.
- Older adults encounter more difficulty than younger adults in learning and remembering routes through novel environments (Barrash, 1994; Evans et al., 1984; Head & Isom, 2010; Lipman & Caplan, 1992; Meneghetti et al., 2011).
- The same is valid for landmark selection and recognition, integration of body-centred information and forming association between landmarks and body turns (Head & Isom, 2010; Liu et al., 2011).
- Negative age effects are also observed on the ability to temporally and spatially organize relevant features and landmarks (Bruce & Herman, 1983; Lipman, 1991; Wilkiniss et al., 1997.

As a result, many older adults develop coping strategies of avoiding unfamiliar routes and places (Burns, 1999; Iaria et al., 2009). Furthermore, some older adults may restrict their daily activities or show resistance to moving in new environments (Head & Isom, 2010). For all these reasons, it is important to design environmental, visual and navigational aids for orienting in the environment.

For more details about the secondary research there is a separate report available ("State of the Art – Entrance").

3 OVERALL CONCLUSION AND IMPLICATIONS

The following subchapters provide an overview of the most important findings for each research question and the related implications for the project. The studies revealed many insights, which are the basis for the development of the system. The implications, which were derived from the findings, are either relevant for the entire project (like financial implications), or for one or several parts of the ENTRANCE system. Thus, it is indicated for each implication, what it relates to. At the end of chapter 3 (see chapter 3.7), the implications will be summarized according to the part they are referring to.

3.1 RQ1: What characterizes the end users of the system?

Table 2 provides an overview of the findings and implications for the first research question.

Study	Finding	Implication
Survey	The end users, who took part in the survey, were **between 50 and 83 years** old, were mainly **married**, having a **high school degree**, and already having **retired**. Regarding impairments and capabilities, the majority indicated to have **rather good visual, hearing and physical capabilities**, some indicated very good and some very bad. Only a very small proportion indicated to have very bad visual, hearing or physical capabilities.	General: • Although the participants indicated rather few visual, hearing or physical impairments, consider different impairments (e.g., configurable font sizes) in order to not exclude those, whose capabilities are decreasing.

Table 2: Findings and implications for RQ1: What characterizes the end users of the system?

3.2 RQ2: How do end users cope with technology? (here: computers and mobile phones)

Table 3 provides an overview of the findings and implications for the second research question.

Study	Finding	Implication
Survey	**More than three quarters** (78,4%) used a mobile phone. The majority of participants, i.e. **more than three quarters**, indicated to use a **cell phone** (78,2%), only 21,8% used a smart phone. Regarding the **frequency of use** it has to be considered that – although more than three quarters used a mobile phone – only half of them used it on a **daily basis (54,4%).** In comparison to this, the computer is used by more than **two thirds (68,7%)** on a daily basis. The following reasons might influence the frequency of use: Participants indicated that they have a landline phone or need their mobile phone only for security reasons, for example when having troubles on the road. Thus, there is no need to use the mobile phone on a daily basis. **Regularly used functions** on the **mobile phone** are **calls (100%)**, **writing and reading text messages (64%)** and **administering contacts (51,7%)**.	Mobile platform: • As only half of the participants used the mobile phone on a daily basis, the end users of the ENTRANCE system need to be motivated to nevertheless bring the mobile phone with them for indoor and outdoor navigation. • As ENTRANCE will use smartphones, ensure that the participants will adequately learn how to use it.
Survey	**Almost three quarters (**73,9%) used a computer. **Regularly used functions** are **reading and writing Emails** (92,5%) and the **Internet** (86,7%). Three quarters also used **office applications** and two thirds (68,7%) **uploaded, edited or shared photos**.	Home platform: • Take the rather good level of computer skills of the target group into account by allowing them to e.g., skip steps in the tutorial. Furthermore, the interface has to strictly follow conventions, as many users are familiar with classic interfaces.
Expert Interviews	Older adults' **computer experiences**, interests, and behaviors **vary** to a large extent, however, a tendency is visible that they are getting more interested in computers and the Internet. The more skills older adults get in using computers, the more they like using them.	Serious games: • As soon as the basic skills are available, the involvement in services like serious games might be possible, thus it is necessary to stabilize the computer skills before using the serious game.

	Women seem to be more interested in starting to use computers, while **men** use them more intensively. In couples there is often one part, who is familiar and interested. Older adults often have **habitual procedures**, which they stick to.	Tutorials: • Allow establishing habitual procedures by providing similar structures for all steps in the tutorial. • Provide also possibilities for multiple users, as couples might use the system together (one operates, the other one watches).
Expert Interviews	The **technology acceptance differs** within the group of the older adults. Regarding the **technology**, some older adults do not accept the **mouse** and **Internet**. Some do not want to use social networks as those require strong involvement. Furthermore, they do not like to download manuals for their technological devices. Regarding the **users' characteristics** the **physical impairments** might influence the technology acceptance, e.g., sight problems.	Home platform: • Try to avoid the necessity of using a mouse, by e.g., providing a touch input possibility. Home platform and mobile platform: • Provide a manual with the first steps for the hardware. • Provide accessible hard- and software.
Expert Interviews	On the one hand, older adults use computers for **social purposes**, e.g., communication via email or Skype. On the other hand, many **individual purposes** might be decisive. Many experts referred to **digital pictures**, which seem to be very important for the older adults in terms of uploading and saving, editing and sharing them. Furthermore, the older adults seem to be interested in the **Internet**, some use the computer for text editing or calculations. Furthermore, **passing** one's **time** and getting away from routines might be reasons for using computers.	General: • Address benefits regarding the system's social potential besides its main purpose of navigation and travelling. Serious games: • Try to capture the older adults' attention and directly address the possibility to spend qualified time by playing the serious game. Tutorials: • As an add-on the basic steps for uploading and saving digital pictures (about their journeys) could be established as the older adults seem to be very interested in this topic.
Expert Interviews	Two categories of problems were identified: **Problems with the technology itself.** Especially **software or system changes** are problematic, as they cause a disturbance in routines and deflect the older adults from known procedures. Furthermore, the **complexity** e.g., of menus, icons or symbols leads to loosing an overview.	Home platform and mobile platform: • Provide an interface, which allows simple procedures and ensure that in case of changes those are illustrated clearly, e.g., in form of tutorials, to avoid problems with the changes.

	Individuals' problems. A **lack of understanding** and basic skills seem to be a very important problem. In case of malfunctioning or not immediately functioning elements older adults might get **frustrated** and discouraged. Some have the perception that they would **be too old** for computers or learning to use them, and some are **overchallenged** even before they begin a class. Too **much information** from e.g., grandchildren or on the Internet might be a problem for older adults too. Several **impairments** (e.g., strokes, sight or motor problems) complicate the computer usage. Some older adults do not even take the first step of starting a computer, and others are **left alone** in case of problems, when e.g., the children configured the computer, but are not available for support afterwards.	• Minimize the complexity of menus and structures and use common labels and icons. Home platform (especially tutorials): • Clarify the labels, icons and symbols, which are used. • Think of further support possibilities if problems are not solvable.
Workshops	Participants referred to **security concerns**, e.g., when credit card information is required. Furthermore, some did not have the impression of understanding the computer. They are familiar with many elements on desktops (e.g., symbols for Internet Explorer or Windows start), but do not know all of them (e.g., the symbol for 'my documents'). They indicated to experience **fears** and **stress** when having problems (e.g., in case of **misunderstandings**, **missing orientation or necessity for quick adaptation** to changing circumstances.	Home platform and mobile platform: • Consider older adults' fears regarding the dangers of the Internet and make sure that they do not need to disclose many personal data. Home platform (especially tutorials): • Address the older adults' fears and try to make clear that it is not likely to destroy or delete anything through false usage. • Address how to use personal data safely on the Internet, e.g., for buying tickets online. • Integrate the tutorials directly into usage (e.g., by requesting the older adults to perform steps within the tutorial themselves). • Avoid pop-up information in the tutorials.
Expert Interviews	Further **fears** regarding computer usage mainly referred to **destroying**, **breaking**, or **deleting** something. Furthermore, the **dangers on the Internet** are dominant, which are increased by negative reports on the media. Another fear is **failure** while using the computer and not remembering what to do next. Some are scared of machines in general. A specific fear refers to **pop-up demands**, as the older adults think they are forced to react.	
Expert Interviews	While older adults seem **not** to use **creative approaches** when interacting with the computer, **playful content** is used, e.g., when dealing with digital pictures, games for entertainment and learning to use the mouse.	Home platform (especially tutorials) and mobile platform: • Take into account that the end users prefer to proceed in the same way by supporting them to establish one way

