

Definition of lab trial protocol

Project identification

Project Number	Memento
Duration	30 months
Coordinator	Jon Arambarri
Coordinator Institution	VirtualWare
Website	www.memento-project.eu

Document Identification

Deliverable ID	D7.1
Release number/date	V0.7 / 09.08.2018
Checked and released by	UNIPG
Work Status	Draft version
Review Status	

Key Information from “Description of Work”

Deliverable Description	
Dissemination Level	
Deliverable Type	Report
Original due date	

Authorship & Reviewer Information

Editor	x
Partners contributing	x
Reviewed by	

Release History

Release Nr	Date	Author(s)	Release Description/Changes made
V01	07.07.2018	Martina Pigliautile (UNIPG)	Table of Content first version
V02	20.07.2018	Elisabeth Stögmann, Theresa König	Add executive summary, conclusion and text to chapter 1+3
V03	02.08.2018	Martina Pigliautile (UNIPG)	Revise the document
V04	03.08.2018	Theresa König (MUV)	Add tasks to 3.1.3
V05	03.08.2018	Martina Pigliautile (UNIPG)	Revise the document Insert comments
V06	08.08.2018	Martina Pigliautile (UNIPG)	Revise the document
V07	08.08.2018	Martina Pigliautile (UNIPG)	Update the document based on Bidaidek suggestions

Memento Consortium

Partner 1	VirtualWare 2007 S.A.
Contact Person	Jon Arambarri / jarambarri@virtualwaregroup.com
Partner 2	AIT Austrian Institute of Technology GmbH
Contact Person	Sten Hanke / sten.hanke@ait.ac.at
Partner 3	BKM Design Studio
Contact Person	Stefan Moritsch / moritsch@bkm-format.com
Partner 4	Medical University of Vienna
Contact Person	Elisabeth Stögmann / elisabeth.stoegmann@meduniwien.ac.at
Partner 5	WeTouch
Contact Person	Günter Kubicki / guenter.kubicki@wetouch.at
Partner 6	Integris
Contact Person	Teresa Pizzuti / teresa.pizzuti@integris.it
Partner 7	Università di Perugia
Contact Person	Patrizie Mecocci / patrizia.mecocci@unipg.it
Partner 8	Bidaideak – Sociedad Vasca de Minusvalidos
Contact Person	Oscar Aguila / oscar.bidaideak@gmail.com
Partner 9	Citard Services Ltd.
Contact Person	Eleni Christodoulou / cseleni@citard-serv.com

Table of Contents

Definition of lab trial protocol.....	1
Abbreviations.....	7
Executive Summary	8
1. About this Document	9
1.1. Role of the Deliverable.....	9
1.2. Relationship to other Memento Deliverables	9
1.3. Structure of this Document	10
2. Overall research design	10
2.1. Introduction.....	10
2.1.1. Evaluation system	14
2.1.2. Evaluation techniques in people with dementia	15
2.1.3. Recruitment criteria for Lab and Field trials	16
2.2. Strategy for the Lab Trial evaluation system	17
2.2.1. Data collection	19
2.2.3. Setting	20
2.2.4. Investigators and roles	20
3. Lab trial preparation.....	20
3.1. Aim.....	20
3.2. Methods.....	20
3.2.1. Users	20
3.2.2. Materials	21
3.2.3. Tasks	21

3.2.4.	Methods: Lab Trial Evaluation user experience	23
4.	Conclusion	24
	List of Figures	25
	List of Tables	26
	References	27
	Appendix 30	

Abbreviations

Abbrev.	Description
MUV	Medical University of Vienna
UNIPG	University of Perugia
MCI	Mild Cognitive Impairment
AD	Alzheimer's Disease
NIA	National Institute on Aging-Alzheimer's Association
CRI	Cognitive Reserve Index
ADL	Activities of daily living
IADL	Instrumental activities of daily living
UX	User's experience
UES	Usability Engagement Scale

Executive Summary

In order to enable a smooth process of lab and field trials, an overall research design has to be developed in advance. This includes the definition of a general research question and determining the criteria for end user recruitment. Likewise, the procedure of involving the end-users in the trials has to be planned in detail and the final evaluation method has to be specified.

For the lab trial, suitable end users have to be recruited and test scenarios have to be described thoroughly. Furthermore, test materials and processes have to be prepared and the evaluation process has to be defined.

Thus, the whole procedure, how the MEMENTO system is tested by the participants of the lab trials, will be exactly prepared and described.

1. About this Document

The memento project mission is to improve the quality of life of people in early and middle stage of dementia, by supporting the management of daily activities with a technical device named MEMENTO.

