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Miraculous-Life

Miraculous-Life for Elderly Independent Living

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Miraculous-Life Consortium

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Abbreviations

Abbrev.	*Description*
SUS	System Usability Scale
VSP	Virtual Support Partner

Executive Summary

The overall evaluation approach of the Miraculous-Life project includes:

- Project pre-trials:
  1) Expert-based evaluation phase
  2) User-based evaluation phase in a controlled environment
- Project trial:
  1) User-based evaluation phase at home, which is associated to the final system evaluation

The pre-trials operations have taken place on the month 8, on the month 16 and on month 24 of the project, in both end-users institutions (MRPS, Switzerland and Orbis, Netherlands); with the objective of attaining high quality feedback indicators and a greater acceptance from the users. The pre-trials have been carried out in a supervised environment, with a small number of selected users (for the first stage of second pre-trial 7 seniors by ORBIS and 9 by MRPS, for the second stage 8 seniors by ORBIS and 7 by MRPS). They aim to validate the robustness of the system and identify possible problems by simulating specific home daily activity life situations, based on the extrapolated scenarios produced during the requirement specification stage. The encountered problems will be dealt with by the development team and possible systems' refinements or scenarios adaptation will be carried out.

The main aim of this deliverable was to assess the acceptance of the Miraculous-Life system based on experiences and evaluation data gathered by the two pilots on the first and second pre-trial (which is composed by two successive rounds/stages); with the aim of validating and refining the user requirements and the use cases, evaluating factors such as robustness, usability and acceptability and suggesting recommendations for the further development.

In this deliverable, we firstly analysed the evolution of the project indicators across the first and the second pre-trials (first and second stage) based on a new mapping proposed in the deliverable D6.1b. Four indicators were analysed: (1) the motivation of the participants in using the system, (2) the preciseness of elder's emotional understanding, (3) the satisfaction feeling of the elder in interacting with the system, (4) the elder's rating of usefulness of the system. Subsequently, we analysed qualitative data gathered during the second pre-trial – in both first and second stage of the second pre-trial – including open questions and recommendations for the further development and upcoming project phases. For each recommendation, we also mentioned the actions taken by the development team to improve the system.

1 About this Document

1.1 Role of the deliverable

This document assesses the acceptance of the final Miraculous-Life system, based on experiences and evaluation data gathered by the two pilots on the first and second pre-trial (which is composed by two successive rounds/stages).

The main role of this deliverable is thus to analyse and assess the data gathered by the two end-users institutions during the first and second pre-trials (on month 8 and on month 16 and on month 24); with the aim of validating and refining the user requirements, evaluating factors such as robustness, usability and acceptability and suggesting recommendations for the further development.

The raw data gathered by the two end-users institutions during the first pre-trial can be found in deliverable D1.4a, while the raw data collected during the second pre-trial (including first and second stage) can be found in the deliverables D1.1b (user need and requirement) and D1.4b (experts and users based evaluations). The analysis and assessment of these data is performed in D6.4b. Thus, D1.1b, D1.4a and D1.4b represents the main input for D6.4b.

Contrary to D1.4b, in D6.4b we will: (1) analyse the data conjointly for both end-user institutions, (2) analyse the quantitative data in terms of indicators, (3) compare the quantitative data gathered on the first pre-trial with the results collected on the second pre-trial (longitudinal approach), (4) describe actions taken by the consortium to improve the system.

1.2 Relationship to other Miraculous-Life deliverables

The deliverable is related to the following Miraculous-Life deliverables:

Deliverable	*Relation*
D1.1	Specification of user needs analysis and design of VSP model: This document presents the end user needs analysis and functional requirements for Miraculous-Life system. The prototypes tested during the pre-trials are developed based on users' needs and users' requirements; as described on the D1.1.
D1.2	Specification of use case scenarios and User Interface: This document presents the use case scenarios and also an analysis of the interaction requirements needed to specify the Human-Computer interface. The scenarios described on the D1.2 will be tested during the two pre-trials. Based on these results possible system's refinements or scenarios (D1.2) will be proposed. Then, the results of D6.4 will be communicated to the technical team with recommendations for the further development.
D1.3	Ethical, Privacy, Legal Considerations and Deontological practice: This document presents the ethical, deontological and legal considerations that are relevant for the Miraculous-Life project. The behaviour adopted by Miraculous-Life researchers during data collection will be compliant with the deontological guidelines presented in the D1.3.

