Report

USABILITY ANALYSIS DOCUMENT
Deliverable D1.2

2019-10-04, Revision 2.2
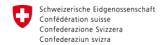
DOCUMENT DETAILS

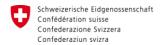|	
Document Number	D1.2
Document Title	Usability analysis document
Document Revision	V2.2
Status	Update
Work Package	WP1
Deliverable Type	Report
Contractual Date of delivery	2018-07-31 (first release), 2018-11-30 (second release), 2019-27-02 (third release for review), 2019-15-03 (v2.0), 2019-13-06 (V2.1), 2019-10-04 (v2.2)
Actual Date of Delivery	2019-03-15
Responsible Partner	Vilans
Contributors	Vilans, MAS, Terz, tanteLouise
Major Reviewers	Creagy, Terz, tanteLouise, AIT
Keywords List	
Dissemination Level	Public
AAL Project Number	AAL-2017-057

DOCUMENT REVISIONS

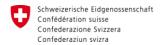| Revision	Date	Status	Author	Description
1.0	20-12-2018	Draft	Cornelisse (Vilans)	
1.1	23-01-2019	Draft	Cornelisse (Vilans)	
1.2	04-02-2019	Draft	Nap (Vilans)	
1.3	27-02-2019	Draft	Cornelisse, Nap & Grool (Vilans)	
1.4	13-03-2019	Draft	Cornelisse, input all partners	
2.0	15-03-2019	Approved	Nap (Vilans)	
2.1	13-06-2019	Approved	Litzenberger (AIT)	Invalidated "Status" description in Appendix and referred to current "clientState" definitions.
2.2	04-10-2019	Update	Nap (Vilans)	

DOCUMENT REVIEWS

Revision reviewed	Date	Remarks, Corrections	Reviewer	New Status
1.0	11-03-2019		Rigamonti (Creagy)	Draft
1.3	2019-03-11		Martin Litzenberger, all partners approved	Draft
2.0	2019-03-25 2019-03-27		Approval partners AIT, Ivengi, Creagy, Carecenter, TerzStiftung, MAS in Consortium Telco Approval partner TL, e-mail Approval Partner Kepler, e-mail	Approved

EXECUTIVE SUMMARY

This deliverable presents the results of the codesign phase of the FreeWalker project in three countries, namely the Netherlands, Switzerland and Austria. In the Netherlands, the user requirements of the FreeWalker concept were assessed from the user perspective in the intramural long-term care setting, while in Switzerland and Austria needs and requirements on the extramural (at home) care setting were retrieved. The codesign phase consisted of three separate sessions in each country: (1) gathering ideas and reflecting on use cases and dynamic safe zones, (2) use case scenarios, (3) paper prototyping and deepening use case scenarios. In total, 66 potential end-users from carers to clients were involved in these three sessions in The Netherlands, Austria and Switzerland. Scenarios were taken for both the intramural and extramural (at home) use of the FreeWalker concept. Discussing and reflecting on these concept scenarios provided inputs for the technical development of the FreeWalker product. All input was gathered throughout the sessions and taken up into a list of requirements from the user perspective. Since the development is an iterative process in which we want to involve user over time. In the D1.2 version we present the results from 3 sessions per country. In the deliverable all data is presented per country and most importantly, is consolidated and presented in a list of requirements including a MoSCoW analysis in section 4.1.

TABLE OF CONTENT

1 INTRODUCTION

The goal of the FreeWalker project is to integrate several proven components of AAL assistive devices and technologies to support independent living and freedom of mobility for people with cognitive challenges. A flexible and versatile solution for guiding and monitoring people with cognitive challenges in the outdoor environment will be realized. A focus will be on supporting caregivers by providing emergency information in order to recover disoriented persons safely. Four different technologies will be integrated and/or developed (1) The FreeWalker logic engine that hosts core movement data and enables route learning to define an adaptive save-area around the elderly home. (2) Two FreeWalker mobile applications, one for the clients (i.e. the elderly people) and one for their care givers. (3) The FreeWalker Location Service with location monitoring technology that distributes alarms to other components and provides the location monitoring device. (4) The FreeWalker Portal that holds critical information about the client.

The FreeWalker project introduces a novel, ICT-based system for supporting people with cognitive challenges (ranging from seniors who are in need for support to those with memory problems and MCI up to those with dementia) (= primary user PU), living at home or in an intramural care setting in "Moving Safely, Living Independently". Formal and informal caregivers (=secondary user SU) will benefit from increased peace of mind, and healthcare authorities (tertiary user TU) will benefit from reduced costs.". The aim is to promote seniors to stay active and physically healthy by reducing the fear of going out. The FreeWalker System will use GPS localization and take into account the information of the daily schedule and habits of a person to understand where the person is going. If there are indications for getting lost or becoming disoriented, different counter measures and support will be initiated. FreeWalker will integrate market-ready components of MOPAS (localization) and CareCenter Software (emergency database). It was foreseen that FreeWalker might include components of the AAL HappyWalker project (navigation), in particular for the extramural home situation in Switzerland, however, all contacts with the development partner from Spain was lost in 2019, so inclusion is very unlikely. Results from the currently running AAL project DayGuide (a guide through tasks of daily live) will be integrated. FreeWalker will be evaluated and tested with over 150 people in Austria, the Netherlands and Switzerland.

1.1 Scope of the document

This document presents the results of the codesign phase of the FreeWalker project in three countries, namely the Netherlands, Switzerland and Austria. In the Netherlands, the user requirements of the FreeWalker concept were assessed from the user perspective in the intramural long-term care setting, while in Switzerland and Austria needs and requirements on the extramural (at home) care setting were retrieved. The codesign phase consisted of three separate sessions in each country: (1) gathering ideas and reflecting on use cases and dynamic safe zones, (2) use case scenarios, (3) paper prototyping and deepening use case scenarios. In total, 66 potential end-users were involved in these three sessions. Scenarios were taken for both the intramural and extramural (at home) use of the FreeWalker concept. Discussing and reflecting on these concept scenarios provides inputs for the technical development of the FreeWalker product. All input was gathered throughout the sessions and taken up into a list of requirements from the user perspective.

1.2 Relation to other project documents

This document is related to a variety of documents and tasks in the FreeWalker project. The EAB described in D1.1 will reflect on the results of T1.2 User needs, Usability analysis and iterative user-centered co-design with D1.2. Furthermore, this deliverable D1.2 is closely related to T1.3 System architecture and specifications with D1.3. The technical requirements from D1.3 are based and should be constantly reflected upon the end-user requirements. The results from D1.2 will further define - via D1.3 - the technical developments in WP2 and will also be linked to scenario's and tasks for the implementation and evaluation in WP3-WP4.

1.3 Contributions of partners

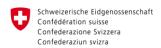| Partner	Chapter	Description of Contribution
Vilans	All chapters	Lotte Cornelisse, Henk Herman Nap & Riske Grool
Terz, MAS & tanteLouise	Input from co-design phases (Terz & MAS: Interviews with persons with SCI, MCI and beginning dementia and with family caregivers)	
AIT	Appendix	Table of alarm states and status descriptions

1.4 Acronyms and Conventions

Table of Acronyms

Acronym	Explanation
AAL	Active Assisted Living
N/A	Not Applicable
PU	Primary User (people with cognitive challenges)
SU	Secondary User (formal and informal caregivers)
TU	Tertiary User (care organisation)
MCI	Mild Cognitive Impairment
SCI	Subjective Cognitive Impairment
PWD	Person with Dementia
TL	tanteLouise
DSZ	Dynamic safe zone
ISZ	Initial safe zone
DSC	Dynamic safe corridor

Convention for Terms

Term	Meaning
notification	
Push notification	A message on Android devices that pop's up automatically at the upper edge of the screen without the users explicit intervention.
Alarm	
Snooze function	The ability to suppress .. what? .. when ..? for how long..?
Safe Zone	A geographic region defined by a closed line, where the PU is considered safe inside
Dynamic safe zone (also the "green zone")	A safe zone that has been automatically generated from observing the PU's walking habits
Dynamic safe corridor (also the "green corridor")	A safe zone that has been automatically generated for temporary use from a PU's calendar appointment for the way to and back home from appointment

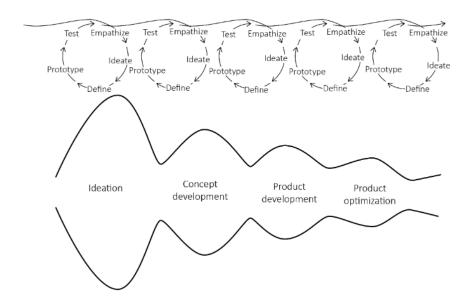| Soft border (limit) (also the "orange zone") | A border around the safe zone with a settable size in which the PU is allowed to "explore" |
Intial safe zone	A safe zone that has been manually defined by a SU or TU by drawing a region on a map
Carer	A carer can be a professional (formal) carer (e.g., a nurse) or an informal carer (e.g., a family member, friend or neighbour that provides care and support on a weekly basis)
Amber alert	A broadcast alert via mobile network used to escalate an alarm that informs the public on a person that is lost (mostly a child).

2 METHOD

In this chapter the methods that were used in the codesign phase are explained. Three rounds of codesign sessions were carried out in 3 countries; The Netherlands, Austria and Switzerland by Vilans-tanteLouise, Terzstiftung and MAS, respectively. Co-design is an approach to iteratively and actively involve all end-users in the design process to ensure that the developments of an UI/product meet the needs & wishes of end-users and is of low-complexity, i.e., high in usability. Codesign is a methodology focused on processes and procedures of design and is not a design style. Codesign will not guarantee acceptance and usage of a product or UI, yet, it will support the development of usable products that meet needs of end-users.
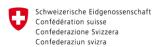
2.1 Goal

The goal of the codesign phase is to analyse the needs and wishes of the end-users that are targeted with the concept of FreeWalker to develop a product that fits with the target group. The codesign phase in FreeWalker is an iterative process in which future end-users from the participating countries are iteratively involved in at least three co-design sessions to get insights about needs and requirement related to the use situation. The aim is to introduce FreeWalker for older people with cognitive disabilities and people with dementia in both the use case of living at home (extramural) and at a care organisation (intramural), whereby the requirements on both use settings were assessed; intramural in the Netherlands and extramural in Switzerland and Austria.

2.2 Process

As discussed, the process of co-design is an iterative process, in which potential end-users are closely involved in discovering how the FreeWalker concept and product should be shaped, functioning and used. The co-design approach reflects a fundamental change in the traditional developer-user relationship, enabling a wide range of people to make a creative contribution in the formulation and solution of a problem. While initially aiming to generate ideas with an open approach, the assessment of end-user perspectives becomes increasingly specifically focused on a certain problem and/or solution as the co-design process progresses, which is reflected in the figures below. The co-design process follows an iterative loop-based design and evaluation path from ideation, concept development, product development to product optimization.
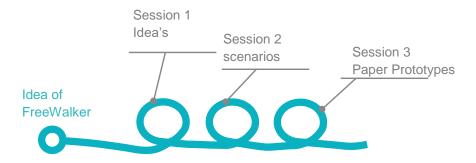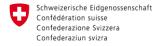
Figure 1. Co-creation phases in FreeWalker

Within the co-design phase of FreeWalker, three iterations were performed in each country to:
- Gather ideas and reflecting on use cases and dynamic safe zones,
- Defining use case scenarios
- Paper prototyping and deepening use case scenarios

Paper prototyping is a technique that can support system design that enhances effectiveness and efficiency in interaction (Nap, De Greef and Bouwhuis, 2005)[1]. Building prototypes on paper and testing them with real users has also been called low-fidelity prototyping (Rettig, 1994)[2]. Using low-fidelity paper prototypes is a cheap and time saving technique to make many iteration steps in interface design. Because paper prototypes can be redrawn with little cost, they are very effective at the beginning of the development process, because they make it possible to try out any design alternatives (Wickens et al., 2004)[3]. Paper prototyping can be effective throughout the product development cycle (Virzi et al., 1996)[4], and leads to almost the same quantity and quality of critical user statements as with computer prototypes (Sefelin et al., 2003)[5].

2.3   The planning of the co-design

The codesign iterations were performed from the end of August 2018 till January 2019. In figure 2 an overview of the planning is given. In the Netherlands, where Vilans is leading the co-design, the co-design was performed first to give the other countries insight in the experiences beside the guidelines performed. When the session was finished in all countries a Skype meeting between the three countries was arranged to discuss findings and prepare the communication to the other consortium partners. After each co-design round/loop the results were presented in a telco with all partners of the consortium.

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[1] Nap, H.H., De Greef, H.P., & Bouwhuis, D.G. (2005). Access for all by cognitive engineering. (CD- ROM). Proceedings of the 5th International Conference of the International Society on Gerontechnology. Nagoya, Japan. Nap, H.H., De Greef, H.P. & Bouwhuis, D.G. Access for all by cognitive engineering. (Abstract). Gerontechnology, 3, 259.
[2] Rettig, M. (1994). Prototyping for Tiny Fingers. Communications of the ACM, April, 37.
[3] Wickens, C.D., Lee, J.D., Liu, Y., & Gordon-Becker, S. (2004). Introduction to Human Factors Engineering (2nd ed.). Upper Saddle River, NJ: Pearson Education.
[4] Virzi, R.A., Sokolov, J.L., & Karis, D. (1996). Usability Problem Identification Using Both Low- and High-Fidelity Prototypes. CHI 96, April 13-18.
[5] Sefelin, R., Tscheligi, M., & Giller V. (2003). Paper Prototyping – What is it good for? A Comparison of Paper- and Computer-based Low-fidelity Prototyping. CHI 2003, New Horizons
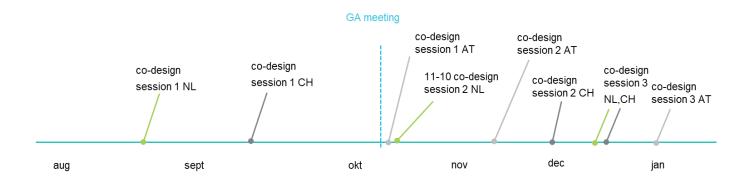
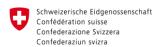Figure 2. Co-design planning in FreeWalker

2.4 Materials

For the different sessions of the codesign iterations various materials were used and these can be found in the Appendices of this deliverable. The development of materials and guidelines was initiated and coordinated by Vilans, discussed with other partners and used to perform the session in all countries on the same level.

For each session a general questionnaire was used to gather information about the participant - among others - gender, age, and experience with technology. Per session specific materials were made. In the first session the users were asked to react on use cases which were presented by using a PowerPoint presentation. A diary format was used to get insight about the daily activities of the target group. In the second session a short presentation was given to let the participants reflect on the results of the previous session. After this, use case scenarios were defined in a creative way. On a flip-over the different users and devices were drawn and based on some scenarios the participants were asked what should happen when and how. In the final session consisted of a paper prototype session using creative materials to design low-fidelity prototypes with the participants.

2.5 Participants

During the iterative design process different representatives of the target group, i.e. potential end-users were involved. In figure 3, it is shown what different primary, secondary and tertiary users are distinguished in the FreeWalker project.