Overall research questions are specified in this document. Criteria of end-users for recruitment of end-users are defined precisely. Trial setting with a fully functioning prototype and a testing situation of the prototype for the end user is defined here.

The lab study will assess the current implementation of MEMENTO by the technical partners. Clinical investigators will assess practicability and user friendliness of the MEMENTO device for the end users. The clinical investigator should focus on assessing the user acceptability, user engagement and the user perception.

1.1. Role of the Deliverable

The main role of this deliverable is to develop the lab trial phase of the evaluation of MEMENTO system, in order to test the user experience.

1.2. Relationship to other Memento Deliverables

Deliverable	Relation
D2.2 – End users requirements	Users description
D2.3 – Definition of Use Cases and Scenarios	The findings of this deliverable feed into the creation of use cases and scenarios, and from there into the development of a first prototype.
D3.1 – Specification of Hardware Design and User Interface	Describes the user interface design for the software components.
D4.1 A – Hardware Specification	Specifies the hardware design and user experience.

D5.1 A – Memento software specification	Describe the software
D6.3 - Test plan for continuous expert tests	Ensure that the implemented features are properly tested

Table 1. Relationship to other Memento Deliverables

1.3. Structure of this Document

This document describes the strategy for the Memento system evaluation. Starting from a user center perspective the evaluation procedure is divided into two phases: lab and field trial.

The first part of the document proposes a description of the research design from a theoretical point of view and participants' recruitment criteria description. The second part comprehends the Lab Trials description from a methodological point of view. Conclusions are given.

2. Overall research design

2.1. Introduction

The WP7's objective is the evaluation of the MEMENTO system from a user experience prospective.

User experience helps to design more usable products and user interfaces and the acceptance of the system is an important test results in an iterative evaluation process.

According to Wilkinson and Gandhi (2015) (Figure 1), a strategy for the MEMENTO evaluation system was elaborated. The following domains are the most cited themes influential to the adoption, usability and success of assistive technologies in older users.

The aim is to develop an evaluation strategy able to cover all domains defined in Table 1.

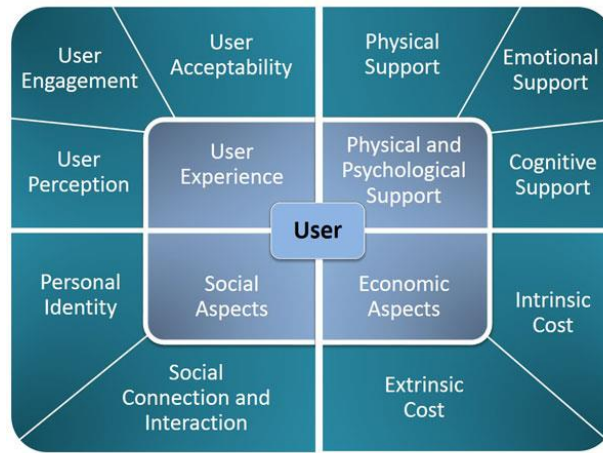


Figure 1 Older people's needs as a Framework for Design Thinking (Wilkinson and Gandhi, 2015).

<p>USER EXPERIENCE</p> <p>Interaction designers aim to create interactive technologies that are enjoyable, pleasurable, motivating, and satisfying. These goals are largely dependent upon users' acceptance of technology, their perceptions of the technology, and their level of engagement with it.</p>	<p>USER ACCEPTABILITY</p>	<p>Acceptability is one of the fundamental requirements of technology stated by older users. The assumption that older adults would use an assistive technology purely because they need it is misguided. However, an interdisciplinary approach toward needs-assessment and design, understanding the user physically and psychologically, and designing accordingly, decreases the risk of subsequent equipment abandonment.</p>
	<p>USER ENGAGEMENT</p>	<p>User engagement can involve physical interaction, social interaction, and activities in terms of entertainment and leisure. Feedback is an important factor for successful engagement, and a lack of feedback may directly contribute to delayed or impaired rates of technology adoption and increased rates of disengagement with technology.</p>