D1.4	User pre-trials evaluation: This document will obtain user feedback and assess the users' acceptance based on pre-trials that will be performed on the first rapid prototypes of the Miraculous-Life system. The deliverable D1.4 contains all the data collected by both end-users institutions during the pre-trials, based on the methodology defined on the D6.1. The analysis of this data is performed in the D6.4. Thus D1.4 represents the main input for the D6.4.
D6.1	Trials Specification and Design: This document provides the design of the pilots' pre-trials and trials. The methods used by researchers during the pre-trials are described on the deliverable D6.1.
D6.2	The role of this deliverable is to describe the Privacy Protection Plan, and build on the foundations of the legal, ethical and privacy considerations that will be adopted during the Miraculous-Life project lifetime. The privacy documents for the pre-trial mentioned in this deliverable were used during the pre-trial are described in D6.2.
D6.3	Pilot setup and deployments: This deliverable (which includes both a report and software) presents how the system will be setup and how the pre-trial tests will be performed. The setup and deployment of the pre-trial are described in D6.3.

1.3 Structure of this document

The objectives and the evaluation methodology of the Miraculous Life project will be described in chapter 2. More information concerning the methodology of the project can be found in deliverable D6.1b.

In both first and second pre-trial, participants (elderly and caregivers) were asked to fill in a questionnaire after having tested the Miraculous Life prototype. The items of the questionnaires were associated with specific objectives and indicators. In chapter 3 we will assess the evolution of the project indicators across the first and the second pre-trials (first and second stage) based on a new mapping proposed in the deliverable D6.1b.

In chapter 4 we will describe the general recommendations related to the system, the virtual support partner (VSP), the user interface, the navigation, and the feedback; while in chapter 5 we will describe recommendations concerning specific use cases tested during the second pre-trial. Note that all the recommendations are based both on the expert- and user-based evaluation outcomes.

1.4 Updates to this document from previous version

While in the deliverable D6.4a, we analysed and discussed both quantitative and qualitative data collected in the first pre-trial (for the raw data, please refer to D1.4a); in the deliverable D6.4b, we will analyse and discuss:

- Quantitative data collected during the first and the second pre-trial (for the raw data, please refer to both D1.4a and D1.4b); allowing thus to assess the evolution of the project indicators across the first and the second pre-trials (first and second stage); and this based on a new mapping proposed in D6.1b.

- Qualitative data gathered during the second pre-trial (first and second stage; for the raw data, please refer to D1.4b), knowing that qualitative data collected in the first pre-trial was already assessed in D6.4a. For the analysis of the qualitative data gathered on the first pre-trial, please refer to D6.4a (see as well D1.4a for the raw data).

Thus, the D6.4b should be understood as being a new complete deliverable and not a revised version of the D6.4a.

2 Evaluation methodology and pre-trial description

2.1 Miraculous-Life objectives

The overall aim of the Miraculous-Life project is to design, develop and evaluate a Virtual Support Partner (VSP) that by analogy to a real life human partner, considering emotional understanding and responding, will attend to the needs of the elderly, while he/she goes about his/her normal daily life activities in the totality of his/her home and provide implicit support and also safety. The six main objectives of the Miraculous-Life are:

1. Stimulate and motivate the elderly to remain longer active at home through a virtual partner support
2. Enhance the engagement of the elderly in carrying out daily activities at home through emotional understanding
3. Increase the elderly's satisfaction in using the system via a natural and intuitive way to interact with the system
4. Improve quality of life and prolong autonomy of the elderly
5. Provide benefits on the social level of the elder and also improve the integrated care processes for elderly care at home
6. Achieve high usefulness of the system for the user through pilots and related evaluation and assessment