Survey	Regarding the four statements that were used in order to assess computer playfulness we found out that **more than the half of the participants (57,9%)** said that they act **spontaneously** when interacting with the computer and that they **have creative ideas (59,7%)** how to proceed during an interaction with a computer. **Three quarters (75,3%) indicated to interact informally**. Although it seems that the majority of the respondents used the computer playfully, a high percentage (75,9%) agreed to always proceed the same way, contradicting with the other statements.	how to handle the computer as well as the mobile phone. Tutorials and serious games: • Provide playful elements not only in the serious game, but also in the tutorials.
Expert Interviews	In general, older adults seem to need **much time and practice**, few information at one time, and only one approach to reach the goal. When training them, they need **explanations of steps and screens**, as well as basic ideas and concepts. Furthermore, the terminology and the buttons and icons need to be clarified. No theoretical training is requested, but a **demonstration** of the steps, and then performing the steps on their own while the trainer watches them. It is important that the **help is immediate** and individual in form of a coaching. Older adults need to be **reassured** and **encouraged**, and they should be facilitated a sense of achievement. The areas of interest differ to a large extent, which would be the starting point for involvement. Either the older adults ask **others** (e.g., family, friends or experts) in case of problems, questions or technical support or they refer to **materials** (e.g., self-taken notes, books or manuals). They seem to dislike support functions on the computer and support hotlines.	Tutorials: • Do not provide automatically proceeding videos or screen sequences, as the older adults have their own pace. • Provide exercises, which the older adult can try after using the tutorial and provide feedback to reassure and encourage the older adult to proceed. • Allow diversity in the tutorial to meet specific needs and wants. Home platform (especially tutorials) and mobile platform: • Provide step-by-step instructions. • Address potential problems and ensure immediate help. • Provide additional materials, e.g., paper documents or videos, which can be used also without the technology.
Expert Interviews	**Motivations** for older adults to use computers seem to be manifold. One important motivation seems to be the **contact** to “the world”, e.g., their children, friends or clubs. Sometimes they are **seeing others interacting** with technology or hearing them talking about it and get motivated thereby to use it themselves. Some feel the need, are interested and **curious** to use the computer. Being **autonomous** and **up to date** also might be motivating. Furthermore, some want to upload and administer their **digital pictures**, for which they need a computer. Some	General: • Integrate functions, which the older adults are looking for and emphasize them (e.g., working with digital pictures). • Emphasize also the voluntariness of using the system in order to avoid the impression of being obliged, forced or persuaded. • The more the system meets the older adults’ needs, the more they will like using it – this can be reached by not only

	are motivated to surf on the **Internet**, and recognizing the **benefits** might also be a motivating factor. While those aspects are rather related to the older adults' "intrinsic" motivation, there are also extrinsic motivations in form of **obligations**, **forces** and **persuasions**. On the one hand, information and access to different services is only available on the Internet. On the other hand there might be the obligation not to be cut off from families, when e.g., children urge their parents to have contact via email to overcome geographical distances. Besides the before mentioned motivations, there are further reasons for buying technologies, e.g., having a computer when the class starts, interest, curiosity and **fun**, as well as having already learned how to use it at work. Some older adults are **animated by friends or colleagues**, or buy a GPS for supporting moving around. Furthermore, it might **make everyday life easier**.	providing the objective functions, which are required, but also rather subtle benefits, like having the impression of remaining young, having fun with the system, or making everyday life easier. • Highlight the benefits and how the usage of the ENTRANCE system could contribute to satisfy the end users trendsetting tendencies.
End User Interviews	Similar motivations for participants to learn how to use technologies were also identified in the end user interviews: • **Personal interest** • Conviction of the **importance of technology** in everyday life • Being **up to date**	
Survey	**Two thirds** of the participants of the survey indicated that they were **rather or very interested** in technology. Almost **three quarters** thought that **technologies could enrich their life**, but also almost the **half** indicated to be **critical of new technologies**. In general, the participants can be referred to as **trendsetters**, i.e. they are quite up to date regarding technologies and are wiling to try out new things.	

Table 3: Findings and implications for RQ2: How do the end users cope with the system?

3.3 RQ3: Which role do epistemic values play?

Table 4 provides an overview of the findings and implications for the third research question.

Study	Finding	Implication
End User Interviews	A variety of different learning strategies was identified: Interviewees mentioned that **participating in a training course** was helpful and that they **asked somebody** in order to find out how to use the technology. Besides, **learning by doing, trying out the technology and doing everything step-by-step** were mentioned as important strategies within the learning process.	Tutorial: • As asking somebody was the most frequently mentioned learning procedure, the use of an avatar can be discussed, or as an alternative, allow people in the help function to enter questions similar to spoken questions. • Provide pictures or short videos in order to support the target group when learning how to use technologies.
Survey	Regarding the strategies in order to learn how to use technologies, **two thirds** of the participants (69,3%) indicated that they **asked somebody, more than a half** (55,4%) of them just **tried it out**, **one third** (33,7%) used **written step-by-step instructions with pictures** and **one fifth** (20,8%) stated to **attend a training course**. However, the **French participants** less often indicated to attend a training course. Although we cannot make any general conclusions there seems to be a trend that asking others and "learning by doing" seem to be important strategies. Only a minority of participants indicated to use **written step-by-step instructions without pictures** (9,9%) and **video instructions** (5,9%).	
End User Interviews	The interviewees **hardly had any experiences** with tutorials and **rarely used tutorials**. Demonstration DVDs (videos) were the only tutorials the participants used. Besides, information was gathered by reading Internet blogs in order to find appropriate solutions for a problem that might occur. Participants thought that **tutorials might be useful** if they were **easy to understand**.	

Survey	Regarding the supportiveness of certain tutorials (step-by-step instructions without pictures, step-by-step instructions with pictures, video instructions), **93%** stated that they would appraise **step-by-step instructions with pictures** as very or rather supportive. **More than the half** of the participants (56,5%), who answered to the question, indicated that they appraised **video instructions** as very supportive or rather supportive. Step-by-step instructions without pictures were appraised by 48,6% as rather or very supportive.	
Survey	The results of the survey indicate that the participants were **hardly experienced in playing serious games**. Only one third (32,4%) stated that they had every played an educational game. Although the participants were not very experienced in terms of playing educational games, **more than the half (53,6%)** stated that they would appraise serious games as either **rather or very supportive** for learning.	Serious game: • Consider that a majority of participants was not experienced in playing serious games. Thus, before providing serious games inform the end users about the goals and benefits of the serious games, and allow them to slowly reconcile them.
End User Interviews	The participants did not have **any or had only small experiences** with educational games for learning. According to this, they had **difficulties to define** the purpose and usefulness of these games. Some referred to educational games for children, which were appraised as being supportive, e.g., to learn how to read. Thus, the participants **did not regularly play** certain kinds of educational games, some mixed them up with board games (e.g., Monopoly). However, some associated educational games with (a) learning how to use technology, or (b) a game, where one has to “think about” (not necessarily played on the computer).	
Workshops	The participants wished for **brief and clear instructions**, which are presented in a sequence of **steps**. However, they emphasized that each individual interface looks differently (due to personal settings and version of software and OS), which would require an **individually adapted tutorial.**	Tutorial • Provide step-by-step instructions, which are brief and easy to understand • Consider individual preferences and needs by e.g.,

	The participants expressed confusion in terms of multiple **available paths** and wished for a tutorial, which shows the most appropriate path for an individual user. However, they emphasized the importance of **not presenting too much information**. The participants suggested providing the possibility to write **questions into the tutorial**, which are then answered in form of **step-by-step instructions**. Furthermore, they appreciated **pictures**, **large symbols, icons, buttons and texts**, as well as **speech output**.	allowing (supported) pre-settings according to the individual preferences • Provide different paths on the tutorial, which can be selected (or are adapted) to the individual users' preferences • Do not present much information at once, but in steps • Allow searching the tutorials on basis of questions • Use pictures, large and distinguishable buttons and icons, and provide the possibility for speech output
Survey	The **family** (children, grandchildren, the partner) and **friends** are those persons that are often **involved in learning** how to use technologies. For example, **two thirds** (65,1%) indicated that they **asked their children**, almost **one third** (31,1%) **their friends**, and **29,2%** pointed out that they got **support from their grandchildren**. Only a minority of participants of the survey indicated to ask professionals (e.g., experts or trainers from a computer class), whereas the French participants even less often referred to those people.	Home platform (especially tutorial), mobile platform and serious game: • Consider that the family seems to play an important role in order to learn how to use technologies by e.g., addressing them as well in the tutorial, or train them also for the mobile device. • As informal support seems to be very important (e.g., formal support might be intimidating), create the tutorial in a rather informal way, e.g., by creative, fun-evoking elements.
End User Interviews	The participants primarily referred to **their trainers** in computer classes as being involved in learning. Besides, **relatives** (e.g., granddaughter, husband) or other people, who e.g., intensively work with computers and have knowledge, were mentioned to be involved in the learning process.	