In the Netherlands, where the research and development have a focus on the situation within a care organisation (intramural), secondary end-users (formal caregivers) are actively involved in the co-design sessions. In the other countries, Austria and Switzerland, the focus is on the (extramural) use of the FreeWalker system outside a care home, in which both primary and secondary users were involved.

Figure 3. Primary, secondary and tertiary end-users in FreeWalker

Below it is shown which and how many representatives of the various end-user groups per country (NL = Netherlands; CH = Switzerland; AT = Austria) were involved in the co-design sessions:

Session 1
NL | $N = 4$, All formal care, 3 Female, age 23-40 years
CH | $N = 6$, Both formal and informal care, 4 Female, age 50-84 years
AT | $N = 20$; 6 Female; 55 – 89 years, 10 persons with SCI, MCI and beginning dementia, 20 informal caregivers

Session 2
NL | $N = 6$, All formal care, 6 Female, age 23-52 years
CH | $N = 4$, 1 formal caregiver, 1 informal caregiver, 2 people with some physical and / or cognitive impairment living at home, 2 female
AT | $N = 5$, 3 persons with SCI and MCI, age 75-86 years (all female) and 2 informal caregivers (1 male, 1 female)

Session 3
NL| $N = 5$, All formal care, 4 Female, age 25-55 years
CH | $N = 7$, 2 formal caregivers, 2 informal caregivers, 3 people with some physical and / or cognitive impairment living in their homes, 2 females,
AT | $N = 9$, 5 females, 4 males, 3 caregivers, 6 persons with SCI, MCI and beginning dementia

3 RESULTS

In this chapter the results of the co-design sessions in the three counties are presented. Paragraph 3.1 focuses on the use of FreeWalker in the intramural use case, which is the focus area in the Netherlands. In paragraph 3.2 the results from Austria and Switzerland are presented about the use of FreeWalker in the home situation (extramural).

3.1 FreeWalker intramural

In the intramural situation the primary end-user is a person with Dementia and care is provided by formal carers (see figure 4). The primary user lives in the care institute and has a personal room but can also make use of a living r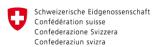oom which is shared with a small group. Formal carers take care of the daily care of these clients. An active aging nurse is involved in the care for the client to stimulate walking and going outside the personal room and living room within the degrees of freedom the client has. In the co-design session secondary users were involved.

Figure 4. Involved end-users in the intramural setting at tanteLouise in The Netherlands.

Results Session 1 (NL)
Several questions and topics were discussed in the codesign sessions. The results are presented below.

What do they already use and know about GPS and safe zones for people with dementia?
Safe zones are used in the intramural location Vissershaven at tanteLouise in the Netherlands. The primary user (PU), i.e. the person with dementia, is wearing a wristband (wearable) that supports/provides access within the predefined degrees of freedom. The location has about 10 people wearing the wristband with different degrees of freedom. There are 3 levels regarding the degree of freedom that a PU has. The PU can freely move around:

- inside the location
- inside the location and garden
- inside the location, garden and within a zone around the garden

In the current situation, the level of freedom is fixed for a period. Caregivers can decide whether the degree of freedom of an individual PU can be increased or decreased.

The new location at tanteLouise (120 PUs) - where they will use this technology - wants to include more dynamic degrees of freedom. It should for instance be possible to adapt the degree of freedom in the morning

and in the afternoon. Also, there will be more levels of freedom; inside location, restaurant, garden. The formal caregivers are used to using technology, but they mentioned that some of their colleagues, especially some older colleagues, encounter difficulties to get used to new technologies.

About the current device
There are two types of wristbands: ones that can be disembodied by the PU and ones that are fixed (or cannot be easily embodied by the wearer). In some cases, wearing a wristband is not desirable since it can be uncomfortable and cause little wounds. Then they try to fix it to the clothes of the PU. For a person wearing a dress, or when weather changes, this is a problem.

Based on the GPS localisation of the wristband, the location of the PU is shown on a Tablet device connected via Wi-Fi to the internet. This connection is lost when you take the tablet with you when searching the PU. Therefore, in the current situation two people are needed to find the PU and they have contact by phone. It would be nice and much more practical to be able to take a device with real-time localisation of the PU with you when searching the PU.

In case someone is lost they also make use of a notification system in the neighbourhood (similar to an Amber Alert). Neighbours get a message about the person that is lost and can respond/get in contact with the care organisation if they see the person coming by.

Situations and scenarios of the person with dementia in current situation
To decide the degrees of freedom, the PUs are trained by the active aging nurse. They train them to walk around. The route is in a circle or round (not from A to B and back). The experience is that when a PU makes use of the degrees of freedom, they generally walk the route they have trained.

In case a family member wants to walk together with the PU, an alarm is given by the wearable when the PU exceeds the zone that is labelled as safe. In other words, the PU is notified by the wearable that he/she does not have the degree of freedom needed for the walk. In that case the carer has to take off the alarm. However, due to the company of the family member, the alarm is redundant or even undesirable. When discussing this situation, family members mentioned that it is good if the system would hold into account that family takes the PU out for a walk. Family always mention to formal caregivers that that they go out for a walk.

Another situation: after a winter period, few people go out for a walk. After winter, the active aging nurse is supporting and training a PU again.

In respect to the localisation itself, it does provide people the opportunity to walk. Some PU really want to go outside. Only giving them the opportunity to go to the garden already creates some rest, even when the PU do not actually make use of the opportunity.

Finally, whenever a PU makes a walk alone or with a carer or family member. In the current location, it does not occur that a PU goes walking with another client of the care organisation. One of the participants mentioned that it is not possible to make a PU responsible for another PU.

Daily activities of Primary users.
To get some idea about the daily activities, which can possibly influence the dynamic safe zone, some examples of activities were given.

- One PU plays card games twice a week.
- Most PUs spend their time in the living room
- Some PUs make use of the garden

- Some PUs do make use of a duo bike, this is always together with a carer or informal carer
- In the past there was a PU that went out to go for a beer at the market square.

Some ideas that came up
- Snooze* the system for a period, for instance when the PU is walking together with family of carer. However, we (formal / professional care) have to be sure that we do not become inattentive.
- Make use of planning in the zones
- Having different sounds of the alarm for different situations

*The 'Snooze' function is reported on multiple occasions in this deliverable. According to end-users, 'Snooze' suppresses the alarm for a (pre)defined time interval, similar to an alarm clock, but then with the possibility to set the time interval or have it linked to an agenda item. In respect to the agenda item, it can be the case that the PU is accompanied by a carer to an appointment and then there should rather be no alarm whenever an alternative route (outside the corridor) is chosen by the carer. Snooze is different from an alarm 'dispatch', i.e., handled. A handled alarm is an alarm that has been de-activated by a SU whenever the PU was outside the safe zone or safe corridor and the PU was found by the SU. The handled alarm is de-activating the alarm until the PU is back into the safe zone and then the alarm is re-activated.
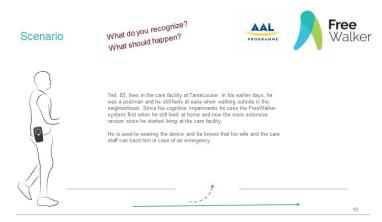
FreeWalker scenario discussion:

Scenario — What do you recognize? What should happen?

Ted, 83, lives in the care facility at TanteLouise. In his earlier days, he was a postman and he still feels at ease when walking outside in the neighborhood. Since his cognitive impairments he uses the FreeWalker system; first when he lived at home and now the more extensive version since he started living at the care facility.

He is used to wearing the device and he knows that his wife and the care staff can track him in case of an emergency.

Use case 1
First scenario can be for a home situation.
We do not have people that already bring some technologies like GPS with them when they start living at our location.

For the home situation, a care organisation can be alarmed in case someone is lost. The organisation of finding the person might be difficult. Important in such a situation is that the device can be connected to our system so the caregivers can use one system to get the alarms.

About the device: "We know that when people suffer more and more from dementia, they try to disconnect the wristband. That is why we also have some fixed versions."

Use case 2

A situation that was announced based on the scenario was about a PU that did not sleep well and tried to walk away. This can last for a few days. In that case it would be nice if you can switch to another degree of freedom. A more dynamic zone would be interesting, to give the PU some more freedom to walk around, but preventing the PU to get lost and out of sight of formal caregivers.

Also, there is the situation that you see that the PU has difficulties when they cross the road. We (as care professionals) see these signals and we discuss often with family etc. what they believe are the right degrees of freedom.

More dynamic zones can help to give different degrees of freedom during the day. We will start with this in the new location. During the night there is no option for a PU to go outside. Only the balcony can be used. But during the day a higher degree of freedom may be desirable.

In the current situation the care organisation cannot switch between the degrees of freedom. They have to make a call to the company that provides the system. It takes around half an hour to switch to another level. This is not easy enough and discourages the caregivers from adjusting the degree of freedom throughout the day, which in turn is in the disadvantage of the PU.
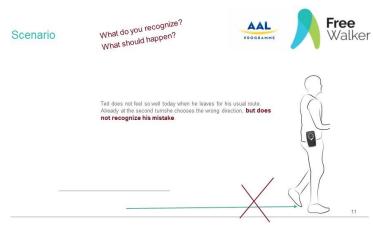

Use case 3

The scenario in which a voice guide is used, will not work for the PU who lives at a care organisation (intramural), because they generally do not understand where the voice is coming from.

The use of the smartphone might be an option for people who are used to it before they got dementia. However, in the current situation – with the current generation of PU - they think that it will be too hard for people who live intramural.

Use case 4

At this point, caregivers know what to do in a certain situation (the protocol is well known). It is also very important that people know what to do, although a checklist might be a nice additional check. But there might be situations that are different, so the interface (protocol) should not be too rigid.

Use case 5

Carers are not sure what client data should be present in the system. "It is important to know your patients, it is not desirable that you have to look up all this information. People should just know this." Still, it is mentioned that for new care professionals it would come in handy. Moreover, in a situation where more people are given the freedom to walk outside (or at a larger location), the need for additional information about the clients might increase.

When you cannot find the PU within half an hour, the care organisation asks the police for help. This is well organised at the moment and should not be triggered automatically. This automatic trigger is not desired by the Police.

In the codesign session it was frequently mentioned that when a PU leaves tanteLouise they go out for a walk that follows a circular path (in a round). This round is the walk they trained with active aging coaches at tanteLouise. Some remarks related to the use of FreeWalker are presented in the figures below.
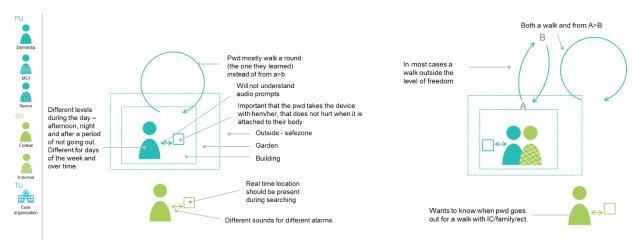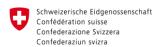

Figure 5. Scenario for PUs at tanteLouise (circular path)

Figure 6. Outside with family scenario

Another scenario that occurs often is that a PU goes out together with someone; for instance, family. These activities are mostly outside the safe zone, an overview of this situation is given in Figure 6.

Results Session 2 (NL)

The second co-design session in the Netherlands was about use case scenarios. The scenarios were discussed by a flip-over on which the different users and devices were drawn and based on some actual use scenarios it was discussed what should happen and how. This paragraph discusses the results that form the basis for the scenario descriptions, since these scenario descriptions were detailed in session 3 of the co-design and the scenarios are presented in the next paragraph.

Patterns and insights for Safe zone

A diary is used to collect information about the rhythm of the PU (Primary User) especially the activities outside.

The fist casus was about a PU who is independent, goes out often and is entitled to his freedom and privacy. This casus is presented due to the focus on the activities outside.

- Mon, -
- Tue, 19:00-23:30 playing cards (bridge)
- Wed, -
- Thu, 19:00-23:30 playing cards (bridge)
- Fri, sat, sun -
- Mon, -
- Tue, 11:00 goes to activity in in a room in the garden of the location of tanteLouise
- Wed, -
- Thu, 19:00 – 23:30 playing cards (bridge)
- Fri, Sat, sun, -
- Mon, 14:00 independently to the super market
- Tue, 19:00 picked up to go playing card game (bridge) brought home at 23:45
- Wed, All day at home
- Thu, 19:00 picked up to go playing card game (bridge) back home at 23:30
- Fri, All day at home
- Sat, 18:00 picked up to eat in a restaurant
- Sun, -
- Mon, did (not) feel emotional due to the illness of his son
- Tue, 19:00-23:30 playing cards (bridge)
- Wed, son is feeling better and PU is feeling relieved

The second casus was about a PU who is diagnosed with Dementia and is attached to his freedom but is not allowed to go outside unaccompanied. This PU Makes use of GPS in case of wandering / walking away, and the risk related to that. In this casus the focus was on behaviour since he cannot go outside alone at the moment.

- Mon, was quietly present in the house
- Tue, did sleep well, during the day quietly present, in the evening restless and agitated
- Wed, did sleep well, was quietly present in the house
- Tue, in the morning angry and agitated, later during the day happy
- Fri, did not sleep well, slept during the day multiple times.

Based on the second case the question can be raised: will the FreeWalker system react to the behaviour of the PU, maybe by using wearables? That would be interesting according to care professionals.

Feedback and ideas related to the FreeWalker concept at that moment

The participants gave feedback on the ideas of the FreeWalker consortium. Like the safe zone, consisting out of an initial safe zone (ISZ) and a soft border limit (SBL), audio feedback, situations to trigger an alarm and information that should be presented at in that situation (see Figure 7 for a visual presentation of the different zones and border limit).

The ideas related to ISZ an SBL are used in the discussion of the FreeWalker concept.

Fig 7. FreeWalker concept that was presented to the participants, including the soft border limit (SBL), initial safe zone (ISZ) and dynamic safe zone (DSZ)

About the extension of the initial safe zone (ISZ), the following aspects are mentioned:
- It is important to make sure who is responsible in which situation. In case the caregiver is responsible, it is important to check if a caregiver can reach the point where one is lost/in a high-risk situation, from his/her location; the care institute. An idea could be that the safe zone cannot extent if the distance is too large to reach the PU in case of emergency. Good to know that in case of the location at tanteLouise, the first street is already quite dangerous.
- How is this done? Can the system monitor patterns? And if so, is it then possible that the area is made smaller. An example; some PUs makes use of the garden but only one part of it, when they go to another direction, they can get lost.
- Also, if recognizing patterns is possible, it would be interesting to monitor them by means of walking distance and speed (I.e., gait velocity). These variables can be used for the prediction of the health status and progression of the decease and can be used.
- Would it be possible to see when PU does deviate from the "normal pattern"?

About the audio support
- For (the current) people with dementia it will not work to use audio because they will not understand were the sound is coming from.
- Maybe later - when people who are used to use smartphones - audio support will become interesting.
- Maybe a message "ask someone around you to help you". However, they think that this is too hard for current people with dementia.