2.2 Evaluation methodology

It is worth remembering here that the evaluation methodology used in the project will consist of an expert-based evaluation, a user-based evaluation in a controlled environment, and a user-based evaluation at the elderly homes. The evaluation methodology of the Miraculous-Life project provides a combination of recognized qualitative and quantitative approaches, covering the project's pre-trials as well as the project's final trial. The overall evaluation approach of the Miraculous-Life project also includes:

- Project pre-trials (on month 8 and, month 16 and on month 24):
  - Expert-based evaluation phase
  - User-based evaluation phase in a controlled environment
- Project trial (month 26 – month 32):
  - User-based evaluation phase at home which is associated to the final system evaluation.

Two realistic environmental settings are used for the operation and evaluation of two end-user institutions in the Netherlands (Orbis) and Switzerland (MRPS). Both pilots will involve elderly people who fulfil the Miraculous-Life target group requirements.

The main role of this deliverable is to analyse and assess the data gathered by the two end-users institutions during the pre-trials (performed on month 8, 16 and on month 24). The

data collected during the trial phase will be presented and analysed in the deliverable D6.5 (Overall system evaluation and initial deployment).

In the chapters 2.2.1 and 2.2.2 the reader can find a brief description of the methodology – including the models and the methods – used during the first pre-trial. Detailed information can be found in D6.1b.

2.2.1 Expert-based evaluation

The first stage of the second pre-trial was performed during the months of May-June 2015. Five evaluators took part on this expert-based evaluation: Maarten Coolen (Orbis, internal), Judith Meijers (Orbis, internal), Donato Cereghetti (MRPS, internal), Christophe Carlei (MRPS, external) and Vincent Widmer (MRPS, external). The second stage of the second pre-trial was performed during the month of December 2015. Four evaluators participated on this expert-based evaluation: Maarten Coolen (Orbis, internal), Romy Schurgers (Orbis, internal), Donato Cereghetti (MRPS, internal) and Vincent Widmer (MRPS, external).

Two inspection techniques were used by the group of experts in order to evaluate the prototypes of the Miraculous-Life system: the cognitive walkthroughs and the heuristics analysis. The cognitive walkthrough is a method for finding usability problems in a user interface, focusing on evaluating a design for ease of learning, particularly by exploration (Wharton et al, 1994 [1]). Cognitive walkthroughs evaluate, in sequence, each of the user actions (or steps) to perform a task, aiming to find design issues that would interfere with learning by exploration. Heuristic evaluation is a usability inspection method used to identify usability issues in interactive systems using recognized usability principles (i.e. the heuristics).

Note that the main purpose of the expert-based evaluation phase is to identify and correct any major design flaws and problems *before* they reach the user-based evaluation phase. Part of the usability problems detected by the group of experts were already fixed by technical partners before the user-based evaluation phase: the prototype tested during the user-based evaluation phase is thus an improved version of the prototype evaluated by experts during the usability inspection phase.

Finally, the raw data of the expert-based evaluations can be found in deliverable D1.4b.

2.2.2 User-based evaluation in a controlled environment

The first stage of the second pre-trial of the Miraculous-Life project was performed during the months of May-June 2015. Totally, 19 users participated to this pre-trial: 7 elderly from ORBIS, 9 elderly from MRPS, 2 caregivers from ORBIS and 3 caregivers from MRPS. The main characteristics of the sample are described in the table 1.

Table 1. Characteristics of the population of the first stage.

Question	*MRPS seniors*	*Orbis seniors*	*MRPS caregivers*	*Orbis caregivers*
Amount of participants	N = 9	N = 7	N = 3	N = 2
A1. Gender	Female = 7	Female = 5	Female = 2	All are female

	Male = 2	Male = 2	Male= 1	
A2. Age	Mean = 82.11, SD = 4.26	Mean = 81.71, SD = 4.79	Mean = 48.67, SD = 4.51	Mean = 46.1, SD = 2.19
A3. Profession	Pensioners	Pensioners	Care coordinator, nurse, auxiliary nurse	Occupational therapist, care co-ordinator
A4. Nationality	All are Swiss	All are Dutch	All are Swiss	All are Dutch

The second stage of the second pre-trial of the Miraculous-Life project was performed during the month of December 2015. Totally, 18 users participated to this pre-trial: 8 elderly from ORBIS, 7 elderly from MRPS, 2 caregivers from ORBIS and 2 caregivers from MRPS. The main characteristics of the sample are described in the table 2.