Table 4: Findings and implications for RQ3: Which role do epistemic values play?

3.4 RQ4: How do end users plan/organize/conduct their travels?

Table 5 provides an overview of the findings and implications for the fourth research question.

Study	Finding	Implication
End User Interviews	Within the interviews a **variety of different travels** the participants were interested in were identified. Most of the participants pointed out their interest in **Culture trips** (motivated by their interest in new countries and cultures and historic places) and **city trips**. Thereby, they perceive a personal benefit of getting away, experiencing new things and extending the personal horizon and sense of life. **Other interests** that were pointed out are: • Travelling to relax (together with the family) • **Short trips** (e.g. going for skiing) • **Taking a cruise** • **Camping** • Traveling as a **backpacker** • **Senior travels**	Serious game and mobile platform: • As culture trips seem to be very important for the end users, integrate information on sights in the navigation.
Survey	**Culture trips** are the kinds of travels the majority of participants indicated to be interested in (74,5 %). Besides, **wellness trips** were mentioned by one third of the participants (35,3%), **combined trips** by one quarter (25,5%) and **adventure trips** by more than one fifth (22,5%). Although a high percentage of participants indicated that they are interested in wellness travels, there seems to be a trend that they are also interested in being active when travelling.	
End User Interviews	The following routines were identified: • Traveling **to the same place** as it is less stressful when they know where to go	Serious game and mobile platform: • As the older adults experienced it as less stressful when they knew where to go, the route should be indicated in

	• **Using certain communication possibilities** (mobile phone, email) in order to stay in contact with the family at home and to know that everything is alright) • Using a certain **travel guide**.	advance to provide a feeling of safety.
Survey	Regarding the organization of the travels, we found out that **more than the half** of the participants (55,6%) **still books their journeys via a local travel** agency. But there also seems to be a **trend regarding booking via the Internet.** More than one third (39,4%) indicated to book via the Internet. One quarter (26,3%) stated to book via the telephone and a minority of respondents (14,1%) did not book in advance.	Home platform and serious game: • Support the end users in booking online by providing them with an easy and secure access and by guiding them through the booking process.
End User Interviews	**TV**, the **Computer** (Internet) and the **telephone** are technologies participants used when **organizing their travels**: • **TV** (for watching travel reports) • **Computer/Internet** (to book the hotel or a flight, or to look up further information on the internet) • The **telephone** (to book something (e.g., to call the hotel) The **mobile phone** (alarm clock and stay in contact with the family), **audio guides** and **GPS** were the only technologies participants used **during the travels**.	Mobile platform: • As the mobile phone is already used during travels, there is great potential for the mobile navigation aid to be used during travels. However, as they have not been used for navigation on-site so far, the benefits need to be clear for the older adults to use it.
End User Interviews	The findings revealed that **events are organized either "on-site" or in advance**. Planning/organizing on-site • Buy/reserve tickets at an office • Buy tickets at the ticket machine Planning/organizing in advance • Buy tickets at the internet	Mobile platform: • The mobile phone could support the older adults in organizing their events both on-site (through navigation to the nearest ticket office of machine) and in advance.

Table 5: Findings and implications for RQ4: How do end users plan/organize/conduct their travels?

3.5 RQ5: How do end users navigate indoor and outdoor?

Table 6 provides an overview of the findings and implications for the fifth research question.

Study	Finding	Implication
End User Interviews	Most of the participants used **(road) maps** in order to find the right way. They adopted rather ego-centered strategies than allo-centered strategies. Further strategies: • Using **maps** • Using **navigation systems** in the car (GPS) • **Asking people** • Using the **signs on the street** • Looking up **information on the Internet** • Using the **iPhone** The interview question gave rather general insights into navigation strategies. It seems to be important **to consider if one is traveling by car/with the bike or as a pedestrian.** Moreover, the place where participants are or go might be decisive for the strategy that is used.	Serious game and mobile platform: • Consider complying with very different levels of pre-knowledge regarding navigation systems. • Provide a stable and clear navigation aid in order to allow the older adults to trust in it • Stick to familiar elements, which might increase trust
End User Interviews	**GPS, Computer (Internet)** and the **iPhone** were technologies participants used for navigation: • In terms of the use of navigation systems (GPS) in the car (e.g., if the city map is not sufficient) diverse attitudes were identified: (1) It was considered as useful, e.g. if the city map is not sufficient; (2) It was not considered as useful as the system did not show the right way. • Looking up information beforehand on the Internet • Using a Smart Phone • Some did not use any technology for navigation	

Survey	Regarding navigation systems, **half of the respondents** indicated to use one. It was mainly used for **in the car** (92,5%) or **route planning** (73,6%). Other functions were only used by a minority, e.g., localizing points of interest (24,5%), or gathering information about the traffic situation (13,2%).	
Workshops	The participants already used **technical support** for route planning and navigation, e.g., GPS in navigation systems and online maps, one participant even navigated with her/his smart phone. However, the participants did **not fully trust** in the digital navigation aids.	
End User Interviews	**Problems in outdoor navigation:** • Finding the right street in an unknown city • Somebody describes the way to a certain destination but the person has problems to remember the description of the way (s/he would have needed some paper to write down all the information) **Problems in indoor navigation**: • Problems at an underground car park (could not remember the color and number of the parking place) • Finding the right train in an unknown city	Serious game and mobile platform: • Provide the most relevant information in a detailed way • Provide the possibility to gather more detailed information if required • Use signage, which is clear and understandable easily, and refer to the signage on-site • Provide the required information (e.g., signs) closely to the target on maps
Workshops	The participants indicated **many problems** when navigating **outdoor**, e.g., • finding the direction • finding cars in car parks • having too few or too many signs available • wrongly placed signs (e.g., too close to a decision point like a crossroad) • unclear descriptions • wrong information or a lack of information points • remembering the correct information Therefore, they wished for support through **clear and understandable signs and descriptions**, as well as enough information points.	

	In **indoor** navigation, they missed the possibility to ask at information points, and referred to unclear signage, e.g., when signs are too far away from the target. For finding the right way indoor the participants wished for detailed information about the way and the target (e.g., direction, floor, department, etc.).	
Workshops	The participants required many **kinds of information** in **outdoor** navigation, e.g., distance, time needed and directions. They orientate themselves by • the **streetscape** (e.g., streets and places, crossroads or traffic lights) • **landmarks** (e.g., buildings, parking places or cemeteries) and navigate on basis of • **directions** (e.g., in front of you, to your right/left) • **actions** (e.g., turn right/left, go straight ahead or follow the street) In **indoor** navigation, the participants also mentioned several **reference points** for orientation and navigation (e.g., localizing the entrance, elevators, pictures, etc.). They also appreciated **detailed information** about the target and the way to it.	Serious game and mobile platform: • Use landmarks and reference points as far as possible • Provide recognizable details of the landmarks and reference points, if they are not unique in the environment (indoor or outdoor) • Present directions as well as actions • Describe the target in advance in order to help the older adults in recognizing it • Consider that street maps are still common strategies when going by car, although technologies are used as navigation support. Thus, the navigation support should comply with traditional maps as far as possible to allow the end users to recognize familiar elements. • As asking other people is a common navigation strategy, the system should integrate help functions, e.g., with the symbol of information counters or offices.
Survey	According to the means of transportation (going by car, walking) different navigation aids are used. When **going by car**, almost **three quarters** of the participants indicated to **use a street map**. Besides, technology also seems to play an important role when navigating by car. Almost **half of the participants (44,2%)** indicated to **use a navigation system** and almost **one third (31,7%)** stated that they **used print-outs of maps** they had looked up before on the Internet. We can therefore conclude that street maps are still important but there is a trend in using technologies (navigation system, computer) when navigating by car. Strategies, such as asking other people (15,4%) or navigating by means of landmarks (13,5%) seem to be not that important when going by car.	