mə'mento
 keeps my mind

	<p>USER PERCEPTION</p>	<p>User perception involves the ideas users gain about how devices work and are manipulated purely through their design. If users' ideas of how interaction is likely to occur based on the product design do not transfer well and the design misleads them, it is likely to result in poor performance and product abandonment.</p>
<p>PHYSICAL AND PSYCHOLOGICAL SUPPORTS Elderly and older adults often require guidance, physical support, health monitoring, and the scheduling of their medicines in their daily life. Therefore, assistive technologies need to provide support and address older user's individual physical, physiological, and psychological requirements.</p>	<p>PHYSICAL SUPPORT</p>	<p>Problems with health can be critical for older people as it restricts them from moving freely in the environment. Older adults possessing limited physical capabilities often experience difficulties in conducting daily activities, particularly regarding self-care and mobility. Effective assistive technology has the potential to enhance their ability to perform daily tasks and transform their mobility.</p>
	<p>EMOTIONAL SUPPORT</p>	<p>Some older adults feel using assistive technology is seen as a symbol of dependence and frailness, and felt stigmatized by association. They expressed that a solution that merely addressed a clinical need was not enough; any feature or functionality also had to "look good." However, well-designed mobility aids can bolster feelings of safety and self-worth by consequently increasing personal independence. This, in turn, can help older adults maintain access to networks of emotional support and facilitate their independence.</p>

mə'mento
 keeps my mind

	COGNITIVE SUPPORT	Assistive technology can support memory loss and dementia by providing support for decision making and activity reminders, and support tasks requiring higher cognitive function. Older adults with cognitive impairments also perform memory tasks more effectively by using external memory aids, so the use of appropriately developed assistive technology in such situations should be encouraged.
<p>ECONOMIC ASPECTS</p> <p>Less financially affluent individuals often avoid using assistive technologies for activities of daily living due to the perceived costs of intervention. Innovation is not the only motivation for design: economic and social issues should also provide an impetus for the design and development of assistive technology.</p>	INTRINSIC COST	The direct financial cost to the user of assistive technology can be high, and this adversely affects rates of user adoption. Designing assistive technology for a more widespread market may assist in reducing the economic barriers and stigma associated with assistive technology use
	EXTRINSIC COST	Long term healthcare for the elderly is resource intensive and expenditure in this area is high. However, appropriately designed assistive technologies can reduce healthcare costs, including costs related to institutional care and in-home nursing. They can reduce healthcare practitioner visits as well as slow the rate of decline in patient capability.
<p>SOCIAL ASPECTS</p> <p>An older adult's quality of life is particularly dependent on a network of social relationships. Failure to consider social aspects can</p>	SOCIAL CONNECTION AND INTERACTION	It has been argued that technological, economic, and social changes have increased social isolation, and that assistive technologies for the elderly have overlooked this issue. Assistive technologies can be designed to broaden social

<p>result in the failure of innovative technologies. Well-designed technologies can enhance older adults' feelings of social connection and reinforce their sense of self-identity.</p>		<p>connectivity functions. Helping users move more easily outside the home, and building connectivity into the design, allows users to maintain access to social networks and encourages both physical and virtual interaction.</p>
	<p>PERSONAL IDENTITY</p>	<p>One aspect of personal identity is derived from an individual understanding their precise location within a group or network of relationships. Assistive devices have been viewed by users as a threat to this identity. However, technology designed with enhanced understanding of users' needs and requirements may help users to reestablish a sense of normality, personal comfort, and individual identity.</p>

Table 2 Created from Wilkinson and Gandhi (2015). Term's definitions

In order to consider all domains, the evaluation system is divided in two phases: lab trial and field trial.

2.1.1. Evaluation system

The first trial phase evaluation will be organized in lab trials.

The lab trials will be executed by using functioning prototype 1 in mobile usability lab environment. Evaluation techniques such as observation, thinking aloud, interview and questionnaires will take place.

The second trial phase will be organized in form of field trials where representative end-users can use the system in daily use. Therefore, the optimized functioning prototype 2 will be installed in the end-user environments. Users will receive the MEMENTO system as “system in a box“ to evaluate it.

The two phases allow to evaluate all the aspects considered in user experience.

While the lab trial phase focuses on the user experience (upper left part of the figure 2), the field trial addresses specially physical and psychological, social and economic aspects.

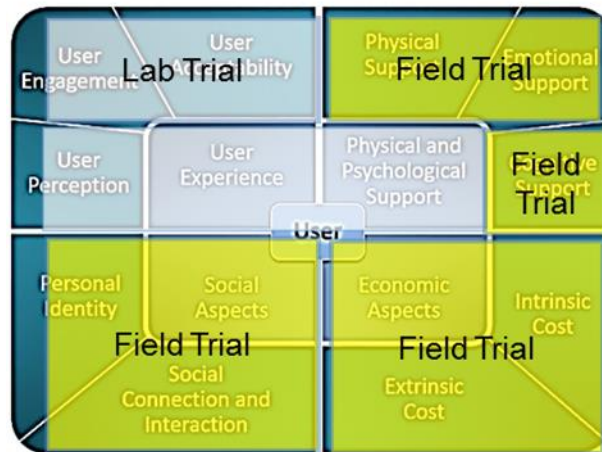


Figure 2. Lab trial and field trial evaluation

2.1.2. Evaluation techniques in people with dementia

User experience is very important in order to obtain data on users' acceptance, perception and engagement.