During the discussion the following **situations of creating an alarm** were mentioned:
- Outside the safe zone.
- Longer outside than expected: example when a PU goes out for playing cards, we know PU will be back around 23:30 but we do not add that in the system. However, that would be helpful to do.
- Long time no movement, can happen that PU stops walking when he/she is lost. However, we should check if he/she is not in a café/ shop etc. That would be interesting anyway, so that you know if it can the case that the PU is inside a building when an alarm is created. So, information/alarms may be desired about inactivity at; landmarks, special buildings, benches in the garden. Especially for caregivers who work but do not live here, since it will be more difficult for them to find the person when the environment is relatively unknown.
- Longer than normal outside.
- Creating an alarm by pressing a button for instance. We should definitely test this with the target group.
- Maybe when walking back and forth of crossing the same point again and again this pattern can show us that PU is lost and searching for the right direction.

Idea's about the **information that should be given** when an alarm is created.
- As an "out of the box idea" I think; Can we have video contact? As such that a caregiver can check if somebody is nearby when the PU has fallen.
- Audio contact, not only to speak with the PU (which will often not be possible or easy) but to check if sound can help by giving information about the context/situation. Or to have contact with people around. In these ideas we really should check the privacy issues.

About the **action done by PU** in case he/she is possibly lost
- This will be hard for people with dementia.
- It is interesting to think about ideas in which the people nearby the PU, at moment of lost, are informed. For instance, in current situations we have received a phone number (via tanteLouise) on the personal walker of a PU which can be called.

About **the GPS device**
- The device should not be too big. The MOPAS that was shown in the session is bigger than their current system. Especially for women who do wear a dress or a skirt it will be hard to wear this device.
- Could it be a smartwatch?
- Can it be a device that we can connect to the wristbands we have.
- The experience is that the look and feel is important. We should test this also with PU.

Answers on specific questions from technical partners

From the technical partners some specific questions were asked and discussed in the session:

How many changes in degrees of freedom for 1 user should there be, given the idea that you want a different setting in the morning, in the afternoon and at night, or in case you want to deviate from the norm when the user does not feel well that day?

- That differs per person, it is hard to say because it is new and in the current situation we could not think about this possibility. What they came up with; day- morning, day-afternoon, night, situation one does not feel well. When they thought about a further situation or situation at home also holidays, some days of visits are announced.

Is it thinkable that a safe zone needs to be reduced? In what situations?

- Yes, that is very interesting. The idea we discussed about monitoring patterns, when a PU did not visit some parts in its safe zone (for instance parts of the garden) it can be that he/she is does not recognize the route and will get lost. Also based on how often the PU went out and taking into account different seasons. After winter for instance, the safe zones are used less.

Which "parameters" are desirable to set an alarm? e.g. time, distance

- Time
- Zone
- Distance for the carer (SU) to be on time at the PU
- Walking speed / gait velocity
- All kind of wearables to measure behaviour, for example heart rate.

About how many people will be involved in a case?

- Differs. We use an escalation ladder. Then an alarm is sent and the first one who gets the alarm is the one working in at the group/house where PU lives in the institution. It would be great if later on we can sent alarms to more carers and the neighbourhood. The current location where people have varying degrees of freedom is much smaller than the new location, so it is hard to say a number. It was asked: can this be flexible per situation?

Result Session 3

Session 3 was about creating paper prototypes and creating "use-cases". To present the results, we used the format from the technical partners. In this format a problem description with precondition is given and in which step by step details are presented what should happen according to the carers. During the session, paper-prototypes were created to design and explain what should happen in the FreeWalker interface that is used by the carer. These paper prototype models were translated in a graphic presented in this paragraph.

Problem No.	1	
Problem Description	The PU goes out for playing a card game and normally the PU is home at 23:30 but it took longer to finish the game and he is not back on time. The carer wants to know if everything is OK.	
Preconditions	Scenario 1: the PU is wearing a simple FreeWalker device, location of playing cards is inside his safe zone Scenario 2: the PU is wearing a simple FreeWalker device, location of playing cards is outside his safe zone In both scenario's it can be that on that particular day the carer is someone who is not working normally on that day. Also, it can be that the carer is not familiar with the location where the PU is playing cards.	
Step No.	**Describe the step**	**Remarks regarding the step**
1	The carer wants to be actively informed, receives an alarm when the PU is not back on the normal time. The alarm is colour coded in red and presented by a high priority alarm sound on the device that the carer is wearing	The FreeWalker system should recognize that he is not back at the normal time and informs and helps the carer to check where the PU is.
2	The carer clicks on the notification and has the option to either snooze the alarm (snoozing time should be adjustable) or check for more details. It should be displayed if the PU is alone or with an informal carer.	
3	When checking for more details: the carer gets the following information on his/her device: Real-time location of the PU Real-time image of the PU (facetime idea? Should be further discussed) Clarity about current situation: is the PU still at the location of playing cards, or did PU leave and is on his/her way (the system should show if PU is outside or within the safe zone)	The FreeWalker interface of the carer should present the location of the PU and it should be clear if he is on the location of playing cards or on his way. Since he is doing this activity weekly the FreeWalker system knows the routine and knows the location of playing cards.
4	The carer has seen the information and acts on one of the following 3 situations: Situation 1: PU is still at location of playing cards. Action: snoozing the notification. Situation 2: Carer sees PU is on his/her way home. Action: snoozing the notification.	

	Situation 3: PU has left location of playing cards and lost his/her way. Action: click for more details and proceed to step 5. Device should show: Time that the PU has been on this location (since when?) Route with all time slots from start location (card game) till current position (reason for this is not as much in tracking the PU, as well as learning from analysis of what went wrong and where)	
5	If possible, the carer calls informal carer or PU.	Option to contact the PU (phone call, message) before choosing the next step in escalating / actioning. If the PU doesn't respond, the call/message should be forwarded to the informal carer who is with the PU in case PU is/was not alone. As soon as contact is made, alarm can be dispatched (i.e., handled by the SU).
6	Carer decides to go find PU: There should be a route on the map for the nearest carer to see how to get to the PU with the time needed to get there. Also, a notification should be sent to colleagues of carer so: a) they know they should keep an eye on the location because carer has left to get PU or b) with the specific information forwarded regarding the PU in case a colleague will be send to PU.	Carer decides to go find PU: There should be a route on the map for the nearest carer to see how to get to the PU with the time needed to get there. Also, a notification should be sent to colleagues of carer so a) they know they should keep an eye on the location because carer has left to get PU or b) with the specific information forwarded regarding the PU in case a colleague will be send to PU.
7	PU is back home (alone or with carer) a notification should be sent to inform carer(s)	

Problem Solution No.	Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.
Solution 1	The problem is solved the carer knows where she/he is the location of playing cards on his normal way home and moving, so walking/driving (when is in the taxi) in the right direction. PU comes back home
Notes	Carer wants to receive a notification when the PU arrives home at all times (also when home in time)

Problem No.	2
Problem Description	The PU goes out for a walk, normally for 1,5 hours. On a day she/he is doing his normal routine walk but gets a blackout moment during his walk. He does not know where he is going and feels lost within the normal walking time. It can happen in between 1 minute and 1,5 hours. This situation is defined as a problem since in the normal situation a notification is only provided when the PU is not back after 1.5 hour, which means that even when the PU feels lost after 10 minutes a notification will be generated only after 1,5 hours. The system should respond timelier to this feeling of being lost.
Preconditions	The PU is wearing the low complex FreeWalker device and he is walking inside his safe zone at the moment he gets the blackout scenario and feels lost.

Step No.	Describe the step	Remarks regarding the step
1	The person is lost due to his blackout and needs to go home but does not know how.	There are two situations possible at that moment 1 PU will press on the button on the FreeWalker device.

		➢ Choice/option to have a button on the MOPAS ➢ Option for personal alarm system; necklace or bracelet 2 PU is not able to think about pressing the alarm button. The FreeWalker system does recognize by walking/moving patterns that PU feels lost Possible patterns: - Identical walk pattern (circles) - Repeatedly walk back-forward - Walk short distances and the stand still Besides possible patterns, the idea was mentioned of using wearables. At the moment of getting lost there is fear and the heart-rate of the PU increases. Possibly this can be measured by a bracelet/smart watch (optimally the same one as the localisation device).
2	The carer wants to be actively informed about his situation by a push notification, with colour red and high priority alarm sound on a device that the carer is wearing	Use alarms sparsely, only when necessary (no continuous alarms, then care professionals will ignore the alarms). The Alarm in this specific scenario is necessary! The notification should be sent to the carer of the group where PU lives. After …(to be further defined)… minutes of no response by the carer (SU) other carers should be alarmed. An interesting idea related to who should be alarmed, is that the carer should have information about which person is most close to the PU. The carer should be able to forward the alarm to this person.
3	A location of the PU should be shared with the carer on the FreeWalker device of the carer	The carer wants to have a live location from the moment an alarm is given because the PU can move after the FreeWalker system did sent a notification.
4 Scenario 1	The carer should go to the PU	Whenever you go, other persons (colleagues) receive prompt that you took the call/task. These other colleagues can look after the other clients. The same holds vice versa.

4 Scenario 2	From a distance, via the FreeWalker device, the carer should support PU to find the way home	This will be hard for some people with dementia, especially the current generation of PU who are not familiar with using mobile/smart phones. However, in this scenario an audio support on the FreeWalker device is needed. PU and carer will talk to each other by using the FreeWalker device.
4 Scenario 3	Carer asks other carer to go to PU.	
4 Scenario 4	The carer can ask people around the PU/ neighbourhood to support the PU. They can send a notification to the people in the region and when one reacts on it the carer can have a call or send information about the specific location	
5	There should be a route on the map for the nearest carer to see how to get to the PU, including information about the time needed to get there.	
6	PU is back home (alone or with carer). Then a notification should be sent to inform carer(s)	
Problem Solution No.	**Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.**	
	The carer knows about the fact that PU feels lost and knows where he is	
	The PU is back home by sending a notification	
	Nearby carers are informed about the fact that PU is back home by using a notification	

Problem No.	3
Problem Description	The PU values his freedom and possibility to walk outside. He practiced his walk before with carer and makes this round route twice a week. However, on one day he did not feel well and took a wrong direction and got lost. (the focus is on leaving a specific route)
Preconditions	PU is walking around and wearing a simple FreeWalker device, but still in safe zone
Step No.	**Describe the step**	**Remarks regarding the step**
	The PU takes a wrong direction. PU does take a direction that deviates from the normal walk.	The FreeWalker system should recognize that the PU deviates from his normal routine walk. > some PUs it is fine if they take a different route > some PUs a direct alarm

Scenario the PUs receives a direct alarm	The SU (carer) should get an alarm that the PU deviates from the normal route.	The carer gets a message when PU (the one where it is not fine if he/she takes another route) does not take the right direction (deviates from route) and will possibly get lost The carer can monitor the walk of the PU on a distance by using the FreeWalker system.
Scenario if it is fine that PU takes a different route	The SU (carer) should get a notification that the PU is lost	The carer can monitor on a distance by using the FreeWalker system. The FreeWalker system notifies that the PU did not find the normal route.
	Carer decides to go find PU: There should be a route on the map for the nearest SU (carer) to see how to get to the PU, including the time needed to get there. Also, a notification should be sent to colleagues of carer so: a) they know they should keep an eye on the location because carer has left to get PU or b) with the specific information forwarded regarding the PU in case a colleague will be send to PU.	
	PU is back home (alone or with carer). Then a notification should be sent to inform carer(s)	
Problem Solution No.	**Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.**	
	PU finds the right direction and continues his normal walk or PU is back home. Depends on how confused he is.	

Problem No.	4	
Problem Description	The PU did not sleep well. The chance of getting lost is high.	
Preconditions	The PU has normally a high degree of freedom/ large safe zone.	
Step No.	**Describe the step**	**Remarks regarding the step**
	The system should know that the PU did not sleep well	To know if the PU did not sleep well there are multiple potential solutions. 1 Carer adds (manually) in the system that the PU did not sleep well. This should be in the signal plan as well. In this case, a connection or integration between signal plan system and FreeWalker would

		be necessary to utilize this information.
		2 FreeWalker knows (automatically) from sleep monitoring functionality that the user did not sleep well. This can be a wearable or the monitoring devices of night care. This can change during the day.
	The FreeWalker system should change the safe zone and the conditions of monitoring and sending alarms to the carers	In case the PU did not sleep well more notifications are needed than usual within a predefined time interval.
	The FreeWalker system should give more alarms since the rules are stricter.	Example: PU normally is allowed to walk in the garden but after a day of not sleeping well and being confused the carers want to be actively informed when he/she enters the garden because PU is not allowed in this situation
Problem Solution No.	**Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.**	
	The system knows that the person does not feel well, did not sleep well and changes the setting of monitoring this PU to a stricter setting of safe zone.	

Problem No.	5	
Problem Description	The PU does go outside without the FreeWalker device and has the chance of getting lost	
Preconditions		
Step No.	**Describe the step**	**Remarks regarding the step**
	The PU leaves the door without the FreeWalker device	The carer should be informed by FreeWalker that the device in not in use. Possible information to be used if PU is not wearing the FreeWalker device ➢ If date in calendar it can be detected that PU is not wearing device ➢ In TL the door sensor system should be interfaced to the FreeWalker system, to ensure that the PU cannot leave the building without the FreeWalker device. ➢ Detection of charging in cradle possible? ➢ Q: Indoor localisation and FreeWalker?

Problem Solution No.	Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.
	The person should take the device when going out.

Problem No.	6	
Problem Description	The PU is nearby a high-risk area (area of with the cares say that is has risk, like dangerous road) and the SU is too far away to be on time at the PU	
Preconditions	The user has a large safe zone and the option to enlarge this zone. There is a busy and dangerous road	
Step No.	**Describe the step**	**Remarks regarding the step**
	The PU is walking in the direction of the dangerous road.	
	A high priority push notification should be sent to the carers with the location of the PU	see steps scenario 1.
Problem Solution No.	**Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.**	
	The PU does not walk alone on the dangerous road	

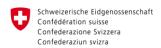| Problem No.	7	
Problem Description	The PU is going out for a walk and is lost	
Preconditions	Scenario 1: PU stops walking Scenario 2: PU is walking back and forth Scenario 3: PU crosses a point multiple times	
Step No.	**Describe the step**	**Remarks regarding the step**
Scenario 1		Alarm after long time no movement. However, we should know and check if he/she is not in a café/ shop etc. It is highly relevant to know if the PU is 'likely' inside a building when an alarm is created. So; landmarks, special buildings, benches in the garden. Especially for carers who work but do not live here.
Scenario 2		Alarm after walking back and forth several times. However, we should check if he/she is in an area, market for instance where it is normal to walk back and forward multiple times
Scenario 3		Alarm after crossing the same point (for example) 4 times. However, we should check if he/she is in an area, for instance at a market, where it is normal to cross a point/street more often.

Problem Solution No.	Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.
	Carer is informed when PU feels lost

Problem No.	8	
Problem Description	The carers would like to already get a notification after a set time in the evening, before night shift starts (e.g. around 10PM, this should be adjustable). This way they are already aware who is outside of the building and still needs to get home. There should be different priorities: standard situation (playing cards every Tuesday evening) or deviating situation (spontaneous walk).	
Preconditions		
Step No.	Describe the step	Remarks regarding the step
	Different colours to quickly distinguish priority when PU is outside building after set evening time (10PM). 1 = Green (standard, according to agenda). 2 = Orange (deviation, spontaneous). 3 = Red (PU with higher risk or in high risk zone)	
Problem Solution No.	Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.	