Table 2. Characteristics of the population of the second stage.

Question	*MRPS seniors*	*Orbis seniors*	*MRPS caregivers*	*Orbis caregivers*
Amount of participants	N = 7	N = 8	N = 2	N = 2
A1. Gender	Female = 5 Male = 2	Female = 6 Male = 2	All are female	All are female
A2. Age	Mean = 83.86, SD = 3.67	Mean = 82.5, SD = 5.07	Mean = 47.00, SD = 9.90	Mean = 46.1, SD = 2.19
A3. Profession	Pensioners	Pensioners	Nurse, auxiliary nurse	Occupational therapist, care co-ordinator
A4. Nationality	All are Swiss	All are Dutch	All are Swiss	All are Dutch

In both pre-trials (first and second stage of the second pre-trial), the population of MRPS is comparable to the population of Orbis. There are no significant differences.

Prior to the user testing phase, the seniors provided their consent by agreeing to participate and signing an informed consent form. These documents can be found in the D6.2b.

During the testing phase, the participants were asked to complete specific tasks with the Miraculous-Life prototype, while observers watch, listen and take note. Users were asked to openly express his or her thoughts, observations, feelings, and comments to the evaluator during the testing. This is known as the Think Aloud method (Lewis and Rieman, 1993 [2]), which enables the researcher to capture the thinking process of the user. Evaluators provided assistance only when absolutely needed and kept notes on what was happening and what was being said during each task. A coding scheme was also designed, in order to collect qualitative data by observing verbal and nonverbal behavior of the participant during

the testing phase. This tool included the following sections: success, problems, non-verbal behavior, steps taken, help needed. After the user testing phase, the participants were asked to fill in a questionnaire.

Technical support during the trial was ensured by technical partners, as stated in the D6.3c. Finally, the raw data of the first pre-trial with end-users can be found in deliverable D1.4a (for the first pre-trial) and D1.4b (for the second pre-trial; which is composed by a first and a second round).

3 Analysis of quantitative data

3.1 Introduction

This chapter analyses the outcomes of the questionnaires administered in the pre-trials in terms of indicators. For each indicator, means, sums and percentages were computed based on the new mapping proposed in the deliverable D6.1b. Note that only the objectives 1, 2, 3 and 6 were considered as being relevant for the pre-trials.

3.2 Relevant objectives for the pre-trials

Objective 1: Stimulate and motivate the elderly to remain longer active at home through a virtual partner support.

It has been identified that elderly people living alone at home are often suffering from loss of motivation, associated with the feeling of being helpless to carry out their daily routine especially after the loss of their partner. The main aim of this objective is to motivate the elder to remain longer active at home by providing human-like support.

Motivation will be provided through a VSP that will attend the elderly daily activity and safety needs, while he/she goes about his/her normal daily life. Daily collaboration and interaction with the VSP will be characterized, like by a real partner, by behaviour and emotional understanding, sharing and guidance of executing daily activities, which are considered as main factors of motivating elder people to exert more effort in executing daily tasks, avoiding thus inactivity and loss of motivation.

Objective 2: Enhance the engagement of the elderly in carrying out daily activities at home through emotional understanding.

One of the main aims of this objective is to improve the engagement of the elderly in carrying out daily activities by understanding the elderly's emotional status (e.g., if the elderly is happy, sad, angry, joyful, fearful, scared, neutral, etc.).

Focus will be given on analysing how the elderly use emotions in real human communication while carrying out of their daily activities. The emotional state of the elderly provides important information on their needs and allows on one side the provision of appropriate adapted support and on the other side comforts them as they feel better understood and thus empowering them to continue carrying out their daily activities.