A recent study on usability assessment in people with cognitive impairment concludes that observational (i.e. think-aloud protocol) and questionnaire-based approaches are not suitable for people with dementia (Gibson et al., 2016).

Task completion-based approaches based on metrics like task completion rate or task completion time, are considered to be better.

In particular, think aloud requires facilitator and/or caregiver interaction and management, while questionnaires are not reliable because the post-test surveys require reflection: a function easily compromised by memory and attention deficits.

However, think-aloud protocol has been used to study usability of different products designed for older adults and caregivers (Chung et al., 2015; Papachristou et al., 2018).

In the panorama' questionnaires, the System Usability Scale (Brooke, 1996) is a common measure of usability (i.e. Vallejo et al., 2015) and the ICF based Usability Scale has been also proposed.

According to our evaluation strategy proposal, the User Engagement Scale (O'Brien and Toms, 2010), a measure of engagement, seems to be an interesting tools.

2.1.3. Recruitment criteria for Lab and Field trials

According to D2.2 deliverable, clinical partners shared and identified the following inclusion criteria resumed in Table 1.

All patients will be treated at the dementia outpatient clinic MUV, Bidaidek, UNIPG.

Written informed consent provided by the patient or their legal guardian.

Diagnosis of MCI due to AD or mild AD according to the NIA AA criteria (Mc Khann et al.) with an MMSE 28 – 24 (inclusive).

Additional information should be collected about each patient and approximate stratification of parameters mentioned below should be taken in consideration:

- Cognitive reserve established with CRI: the concept of "reserve" has been used to explain the difference between individuals in their capacity to cope with or compensate for pathology. Considering the importance of the cognitive reserve, the Cognitive Reserve Index (CRI, Nucci et al., 2012) will be taken into account. The CRI is established by a semi-structured interview (see appendix) that gathers and quantifies all the experiences that a person has acquired throughout their life. The CRI questionnaire includes demographic data and 20 items grouped into three sections: CRI-Education, CRI-Working Activities and CRI-Leisure Time Activities.
- Technical proficiency patient: we define the technical proficiency as the skills required to operate an information system (i.e., a hardware/software solution). Our ambition is to test the MEMENTO device with end users having different levels of technical skills.
- Technical proficiency caregiver: the technical skills of the caregiver are important for supporting the patient and using

various software solutions of the MEMENTO system (i.e., accessing the calendar from another technical device).

- Age and Sex: both aspects should be considered in terms of the general attitude towards technology, design requirements and needs regarding the individual life phase.
- Caregiver status: the caregiver status is relevant regarding their availability in daily live. Subjects living with their spouse or in a family context, as well as subjects living alone with an informal supervisor (son/daughter/niece/...) will be included in the trial.

Table 2. PATIENT SELECTION CRITERIA LAB and FIELDTRIAL (according to Perugia's meeting)	
Diagnosis of MCI due to AD and mild AD (amnestic type) (McKhan criteria)	
Flexibility in ADL and IADL Index of Independence in Katz Index of Activities of Daily Living) (ADL) equals 5 or 6 (occasional incontinence is admitted)	
Lawton - Brody Instrumental Activities Of Daily Living Scale (I.A.D.L.) equal or below 5	
<ul style="list-style-type: none"> a. subjects must be able to dial a few well-known numbers on the cellular phone b. subjects that are able to get around (or travel) outside of the home (alone or accompanied) 	
no history of traumatic brain injury; no history of neurological disorders; no clinical evidence or history of mental disorders ; pharmacological well-compensated hypertension, diabetes, and anxious/depressive symptoms	
corrected sensory deficits	
primary school as minimal education level	
Cognitive deficits documented as follows	
correct total score Mini-Mental State Examination (MMSE)	RANGE 24-28
Different levels of cognitive reserve (CRIq scores)	
Different levels of Technical Proficiency	
subjects who living alone with an informal supervisor (son/daughter/niece) or subjects who live with their spouse	

Table 3. Recruitment criteria

2.2. Strategy for the Lab Trial evaluation system

The main objective of this phase is presenting testing with real users during the prototype development phase using a Living Usability Labs methodology (Dias et al., 2015).

This approach is user centered and it is useful to develop, exploit, experiment and assess ideas, scenarios, concepts and products in real-life utilization.

The Lab Trials phase focuses on the user experience with the aim to create an enjoyable, pleasurable, motivating and satisfying system. In particular, acceptability, engagement and perception are evaluated.