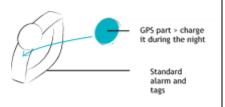| Problem No.	9	
Problem Description	The person from the walking group will go out with a group of PUs. Both PUs that are allowed to leave the building and PUs who are not.	
Preconditions	The carers do not want to have 10 alarms when the person of the walking club is taking them with her/him	
Step No.	Describe the step	Remarks regarding the step
	Person of the walking group can select which PUs he/she is taking with her/him	
	An item to the agenda is made	
	For all PUs that really leave the building together with the person of the walking group, a notification without a sound (instead of an alarm) will be sent to the carer(s) in the case that the PUs leaves the building or leave the safe zone.	
	When they are back, a notification (no sound) should be sent to the carer(s) that people from the walking club are back	
	FreeWalker should monitor the PUs from that moment in the way how it is set.	
Problem Solution No.	Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.	

	When a walking club is going out, both PUs with freedom outside the perimeters of the care organization and PUs without that freedom can go walking. Carers want to be informed but they do not want to get 10 alarms of 10 people leaving the building. The reason why they do not want to get 10 alarms is because they do not know that the walking club is taking 10 people with them or 9, because they can then not distinguish whether one of the notifications is from some PU that leaves the walking group without permission.

Ideas and requirements that did not directly fit in the problem description format

	o Device should be as small as possible o It should be easy to clean o For some users it is important that they cannot lose the device. o Wristband or a device that can be attached to the current wristband

	o Choose a sound for the alarm, a nice sound, and have the possibility to have different sounds for different alarms.
	o The alarm should be sent to
	    1 The carer of the group/house the PU lives in the institution
	    2. One who is nearby the person. This can be a carer from another group, the desk employee etc. The system should check in this case who is most nearby the PU.
	o The situation in which an alarm is created differs per PU. Sometimes the carer needs an alarm directly when the PU leaves the garden, in other situations maybe the carer can have a reminder. This differs per PU. Also, the trigger is different; it can be necessary when leaving the safe zone for PU-A but for PU-B it can require an alarm when a walking pattern differs from the normal pattern. And for PU-C you only need alarms when he/she is away for more than [to be defined in following co-design sessions] minutes.
	o We make use of "escalation ladders" when sending an alarm. It would be good to use that here as well. When carer-A did not react on the alarm it should be sent to B-C-D etc.
	o Include a video and audio connection to check the situation and possibly contact people nearby the PU.
	o Add appointments (can be recurring) in the system. Interesting to add the end time.
	o Important location/ landmarks on the map so you can indicate that he/she is 'likely' in a building/shop.

	o Drawing should simply be done as precisely as possible. On a tablet or laptop of desktop. o Build the profile of the PU. What types situation should activate an alarm, what do you want to monitor etc.

The graph below depicts the various screens per task sequence. A full high-resolution version has been shared with CREAGY, who is building and designing the mobile application.

3.2 FreeWalker at home

In the situation of FreeWalker at home, the Primary user; someone suffering with SCI or MCI makes use of a client device that has more functionalities than location tracking. The secondary user is an informal carer.

Results Session 1 (Switzerland)

Current experiences with getting lost, wandering or GPS trackers
All of the participants from sessions 1 are in direct contact with people with cognitive impairments or dementia, but none of them is currently using a GPS tracker or working with people who use a GPS-tracker. The oldest participant used a GPS alarm system several years ago but was disappointed and discouraged by the low battery capacity and was therefore quite skeptical of the usefulness of such devices.
All of the participants have had experiences with people who were getting lost. For example, during vacations in new cities, in shopping malls where they went to the 2nd floor instead of the -2-parking floor, during daily walks. Relatives who regularly confuse left and right, take the wrong direction.
A relative getting lost or being disoriented was reported to have usually been the first sign of dementia before an actual diagnosis took place.
These encounters were reported as stressful for both participants and the biggest challenge was usually to stay calm and relaxed.
Caring for a person with cognitive impairment is a demanding task, as you can't let them out of sight for one moment. Reducing this caregiver burden would be greatly appreciated.

FreeWalker scenarios:

Scenario 1:

In the first scenario the discussion revolved about if or why a person with mild cognitive impairments would use FreeWalker. At this stage the person themselves often does not realize that there is a problem or does not want to accept it. FreeWalker would need to offer clear benefits for people, who are still living independently but are at an increasing risk of getting lost. Fall detection was mentioned, as they usually are more afraid of falling than of getting lost at this stage. Another option is a simple navigation device on a smartphone, that is easy to use. Who knows about her appointment? Usually a caregiver is informed, if an activity deviates from the normal routine. The caregiver would then preferably accompany the person to her appointment. If that wouldn't be possible, FreeWalker can provide a timesaving safety net. The caregiver could add the route beforehand to the system, so that the primary user has the navigation available.

➔ How do we make the primary user (learn to) use FreeWalker before he/she actually "needs" it?

Scenario 2:

There were wildly different opinions, if this scenario already warrants a notification. If it is clear, that the primary user is not following his intended route, she should get a notification. Either after a certain amount of time or certain distance, defined by the caregiver and or primary user. But she might turn around again or take a different route, while still going in the right direction and an intervention by FreeWalker would not be needed.

Some argued that at this point the caregiver should already be notified, so that they could call the primary user and ask where she is going or if she needs help. Others argued that this does not constitute an emergency and that notifying the caregiver would not reduce the caregiver burden and create unnecessary stressful situations.

If the primary user only has mild cognitive impairments, she could feel incapacitating if a caregiver gets contacted after a simple mistake or deviation. Primary user needs to accept the use of the device.

➔ User needs differ from case by case and should be addressed by FreeWalker

Scenario 3:[6]

In this case, the caregiver should definitely be informed about the current situation. In the best case, they would be able to call the primary user directly and ask about the current status and if necessary, to calm them down. Message could say: "Hello, Kathrin has gone out of the planned route. You might want to check in with her".

The primary user should be alarmed by a loud tone or by vibration. She could be in a loud environment and/or have hearing problems, so she did not hear the message.

The message to the primary user could also contain a prompt to seek help or call the caregiver. They might not be receptive to navigational messages.

Depending on their state, clear and simple navigational messages like "turn around" or "go left" should be prompted.

If a caregiver is not available or does not react to the notifications, the next caregiver/relative in line should be contacted. Or if defined by the caregivers all at once.

➔ What is the best way to inform primary user/caregiver?

Scenario 4/5:

The checklist is deemed a very useful feature, as the situation can be stressful and this way important steps are not forgotten. Maximum 4-5 questions or points. If other caregivers are involved, they could also see what actions have already been taken. The checklist should not be too rigid and in the best case customizable. From the co-design sessions it is unclear who will define the checklist. This needs to be further elaborated in upcoming (co-design) dicussions.

If a caregiver is responding to the messages, the police should not be automatically alarmed. The caregiver might be able to walk or drive to the location of the primary user. In case of an emergency where the police get involved, a personal description (life threatening medical conditions should be included) is very useful and saves a lot of time. FreeWalker should prompt to fill out this description before the first usage.

If no caregiver reacts, the police should be alarmed with the personal description, the location of the primary user as well with contact information of the caregivers. FreeWalker should display that the police got involved.

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[6] In Switzerland, Terz will be working with people whose cognitive challenges still allow them to use a smartphone.

➔ In case of an emergency, caregiver needs to stay calm. Checklist and personal description prevent a lot of stress

Key takeaways:

Main functions:
- Telephone function, audio connection to caregiver
- Physical alarm button
- Simple to use
- Safe zone (distance) and alarm triggers (time, who) should be customizable
- System should learn from the usage and adapts its safe zones

Possible Obstacles:
- Caregiver has access to movement patterns
- Device is too big and bulky
- FreeWalker is too complicated to use
- Person could rely too much on the device, take unnecessary risks
- Is it worth using FreeWalker for a short period of time? (if dementia progresses)

Things to keep in mind:
- Difficult to convince people with MCI to use such a device, empowerment of the user instead of tracking
- People with hearing devices/hearing problems should be considered
- How to handle several caregivers for one primary user
- Caregivers would benefit the most of this system

Results Session 1 Austria

In Austria the first co-design session was conducted in two sessions (1.1 and 1.2) and one individual interview (1.3)

Session 1.1: 6 Persons (3 male) attended the focus groups. They were on average 78.6 years old (70 – 84 years). The highest level of degree was primary or secondary education (4 persons). One person has completed a tertiary education; one person didn't know his or her level of education. Three persons had a cognitive impairment themselves, one of which was informal caregiver for her partner who has a cognitive impairment, too. Only one person stated that he has some experience with personal computers and smartphones; all other persons did not have any experience in using them. One person stated that she is pretty satisfied if she manages to make a phone call with the mobile phone. It was therefore not possible to continue with discussing the scenarios. But nevertheless, the finding is useful as it shows some resistance in the population to use technical applications.

Session 1.2: During the "Alzheimer holiday" we performed a focus group discussion with 13 persons (3 female; mean age: 77.4 years; 55 – 89 years). This group consisted of highly educated persons with a lot of experience with technical applications (such as smartphones, tablets, GPS). Mostly the caregivers participated in the discussion- but at some points in the discussion, persons with dementia themselves provided information.
Main points from the scenarios:
- If the system is not implemented very early in the disease process, it will not be meaningful.
- If the person walks in the street with the smartphone it is highly possible that the person will be even more dysfunctional since the attention will be deviated from the environment (one person said: "look at the young people- they are almost overrun by traffic because they are constantly looking at their phone!")

- We don't want to become too dependent on technical appliances- "after all I am not an idiot" (person with dementia)
- "If I walk with the smartphone, I have trouble deciding whether I have to walk right or left."
- If I hear a voice coming from my phone- I get confused with the noise around me.
- If the sun is shining, I cannot see anything on the screen of the smart phone.
- My husband does not go to the doctor alone – "I need to know what the doctor is saying…"
- You are targeting the wrong generation with this product!
- From my point of view: "Cell phone is only for making phone calls" (person with dementia)
- Internet? – I cannot rely on this form of protection – I feel too insecure ("especially since it does not work under trees")
- The cell phone should have nothing else on it- just the FreeWalker system- otherwise persons with cognitive deficits are getting confused
- Very simple design- no other distraction
- Screen saver is a problem- if the app disappears
- FreeWalker may help- very early in the disease process- if at all
- This application needs to be individualized
- I need to see how this would look like and how it works (more persons said this!!)
- For the majority (of the current generation) of people with dementia it will not work to use audio because they will not understand were the sound is coming from. However, persons with SCI and MCI in Austria have indicated during the interviews that they would like to have voice guidance. Most of them asked to be able to choose between voice and visual guidance.

Session 1.3: Results from an individual intake Interview: (68-year-old person with dementia male, wife, caregiver)
Problem: Husband does not want to walk outside
If FreeWalker could promote walking outside (e.g., step counter with progress) this
        system could be helpful.

Based on the results of both Switzerland and Austria the situation of figure 8 was drawn for the situation where FreeWalker is used at home.

Figure 8. FreeWalker at home scenario that was discussed in Switzerland and Austria

Results Session 2 (Switzerland)

The target group of PUs at TERZ very often live at home, supported by an informal caregiver. They usually are in a position to manage their daily life quite independently. The focus of FreeWalker adding value lies on specific situations that could be described as:

➔ "slightly more dangerous than usually"

This is very often the case if:

- the PU goes out when it is dark outside
- the PU is in an area without or with only a few other people
- extreme noise or blinking lights may cause a hazardous situation
- chilling cold or very hot weather conditions
- the PU is facing an unknown situation, e.g. a (unexpected temporary) diversion for
  pedestrians that requires a
  completely new route
- the PU suffers from an immediate health issue while alone
- a combination of some of the above

Very often people quite successfully try to hide dementia in an early stage – nevertheless, they have an informal caregiver (very often their daughter) who is or is not fully aware of the real situation. Giving the caregiver peace of mind is therefore a very strong message, and

➔ FreeWalker should not only be labelled with a focus on dementia; hence "FreeWalker - moving safely, living independently" is the right message (as we have it in our dissemination plan).

Participants of the workshops intensively discussed the boat (see below) and shopping-centre scenarios and came to the conclusion that – because many other people are around who are usually willing to help – there is no real danger, but FreeWalker could help to give peace of mind to the SU and to learn about the habits of the PU. These PU do not usually carry a document with their deficits / medication with them.

The PU enters a boat without permission.
- ➔ An alarm will be triggered as the PU leaves the save zone
- ➔ Time might be too short for a SU to prevent PU from being on the boat while it leaves
- ➔ But at least the SU knows where the PU is and can take action, e.g. informing the boat company -> captain and drive to the next boat stop (which in this case does not make sense as the boat crosses the lake to Germany; captain should find the PU (PU to send a picture to captain) and prevent the PU from leaving the boat in Germany, otherwise the SU has a real problem.

Another scenario describing a visit to a fun fair, however, is dangerous in the sense, that even though many people are around, some might be drunk, it is loud, various lights are shining, orientation is difficult even for people with no disabilities.

→ Does FreeWalker measure temperature and send an alarm when PU is out under extreme temperature conditions?
→ Would FreeWalker work in Germany? (the boat example)

Setting up the system

Participants reported that this might take a lot of time and must be carried out very empathetically in order to improve the probability of acceptance of FreeWalker by the PU. This should not be a technology-driven discussion, but a talk with a SU listening carefully what the PU describes, e.g. daily routines, preferred walking areas, use of private or public transportation, cooking / eating habits, situations or locations causing fear, and preferred sports activities.

→ Would be nice to have the option to insert medication into FreeWalker,
→ and then link it to pharmacies (?)

What - if

We discussed various what – if situations; some are closely linked with FreeWalker, others not. E.g.: PU is in a shopping centre (without SU), falls down and needs assistance, but there is no mobile connection -> somebody walks out the door to organise assistance. What the example wants to say:

→ it is not the intention "to delegate common sense to FreeWalker".

General   Requirements   &   Preconditions
In order to conform to individual situations, FreeWalker must offer various "sensitivity" options at different points (e.g. for making monitoring more or less tightly; for the frequency of information / alarms; for various lengths of snoozing; for various lengths for "alarm when not moving", for emergency actions, …)

- FreeWalker should learn what is normal and what is a deviation from normal and then inform the PU and inform / alarm the SU accordingly based on the preselected "sensitivity"
- FreeWalker should also add value for non-dangerous situations (simple information, map with direction home as requested (something. that also absolutely healthy people value highly), peace of mind for SU
- FreeWalker should incorporate fall detection (in case PU falls during walk to *location*)
- FreeWalker should recognise when PU stops walking while on way to *location* and do something after M minutes (M should be defined by PU and carer) ->
- FreeWalker should offer a kind of a Logbook, where all the incidents are stored in a way that is useful for learnings / future action (useful for PU, SU, Medical Doctor; FreeWalker = machine learning)
- It must be easy to draw and change (reduce, extend) all kind of zones. Ideally by using a pen and Google Maps or similar (assuming that pens are not available in most cases). What is the solution in CareLink?
- The voice of the SU is important as it can build trust in hazardous situations. Hence audio quality needs to be good. What it the PU has a hearing aid? Can FreeWalker be linked to hearing aids?
- Acoustic-alarms can create fear and confuse people.