	When walking**, maps and asking other people** seem to be common strategies in order to navigate. **59,6%** of the respondents indicated that they **used maps** and more than **half of the respondents (54,8%)** indicated that they **asked other people**. **Orientation by landmarks** seems to be also a **common strategy**, as it was mentioned by more than a third of the respondents (38,5%). Only a minority (18,3%) indicated that they used print-outs of maps they had beforehand looked up on the Internet and only 13,5% stated to use a navigation system. **Using landmarks (55,1%)** and **using street maps (46,9%)** are common strategies when navigating in **familiar outdoor environments**, for example in one's hometown.	
End User Interviews	The most common strategies we identified when participants were orientating themselves inside are **1) looking for any kinds of signs** and **2) asking other people** (e.g., pedestrians or people at the reception or at an information center). Furthermore, the participants suggested to **memorize "goal points**" (e.g., at the underground car park try to memorize the number and where the exit is).	Serious game and mobile platform: • Consider that information boards and signs are the most common used navigation aids when navigating in familiar as well as unfamiliar indoor environments. By using the same signs in the system, which are in the physical indoor environment, the end users will be supported best, and provide those information, which is usually provided on information boards.
Survey	In **unfamiliar outdoor environments**, besides **using street maps (74,8%)** the **navigation system (36,4%), asking other people (35,5%)** and **using landmarks (33,6%)** are common strategies. Regarding the **indoor navigation** the majority of the respondents **(85,5%)** usually **used information boards** or **paid attention to signs (70%).** There seems to be hardly any difference regarding the strategies when navigating in familiar indoor environments or unfamiliar indoor environments. **Two thirds (67,9%)** indicated to **use information boards** when navigating in **familiar indoor environments** and **three thirds (67,9%) used sings.** More than **three quarter** (**81,5%) used information boards in unfamiliar** indoor environments and more than **three third (69,4%) used signs**.	

Table 6: Findings and implications for RQ5: How do end users navigate indoor and outdoor?

3.6 RQ6: In how far are end users willing to pay for a system like Entrance?

Finally, Table 7 provides an overview of the findings and implications for the sixth research question.

Study	Finding	Implication
Survey	Receiving **additional information regarding points of interest** on a smart phone (**54,5%**), being **provided with navigation advice** (**59,8%**) and **saving GPS data of taken pictures** (**54%**) were those services the majority of the respondents indicated to be rather interested or interested in. Only **37,7%** indicated that they would be rather interested or interested in booking events on a smart phone.	General: • Provide the end users with different functions, inform them about and let them experience the possibilities and benefits so that they can choose their favorite functions.
Survey	**48,5%** indicated that they would **prefer a free service**, augmented with advertisements and only 19,6% stated that they would prefer paying by themselves. The amount, which the participants would be **willing to pay** for the trip assistance service, ranged from **not being willing to spend any money** to **spending up to 50€ per month**.	General: • Try to find a possibility to provide a (rather) free service.

Table 7: Findings and implications for RQ6: In how far are end users willing to pay for a system like Entrance?

The above-presented findings allowed deriving several implications for the development in the Entrance project. As the Entrance system consists of different parts, the implications furthermore address specific parts, or the system in general. In the following chapter (chapter 3.7), the implications are summarized for each part of the system to give an overview of what needs to be considered in the development.

3.7 Summarized Implications

In the following, the general implications are summarized for the Entrance system. Afterwards, specific implications for the individual parts of the system are presented (home platform and tutorial, mobile platform, serious game).

General:

- Although the participants indicated rather few visual, hearing or physical impairments, consider different impairments (e.g., configurable font sizes) in order to not exclude those, whose capabilities are decreasing.
- Address the benefits regarding the social potential of using the system, besides its main purposes of navigation and travelling.
- Integrate functions, which the older adults are looking for and emphasize them (e.g., working with digital pictures).
- Emphasize also the voluntariness of using the system in order to avoid the impression of being obliged, forced or persuaded.
- The more the system meets the older adults' needs, the more they will like using it – this can be reached by not only providing the objective functions, which are required, but also rather subtle benefits, like having the impression of remaining young, having fun with the system, or making everyday life easier.
- Provide the end users with different functions, inform them about and let them experience the possibilities and benefits so that they can choose their favorite functions.
- Try to find a possibility to provide a (rather) free service.

Home platform and tutorial:

- Take the rather good level of computer skills of the target group into account by allowing them to e.g., skip steps in the tutorial. Furthermore, the interface has to strictly follow conventions, as many users are familiar with classic interfaces.
- Try to avoid the necessity of using a mouse, by e.g., providing a touch input possibility.
- Clarify the labels, icons and symbols, which are used.
- Think of further support possibilities if problems are not solvable.
- Allow establishing habitual procedures by providing similar structures for all steps in the tutorial.
- Provide also possibilities for multiple users, as couples might use the system together (one operates, the other one watches).
- As an add-on the basic steps for uploading and saving digital pictures (about their journeys) could be established as the older adults seem to be very interested in this topic.
- Address the older adults' fears and try to make clear that it is not likely to destroy or delete anything through false usage.
- Address how to use personal data safely on the Internet, e.g., for buying tickets online.
- Integrate the tutorials directly into usage (e.g., by requesting the older adults to perform steps within the tutorial themselves).
- Avoid pop-up information in the tutorials.
- Do not provide automatically proceeding videos or screen sequences, as the older adults have their own pace.

- Provide exercises, which the older adult can try after using the tutorial and provide feedback to reassure and encourage the older adult to proceed.
- Allow diversity in the tutorial to meet specific needs and wants.
- As asking somebody was the most frequently mentioned learning procedure, the use of an avatar can be discussed, or as an alternative, allow people in the help function to enter questions similar to spoken questions.
- Provide pictures or short videos in order to support the target group when learning how to use technologies.
- Provide step-by-step instructions, which are brief and easy to understand
- Consider individual preferences and needs by e.g., allowing (supported) pre-settings according to the individual preferences
- Provide different paths on the tutorial, which can be selected (or are adapted) to the individual users' preferences
- Do not present much information at once, but in steps
- Allow searching the tutorials on basis of questions
- Use pictures, large and distinguishable buttons and icons, and provide the possibility for speech output

Mobile platform:

- As only half of the participants used the mobile phone on a daily basis, the end users of the ENTRANCE system need to be motivated to nevertheless bring the mobile phone with them for indoor and outdoor navigation.
- As ENTRANCE will use smartphones, ensure that the participants will adequately learn how to use it.
- As the mobile phone is already used during travels, there is great potential for the mobile navigation aid to be used during travels. However, as they have not been used for navigation on-site so far, the benefits need to be clear for the older adults to use it.
- The mobile phone could support the older adults in organizing their events both on-site (through navigation to the nearest ticket office of machine) and in advance.

Home platform and mobile platform:

- Provide a manual with the first steps for the hardware.
- Provide accessible hard- and software.
- Provide an interface, which allows simple procedures and ensure that in case of changes those are illustrated clearly, e.g., in form of tutorials, to avoid problems with the changes.
- Minimize the complexity of menus and structures and use common labels and icons.
- Consider older adults' fears regarding the dangers of the Internet and make sure that they do not need to disclose many personal data.
- Take into account that the end users prefer to proceed in the same way by supporting them to establish one way how to handle the computer as well as the mobile phone.
- Provide step-by-step instructions.
- Address potential problems and ensure immediate help.
- Provide additional materials, e.g., paper documents or videos, which can be used also without the technology.

Serious games:

- As soon as the basic skills are available, the involvement in services like serious games might be possible, thus it is necessary to stabilize the computer skills before using the serious game.
- Try to capture the older adults' attention and directly address the possibility to spend qualified time by playing the serious game.
- Consider that a majority of participants was not experienced in playing serious games. Thus, before providing serious games inform the end users about the goals and benefits of the serious games, and allow them to slowly reconcile them.

Serious game and mobile platform:

- As culture trips seem to be very important for the end users, integrate information on sights in the navigation.
- As the older adults experienced it as less stressful when they knew where to go, the route should be indicated in advance to provide a feeling of safety.
- Support the end users in booking online by providing them with an easy and secure access and by guiding them through the booking process.
- Consider complying with very different levels of pre-knowledge regarding navigation systems.
- Provide a stable and clear navigation aid in order to allow the older adults to trust in it.
- Stick to familiar elements, which might increase trust.
- Provide the most relevant information in a detailed way.
- Provide the possibility to gather more detailed information if required.
- Use signage, which is clear and understandable easily, and refer to the signage on-site.
- Provide the required information (e.g., signs) closely to the target on maps.
- Use landmarks and reference points as far as possible.
- Provide recognizable details of the landmarks and reference points, if they are not unique in the environment (indoor or outdoor).
- Present directions as well as actions.
- Describe the target in advance in order to help the older adults in recognizing it
- Consider that street maps are still common strategies when going by car, although technologies are used as navigation support. Thus, the navigation support should comply with traditional maps as far as possible to allow the end users to recognize familiar elements.
- As asking other people is a common navigation strategy, the system should integrate help functions, e.g., with the symbol of information counters or offices.
- Consider that information boards and signs are the most common used navigation aids when navigating in familiar as well as unfamiliar indoor environments. By using the same signs in the system, which are in the physical indoor environment, the end users will be supported best, and provide those information, which is usually provided on information boards.