The acceptability is a fundamental aspect to take into consideration in order to reduce the risk of abandonment. It is guaranteed by an interdisciplinary approach that carefully considers the older people's perspective, designing the system according to their physically and psychologically needs.

At the same time, it is important to collect feedback on user engagement of the technology in physical and social interactions, leisure and entertainment activities. A greater engagement reduces the risk of delayed or impaired rates of technology adoption.

O'Braian and Tom (2008) developed an operational definition of engagement to identify the key components that make up engagement. They defined the engagement as a quality of user experience characterized by attributes of challenge, positive affect, endurance, aesthetic and sensory appeal, attention, feedback, variety/novelty, interactivity, and perceived user control.

Finally, it is very important to consider the perception: users' ideas of how interaction is likely to occur based on the product design.

At the same time, following the Quesenbery's (2014) framework for assessing a design in terms of user experience, five dimensions are considered:

- **Effective:** to consider how effective the system is at delivering content in its entirety and whether all goals are met.
- **Efficient:** to assess how fast can the aims of the system be met.
- **Engaging:** to evaluate the system' ability to attract users' attention and provides a congenial experience.
- **Error Tolerant:** to cope with errors possibilities.
- **Easy to Learn:** to ensure the system is understood, there should be support in place for new users, which does not interfere with regular users. New functions should be accompanied by easily accessible documentation where necessary too.

These dimensions seem interesting in order to define potential interviews or the task completion-based approaches.

2.2.1. Data collection

All data will be collected through direct observation and questionnaires. For direct observation, a set of tasks was developed by meetings between technical and clinical partners.

From this, an observation form was specifically developed to collect measures such as task execution time, task completion rate (and how easily the participant completed the task), assistances during task completion, and the participant's visible emotional state. All tasks were decomposed into activities that will be evaluated separately.

Demographic and clinical data, and information on technical proficiency will be collected.

The User Engagement Scale is administered after the completion of the tasks.

2.2.2. Protocol

Testing will be performed according to studies on usability in people with dementia (Dias et al., 2015), considering a task-oriented analysis in which participants will be asked to perform predefined tasks. Before the test, all participants will be asked to sign a Consent Form and then to fill out the demographic questionnaire together with technology-related questions.

Afterwards, a facilitator presents Memento to the participants explaining the main functionalities of the products.

At the beginning of the task-related phase, the facilitator explains to the participants that he/she should accomplish tasks with the Memento without time limits. Tasks are given in a sequential manner, in random order, in a way that only after completing one task and filling the questionnaires related to that task, the facilitator presents a new task. Each task will be read aloud by the facilitator and also delivered to the participant written on paper. The usability test will be finished when all tasks were completed by the participant.

A clinical investigator should focus on assessing the user acceptability, user engagement and the user perception. All comments from patients and caregivers should be noted by the investigator in a semi-structured way (e.g. each use case should be commented by the patient and the caregiver). Evaluation techniques such as observation, talking and questionnaires will take place.

2.2.3. Setting

The lab trials will take place in the study center in the presence of one person from the clinical team and, if necessary, one person from the technical team.

Each patient and (if available) their caregiver will be given enough time (1-2 hours each) to test the device, in particular to try out all developed use cases.

2.2.4. Investigators and roles

The technical partner should focus on detection of open UX issues and challenges for the system by means of a thorough test in a collaborative setup. The UX requirements and the Usability Heuristics proposed by Nielsen (1995) will be taken into consideration. Quesenbery's criteria closely relate to the ten heuristics proposed by Nielsen (1995), emphasizing the importance of error tolerance and user engagement. The lab trial will contribute to evaluate the integrity and completeness of the functionalities of the MEMENTO system.

3. Lab trial preparation

3.1. Aim

The aim of the lab trial preparation is to optimize time of execution and evaluation of the process and to provide the basis for an effective testing of the MEMENTO device by the end users.

3.2. Methods

3.2.1. Users

Users (persons with dementia and their caregivers) will be interviewed and will interact with the system for about 1-2 hours. The interviews are semi-directive (open questions) and will be held in co-discovery (participants will be grouped by couple).

The functionalities of the system to assess are presented to the users in different scenarios and each user has time to discover them before being questioned and before the MEMENTO interaction.

5 patients (and whenever possible their caregivers) are planned to be included in the lab trials in each clinical centre (MUV, UNIPG, Bidaidek, selected according to recruited criteria mentioned above.

3.2.2. Materials

One functioning prototype of the MEMENTO system is planned to be available in each center to evaluate and test with the selected end users in the course of the lab trials. The developed use case scenarios, as defined in deliverable D2.3, should be ready for verification on the device at that time.