- FreeWalker should include a "how to deal with" with people with dementia (how to approach them when they are confused, how to convince them to go home, the need to accompany them, …)

From the co-design sessions a number of questions were raised which are reported in Appendix 6.6. Most of the questions are dealt with in the requirements analysis and will be further discussed in the project phases.

Results Session 2 Austria
Based on the session with several possible end user the flowing scenario descriptions are made:

Problem No.	1 WEATHER	
Problem Description	The PU (person with SCI or MCI and an appointed contact person such as a family member, friend etc) plans to go out for a walk for 1 hour. One day he is doing his normal routine walk but has forgotten that it´s getting dark because of winter. It is snowing and the PU is afraid to fall. Consider: a geographically safe zone might not be a safe zone considering bad weather - for example!	
Preconditions	The PU is wearing the FreeWalker device and he is inside his safe zone	
Step No.	Describe the step	Remarks regarding the step
1	The person is insecure because of the environmental conditions	The system should provide information about the weather condition and the time to darkness
	The PU decides to inform his /her son that he is planning to go outside now	S.O.S Button (PU is active) and/or SMS weather warning gives an accurate forecast for a certain time and place and informs the contact person by SMS to his/her cell phone and/or by e-mail
	Live location of the PU should be shared with the contact person inside and outside the safe zone Alarm only if person is leaving the safe zone and does not return after 10 minutes	GPS Coordinates via SMS are sent every 10 minutes (a map where the contact person can see where the person is walking)
Scenario 1	In case of problems: stepwise help: Step 1 : The contact person should support PU to find way home	Gives simple instructions with his own voice (make a left now..) The contact person receives a map via SMS to show the quickest way
Scenario 2	Emergency: The contact person is alarmed to go to the PU or send somebody	taxi
Problem Solution No.	Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.	

The contact person knows about the fact that PU is insecure and where he is (because of weather warning and/or S.O.S button). But the fact that both know is that they are connected if support is needed- this is empowering the person to leave the house more frequently on his/her own.

After a short phone call the contact person can…
….send a Taxi to location
….send a person to location
….

Problem No.	2 NEW WAY TO THE DOCTOR	
Problem Description	The PU has to go to the doctor. There is a problem on the way and the usual path needs to be changed	
Preconditions	The PU is wearing the FreeWalker device and he is inside his safe zone	
Step No.	Describe the step	Remarks regarding the step
1	The person is insecure because of the traffic outside and a construction site is blocking the usual way.	Because the PU can look at the entire route beforehand, he/she knows that there is a new route necessary
	the PU leaves his home and has to go a new route to the doctor (away from the construction site)	FreeWalker is informed about the situation with the construction site and find´s a new and safe route for the PU to go to the doctor.
	The PU follows the instructions of the FreeWalker system	GPS Navigation per voice and/or with visual help (for example an simple arrow key →, ↑, ← and a distance measure (the distance measure gives ok when distance is arrived at)
	The PU arrives at the doctor without any problems	The contact person is informed with an ok
Scenario 2	The PU is insecure about the new route and informs the carer per SMS Button…"I need help, can you call me?" carer should support PU to find way home and/or to the doctor	The contact person calls the PU and is informed about his location because of the GPS Coordinates which arrived per SMS. The contact person helps the PU per Mobile-phone and instructions to find his way home
	The PU is still insecure	The contact person sends help through another person (taxi, relatives, friends)
Problem Solution No.	Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.	

The contact person knows about the fact that PU is insecure and where he is (because of information about the traffic situation and/or S.O.S button)

After a short phone call the caregiver can…
….send a Taxi to location
….send a person to location
….help with instructions

Problem No.	3 BRING ME to a NEW DESTINATION	
Problem Description	The PU (person with SCI and MCI) is visiting a new friend for the first time. He wants to walk alone to get to know the new route. Consider: the address is outside the safe zone	
Preconditions	The PU is wearing the FreeWalker device and he is inside his safe zone	
Step No.	Describe the step	Remarks regarding the step
1	The person is insecure because of the new route and needs help from the FreeWalker device.	The person is planning the journey at home (shortest way, information about public transport, construction places, parks, etc)
	the PU receives help via voice and/or GPS Systems (simple arrows and distance measure- very simple map?	Duration of walk, recognition of dangerous situations: railroad crossing, black ice, darkness, crosswalks
	Live location of the PU should be shared with the carer	GPS Coordinates via SMS
Scenario 1	The PU arrives at the friend`s location without any problems	Contact person is informed
Scenario 2	The contact person should support PU to find way or to find home	Taxi, per mobile phone (voice), send a well- known person
Problem Solution No.	Describe the conditions that must be met for the problem to be considered solved. There might be different problem solutions to be listed with different solution numbers and description.	
	The carer knows about the fact that PU is insecure and where he is (because of S.O.S button) After a short phone call the cargiver can… ….send a Taxi to location ….send a person to location ….. press the "bring me home" button …..call a taxi (automatic dialling)	

Results Session 3 Switzerland

In de third session the scenarios are visualized by using paper prototypes. Underneath the visuals of the session are presented per scenario.

Scenario 1: Card game

Scenario 1: Card Game

Scenario 1 (cont'd)

ORGANIZING HELP routine

NOT ANSWERING THE PHONE routine

Are both routines the same?

Scenario 1 – Variation a) Same as scenario 1, but: "Today, the PU does not feel well or prefers to watch TV and stays at home".

aa) The agenda is adapted accordingly, either …
… on the SU's …

Agenda:
Change for one time

Notification to PU's device

… or on the PU's device

Agenda:
Change for one time

Notification to carer's device

SOLVED ✓

ab) Nobody adapts the agenda

FW recognises that PU does not leave home at expected time

Notification to PU's device

You are scheduled to go out for playing cards

PU does not press any button

PU does not react to my request of pressing a button
What do you want me to do?

OK, I am just late

OK, but I do not go today

NOT ok, I do not feel well

Same text
Same text
Same text

Scenario 1 – Variation b) Same as scenario 1, but: "Today, the PU does not want to go out for playing cards and decides to go for a walk instead"

bb) Nobody adapts the agenda

FW recognises that PU
- leaves home at expected time
- does not use the corridor to the place of the card game

Notification to PU's device

You have left the correct path to the place of card game

PU does not press any button

PU does not react to my request of pressing a button
What do you want me to do?

OK, I am taking a different route

OK, but I do not go the place of the card game

NOT ok, I do not feel well

Same text
Same text
Same text

Scenario 1 – Variation c) Same as scenario 1, but: "The game was moved from Wed to Friday"

cb) Nobody adapts the agenda -> in same as variation a)

FW recognises that PU
- does not leave home at expected time

Notification to PU's device

You are scheduled to go out for playing cards

PU does not press any button

PU does not react to my request of pressing a button
What do you want me to do?

🟨 OK, I am just late

⬜ OK, but I do not go today

🟥 NOT ok, I do not feel well

🟨 Same text
⬜ Same text
🟥 Same text

Scenario 1 – Variation d) Same as scenario 1, but: "The game was moved from Wed to Tuesday"

db) Nobody adapts the agenda

FW recognises that PU
- leaves home on Tuesday evening even though agenda does not show any external activity

Notification to PU's device

You are NOT scheduled to go out

PU does not press any button

PU does not react to my request of pressing a button
What do you want me to do?

🟨 OK, I changed my plan

⬜ …

🟥 NOT ok, I do not feel well

🟨 Same text
⬜ Same text
🟥 Same text

Scenario 1 – Variation e) Same as scenario 1, but: : "The PU does not feel well during the game and goes home earlier"

eb) Nobody adapts the agenda

FW recognises that PU
- leaves place of card game earlier than scheduled

Notification to PU's device

You are leaving EARLY

PU does not press any button

PU does not react to my request of pressing a button
What do you want me to do?

🟨 OK, I changed my plan

⬜ …

🟥 NOT ok, I do not feel well

🟨 Same text
⬜ Same text
🟥 Same text

Scenario 2 - Blackout moment during walk and PU gets lost (still within safe zone)
2a) FreeWalker is capable of recognising erratic movements / wandering

FW recognises
- erratic
movements /
wandering

Notification to
PU's device

You are
WANDERING

PU does not
press any
button

PU does not react to my
request of pressing a
button
What do you want me to do?

🟨 OK, show my position

⬜ OK, show my position and guide me home

🟥 NOT ok, I need help

🟨 Same text
⬜ Same text
🟥 Same text

Scenario 2 – Blackout during walk
2b) FreeWalker is not capable of recognising erratic movements / wandering
Alternatively a FreeWalker has a time limit, e.g. 2 hours between leaving home and returning, except in cases that something specific is scheduled in the agenda

FW recognises
- that PU is out of
home longer
than 2 hours

Notification to
PU's device

Snooze after 30
Minutes it PU is
not at home

You are OUT OF
HOME longer than
2 hours

PU does not
press any
button

PU does not react to my
request of pressing a
button
What do you want me to do?

🟨 OK, I am fine

⬜ OK, show my position and guide me home

🟥 NOT ok, I need help

🟨 Same text
⬜ Same text
🟥 Same text

Scenario 3 – A diversion for pedestrians forces PU to take a different route
3a) PU is still within the predefined zones
-> if the PU does not show any sign of wandering: no problem
-> if the PU shows signs of wandering: Scenario 2a) / 2b)

Regular Save Zone

Reduced Save Zone for today

3b) PU is leaving one of the predefined zones

-> standard procedure of an alarm being triggered

Scenario 4 – PU does not sleep well

4a) Assuming that FreeWalker does not support sleep monitoring nothing happens …
… until the PU does unexpected = covered in the other scenarios

4b) In case FreeWalker does monitor sleep, a message should be sent to the SU who then has to decide whether or not further action is needed (e.g. calling the PU). We would not consider this to be an emergency or dangerous situation, unless experience in a specific case shows the opposite. In those cases the SU knows what to do, e.g. adapt FreeWalker (by temporarily reducing safe zone), visit the PU, …

Scenario 5 – PU has forgotten to load the battery (TL: PU goes outside without FreeWalker)

An alarm should be sent to the PU prior to complete battery discharge

If battery level has fallen below a predefined value, the SU gets an alarm too

Notification to PU's device

Please charge the battery

Scenario 6 – PU unexpectedly enters a tourist boat (TL: is nearby a high-risk area)

Save Zone (Switzerland)

How do I create such a Save Zone? Using Google Maps and a pen?

direction to Germany

FW recognises that PU is leaving the safe zone and triggers an alarm

Leaving the Save Zone is a standard procedure; the questions here, however, are:
- does FW recognise that the PU is on a boat?
- does it matter that the boat will pass the boarder to Germany? Will the geo positioning still work?
- can the PU be contacted in Germany (roaming?)
- will FW be working in Germany?

Scenario 7 – PU is out for a walk.
7a) After a while, PU stops walking …, for 5 minutes, for 15 minutes, for 30 minutes, for 45 minutes … (TL: Problem 7, Scenario 1)

Notification to PU after X …. (predefined) minutes.

Notification to PU's device

You HAVE NOT BEEN MOVING for … X minutes

PU does not press any button

PU does not react to my request of pressing a button
What do you want me to do?

Notification to SU when PU enters a café / shop (???)

OK, I am fine and continue walking soon

OK, I am in a café / shop

NOT ok, I need help

Same text
Same text
Same text

Scenario 7 – PU is out for a walk.
    7b) After a while, PU walks back and forth, or in a circle, or in any other unusual pattern (TL: Problem 7, Scenarios 2 & 3)
    -> Scenario 2a) or 2b)

Scenario 8 – PU is visiting a fun fair together with SU and gets lost
    9a) there is a physical alarm button on the smartphone
    9b) there is no physical button on the smartphone
    (no comparable problem in TL)
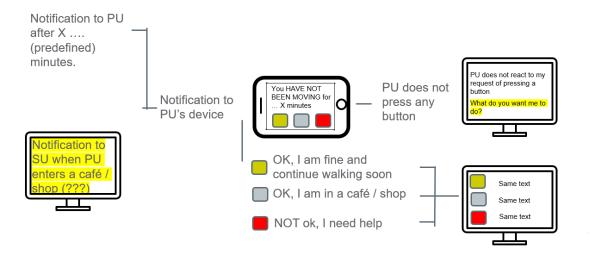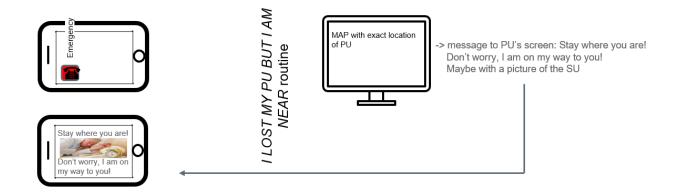   -> as both (the PU and the SU) are aware of the situation, the action of finding together might be initiated simultaneously
    -> will this cause any specific problems ("interference")?
    -> as it is very loud and crowdy audio communication between PU and SU might not be advisable

Emergency

I LOST MY PU BUT I AM NEAR routine

MAP with exact location of PU

-> message to PU's screen: Stay where you are! Don't worry, I am on my way to you! Maybe with a picture of the SU

Stay where you are!
Don't worry, I am on my way to you!

Scenario 9 – PU is in a shopping centre together with SU and gets lost. This is a variation of the fun fair scenario adding some complexity: the various levels (from underground garage to top), the elevators as an additional place to get lost – but without the aggressive fun fair-typical surrounding conditions (less noise, people usually more supportive) (no comparable problem in TL)

Results Session 3 Austria

In the co-design session, the scenarios as described in the results of session two are used to come up with paper prototypes.

Co-creation with a Caregiver

Within the safe zone, the person can select destinations (Walk, Shopping, Pharmacy, Sports, Friends….)

The Person decided to go on a shopping trip, Map of way is shown, shopping list is displayed

Weather scenario

Person is getting tired on the way and needs options of support

FreeWalker Study Evaluation

The evaluators of the field trial represent a small "user" group of the FreeWalker system, that exists only during the research project and the study phase. Certain requirements are related only to this user group and will not be existing for a final product.

- As an evaluator I want to have data collected by the FreeWalker system exported in an anonymous way
- As an evaluator I want a number of parameters to be constantly calculated per day per PU. Examples of such parameters are:

   total time not at home, (in the safe zone, now called "green" zone), total time exploring (in the soft border, now called the "orange" zone), max. distance from home per day, total distance walked per day, total time used a vehicle per day, number of reminders to primary client to return to the safe-zone per day, number of wandering alarms triggered by system per day, number of out-of-zone alarms triggered by system per day, number of alarms triggered by alarm button press by the primary client per day, number of alarms triggered by alarm button press by the carer per day, number of appointments made per day

- As an evaluator I want to have data exported into an Excel table file format
- As an evaluator I want to have the information on which alarm was a false alarm and which alarm was justified. A feedback button on the SU user interface, to be activated after each alarm, would be good for collecting this information from the SU.