Tutorials and serious games:

- Provide playful elements not only in the serious game, but also in the tutorials.

Home platform (especially tutorial), mobile platform and serious game:

- Consider that the family seems to play an important role in order to learn how to use technologies by e.g., addressing them as well in the tutorial, or train them also for the mobile device.
- As informal support seems to be very important (e.g., formal support might be intimidating), create the tutorial in a rather informal way, e.g., by creative, fun-evoking elements.

After having presented the implications, which were derived from the findings in the requirements analysis, the final outcome of this analysis will be presented in the next chapter (chapter 4), i.e. the personas for the Entrance project.

4 PERSONAS

The results from the requirements analysis were finally the basis for the creation of personas. Personas are fictive users, which represent potential users (see e.g., Cooper 2007). Thereby, not an average user is presented, but one with specific characteristics of the target group.

For the creation of the persona, we used a combined approach by integrating both quantitative and qualitative data (see Moser et al. 2012 for an overview of the different persona creation approaches). The first step was a cluster analysis of all relevant aspects for the persona (i.e. behavioral variables), in this case the visual and hearing capabilities, the attitude towards technologies, mobile phone, computer, and navigation system usage, trendsetting behavior, experiences with serious games, and interest in navigation support. From those data, two clusters were extracted in SPSS 20.0.0. Those two clusters were then used as the basis for the creation of two personas. Afterwards, the qualitative data (i.e. interview transcripts) were used and also clustered according to the outcome of the quantitative clusters for enriching the personas with narrative information. Finally, the names and occupation was added as purely fictive data. Those were sensitively chosen according to their existence in the project partners' country of origin, so that they were appropriate and understandable for all partners. The final personas (George and Luise) are illustrated in Figure 17 and Figure 18.

Figure 17: Persona 1 – George

Figure 18: Persona 2 – Luise

After finishing the personas, they were presented to end users for evaluation. Therefore, they were distributed on the homepage of ALab, whose end users could recognize themselves in the two personas. Also 50plus indicated that the personas would illustrate their end users well.

5 THE CAPABILITY APROACH AND ASSOCIATED PRELIMINARY DESIGN AND EVALUATION GUIDELINES

Information technologies such as those developed in the ENTRANCE project create new spaces of action and experience for older users. However, they also raise many **ethical questions** such as the impact of indoor sensing and user logging analysis on privacy, and the use of computer games and the potential risk of isolation. As suggested by Coeckelbergh (2011), one way of analysing and evaluating what information technologies do and might do to humans and society is using the **capability approach** as a normative-ethical framework. This approach helps us to reflect on how information technologies might remove human capabilities or add new capabilities, i.e. to highlight how technologies shape what people are or will actually be able to do.

The **capability approach** (also referred to as the **capabilities approach**) was initially developed in the 1980s as an approach to welfare economics (Sen, 1985). In this approach, Amartya Sen, Nobel prize in Economics, brought together a number of ideas that were hitherto inadequately formulated in traditional approaches to the economics of welfare. The core focus of the capability approach is on what individuals are able to do (i.e., capable of). Initially, Sen argued for five components in assessing capabilities:

- The importance of real freedoms in the assessment of a person's advantage;
- Individual differences in the ability to transform resources into valuable activities;
- The multivariate nature of activities giving rise to happiness;
- A balance of materialistic and nonmaterialistic factors in evaluating human welfare;
- Concern for the distribution of opportunities within society.

Later, in collaboration with Martha Nussbaum, a political philosopher, Sen tried to establish the capabilities approach as a paradigm for human development. This work has attracted considerable interest from researchers in many academic fields, ranging from development studies and welfare economics to education and philosophy. The major reason for this is most probably the universal nature and importance of development and competences/capabilities improvement.

We think the capability approach, and namely its version presented in Nussbaum's works (e.g. Nussbaum & Sen 1993; Nussbaum, 2000, 2006) can be a valuable framework for the design and development of technologies for users with specific needs because of its strong **focus on development and dignity**. According to Nussbaum (2006) the concept of **dignity** can even be considered as a basis for capabilities. Dignity requires 'an appropriate threshold level' (Nussbaum, op. cit., p. 75) of the following 'central' human capabilities (as summarized in Coeckelbergh, 2011):

- **Life**: 'Being able to live to the end of a human life of normal length; not dying prematurely, or before one's life is so reduced as to be not worth living'.
- **Bodily Health:** includes nourishment and shelter.
- **Bodily Integrity**: free movement, freedom from sexual assault.
- Being able to use your **senses**, **imagination**, and **thought**; experiencing and producing culture, freedom of expression and freedom of religion.
- **Emotions**: being able to have attachments to things and people.
- Practical Reason: being able to engage in a conception of the good and critical reflection about the planning of one's life.
- **Affiliation**: being able to live with and toward others, imagine the other, and respect the other.

- **Other species**: being able to live with concern to animals, plants and nature.
- **Play**: being able to laugh, to play, to enjoy recreational activities.
- **Control over one's environment**: political choice and participation, being able to hold property, being able to work as a human being in mutual recognition.

This list of capabilities shows that they can be understood **not only as minimal dignity and development requirements**, but rather as formulations of the ethical 'maximum', i.e. they can be interpreted as what **good life** or human flourishment requires. Nussbaum gives an example in this direction showing that after having identified a threshold, 'we seek a higher threshold, the level above which not just mere human life, but good life, becomes possible' (Nussbaum 2006, p. 181). If we transpose this to technology, we will move **from accessibility and usability requirements** (threshold 1) to **requirements oriented towards the enhancement of users' competences/capabilities** (threshold 2). This first and quite schematic transposition is explained by the fact that there is limited research on the use of the capability approach for technology design and evaluation. An interest to this topic in the field of ICT has only recently emerged (e.g. Coeckelbergh, 2011; Johnstone, 2007; Oosterlaken & van den Hoven, 2011; Wresch, 2007; Zeng, 2007).

As mentioned by Coeckelbergh (op. cit.), the usual way of defining the relation between capabilities and technology is to think of technologies as means, instruments or resources to reach the aims (capabilities). However, there should also be "conversion factors", i.e. factors and elements which help users transform a resource into a "functioning", a useful characteristic. More concretely, the idea is that just having access to a PC or a mobile phone is not enough to provide, for instance, one's capability for affiliation. Instead, what matters is that **the person can actually and effectively use the technology** for that kind of activities.

Another idea inspired by Nussbaum's capabilities and important for the design of technologies for people with special needs is **human diversity**, a core theme within the capability approach (Toboso, 2011). Thus, Toboso (op. cit.) asserts that ''a tradition of 'standard' design for users — anchored in some hypothetical parameters of "normality"— still prevails in product and services development. However, in order to expand the capabilities of all people in their full diversity, more attention should be paid to ''universal design'' and **user participation** in the design of ICT. To facilitate this change, Toboso proposes to replace the idea of disability, ''with its negative connotations'', with the more general concept of ''functional diversity''— ''describing the reality of persons who have the potential to access the same functionings as other people but in a different way".

Such a vision is very close to the vision of **user empowerment** (e.g. Johnstone, 2007; Mendes-Filho, Tan & Mills, 2010). The idea of **user empowerment** has emerged with the wide-spreading of user-generated content on the Web. User-generated content constitutes the data, information, or media produced by the general public (rather than professionals) on the internet (Arriga & Levina, 2008). In all user-generated content activities, the user is the central point being **not only consumer**, but **also content contributor** playing simultaneously the roles of producers as well as consumers of the Internet content. This fact **gives users unprecedented power** through the web, allowing them to exchange opinions or experiences with others from all over the world (Litvin, Goldsmith & Pan, 2008), enabling electronic word-of-mouth communication through bulleting boards and news groups (Niininen, Buhalis & March, 2007). In general, **empowerment has two meaning**s. First, it can be considered in terms of authority delegation and decentralisation of decision-making power (Burke, 1986) and, second, as a motivational construct (Thomas & Velthouse, 1990). In the light of the capability approach and regarding technologies for users with special needs, including older adults, a view of **empowerment** as a **motivational construct** is particularly valuable, since it can be considered an **enabling process** or a **conversion factor**. This enabling process is based on and **can be measured by** the following four cognitive dimensions (Spreitzer, 1995):

- **Meaning:** defined as the value of a work goal or purpose, judged in relation to an individual's own ideals (Thomas & Velthouse, 1990).
- **Competence:** defined as the individual's belief in his/her capability to perform activities with skill (Gist, 1987).
- **Self-determination**: defined as the individual's autonomy in having choice in initiating and regulating work behaviours and processes, such as making decisions about work methods, pace and effort (Spector, 1986).
- **Impact**: defined as the degree to which an individual can influence strategic, administrative, or operating outcomes at work (Ashforth, 1989).