Objective 3: Increase the elderly's satisfaction in using the system via a natural and intuitive way to interact with the system.

Elderly's satisfaction in using the system will be increased by the provision of an Avatar based interface capable of interacting with the user through both language (emotional speech) and non-verbal behaviours (emotional facial expression). In order to engage the elder in a relevant, human-like conversation the Avatar interface will be also able to express emotions, (i.e., happy, concerned, neutral state) through face expressions with lifelike motion and voice intonations, matching the conversation context and synchronized with the synthesized speech.

The satisfaction of the elder in using the system will be also increased through the provision of a dialogue management that will make the system more engaging to the elders to interact

with. The system will be able to hold multiple interactions and build emotional attachments with the elder in the same way humans do.

Objective 6: Achieve high usefulness of the system for the user through pilots and related evaluation and assessment.

The main aim of this objective is to prove high usefulness of the system for the user through the carrying of two pilots and related evaluation and assessment. Two realistic environmental settings will be considered through the operation and evaluation of two pilots in the Netherlands (ORBIS) and Switzerland (MRPS).

3.3 Quantifiable success indicators for the pre-trials

Objective 1: Stimulate and motivate the elderly to remain longer active at home through a virtual partner support

Expected Impact: Motivating elder people to exert more effort in executing daily tasks, avoiding thus inactivity and loss of motivation.

For this objective one indicator has been considered as being relevant for the pre-trials:

- Second indicator: Motivation of the elder in using the system to be substantially increased (targeting 80%) from the beginning till the end of the project.

Objective 2: Enhance the engagement of the elderly in carrying out daily activities at home through emotional understanding

Expected Impact: The elders feel overall better understood and empowered to continue an active life at home.

For this objective one indicator has been considered as being relevant for the pre-trials:

- First indicator: The preciseness of elder's emotional understanding to be significantly improved (targeting 60%) from the beginning till the end of the project.

Objective 3: Increase the elderly's satisfaction in using the system via a natural and intuitive way to interact with the system

Expected Impact: The elders accepts and embrace the system and feel overall better motivated to use the system.

For this objective one indicator has been considered as being relevant for the pre-trials:

- First indicator: The satisfaction feeling of the elder in interacting with the system to be increased from good (initial target 45%) at month 24, to very good (final target 75%) at the end of the project.

Objective 6: Achieve high usefulness of the system for the user through pilots and related evaluation and assessment

Expected Impact: The elder recognizes technological solutions to be of high usefulness in carrying out their daily activities at home.

For this objective one indicator has been considered as being relevant for the pre-trials:

- First indicator: The elder's rating of usefulness of the system to be substantially increased (targeting 75%) from the beginning till the end of the project.

3.4 Mapping between objectives, indicators and measurements

This section provides a summary of all the objectives and their respective indicators measured in all pre-trial studies. More information can be found in D6.1b.

Table 3. Mapping between project objectives, indicators and measurements. Pre-trial 1 = first pre=trial; pre-trial 2 = first stage second pre-trial; pre-trial 3= second stage second pre-trial.

Objective	*Indicator*	*Questionnaire*	*Pre-trial*		
			1	*2*	*3*
Objective 1 Stimulate and motivate the elder to remain longer active at home through a virtual partner support.	Second indicator Motivation of the elder in using the system to be substantially increased (targeting 80%) from the beginning till the end of the project.	MOTIVATION IN USING THE SYSTEM		X	X
Objective 2 Enhance the engagement of the elder in carrying out daily activities at home through emotional understanding.	First indicator The preciseness of elder's emotional understanding to be significantly improved (targeting 60%) from the beginning till the end of the project.	Eight items of Part D of the questionnaire were associated with this indicator: D2, D3, D4, D5, D6, D7, D8, D9	X	X	X
Objective 3 Increase the elder's satisfaction in using the system via a natural and intuitive way to interact with the system.	First indicator The satisfaction feeling of the elder in interacting with the system to be increased from good (initial target 45%) at month 24, to very good (final target 75%) at the end of the project.	SYSTEM USABILITY SCALE (SUS)	X	X	X
		USER SATISFACTION	X	X	X
		EASE OF LEARNING	X		
Objective 6 Achieve high usefulness of the system for the user through pilots and related evaluation and assessment.	First indicator The elder's rating of usefulness of the system to be substantially increased (targeting 75%) from the beginning till the end of the project.	SYSTEM USEFULNESS	X	X	X