4 RECOMMENDATIONS

The results of all co-design sessions resulted in a list of requirements used in development. In the following sections we will present the requirements for the intramural setting (at tanteLouise, The Netherlands) and the extramural setting (at MAS in Austria and Terz in Switzerland).

4.1 List of requirements - MoSCoW

As not all requirements might be as importance to be implemented directly in order for FreeWalker to be successful, the level of importance of a singular requirement will be rating using the labels from **M**o**SC**o**W**. This divides requirements into Must, Could, Should, and Would:

Must include requirements that are critical for the FreeWalker system to become a success and be a useful product for its users.

Should include requirements that are equally as important as must requirements but could be implemented in a different manner or at a later stage as well.

Could include requirements that are desirable but not a necessity and could improve user experience or customer satisfaction for little development cost. These requirements will typically be included if time and resources permit.

Would include requirements that are least critical, might have the lowest-payback items, or are less appropriate at this time. They are requirements that might be considered again in a later stage of the project.

4.2 Methodology - MoSCoW

Partners rated the requirements with a MUST, SHOULD, COULD or WOULD. These labels were quantified by a 4 for MUST, 3 for SHOULD, 2 for COULD, and 1 for WOULD. The means and modus were calculated on the ratings of the partners per requirement. The mean scores were used for the cut off points, a MUST has a mean score '>3', a SHOULD '>2.5 ≤ 3', a COULD '≥2 ≤2.5', and a WOULD '≥1 <2'. Whenever there was doubt among the scores, the modus was used to check the highest frequency reported of a score which resulted for a couple of requirements in changing the score from a COULD to a SHOULD. After all requirements were rated and the ranking was made, partners - in particular the technical partners - decided in a group discussion and online to which extent a requirement was technically feasible in respect to complexity and costs and for which development stage it is planned (1 = pre-alpha; 2 = alpha; 3 = prototype/beta, all). Requirements with a MUST or SHOULD are included in further developments while requirements with a COULD or WOULD might be included and are considered requirements for a possible future follow-up project.

The current MoSCoW analysis, see below, has the mean MoSCoW ratings from partners included in the ranking, the unique ID/number, the requirement, technical and project feasibility, phase, and the source of the requirement.
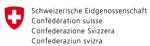
4.3 FreeWalker Must:

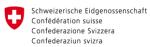| number	requirement	Technical/Project feasability	Phase	Source	MEAN
1	The carer (SU) that needs to search for a person with dementia (PU) who is lost, needs the exact location on the carer app during searching [map of the city, real-	YES	1	co-design NL S1	4
33	The system should show if the PU is outside or within the safe zone and current position of PU should be clear (still at destination or already on his/her way back	YES	2	co-design NL S3	4
40	The system should have an option / to have alarm button on the MOPAS device or on a personal alarm system like a necklace or bracelet (situation: PU is within safe	YES	1 (GPS/MOPAS) 2 Primary User	co-design NL S3	4
54	Device needs to have a physical alarm button	YES	1 (GPS/MOPAS) 2 Primary User	co-design CH S1	4
2	The device for the PU should not hurt the PU when it is worn/attached to their body.	YES	1	co-design NL S1	4
81	Snooze, Map and Dial functionality	YES	1 (map), 2 (dial), 3 (snooze)	co-design CH S3	4
84	Alarm whenever with notification to PU has fogotten to load battery	YES (battery low alarm)	1	co-design CH S3	4
110	Alarm created when Pressing an alarm button	YES	1	co-design NL S4	4
124	With a new client: you should start with a standardized ISZ. But this safe zone	YES (but what should be adjustable? the initial	1	co-design NL S4	4
128	Information of the client in the system: Name & Surname	YES	1	co-design NL S4	4
134	Information of the client in the system: How to approach the client?	YES	1	co-design NL S4	4
76	All FreeWalker components must have CE certification	YES	1	legal issue	4
1670	As the study evaluator I want to have access to various data produced during the pilot operation	YES	3		4
2270	As a study evaluator I want to access user data in an anonymized way	YES	3		4
2429	FreeWalker system shall preserve the privacy of the PU at all times	YES	all	General discussion, Legal issue	4
2441	As a carer I want the FreeWalker dynamic safe zones to work in a surrounding of	YES	1	terz Stiftung	4
2483	FreeWalker will integrate a learning system that learns the PWDs typical outdoor	YES	1	DoW p.4	4
2484	FreeWalker will integrate a database on essential information about the person (age, address, health status, ..) for restricted use by caregivers, officials and	YES	1	DoW p.4	4
2485	FreeWalker will integrate a logic engine that connects all information and issues	YES	1	DoW p.4	4

number	requirement	Technical/Project feasability	Phase	Source	MEAN
2486	FreeWalker will integrate an intuitive mobile user interface for the informal caregivers to anticipate critical developments and to prevent critical situations	YES	1	DoW p.4	4
2487	The logic engine will include information from the personal calendar to dynamically set up safe areas and safe corridors depending on special routes to	YES	2	DoW p.4	4
2488	FreeWalker will integrate an optional navigation aid that can be utilized by the end user to be guided home in case of lost orientation (adopted from the AAL project	UNCLEAR complex technical issue		DoW p.4	4
19	The system should have the option to escalate the alarm when SU does not react. The alarm should be sent to another SU. : 1) The carer of the group of the institution where the PU lives 2) After some time when this carer doesn't respond (specific amount of minutes should be defined) the alarm should be send to SU who is available and most nearby the PU (carer from another group, desk employee	YES	3	co-design NL S2	3.8
20	Drawing the safe zone should be done on a device that is suitable to this (very)	YES	To be defined later	co-design NL S2	3.8
55	Device needs to be simple to use (high usability / accessibility)	YES	all	co-design CH S1	3.8
31	When PU is not back in time and alarm is triggered, live location (within the interval - e.g., 15 seconds, updated, dynamic, moving) of PU should be displayed on	YES	2	co-design NL S3	3.8
106	Whenever you click on a picture of a client, at alarm Open the geographic map of	YES in principle but formulation of Req. is very	1	co-design NL S4	3.666666667
107	Zoom in the map for more detail (landmarks, street names need to be visible	YES	1	co-design NL S4	3.666666667
111	Alarm created when When someone is leaving the safety zone	YES	1	co-design NL S4	3.666666667
112	Alarm created when When someone not arrived back from an appointment on	YES	2	co-design NL S4	3.666666667
117	Do not provide too many notifications as it might cause an information overload	YES in principle but Req. formulation is very va	all	co-design NL S4	3.666666667
118	At an alarm, I do wish to know if someone returns to the safe zone	YES	1	co-design NL S4	3.666666667
119	Notification if an alarm is dealt with, and who dealt with it.	YES	3	co-design NL S4	3.666666667
127	If you provide a destination, the system should automatically calculate a route,	YES	2	co-design NL S4	3.666666667
129	Information of the client in the system: Picture	YES	3	co-design NL S4	3.666666667
130	Information of the client in the system: Address/house	YES	1	co-design NL S4	3.666666667
132	Information of the client in the system: Telephone number (of client and of the	YES	1	co-design NL S4	3.666666667
133	Information of the client in the system: Important medical information	YES	1	co-design NL S4	3.666666667
147	It should be difficult to remove the device.	YES (but details may be complex, how to test?)	all	co-design NL S4	3.666666667

number	requirement	Technical/Project feasability	Phase	Source	MEAN
23	The system should have the option to add appointments (can be recurring) to	YES	2 (portal & app)	co-design NL S2	3.6
35	The system should present details about the situation when an alarm is triggered; it should provide the possibility to click for more details after alarm is triggered. Device should show: 1) Time that the PU has been on this location (since when?) 2)	YES	2	co-design NL S3	3.6
56	Safe zone (distance) and alarm triggers (time, who) should be customizable	YES	1 (safe zone) 2 (time, triggers) 3 (who)	co-design CH S1	3.6
82	When PU presses/alarms HELP, organize routine	what does it mean? checklist? organisation of search team?		co-design CH S3	3.5
145	changes in degree of freedom or save zone should be made by the	YES	1	co-design NL S4	3.5
8	The system should have the option to create a notification when the PU deviates from "normal pattern", e.g., when wandering.	YES	3	co-design NL S2	3.4
26	The freewalker system should have the possibility to set up triggers for an alarm or	YES	duplicate	co-design NL S2	3.4
53	Device needs to have a telephone function / audio connection to caregiver	YES	1	co-design CH S1	3.4
57	System should learn from the usage and adapts its safezones	YES	1	co-design CH S1	3.4
59	Device should have GPS function which is simple to use (in case PU gets lost so they	RISK complexity	3	co-design CH S1	3.4
71	It must be easy to draw and change (reduce, extend) all kind of zones. Ideally by using a pen and Google Maps or similar (assuming that pens are not available in	YES	duplicate	co-design CH S2	3.4
77	The PU can look at the entire route beforehand	YES	2	co-design AU S2	3.333333333
125	The option that the zone expands is not handy for all clients, especially new ones,	YES	1	co-design NL S4	3.333333333
3	SU should have the option to snooze [any future alarms for a period of time of] the freewalker system for a period, for instance when the pwd is walking together with family of carer	YES	3	co-design NL S1	3.2
9	The system should have an option to create an notification when there is no movement for a long time, it can happen that PU stops walking when he/she is lost.	YES	3	co-design NL S2	3.2
10	The system should present/map important landmarks to [the SU] indicate if it can be that PU is inside a building when an alarm is created. For example special buildings, benches in the garden. Especially for carers who work but do not live	YES (when using existing landmarks in e.g. Google maps, high complexity when manually put in)	1	co-design NL S2	3.2
12	the system should have the option to create an alarm of notification when PU is walking back and forth or crossing the same point again and again, possibly	YES (risky with false alarms)	3	co-design NL S2	3.2
36	The system should have the option to contact the PU (phone call, message) before choosing the next step in escalating / actioning. If the PU doesn't respond, the	YES	3	co-design NL S3	3.2
39	The system should sent an notification when PU is back home (alone or with carer)	YES	1	co-design NL S3	3.2
41	The Freewalker system does recognize walking/moving patterns and can identify when PU (feels)/is lost. It will send an alarm / notification to carer. Possible	YES (risky, we may have high false alarm rate)	duplicate (3, extended)	co-design NL S3	3.2

4.4 FreeWalker Should:

number	requirement	Technical/Project feasability	Phase	Source	MEAN
30	It should be displayed if the PU is alone or with an informal carer.	YES	2	co-design NL S3	3
6	The system should decrease the save zone based on patterns. An example; some PUs make use of the garden but only one part of it, when they go to another direction they can be lost, SU should get an notification.	YES	1	co-design NL S2	3
11	The system should have the option to create a notification or alarm when PU is longer than normal outside [within the safe zone]	YES (experimental)	3	co-design NL S2	3
50	A high priority push notification should be sent to SU with the location of the PU when he/she is walking towards / near to a "high risk area" (e.g. a dangerous busy	YES	1	co-design NL S3	3
70	FreeWalker should offer a kind of a Logbook, where all the incidents are stored in a way that is useful for learnings / future action (useful for PU, SU, Medical Doctor;	YES	3	co-design CH S2	3
52	With regards to setting of alarms when PU is leaving the building with the walking group: There should be an option for the person who is leading the walking group to select which PU's are indeed coming along with the standard scheduled walk, at the actual time when leaving for the walk. In the walking group, both PU's that can and those who can't leave the building are included. The reason for being able to select which PU's are joining, is that carers don't want to receive all unnecesary alarms for all the PU's who are leaving the building with the carer to go for the	YES	3 (complex, later stage)	co-design NL S3	3
80	Snooze function when PU is not on time at home (30 minutes) or notify when X is at	YES, in principle but "snooze" is ill-defined curl	3	co-design CH S3	3
83	Notifications to PU device, e.g., PU can select options whenever not in time (OK, I	YES	3	co-design CH S3	3
115	Alarm created when At 22.00 (night shift starts) an alarm if someone has not	YES in principle but vague formulation, is it no	3	co-design NL S4	3
120	Person that is taking care of the group and that escalation should receive an alarm	YES but vague formulation of the Req.	3	co-design NL S4	3
126	There are several standard scenarios (3 or 4)-such as a walk to the library, or a	YES, but clarify what adjusted means in this cu	3	co-design NL S4	3
135	Information of the client in the system : Reanimation, yes/no?	YES, legal issue?	3	co-design NL S4	3
136	Information of the client in the system : RM/IBS? If someone with such a	UNCLEAR what it means?		co-design NL S4	3
144	Temporary changes in the degrees of freedom for the client should be adjustable	YES	3	co-design NL S4	3
74	FreeWalker must also work in a neighbor country if the PU lives close to a border		all	D1.2	3
15	The device of the PU should be as small as small as possible. Especially for women who do wear a dress or a skirt is will be hard to wear this device. Smartphone for	YES	1	co-design NL S2	2.8

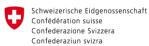| number	requirement	Technical/Project feasability	Phase	Source	MEAN
18	The device of the PU should be easy to clean	YES	1	co-design NL S2	2.8
21	For some users it is important that they cannot lose the device so it should be attached in a way it can't get lost	YES	1	co-design NL S2	2.8
42	The freewalker should have audio support. There should be an option that PU en SU will talk to each other by using the Freewalker and SU can support PU to find his/her way home	YES	1 duplicate	co-design NL S3	2.8
51	The freewalker system should have the option to give an overview of situation: who is outside/at home at a set time in the evening, before night shift starts (e.g.	YES	3 (complex, later stage)	co-design NL S3	2.8
4	The save zone should adapt the locations of events in the agenda of the PU (corridor functionality)	YES	2	co-design NL S1	2.8
116	Alarm created when At a fall (if FreeWalker has fall detection).	YES (But only with MOPAS)	1	co-design NL S4	2.666666667
137	Information of the client in the system: Additional notes	YES	1	co-design NL S4	2.666666667
5	Having different sounds of the alarm for different situations like alarm vs	YES	1	co-design NL S1	2.6
28	The carer should be actively informed by a push notification, with colour red and high priority alarm sound on a device that the carer is wearing about the situation	duplicate	duplicate	co-design NL S3	2.6
58	Device should have fall detection	YES (Mopas BT yes, lite…)	1	co-design CH S1	2.6
38	The system should have the option to sent a notification to colleagues of carer so they know they should keep an eye on the location because carer has left to get PU	Not for FreeWalker		co-design NL S3	2.6
49	In case PU goes outside without taking the FreeWalker device, a notification/alarm should be sent to SU. (also with low battery)	YES (already in, coupled with agenda and battery signal)	1	co-design NL S3	2.6
60	Notification should be sent if it is clear, that the primary user is not following his intended route. Either after a certain amount of time or certain distance, defined	YES ("green" corridor)	2	co-design CH S1	2.6