These dimensions have been validated across multiple sectors and organizations and have been found to be stable over time and reliably measured (Liden, Wayne, & Sparrowe, 2000). In the ENTRANCE project, we will try to transpose them in guidelines for the design and evaluation of HCI. For this, we will use the validated instruments (i.e. questionnaires) developed in industrial psychology and management science (e.g. Spreitzer, 1995).

On the basis of these assumptions, concepts and theoretical constructs, we have done a preliminary aggregation of design principles and evaluation guidelines which can be associated to the capability approach and Nussbaum's principles presented before. These design principles, taken from literature in the field of universal design and user empowerment are summarized in the table below.

Nussbaum's principle	Associated design principles	Associated design guidelines
Bodily integrity: "being able to move freely from place to place; having one's bodily boundaries treated as sovereign	**Cause no harm**: The system should maintain or improve the **safety** of the service user above other quality of life needs. **Low physical effort:** The design can be used efficiently and comfortably and with a minimum of fatigue. **Size and space for approach and use**: Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility (Connell et al., 1997; Gray et al., 2012)	The interface shall be operable by users with limited manual dexterity. Design considerations must include: 1) size of interaction components; 2) time-delays of input sequences (i.e. before system prompts for completion of input); 3) Timely and adequate tactile feedback. The interface shall allow the user to maintain a neutral body position. The interface shall require the use of reasonable operating forces. The interface shall minimize sustained physical effort. The interfaces shall accommodate to variations in hand and grip size. The interface shall provide adequate space for the use of assistive devices or personal assistance. The interface must require mobility and agility that is with the users ability. The mobile interface should be easy to carry around.

Senses: Being able to use the senses…Being able to have pleasurable experiences, and to avoid non-necessary pain	**Perceptible Information**: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities (Connell et al., 1997; Rimmer, 2007). **Sensory Engagement**: The interface should be based on the principle of sensory affordance, i.e. on design features that help, aid, support, facilitate, or enable the user in sensing (e.g., seeing, hearing, feeling, Hartson, 2003). **Pleasure**: The interface should provide the user with emotional and hedonic benefits (Jordan, 1998).	Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information. Every action should be acknowledged in some way (visible, audible or tactile) by the system in a way the user expects. Each action should be reversible. Actions which are not reversible should be confirmed by the user. This encourages the user to explore, knowing that no 'damage' can be done accidentally. Provide adequate contrast between essential information and its surroundings. Maximize "legibility" of essential information. Small text can be difficult to make out and, in this sense avoided, because of age-related decline in visual acuity means that. Poor colour contrast should also be avoided. The interface should be accessible by hearing impaired users. It is highly likely that a significant proportion of the target users of this system will have experienced some age-related decline in hearing. Provide compatibility with a variety of techniques or devices used by people with sensory limitations. Provide adequate auditory quality of audio information. Provide adequate quality of haptic, tactile and force interaction. Aim for subtractive design, i.e. - reduce clutter by eliminating any visual/audio/tactile element that does not contribute directly to communication. Sensory hierarchy - by understanding the importance of users' tasks, establish a sensory hierarchy. An important object can be given extra sensory prominence.

		Affordance should be given special attention, i.e. users should easily determine the action that should be taken with an object. A way of providing good affordance is using real-world analogies or mimicing real world objects. Design a system that can be considered successful even if user engagement is low or nil. While it is likely that many users will wish to interact with the system proactively, this should not be critical to the 'success' of the system (Rimmer, 2007).
Imagination : "Being able to use imagination and thought in connection with experiencing and producing self-expressive works and events of one's own choice…" "Being able to laugh, to play, to enjoy recreational activities" "Being able to have attachments to things and persons outside themselves…To love, to grieve, to experience longing, gratitude, and justified anger".	**Compelling content:** The design should be based on a tension between the user's base knowledge and the gap between the knowledge or skill to be developed. Such tension fosters a sense of curiosity, challenge and imagination (McGinnis et al., 2008). **Designing for pleasure**: The design should be target "physio-pleasure,", "socio-pleasure", "psycho-pleasure" and 'ideo-pleasure" (Jordan, 1997).	The system should offer a learning environment in a story format, 'using fantasy to provoke curiosity, allowing the learner choice and control, and providing opportunities for creativity' (Becta, 2001). Offer usability plus reliability to prevent frustration from undermining the fun. Engage users with fun features (Scollan, 2007). It should be grounded on a context relevant to older adults' lifelong learning (Brownfield & Vik, 1983; Griffiths, 1996; Prensky, 2001). Keep the start up simple: target audience thresholds of interest and concentration may be low (Oyen & Bebko, 1996; Becta, 2001). Provide short modules (to maximise the likelihood of satisfactory outcomes) but also make available longer sessions (to encourage involvement). Engage players in intrinsic learning via multimedia features that complement each other. Vary the nature of challenge, means of scoring, etc, and provide different levels of challenge. The interface should feel good in the hand. The interface should be operable without causing

		damage to fingernails. The interface should have aesthetic looks. The interface should convey user's socio-economic & cultural status. The interface should convey user's interests and should be competitive amongst one's friend's circles. The interface should provide possibilities for personalization.
Thought : Being able to use one's mind in ways protected by guarantees of freedom of expression…	**Authentic learning experience:** The content of the learning game should be linked to users' prior knowledge and be relevant to their everyday lives and careers (McGinnis et al., 2008). **Active user's participation:** In educational games, active participation is the key, as the player seeks to understand and control his/her play cycle while challenged by some form of opposition (Fabricatore, 2000). Learning is usually incidental, or intentional only in respect of becoming a better gamer.	Ensure that the game structure suits the learning objectives (e.g. when designing for memory recall, avoid incorporation of multiple goals and other distracting components that can inhibit performance). Embed learning opportunities in the game structure and make links to external material parts of the game (Prensky, 2001). The interface, especially the learning game, should encourage both individual accountability and productive interdependence (Becta, 2001). Keep the games and instructions fairly simple to minimize levels of frustration and time spent learning the rules of the game. Ensure a clear route through the software, and constant access to information that aids navigation. Consider target audience needs when determining the pace and duration of the game. Keep the start up simple: target audience thresholds of interest and concentration may be low (Oyen & Bebko, 1996; Becta, 2001). Ensure that frequent play enables progression through different skills levels and skills sets and that there is a means of recording progress if required. Integrate feedback and

		debriefing into the game, encouraging a focus on process as well as on performance measures achieved. Different kinds of feedback should be provided (i.e. system-initiated feedback as well as opportunities to access debrief or real-world feedback). Afford the chance to correct and learn from errors so that learners can improve performance and achieve goals. Encourage reflection, evaluation and participative learning via opportunities for discussion, annotation and input of resources. Support and prompts should be provided to facilitate effective discussion (Mitchell & Savill-Smith, 2004).
Affiliation: Being able to live for and toward others, to recognize and show concern for other human beings, to engage in various forms of social interaction…	**Social identity:** The content interface should encourage learning achieved through social interaction and collaboration, as the sense of belonging to a social group improves motivation and effective learning overall. **User-generated content:** The interface should provide users with the opportunity to generate data, information, or media, which can be shared with others (McGinnis et al., 2008).	Cater for users' affective and social needs, with opportunities for interaction with human as well as virtual agents (peers, teachers, mentors, Mitchell & Savill-Smith, 2004). Provide the possibility of interaction with "warm experts" (Bakardjieva, 2005). These are friends or family members who know how to handle the applications and devices. They are vital to understanding how to work with them. Put special emphasis on the usability of the tools for content creation (Karahasanovic et al., 2009). Encourage the use and sharing of collective memories (Karahasanovic et al., 2009).
Control over one's environment: Being able to participate effectively in political choices that govern one's life…	**Empowerment:** The user should be in control of their user experience while in a supportive, collaborative environment (McGinnis et al., 2008)	Do not store or transmit personal information without user awareness and autorisation Use procedures to ensure anonymity Use secure means to store and transmit authorized personal information

		Avoid unnecessary automatic or external decisions by the system Inform the user about decisions taken automatically or externally Allow intervention only by authorized personnel Use location systems only with stakeholders' awareness and consent Delete location information after convenient usage and do not record it unnecessarily Use discrete location devices Use tagging devices only with strict ethical considerations (Abascal & Nicolle, 2005)

Table 8: Nussbaum's principles and associated design guidelines

These design principles and guidelines will be further refined, organized in a usable form and tested by HCI experts and experts working with older users.