3.5 Results

In this chapter, we will analyse the quantitative data collected during the first and second pre-trial (both first and second stage) in terms of indicators; aiming to evaluate the progress reached during the pre-trial phase through a longitudinal approach.

Two strategies were used in order to analyse the data: (1) by combining MRPS and Orbis users, allowing to assess the data in a holistic way (2) by analysing separately MRPS and

Orbis users, allowing to identify potential differences between the two end-users organizations.

Because of the small amount of participants during the pre-trial phases (see chapter 2.2.2):

- The results presented on this deliverable should be considered as being a "first impression" related to the achievement of the project's goals. The data collected during the trial phase, will allow to assess this achievement with higher reliability.
- We did not analyse data based on demographic variables during the pre-trials. Note that this approach will be used, in order to analyse the data collected during the trial phase.

Furthermore during the first stage of the second pre-trial, stability problems were experienced: the system stopped several times and investigators had to restart it. In the second stage, the performance problems experienced during the first stage were solved. The system appeared to be more stable and performant. This may explain why in the second stage we obtained better results than the first stage as can be seen below.

Different use cases were tested during the different pre-trials. Also manual triggering of these use cases differentiated per pre-trial depending on the services which are tested. This influences the way the user interacts with the system and may also influence the way the user perceives the system and thus below results.

3.5.1 Objective 1: Second indicator

Motivation in using the system. The motivation of the users in using the system was measured during the second pre-trial (first and second stage), through a questionnaire composed by 3 questions (Likert Scales, from -3 to 3). The mean and the sum on these questions were computed for each participant, allowing to calculate subsequently the general averages on the groups of users. Finally, we estimated the portion of users motivated in using the system by calculating the proportion of participants who obtained a mean on these items higher than 0.

First approach: MRPS and Orbis users combined. The following table resumes the data collected on the second pre-trial (first and second stage) for MRPS and Orbis user combined:

Table 4. Motivation in using the system: MRPS and Orbis combined.

Group	*Second pre-trial, first stage*	*Second pre-trial, second stage*
Seniors	Mean = 0.53±2.36 Sum = 1.60±7.07 Motivated = 73%	Mean = 1.18±1.51 Sum = 3.54±4.54 Motivated = 79%
Caregivers	Mean = 1.00±0.67 Sum = 3.00±2.00 Motivated = 100%	Mean = 2.78±0.38 Sum = 8.33±1.15 Motivated = 100%

The mean scores are also represented in the following figure:

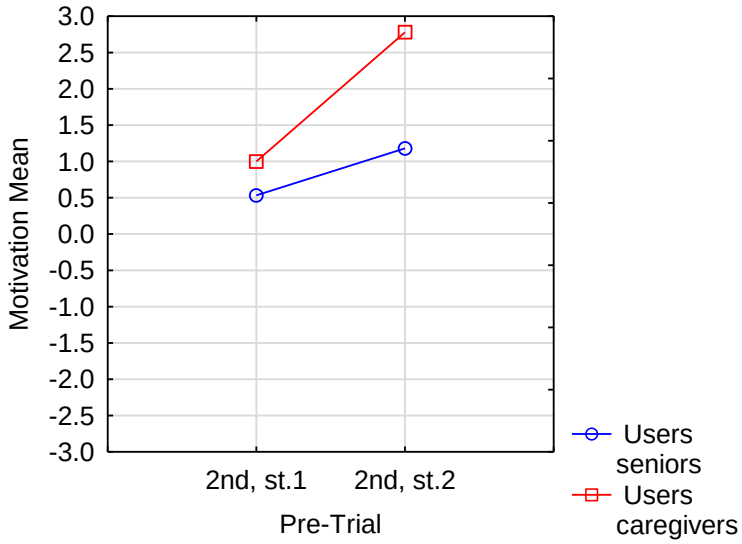

Figure 1. Motivation in using the system: MRPS and Orbis combined.