4.5 FreeWalker Could:

number	requirement	Technical/Project feasability	Phase	Source	MEAN
131	Information of the client in the system: Way of transport			co-design NL S4	2.5
138	Information needed in the history of the client: Which route did someone walk			co-design NL S4	2.5
139	Information needed in the history of the client: Number of alarms (all time) – List			co-design NL S4	2.5
140	Information needed in the history of the client: Number of times outside DSZ (all			co-design NL S4	2.5
32	When PU is not back in time and alarm is triggered, live image of PU should be displayed on the carers device.			co-design NL S3	2.4
27	There should be different parameters to set of as a trigger to an alarm: time, zone, distance for the carer (SU) to be on time at the PU, walking speed, heart rate			co-design NL S2	2.4
76	The contact person receives a map via SMS to show the quickest way			co-design AU S2	2.333333333
142	There will be both personal and group appointments in the calander/activities			co-design NL S4	2.333333333
143	You should be able to make/add appointments in the calender through the portal			co-design NL S4	2.333333333
17	It would be nice to have the option to choose a sound for the alarm (a nice sound)			co-design NL S2	2.2
37	There should be a route on the map for the (nearest) available carer to see how to get to the PU with the time needed to get there.			co-design NL S3	2.2
64	If no caregiver reacts, the police should be alarmed with the personal description, the location of the primary user as well with contact information of the caregiv			co-design CH S1	2.2
25	The system should have the option to set different degrees of freedom, save zones per user (for morning, afternoon and night but also when deviating from the norm			co-design NL S2	2
62	Option for caregiver to add the route beforehand to the system, so that the primary user has the navigation available.			co-design CH S1	2
78	GPS Navigation per voice and/or with visual help (for example an simple arrow key →, ↑, ← and a distance measure (the distance measure gives ok when distance is			co-design AU S2	2
97	Within the safe zone, the person can select destinations (Walk, Shopping, Pharmacy, Sports, Friends….)			co-design AU S3	2
100	Person is getting tired on the way and needs options of support			co-design AU S3	2
108	Kknowing at what pace someone is moving (3km/h, 15 km/h, 50km/h)			co-design NL S4	2
113	Alarm created when When someone has stopped walking -someone might be on a			co-design NL S4	2
114	Alarm created when When someone is moving back and forth			co-design NL S4	2
121	Present location if someone goes for a usual walk (not an agenda item) but takes			co-design NL S4	2
122	Battery should ideally last from 7 AM till 11 PM			co-design NL S4	2
123	Per zone: in a more dangerous zone the frequency of location presentation should			co-design NL S4	2
141	Information needed in the history of the client: Walking speed (all time)			co-design NL S4	2
146	All activities (appointments) are made in the electronic care system, it would be			co-design NL S4	2
75	As a study evaluator I want to have feedback of the SU's on false alarms logged in the system (possibly via a special button on the SU App)			Milan Vosko in GA04	2

4.6 FreeWalker Would:

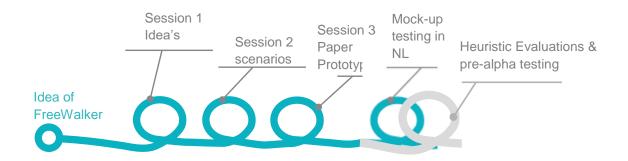| number	requirement	Technical/Project feasability	Phase	Source	MEAN
14	It would be nice is the systems facilitates audio contact in case of an alarm, not only to speak with the but to check if sound can help by having information about the situation or have contact with people around.			co-design NL S2	1.8
45	The FreeWalker system should recognize that the PU deviates from his normal route and send an alarm to the carer, also when in safe zone (PU is trained to			co-design NL S3	1.8
74	The system should provide information about the weather condition and the time	...		co-design AU S2	1.666666667
75	Gives simple instructions with his own voice (make a left now..)	...		co-design AU S2	1.666666667
98	When going on a shopping trip, Map of way is shown, shopping list is displayed			co-design AU S3	1.666666667
99	Warning bad weather and whenever when it gets dard, with go home / red button (help)			co-design AU S3	1.666666667
48	In case of PU didn't sleep well: The FreeWalker system should work normally but give more alarms since the rules are stricter. More notifications are needed than			co-design NL S3	1.6
69	FreeWalker should also add value for non-dangerous situations (simple information, map with direction home as requested (sth. that also absolutely healthy people value highly), peace of mind for SU			co-design CH S2	1.6
73	FreeWalker should include a "how to deal with" with people with dementia (how to approach them when they are confused, how to convince them to go home, the			co-design CH S2	1.6
79	GPS Coordinates via SMS			co-design AU S2	1.5
13	It could be nice if the system, when privacy allows, has the option to have video contact that a carer can check does it look like he/ she has fallen, can we see if			co-design NL S2	1.4
16	It would be nice if the system can connect to a system that is currently used to open doors.			co-design NL S2	1.4
47	In case of PU didn't sleep well: The FreeWalker system should change the safe zone and the conditions of monitoring and sending alarms to the carers (e.g.: normally			co-design NL S3	1.4
65	Device should be able to measure temperature and send an alarm when PU is out			co-design CH S2	1.4
66	Possibility to send alert when specific situations are happening that could be described as "slightly more dangerous than usually" (weather conditions, dark/night			co-design CH S2	1.4
67	Option to insert medication into FreeWalker, and then link it to pharmacies			co-design CH S2	1.4
68	Freewalker should learn what is normal and what is a deviation from normal and then inform the PU and inform / alarm the SU accordingly based on the	duplicate	duplicate	co-design CH S2	1.4
7	It would be nice if walking patterns of the PU can be used to monitor walking distance and speed over time, so it can be used in relations with monitoring the			co-design NL S2	1.2
46	The system should know that the PU did not sleep well, as this can cause a higher risk of getting lost for the PU. Two options how this could be done: 1) this is added in the "signal plan" by the carer, which system is connected/synced to the			co-design NL S3	1.2
43	It would be nice if the freewalker system can be connected to the "Amber alert			co-design NL S3	1.2
63	In case PU deviates from route, notification should be sent to caregiver. PU should be alarmed by a loud tone or vibration and audio contact between caregiver and PU should be possible in order to give directions.If a caregiver is responding to the messages, the police shouldn't be automatically alarmed. The caregiver might be			co-design CH S1	1.2
72	The voice of the SU is important as it can build trust in hazardous situations. Hence audio quality needs to be good. What it the PU has a hearing aid? Can FreeWalker			co-design CH S2	1

4.7 Next steps in user involvement.

Since the development is an iterative process in which we want to involve user over time. In this deliverable we presented the results from 3 sessions per country which will be followed with the mock-up testing in the intramural setting. Further testing will be performed with the working prototypes by means of heuristic evaluations and pre-alpha usability and performance testing (from September/October 2019).
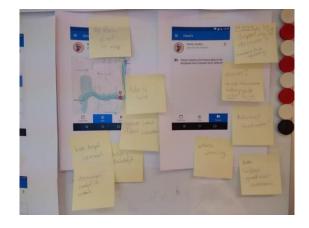
4.8 Mock-up testing in the intramural setting.

Session 4 |Testing the carer app (first mock-up) and questions from technical partners.
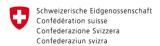***Participants N=6***

This paragraph presents the results of the 4-codesign session in the Netherlands which was used to collect feedback on the SU- app and find answers to the questions of the technical partners. To present the information the question from the technical partner is provided and by using an italic font the answer is presented underneath.

1 |SU app

Comments related to the carer app and ideas to improve are also added to AdobeXD a program that is used to build the mock-ups.

The feedback given by the user:

Related to the overview screen:
- *Clear*
- *It's immediately obvious whether someone is in trouble (urgency is obvious)*
- *It's clear where they are, at what time*
- *The buttons at the bottom are not immediately clear, only after scrolling I realised these were buttons*
- *Needs information on client specifics (someone needs antibiotics, no reanimation)*
  - o *What is urgent information that a care professional needs?*
  - o *How to approach someone? "this person is very responsive to his/her first name"*
- *Pictures of clients: Useful. Also used in current systems*
  - o *House, apartment/room number should be visible in the file, not in the overview*
- *The red, orange, and green/blue circles are not that obvious.*
  - o *At an alarm it should be more obvious:*
    - ▪ *Dual coding*
    - ▪ *Larger red surface for the circle*
    - ▪ *Change picture from a circle to a square*
  - o *What does the colour code mean, and how should you respond to a change in the colour code):*
    - ▪ *Green: In the safe zone (at home, or walking within the limits of the desired zone)*
    - ▪ *Orange: (Ivegi): deviation zone of about 25 meters to account for GPS inaccuracies.*
    - ▪ *Red: urgent situations*
- *The symbols used were not clear yet*
  - ▪ *Participants were especially confused about the meaning of the icon with two persons (many people thought this would represent a client that is under supervision)*
    Idea to have an icon that presents a person walking to a location pin.
  - ▪ *If someone does something that is okay (status is green), do we have to know more information than home/not a home? Difficult (privacy wise): it would provide more comfort for the care professionals to know more.*

    Overview screen filter:
  - o *It would be nice to filter who has what status (at home, walking, etc.)*

What should happen when you click on a picture of a client:
  - o *At an alarm: Open the geographic map of the location immediately*
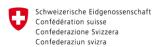 - o *Without an alarm: Open the client file (dossier)*

Location screens:
- *Clear map*
- *it is not clear where SU is*
- *It is not clear in which direction PU is walking*
- *There is no clear distinction between the start and destination point (where is the user going?)*
- *I would like to be able to zoom in the map for more detail (landmarks, street names need to be visible)*
  → *"this will be possible in the live version" according to Ivengi*

Information required:
- *Make a link between the client file (dossier) in the system of tanteLouise and the app.*
- *Way of transport/moving? On foot, with a rollator, scoot mobile, by bike?*

2 | FreeWalker concept in general. Questions related to the FreeWalker concept.

- **Way of transport**
  - o Will the PU make use of Public transport, bike or car?
    Hardly, but biking (electric) might happen in the near future. There is already one electric bike request on the waiting list. Furthermore, it can be that someone takes a bus unexpected.

  - o Does the SU need to know if PU is walking or using public transport/car?
    Yes, but only knowing at what pace someone is moving (3km/h, 15 km/h, 50km/h) is sufficient.

- **When should an alarm- notification be created?**
  - o When should an Alarm be created? (Falling, PU used emergency button, PU stops walking for an X amount of minutes, PU is lost, PU is not back on time)
    - *Pressing an alarm button*
    - *When someone is leaving the safety zone*
    - *When someone not arrived back from an appointment on time*
    - *When someone has stopped walking -someone might be on a bench- or is wandering around (lost)*
    - *When someone is moving back and forth*
    - *At 22:00 (night shift starts) an alarm if someone has not returned before the night shift starts.*
    - *At a fall (if FreeWalker has fall detection).*

  - o Which notification should be created? At home, back at home, left home, arrived at appointment, etc? Should there always be a notification when a PU arrives (back) to care institute (TL) or only in some cases (Privacy issue).

    Do not provide too many notifications as it might cause an information overload, resulting in not responding to notifications anymore. No, we do not need these notifications, and we do not want any other notifications. Actually, notifications are not necessary, only alarms.

    At an alarm, I do wish to know if someone returns to the safe zone. Notification if an alarm is dealt with, and who dealt with it.
    - o *Someone has to accept an alarm, to show that a care professional is working on it. This should be visible in the app.*

  - ➤ Does it differ per client?
    No.

  - ➤ What about privacy
    - o Who should get the alarm- notification?
    Person that is taking care of the group and that escalation> use escalation of alarms we already have.

- **No alarm but the location is needed**
  - o Is there a situation in which the location should be presented without getting an alarm? (privacy)

    Yes, if someone goes for a usual walk (not an agenda item) but takes longer that the usual time.
    You should not watch it, if you don't have to.

Ivengi: Only at an alarm you can trace someone, but you can <u>always</u> see the current location of a client on the portal.

o   Can there be a situation that a carer creates an alarm when PU is lost (in period the system is snoozed for instance) how would this be done? Via the portal and/or SU app?

This is a situation that could indeed happen, you should immediately see location and route the PU is waking at the moment this happens. So these are the same requirements as with an alarm.

Snooze function:
o   *Silence/snooze the system for a particular time*
▪   *Should a SU be able to stop the snooze time or set a manual alarm? For example, a person goes out with a friend or relative (snooze the alarm), and the relative calls that the person with dementia is missing (set the alarm manually). <u>Yes, this is required.</u>*
o   *Ivengi: the system has an automatic reset as soon as a person returns to the safe zone.*

- **Time till an alarm can be created**
   o   To save battery the location will be given each minute, this could result in a situation that an alarm is given when a PU has left the safe zone 1 minute ago. Also 20 seconds is possible but then the battery will be low in a few hours. Are there situations in with 20 seconds is needed or is 1 minute fine?

   Differs per person: some persons move faster than others.
   Per zone: in a more dangerous zone the frequency should be higher.
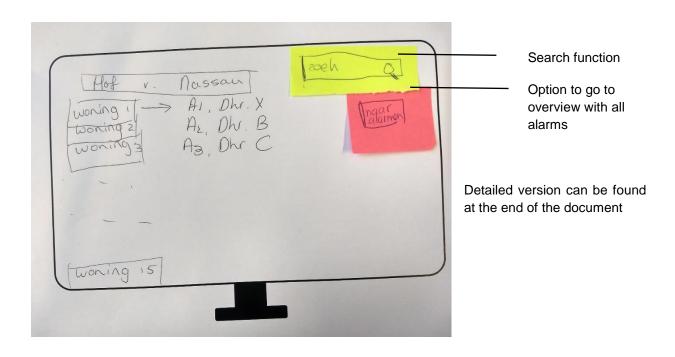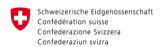   *Battery should ideally last from 7 AM till 11 PM (full shift)*

3 | Paper prototyping the portal

- **Client**
  - In the previous session we spoke about different client profiles. Are there predefined profiles? Like High risk client? And what is the definition for that profile?

  - *With a new client: you should start with a standardized ISZ. But this safe zone should be adjustable per client over time.*
  - *The option that the zone expands is not handy for all clients, especially new ones, there should be exceptions possible*
  - *Standard… unless it must be different.*
  - *There are several standard scenarios (3 or 4)-such as a walk to the library, or a walk to the park-, which could be adjusted later on, depending on the client.*
  - *If you provide a destination, the system should automatically calculate a route, rather than having to drag/mark the entire zone.*

  - Should the clients be clusters in the system? Per group per location? Are there situation in which people can view people from different clusters of multiple clusters? Etc.
    - *Suggestion 1 – Alarms accessible through special button*
      - *Location ⌐*
        - *House ⌐*
          - *Apartment + client*
    - *Editing, not everyone can edit everything. Not all carers will have access to the portal.*

Search function

Option to go to overview with all alarms

Detailed version can be found at the end of the document

- o Which information of the client should be in the system?
  - *Name & Surname*
  - *Picture*
  - *Address/house*
  - *Way of transport*
  - *Telephone number (of client and of the house the client lives in)*
  - *Important medical information*
  - *How to approach the client?*
  - *Reanimation, yes/no?*
  - *RM/IBS? If someone with such a classification is lost, the prosecutor should be warned*
  - *Additional notes*

- o Which information is needed in the history of the client

  - *Which route did someone walk (past 7 days)*
  - *Number of alarms (all time) – List of alarms*
    - *Urgency*
  - *Number of times outside DSZ (all time)*
    - *When did this event occur?*
  - *Walking speed (all time)*

  For how long in time do you want to store data?
  This obviously determines on the type of data.