3.2.3. Tasks

With reference to the Use Case Scenarios defined in D2.3, at least two use cases will be tested and discussed in the course of the lab trials. Tasks to be performed by the users and caregivers will be defined for each use case in addition to general tasks, such as creating caregiver and patient accounts.

The final tasks will be determined in September when Memento's features of prototype 1 will be more defined. However, the following examples give an idea of the experimental tests.

1) Use Cases Section Information

Medication: Correct medication is a challenge, it might not be taken at the right time, is forgotten or the dose is incorrect.

Task Patient:

"During your last medical appointment the doctor prescribed you a new medication. Use the medication reminder application of the main device to ensure that you do not forget to take the medicine. Your task is to create a new medication reminder."

Task Caregiver:

"Imagine that the time of medication intake has to be changed for one drug. Use the caregiver interface to view the medication and edit the time of the reminder."

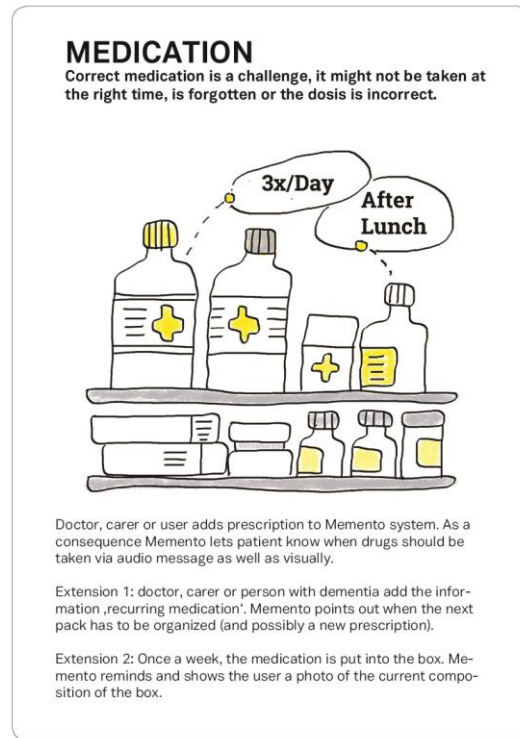


Figure 3. Medication scenario

2) Use Cases Section Organisation

Appointments: End User forgets appointments.

Task Patient:

“Imagine that you just made a doctor’s appointment. Use the main device to schedule the appointment on November 19th and set a reminder. Also check the calendar on the all-day device.”

Task Caregiver

“You run across a friend on the street and you decide to meet for a cup of coffee the other day. Add a new appointment to the calendar on the caregiver interface and set a reminder.”

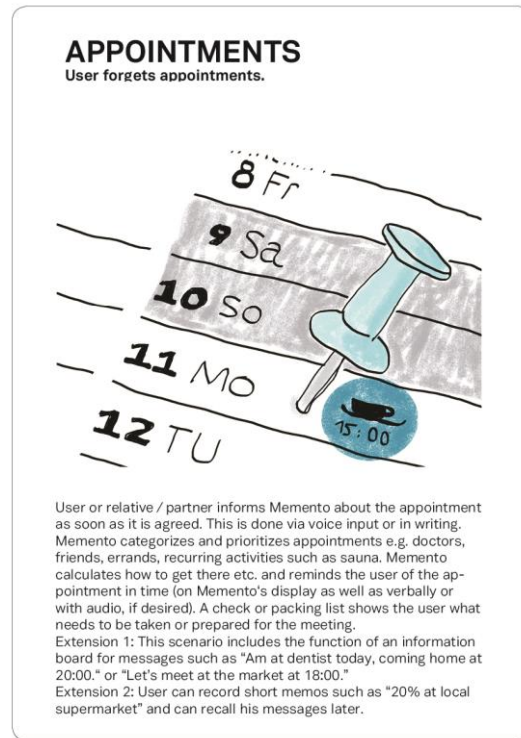


Figure 4. Appointments scenario

3.2.4. Methods: Lab Trial Evaluation user experience

1) Task completion-based approaches:

- Percentage of users who complete the task
- Amount of time in seconds required by user to complete the task.

2) Observational approaches

Users' observation.