6 SUMMARY AND FUTURE STEPS

The requirements analysis revealed many insights on the users' characteristics, their usage of technology, the role of epistemic values, their traveling and navigation behaviour, as well as financial issues.

Among many other findings, we identified our target group being between 50 and 83 years old, being mainly married and retired, with rather good visual, hearing, and physical capabilities.

Many of the participants in our studies used a mobile phone, however, they rarely indicated to use smartphones. The majority of the participants also used a computer for a variety of functions, from emails and the Internet to working with digital pictures. They often have habitual procedures when using digital technology, and then are strongly affected by system changes or updates. Furthermore, there seem to be many fears and problems in using computers, like the fear of destroying or deleting something, a problem due to a missing understanding of the basic principles, or being overchallenged. Nevertheless, the participants expressed motivations to learn how to use computers, for example to be autonomous, to be up to date, or being curious. Some also indicated obligations and forces to not be left behind when not using digital technology.

Regarding curiosity, interest and learning, the target group seems to be very curious and interested. However, it is assumed that some might need much time and practice in their own pace, as well as embracing explanations and step-by-step instructions. The majority of participants indicated to cope with new technology through learning by doing, trying out the technology, or doing everything step-by-step. Furthermore, other people are often referred to for help, from family and friends to professionals (like experts or trainers from computer classes). In reference to educational games or tutorial, most of the participants were not familiar with them and could not appraise the usefulness of these applications.

In terms of traveling the participants indicated many different interests, mainly in culture and city trips. Other interests were journeys for relaxation, short trips, cruises, etc. Among the few routines that were found, some travel to the same place every time, use certain communication possibilities, or a specific travel guide. For booking journeys many indicated to book them via their local travel agency, some book on the Internet, and a few on the telephone.

For navigation, the participants indicated to primarily use maps, navigation systems, or they ask other people for help. GPS, the computer or a smartphone were also mentioned, but not very often. Some found them useful, others expressed mistrust in the technological support. Furthermore, several outdoor navigation problems were identified, such as finding the right street in an unknown city, remembering a way description, having insufficient signs, or a lack of information points. In indoor environments, the participants indicated to sometimes have problems in finding the car again in the car park, to have unclear signage, or a missing possibility to ask someone. When going by car, the majority of participants indicated to use a street map for navigation, when walking maps or asking other people seem to be dominant. In familiar outdoor environments, primarily landmarks and maps are used for navigation, whereas in unfamiliar outdoor environments street maps, navigation system, and asking others were mentioned frequently. Both in familiar and unfamiliar indoor environments, information boards were mentioned most often, followed by signs.

The participants finally indicated interest in several features of smartphones, like being provided with navigation advice, additional information about points of interest, or saving GPS data of taken pictures. Nevertheless, many participants requested a free service, which is augmented with advertisements rather than paying themselves.

From all the gathered data, implications were derived for the different parts of the Entrance system, as well as for the integrated system. Furthermore, the data was clustered for creating personas. Finally, two personas were created (Luise and George), which represent the end users for the Entrance project.

The findings from the requirements analysis and the derived implications were presented to the consortium of Entrance, and the two personas were introduced to them. The technical development in WP3 (home platform), WP4 (mobile platform), and WP5 (serious game) is consequently based on the findings of this analysis, and will be subsequently evaluated in regards to the users' needs and wishes. The personas will be the foundation for the recruitment of end users for the evaluation and for the evaluation foci. Furthermore, all requirements will be transferred into the evaluation framework in order to not lose focus of the targeted end users of the Entrance system.

As for the design guidelines based on the capability framework, a preliminary version was discussed with the ENTRANCE partners participating in WP2. These guidelines will be improved, tested by two HCI experts, further improved and then tested by other HCI experts and experts in gerontology. The stabilized version of the guidelines will be presented in the D2.2 (due M19).

REFERENCES

Abascal, J. & Nicolle, C. (2005). Moving towards inclusive design guidelines for socially and ethically aware HCI. Interacting with Computers 17, 484-505.

Ashforth, B. E. (1989). The experience of powerlessness in organizations. Organizational behavior and human decision processes, 43, 207-242.

Arriaga, M. & Levina, N. (2008) "Social dynamics in online cultural fields." In Proceedings of the International Conference on Information Systems, 14-17 December, Paris, France.

Bakardjieva, M. (2005). Internet society: the internet in everyday life. London, Thousand Oaks, New Delhi: Sage.

Barrash, J. (1994). Age-related decline in route learning ability. Developmental Neuropsychology, 10, 189-201.

Beck, E., Obrist, M., Bernhaupt, R., Tscheligi, M. (2008): Instant Card Technique: How and Why to apply in User-Centered Design. Proceedings of the Participatory Design Conference. 162-165.

Becta. (2001). Computer games in education project. Available at http://www.becta.org.uk/research/research.cfm?section=1&id=2826.

Brownfield S, Vik G (1983). Teaching basic skills with computer games. Training and Developmental Journal, 37, 52–56.

Bruce, P.R. & Herman, J.F. (1983). Spatial knowledge of young and elderly adults: scene recognition from familiar and novel perspectives. Experimental Aging Research, 9, 169-173.

Burke, W.W. (1986). Leadership as empowering others. In S. Srivastva (Ed.), Executive power (pp. 51-77). San Francisco: Jossey-Bass.

Burns, P.C. (1999). Navigation and the mobility of older drivers. The journals of gerontology Series B Psychological sciences and social sciences, 54, 49-55.

Coeckelbergh, M. (2011). Human development or human enhancement? A methodological reflection on capabilites and the evaluation of information technologies. Ethics and Information Technologies, 13, 81-92.

Collia, D.V., Sharp, J., and Giesbrecht, L. 2003. The 2001 national household travel survey: A look into the travel patterns of older Americans. In Journal of Safety Research 34(4), Elsevier, 461-470.

Conger, J. & Kanungo, R. (1988). The empowerment process: Integrating theory and practice. Academy of Management Review, 13, 471-482.

Connell, B. R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., et al. (1997). The principles of universal design. www.ncsu.edu/project/design-projects/udi/center-for-universal-design/the-principles-of-universal-design/

Cooper, A., Reimann, R., and Cronin, D. 2007. About face 3: the essentials of interaction design. Wiley-India.

Driscoll, I., Hamilton, D. A., Yeo, R. A., Brooks, W. M., Sutherland, R.J. (2005). Virtual navigation in humans: the impact of age, sex, and hormones on place learning. Hormones & Behaviour, 4, 326–335.

Empirica 2008. Assessment of the Senior Market for ICT. SeniorWatch 2 – Progress and Devel-opments. Available on: http://ec.europa.eu/information_society/newsroom/cf/itemlongdetail.cfm?item_id=4286

Evans, G.W., Brennan, P.L., Skorpanich, M.A. & Held, D. (1984). Cognitive mapping and elderly adults: verbal and location memory for urban landmarks. Journal of Gerontology, 452 – 457.

Fabricatore, C. (2000). Learning and videogames: an unexploited synergy. Available at www.learndev.org/dl/FabricatoreAECT2000.PDF

Flick, U. 2011. Das Episodische Interview. In. Flick, U., Oelerich, G., Otto, H-U. Empirische Forschung und Soziale Arbeit. Wiesbaden. 273-280.

Gist, M. (1987). Self-efficacy: Implications for organizational behavior and human resource management. Academy of Management Review, 12, 472-485.

Gray, J., Zimmerman, J. & Rimmer, J. (2012). Built environment instruments for walkability, bikeability, and recreation: disability and universal design relevant? Disability & Health Journal. 5, 87-101.

Griffiths, M. D. (1996). Computer game playing in children and adolescents: a review of the literature. In T. Gill (ed.) Electronic children: how children are responding to the information revolution. London: National Children's Bureau, 41–58.

Hagethorn, F.N., Kröse, B.J.A., de Greef, P., and Helmer, M.E. 2008. Creating Design Guidelines for a Navigational Aid for Mild Dementia Pedestrians. In Ambient Intelligence, Springer, 276-289.

Hartson, H. R. (2003). Cognitive, physical, sensory, and functional affordances in interaction design. Behavior and Information Technology, 22, 315-338.

Hasselhorn, M., Titz, C., and Behrendt, J. 2009. Kognitive und motivationale Veränderungen im Alter. In Staudinger, U.M., and Heidemeier, H. (Ed.). Altern, Bildung und lebenslanges Lernen. Wissenschaftliche Verlagsgesellschaft, Stuttgart, 105-118.