- o Should there be an option to inform others, like family and the emergency organisation by using FreeWalker, which information should be added in the portal. Which information about the client should be included?

  *Automatic family alert, **definitely not**.*
  Automatic neighbourhood alert, Look out for (name) and (picture).
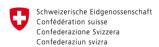
- **Activities**
  - o Calendar/activities can be set in the portal. Will there be both personal and group appointments?

    Yes, there will be both personal and group appointments.
    You should be able to make/add appointments in the calender through the portal and the app. Because everyone should be able to add things to the calendar and not everybody will get entry to the portal.

    Temporary changes in the degrees of freedom for the client should be adjustable in the application. But changes in degree of freedom or safe zone should be made by the multidisciplinary team and therefor in the portal.

    All activities (appointments) are made in the electronic care system, it would be nice if we can connect that with FreeWalker. Till this connection is possible activities should be added in the app.
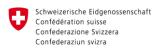
4 | Client device

What is good?	Challenges
Smaller 23 grams Speech functionality 24 hour battery Can be connected to Wi-Fi Easy to charge with a magnetic New devices are usable	Fall detection is poor at the wrist, as it continuously moves. It is difficult to distinguish regular movements from a fall. *It could be used on the trouser.* People do not always want to wear a device. So, clients get very creative to remove the devices (even cutting their own trousers). So, it should be difficult to remove the device. *Suggestions: using anti-theft clothing magnets* *tL will send images with solutions to avoid persons cutting off the device.* The devices are not water proof Alarm button: Will people know how to ask for help / press alarm button?

For the pilot at tanteLouise it is important that we can connect the client device to the cloths of the PU. With the current GPS system at tanteLouise we do use a magnet to attach it to the PU (see pictures of current system on the next page).
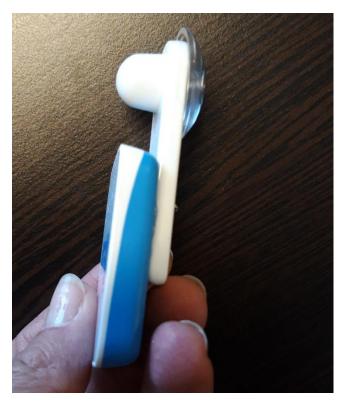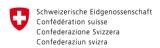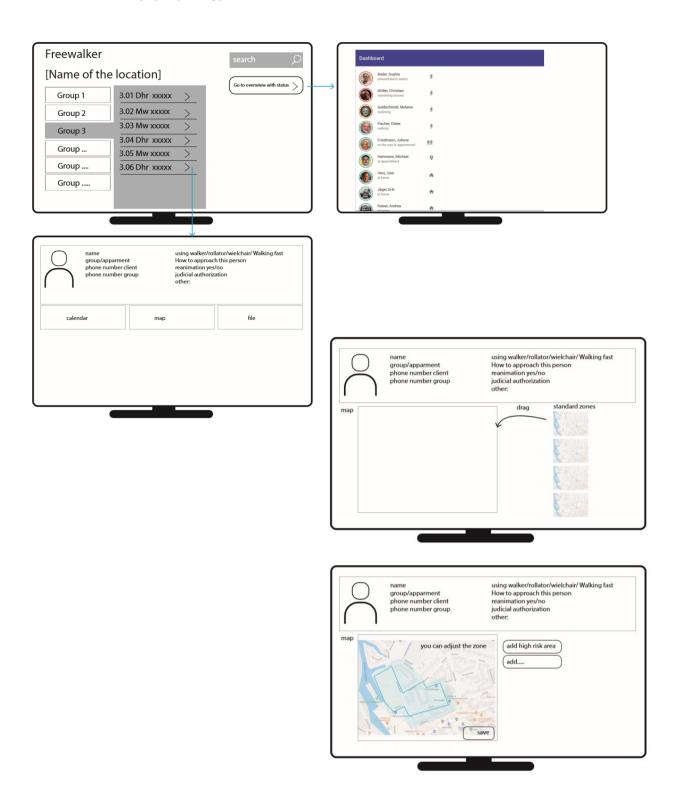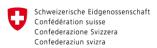
Visual details from paper prototypes:

5 CONCLUSION

We successfully performed three iterative co-design sessions at three different end-user sites in three different countries (The Netherlands, Austria & Switzerland). In the Netherlands at tanteLouise, we performed the co-design sessions for the intramural care setting with people with dementia. In Austria at MAS and in Switzerland at Terz, co-design was performed with reference to extramural care setting for people who are in need for support to people with memory problems and MCI. In the first session we gathered ideas and reflections on use cases and the dynamic safety zones which are described in this deliverable. In the following second sessions we gained insights into scenarios for usage. In the final third session, paper prototyping was performed to gather an in-depth understanding about the various scenarios for use. The three iterative co-design sessions in three different countries resulted in a relevant and valuable list of functional and non-functional requirements which were ranked by a MoSCoW analysis. Mock-up testing took place with the carer app (first mock-up) in the Netherlands with 6 participants. Scenarios are made for intramural and extramural use of the FreeWalker system which serves as input for the technical developments in the project (technical scenarios). FreeWalker partner CREAGY will use the results from the co-design sessions described in this deliverable for the design of the FreeWalker app (see D2.1 & D2.2).

6 APPENDIX

Index of the appendix:

6.1 General questionnaire and informed content
6.2 Materials co-design session 1
6.3 Materials co-design session 2
6.4 Materials co-design session 3
6.5 Table of Status Descriptions
6.6 Additional Questions from the co-design phase at terzStiftung
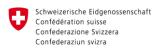6.7 Excel Table of List of Requirements (as a separate Excel file)

6.1 General questionnaire

Date: _____/_____/_____ (dd /mm /yyyy)

---

1 GENERAL

1.1 Date of birth: _____/_____/_____ (dd /mm /yyyy)

1.2 Place of residence: _____

1.3 Gender
   ☐ Male
   ☐ Female

1.4 What is the highest degree or level of school you have completed?
   ☐ No education
   ☐ Primary education
   ☐ Secondary education
   ☐ Tertiary education (university or further education level)
   ☐ Don't know
   ☐ I don't want to answer

1.5 What is your experience with cognitive impairments?
   ☐ I have cognitive impairments myself
   ☐ I am an informal caregiver of someone with cognitive impairments
          o Partner
          o Parents
          o Other,.......
   ☐ I am a formal caregiver of people with cognitive impairments
   ☐ Other,......
   ☐ I don't want to answer

1.6 Can you elaborate about this experience (level of cognitive impairments, time from diagnosis..)

2 COMPUTER USE

2.1 How would you describe your skills regarding the following devices?

Please, answer using the scale below:
5 = I know it very well and can do about everything with it.
4 = I know most of its features, and confident in its operation.
3 = I know its main features but sometimes I need help for its operation / setting.
2 = I can operate its very basic features, but I often need help for its operation / setting.
1 = I am unable to use this device.

	1	2	3	4	5	I don't have any experience	I don't want to answer
Smartphone	☐	☐	☐	☐	☐	☐	☐
PC	☐	☐	☐	☐	☐	☐	☐
Tablet	☐	☐	☐	☐	☐	☐	☐
GPS localisation system	☐	☐	☐	☐	☐	☐	☐

2.2 Can you elaborate about this experience (what type of applications do you use, when did you decide to start using it, are you tech-savvy,…).
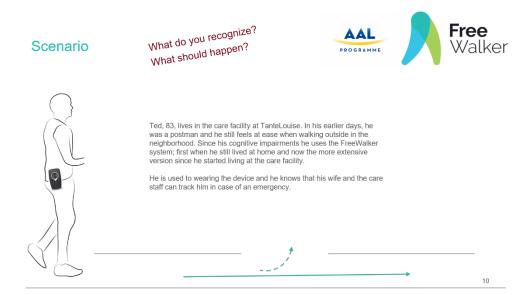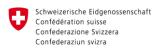
6.2 Materials co-design session 1

session 1 – scenario's NL

Scenario

What do you recognize?
What should happen?

Ted, 83, lives in the care facility at TanteLouise. In his earlier days, he was a postman and he still feels at ease when walking outside in the neighborhood. Since his cognitive impairments he uses the FreeWalker system; first when he still lived at home and now the more extensive version since he started living at the care facility.

He is used to wearing the device and he knows that his wife and the care staff can track him in case of an emergency.

10

6.3 Materials co-design session 2

Guideline and materials | Co-design session 2

Materials:
- General questionnaire
- PowerPoint presentation
- Flipover, markers, post its, visualisation of different users of Freewalker. All to brainstorm an visualise their ideas.
- MOPAS device and ivengi smartphone with the Clickable PDF of Happy Walker Navigation (>sent the PDF to the smartphone).

Make use of the PowerPoint presentations to discuss the ideas of the dynamic safe zone.
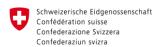

For the brainstorm part of the session, ask user to visualise the Freewalker concept. Ask questions like; what about the device for the PU (show MOPAS and phone) how should it look, which function should it have etc. Also for the carer app and the portal, which information do you need on the app when are you using this how many people are involved etc..

Example from the Netherlands:

Collecting the results:
- A small report of the meeting
- Descriptions of problem and/or how to solve

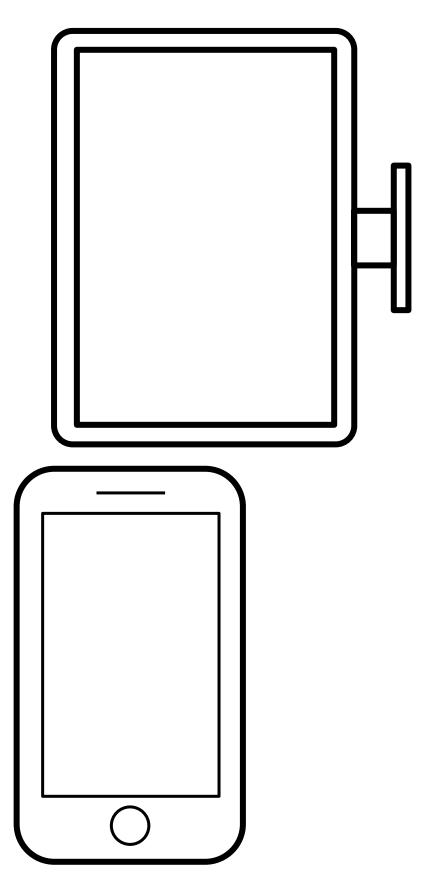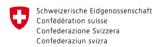| Concrete problem	Concrete «how to solve it»
Example: «The primary user has an appointment with the doctor and is on the way to the doctor alone. Suddenly, the primary user gets confused and does no longer know why he/she is on the way and where he/she has to go».	Example: «First, the user has to press the button on the Mopas device. Then, ….. And then, …. And finally, ….. The user knows again that he/she is on the way to the doctor and follows a path within the dynamic geo zone.»
…	…
.	.

6.4 Materials co-design session 3

6.5 Table of Status Descriptions

Status Description	Alarm State	Push Notif.	Explanation	For	Original Data source
close to home	G	No		all	LE
outside	G	No	is outside but inside green zone, or green corridor	all	LE
using a vehicle	G	No	is using a vehicle (derived from speed)	all	LE
close to appointment	G	No		all	LE
in company	G	No	is in company of somebody, usually in combination with "snoozing" or with appointment with the feature "accompanied"		SU App
device is charging	W	No	location device ... where us...	...ev/PU App	LS
exploring	O	No	...ge zone	All	LE
reminded	O		...system to return	PU App	LE
late for appointment			...tart for, or reach appointment, ...ne	All	LE
battery low			...s		All	LS
erratic movement	O	Yes	Inside green zone but with strange behaviour (potentially high false alarm rate must be expected)	All	LE
pressed alarm	R	Yes	Alarm button press. Also a response "I am not ok" to a reminder (PU App, only).	all	LS
has fallen	R	Yes		PU Dev	LS
Out of zone	R	Yes	outside of the orange zone	All	LE
Not reacting	R	Yes	PU is not responding to a reminder	PU App	LE
alarm by carer	R	Yes	carer initiated alarm	All	SU App
Lost signal, possibly inside building	G	No	Lost GPS signal	All	LS

Invalidated: Use current version of „clientState"
definitions in "settings.json" on
https://gogs.freewalker.eu

Lost signal, >1h	O	Yes	Lost the GPS signal for over an hour	All	LS
no information	W	No	no connection, not active, ..	All	LS

Legend:

G / O / R / W   .. states Green / Orange / Red / White
LS   .. locating service
LE   .. logic engine
EP   .. emergency portal
PU App / PU Dev   .. the possible devices: Smart Phone / MOPAS light & MOPAS BT
Push Notif.   .. uses Android Push Notification to inform SU user on Carer App
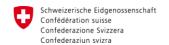
6.6 Additional Questions from the co-design phase at terzStiftung

From the co-design sessions at terzStiftung a number of questions were reported that are under discussion in the FreeWalker consortium.

➔ Can PU choose between FreeWalker using their regular smartphone …
… and the Amplicom smartphone with a physical emergency button?
Can they in both cases additionally choose between

a) using no additional GPS device?
b) using a MOPAS GPS device?
c) using a different GPS device, e.g. a smart watch?

TERZ-participants would prefer 1a) (using their regular smartphone without additional GPS device), however, they would appreciate to switch later – depending on their health conditions – to options 3b) or 3b) (using a GPS device in addition to their regular smartphone), depending on what the concrete benefits compared to 1a) would be

➔ Fall detection is important to older TERZ-participants. What minimal equipment is needed for fall detection?
➔ Can the physical alarm button (as provided in the Amplicom) be replaced ("simulated") by a special icon on the screen of a regular smartphone?
➔ Can FreeWalker recognise
a) that PU is leaving or entering home?
b) that PU is entering / leaving a predefined not-moving location (e.g. a café shop, a friend's apartment (= the playing card example), a shopping centre, a church)
c) that the PU is entering a location without GPS connection (underground station?, parking lot?)
d) that the PU is entering / leaving a moving location (a bus, a train, a boat)
➔ Is a level-detection of some kind possible (e.g. if the PU is lost in a shopping center)? TERZ-participants mentioned some examples
- iPhone with a "barometric pressor sensor" that should be quite exact (link in German)
- Keruve, a wrist watch
➔ The sensor is too big, could it be incorporated into wristwatch / necklace / rings / bracelets (jewellery in general) – shoe sole not a good idea, as you change shoes often
➔ Is it planned to have medication information available? And maybe link it to pharmacies?

- ➜ Could / should FreeWalker replace insurance cards / handicapped IDs?
- ➜ Can FreeWalker measure the temperature of the environment and send a message in case of extreme cold or heat?
- ➜ Can FreeWalker be extended in the sense that heart diseases can be monitored? Measure ones pulse? Link to heart sensors?
- ➜ What happens if the PU goes to the cellar / basement where there is no GPS reception?