3) Questionnaire-based approaches: User Engagement Scale (O'Brien and Toms, 2010)

A preliminary version (adapt* from the original version)

1. I lost myself into Memento experience.*
2. I was so involved in the Memento use that I lost track of time.*
3. I blocked out things around me when I was using Memento.*
4. When I used Memento, I lost track of the world around me.*

mə'mento keeps my mind

5. The time I spent with Memento just slipped away*
6. I was absorbed in my Memento task*
7. Using Memento, I let myself go*
8. I was really drawn into my Memento's task*
9. I felt involved in Memento's task*
10. This Memento experience was fun.
11. I continued to use Memento out of curiosity.
12. The content of the Memento incited my curiosity.
13. I felt interested in Memento task.
14. Using Memento was worthwhile.
15. I consider Memento experience a success.
16. This Memento experience did not work out the way I had planned.**
17. My Memento experience was rewarding.
18. I would recommend Memento to my friends and family.
19. This system is attractive.
20. This system was aesthetically appealing.
21. I liked the graphics and images used on this system.
22. This system appealed to my visual senses.
23. The screen layout of this system was visually pleasing.
24. I felt frustrated while using Memento.*
25. I found this system confusing to use.*
26. I felt annoyed while using Memento.*
27. I felt discouraged while using Memento.*
28. Using Memento was mentally taxing.*
29. This system was demanding.*
30. I felt in control of my Memento experience.
31. I could not do some of the things I needed to do on Memento.*

The scale was administered using a five-point scale with "strongly disagree" and "strongly agree" at the respective endpoints. Items identified with an asterisk (*) indicate that item will be adapted based on the task (***) indicate items that were reverse-coded.

4. Conclusion

The aim of the lab trial is to obtain extensive information about the user experience, such as user interface and the acceptance of the system.

This deliverable describes the overall design of the lab trials and the procedure of testing the MEMENTO system together with the end users. The document contains information about the criteria for end user recruitment, the conduct of the lab trials and the evaluation method.

The tasks paragraph is related to software development and it will be update before the lab trials execution.

List of Figures

Figure 1 Older people's needs as a Framework for Design Thinking (Wilkinson and Gandhi, 2015).	11
Figure 2. Lab trial and field trial evaluation	15
Figure 3. Medication scenario	22
Figure 4. Appointments scenario	23

List of Tables

Table 1: Relationship to other Memento Deliverables	9
Table 2 Created from Wilkinson and Gandhi (2015).	
Term's definitions	14
Table 3. Recruitment criteria	17

References

Brooke, J. (1996). SUS-A quick and dirty usability scale. *Usability evaluation in industry*, 189(194), 4-7.

Chung, J., Chaudhuri, S., Le, T., Chi, N. C., Thompson, H. J., & Demiris, G. (2015). The use of think-aloud to evaluate a navigation structure for a multimedia health and wellness application for older adults and their caregivers. *Educational Gerontology*, 41(12), 916-929.

Dias, M. S., Vilar, E., Sousa, F., Vasconcelos, A., Pinto, F. M., Saldanha, N., & Eloy, S. (2015, August). A living labs approach for usability testing of Ambient Assisted Living technologies. In *International Conference of Design, User Experience, and Usability* (pp. 167-178). Springer, Cham.

Gibson, A., McCauley, C., Mulvenna, M., Ryan, A., Laird, L., Curran, K., ... & Bond, R. (2016, October). Assessing usability testing for people living with dementia. In *Proceedings of the 4th Workshop on ICTs for improving Patients Rehabilitation Research Techniques* (pp. 25-31). ACM.

McKhann, G. M., Knopman, D. S., Chertkow, H., Hyman, B. T., Jack Jr, C. R., Kawas, C. H., ... & Mohs, R. C. (2011). The diagnosis of dementia due to Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's & dementia*, 7(3), 263-269.

Nucci, M., Mapelli, D., & Mondini, S. (2012). Cognitive Reserve Index questionnaire (CRIq): a new instrument for measuring cognitive reserve. *Aging clinical and experimental research*, 24(3), 218-226.

O'Brien, H. L., & Toms, E. G. (2008). What is user engagement? A conceptual framework for defining user engagement with technology. *Journal of the American society for Information Science and Technology*, 59(6), 938-955.

O'Brien, H. L., & Toms, E. G. (2010). The development and evaluation of a survey to measure user engagement. *Journal of the American Society for Information Science and Technology*, 61(1), 50-69.

Papachristou, I., Hickeys, G., & Iliffe, S. (2018). Involving caregivers of people with dementia to validate booklets on food-related activities: a

qualitative think-aloud study. *Journal of Applied Gerontology*, 37(5), 644-664.

Whiteman, K. L., Lohman, M. C., Gill, L. E., Bruce, M. L., & Bartels, S. J. (2017). Adapting a psychosocial intervention for smartphone delivery to middle-aged and older adults with serious mental illness. *The American Journal of Geriatric Psychiatry*, 25(8), 819-828.

Wilkinson, C., & Ghandi, D. (2015). Future proofing tomorrow's technology: UX for an aging population. *User Experience Magazine*, 15(1).