Head, D. & Isom, M. (2010). Age effects on wayfinding and route learning skills. Behavioural Brain Research, 209, 49-58.

Hoogendoorn, S.P., and Bovy, P.H.L. 2004. Pedestrian route-choice and activity scheduling theory and models. In Transportation Research Part B: Methodological 38,2, Elsevier, 169-190.

Iaria, G., Palermob, L., Committeri, G., & Bartona, J.J.S. (2009). Age differences in the formation and use of cognitive maps. Behavioural Brain Research, 196, 187-191.

Jang, S.C.S., and Ham, S. 2009. A double-hurdle analysis of travel expenditure: Baby boomer seniors versus older seniors. In Tourism Management 30(3), Elsevier, 372-380.

Jarvis, P. 2010. Adult Education and Lifelong Learning. Theory and practice. Forth Edition. Routledge, London and New York.

Jenkings, A. 2011. Participation in learning and wellbeing among older adults. In International Journal of Lifelong Learning 30(3), Taylor & Frances, 403-420.

Johnstone, J. (2007). Technology as empowerment: A capability approach to computer ethics. Ethics and Information Technology, 9, 73–87.

Jordan, P. W. (1998). Human factors for pleasure in product use. Applied Ergonomics, 29, 25-33.

Karahasanovic, A., Brandtzæg, P.B., Heim, J., Lüders, M., Vermeir, L. , Pierson, J., Lievens, B., Vanattenhoven, J. & Jans, G. (2009). Co-creation and user-generated content – elderly people's user requirements. Journal of Computers in Human Behaviour, 25, 655-678.

Keyani, P., Hsieh, G., Mutlu, B., Esterday, M., Forlizzi, J. 2005. DanceAlong: Supporting positive social exchange and exercise for the elderly through dance. In: CHI 2005, April 2-7, 2005, Portland, Oregon, USA

Khoo, E. T., Lee, S.P., Cheok, A.D., Kodagoda, S., Zhou, Y., Toh, G.S. 2006. Age Invaders: So-cial and physical inter-generational family entertainment. In: CHI 2006: Interactivity. PDA`s, Space Invaders, and Chickens: Mobility and Collaboration, April 22-27, 2006, Montreal, Quebec, Canada, 243-246

Kirasic, K. C. (1991). Spatial cognition and behavior in young and elderly adults: implications for learning new environments. Psychology of Aging, 6, 10–18.

Kirasic, K.C., Allen, G.L. & Haggerty, D (1992). Age-related differences in adults' macrospatial cognitive processes. Experimental Aging Research, 18, 33–39.

Kvale, S. 2007. Doing Interviews. SAGE Qualitative Research Kit. London [u.a.]

Lee, S.H., and Tideswell, C. 2005. Understanding attitudes towards leisure travel and the constraints faced by senior Koreans. In Journal of Vacation Marketing 11(3), Sage Publications, 249-263.

Liden, R. C., Wayne, S. J. & Sparrowe, R. T. (2000). An examination of the mediating role of psychological empowerment on the relations between the job, interpersonal relationships, and work outcomes. Journal of Applied Psychology, 85, 407-416.

Lipman, P.D. & Caplan, L.J. (1992). Adult age differences in memory for routes: effects of instruction and spatial diagram. Psychology of Aging, 7, 435-442.

Litvin, S.W., Goldsmith, R.E. & Pan, B (2008). Electronic word-of-mouth in hospitality and tourism management. Tourism Management, 29, 458-468.

Liu A.L., Hile, H., Kautz, H., Borriello, G., Brown, P.A., Harniss, M. & Johnson, K. (2008). Indoor wayfinding: developing a functional interface for individuals with cognitive impairments. Disability and Rehabilitation: Assistive Technology, 3, 69-81.

Mao, J.Y., Vredenburg, K., Smith, P.W., and Carey, T. 2001. User-centered design methods in practice: a survey of the state of the art. Proc. 2001 conference of the Centre for Advanced Studies on Collaborative Research. IBM Press.

McGinnis P.L., Gentry, J. & Gao, T. (2008). The impact of flow and communitas on enduring involvement in extended service encounters. Journal of Service Research 11, 74-90.

Mendes-Filho, L., Tan, F. B. & Mills, A. (2010). 48P. User-generated content and perceived control: A pilot study of empowering consumer decision making. In Proceedings of CONF-IRM 2010. Paper 20.

Meneghetti, C., Fiore, F., Borella, E. & De Beni, R. (2011). Learning a map of environment: the role of visuo-spatial abilities in young and older adults. Applied Cognitive Psychology, in press.

Mitchell, A. & Savill-Smith, C. (2004). The use of computer and video games for learning. A review of the literature, LSDA, London.

Moffat, S.D., Zonderman, A.B., & Resnick, S.M. (2001). Age differences in spatial memory in a virtual environment navigation task. Neurobiology of Aging, 22, 87–96.

Moser, C., Fuchsberger, V., Neureiter, K., Sellner, W., and Tscheligi, M. 2012. Revisiting personas: the making-of for special user groups. In CHI EA 2012, 53-468.

Mubin, O., Shahid, S., Al Mahmud, A. 2008. Walk 2 Win: Towards Designing a Mobile Game for Elderly's Social Engagement. In Proceedings of the 22nd Annual British HCI Conference. Vol. II, 11-14.

Niininen, O., Buhalis, D. & March, R. (2007) Customer empowerment in tourism through Consumer Centric Marketing (CCM), Qualitative Marketing Research – An International Journal, 10, 3.

Nussbaum, M. C. (2006). Frontiers of justice: Disability, nationality, species membership. Cambridge, MA and London: The Belknap Press of 416 Harvard University Press.

Nussbaum, M. C. (2000). Women and human development: The capabilities approach. Cambridge: Cambridge University Press.

Nussbaum, M. C., & Sen, A. (Eds.). (1993). The quality of life. Oxford: Clarendon Press.

Oosterlaken, I. & van den Hoven, J. (2011). Editorial: ICT and the capability approach. Ethics in Information Technologies, 13, 65-67.

Oyen, A-S. & Bebko, J.M. (1996) The effects of computer games and lesson contexts on children's mnemonic strategies. Journal of Experimental Child Psychology, 62, 173-189.

Prensky, M. (2001). Digital game-based learning. New York: McGraw-Hill.

Scollan, R. (2007). Designing a pleasurable interface: Emotion in Human-Computer Interaction. Research paper, University of Baltimore.

Selwyn, N. 1997. Teaching Information Technology to the 'Computer Shy': a theoretical perspective on a practical problem. In Journal of Vocational Education and Training 49(3), Taylor & Francis,395-408.

Selwyn, N., Gorard, S., Furlong, J. 2004. Adults' Use of ICTs for Learning: reducing or increasing educational inequalitities? In Journal of Vocational Education and Training 56(2), Taylor & Francis, 269-290.

Sen, Amartya K. (1985). Commodities and Capabilities. Oxford: Oxford University Press.

Śniadek, J. 2006. Age of seniors - a challenge for tourism and leisure industry. In Studies in Physical Culture and Tourism 13, 103-105.

Spector, P. E. (1986). Perceived control by employees: A meta-analysis of studies concerning autonomy and participation at work. Human Relations, 39, 1005-1016.

Spreitzer, G. M. (1995). Psychological empowerment in the workplace: Dimensions, measurement, and validation. Academy of Management Journal, 38, 1442-1465.

Thomas, K.W. & Velthouse, B.A. (1990). Cognitive elements of empowerment: An 'interpretive' model of intrinsic task motivation. The Academy of Management Review, 15, 666-681.

Toboso, M. (2011) Rethinking disability in Amartya Sen's approach: ICT and equality of opportunity. Ethics and Information Technology, 13, 107-118.

Wilkniss, S.M., Jones, M.G., Korol, D.L., Gold, P. E. & Manning, C.A. (1997). Age-related differences in an ecologically based study of route learning. Psychology of Aging, 12, 372–375.

Wresch, W. (2007). 500 million missing web sites: Amartya Sen's capability approach and measures of technological deprivation in developing countries. In E. Rooksby & J. Weckert (Eds.), Information technology and social justice. Hershey: Information Science Publishing.

Xu, J., Fang, Z.G., Dong, D.H., and Zhou, F. 2010. An Outdoor Navigation Aid System for the Visually Impaired. In Industrial Engineering and Engineering Management (IEEM), 2010 IEEE International Conference, IEEE, 2435-2439.

Zheng, Y. (2007). Exploring the value of the capability approach for E-development. Paper presented at the 9th International Conference on Social Implications of Computers in Developing Countries. Sao Paulo, Brazil.