Partners

Supporting Organizations



blkm



CiTARD Services Ltd



VIRTUALVARE

WETOUGH

Appendix

Cognitive Reserve Index

CRIq

questionnaire

Instructions: The CRIq can be administered by a family member or the caregiver when the participant cannot be interviewed due to attested or suspected cognitive decline. Check the appropriate box at the bottom of the questionnaire.

Surname: Name:

Date of birth:/...../..... Place of birth: Age:

Place of residence: Nationality:

Civil status: single married divorced widowed

CRI-Education

Instructions: Count 1 for each year of education. Count 0.5 for every 6-month period of vocational training courses taken.

	Years
1. Years of education (including postgraduate studies and any specialization)
2. Vocational training (0.5 for every 6 months)

CRI-WorkingActivity

Instruction: Indicate working years rounded off on a five-year scale (0-5-10-15-20, etc.; e.g., if a person has been working for 17 years, write down 20). The degree of intellectual involvement and personal responsibility discriminates between the 5 levels of working activity. Report on all working activities, even in the case of simultaneously held multiple jobs.

	Years
1. Low skilled manual work (farm work, gardener, housemaid, caregiver, waiter, driver, mechanic, plumber, call center operator, babysitter, etc.)
2. Skilled manual work (craftsman, cook, store clerk, tailor, representative, serviceman/servicewoman, hairdresser, clerical worker, nurse, etc.)
3. Skilled non manual work (business owner, white-collar employee, sales agent, priest or monk/nun, real estate agent, nursery school teacher, musician, etc.)
4. Professional occupation (Managing director of a small company, lawyer, qualified freelance professional, contractor, doctor, teacher, engineer, etc.)
5. Highly responsible or intellectual occupation (Managing director of a big company, senior manager, judge, university professor, surgeon, politician, etc.)

CRI-LeisureTime

Instructions:

- Each item refers to activities carried out regularly throughout adult life (i.e. from 18 years onwards).
- All paid activities are excluded from this section (for paid activities, return to CRI-WorkingActivity).
- Register answers according to the frequency mentioned for each activity (e.g., weakly, monthly, annual).
- The column Years refers to the number of years in which the mentioned activity has been carried out Often/Always, overstating according to a scale of 5 to 5 years (5-10-15-20, etc.). For example, whether a person regularly reads a newspaper for 27 years, will be registered Often/Always for 30 years, even if he/she has stopped reading for many years.
- If the activity has never or seldomly been carried out (option Never/Rarely) the number of years need not be indicated.
- If over the participants lifespan the activity changed in frequency in a significant manner, only the period (in number of years) of the highest frequency is to be considered. For example, if a person drove a car every day for 40 years, but in the following 15 years he/she did so only once or twice a week, than the answer is Often/Always for 40 years.

1. ACTIVITIES WITH WEEKLY FREQUENCY

	less or equal then 2 times in a week	more or equal then 3 times in a week	Years
1. Reading newspapers and magazines	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
2. Domestic chores (cooking, washing, grocery shopping, ironing, etc.)	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
3. Driving (not biking)	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
4. Leisure activities (sports, hunting, dancing, chess, coin collecting, etc.)	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
5. Using new technologies (digital cameras, computer, Internet etc.)	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....

2. ACTIVITIES WITH MONTHLY FREQUENCY

	less or equal then 2 times in a month	more or equal then 3 times in a month	Years
1. Social activities (political parties, recreational clubs, associations, etc.)	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
2. Cinema, theater	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
3. Gardening, DIY, small-scale operations such as knitting, etc.	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
4. Looking after grandchildren/nieces/nephews or elderly parents	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
5. Voluntary work	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
6. Artistic activities (music, singing, performance, painting, writing, etc.)	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....

3. ACTIVITIES WITH ANNUAL FREQUENCY

	less or equal then 2 times in a year	more or equal then 3 times in a year	Years
1. Exhibitions, concerts, conferences	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
2. Journeys lasting several days	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
3. Reading books	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....

4. ACTIVITIES WITH FIXED FREQUENCY

1. Children	<input type="checkbox"/> No	<input type="checkbox"/> Yes	number
-------------	-----------------------------	------------------------------	--------------

			Years
2. Pet care	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....
3. Managing one's current account	<input type="checkbox"/> Never/Rarely	<input type="checkbox"/> Often/Always	.....

Questionnaire administered to: interested party family/caregiver

Date:/...../.....

Interviewer:

RESULTS

CRI-Education

CRI-WorkingActivity

CRI-LeisureTime

CRI

low medium-low medium medium-high high
 ≤ 70 70 : 84 85 : 114 115 : 130 ≥ 130