A factorial ANOVA 2x2 was performed in order to evaluate the effect of the pre-trial (first stage, second stage) and group of users (seniors, caregivers) on the motivation mean score:

- Pre-trial: no principal effect was observed ($F(1,30) = 2.04$, $p = 0.16$).
- Group: no principal effect was observed ($F(1,30) = 1.48$, $p = 0.23$).
- Interaction: no significant interaction effect between the two factors was observed ($F(1,30) = 0.45$, $p = 0.51$).

Second approach: MRPS and Orbis users analysed separately

The following table resumes the data collected on the first and second pre-trial (first and second stage), depending on the population and the end-user organization:

Table 5. Motivation in using the system: MRPS and Orbis separated.

Institution	*Group*	*Second pre-trial, first stage*	*Second pre-trial, second stage*
MRPS	Seniors	Mean = -0.25±2.43 Sum = -0.75±7.30 Motivated = 63%	Mean = 0.48±1.75 Sum = 1.43±5.26 Motivated = 57%
MRPS	Caregivers	Mean = 1.00±0.94 Sum = 3.00±2.83 Motivated = 100%	Mean = 3.00±NA Sum = 9.00±NA Motivated = 100%
Orbis	Seniors	Mean = 1.43±2.07	Mean = 2.00±0.56

		Sum = 4.29±6.21 Motivated = 86%	Sum = 6.00±1.67 Motivated = 100%
Orbis	Caregivers	Mean = 1.00±NA Sum = 3.00±NA Motivated = 100%	Mean = 2.67±0.47 Sum = 8.00±1.41 Motivated = 100%

The mean scores are also represented in the following figure:

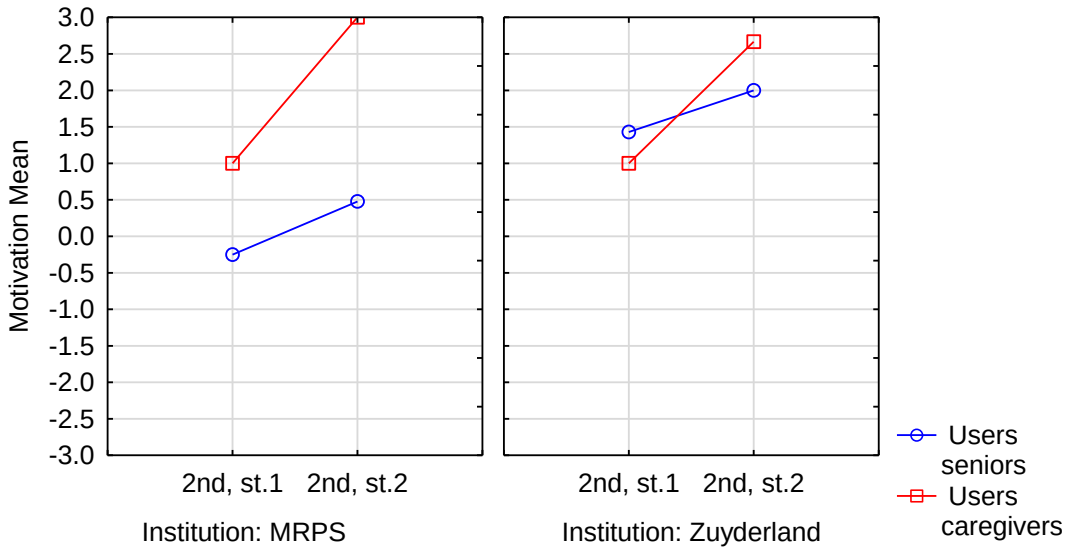

Figure 2. Motivation in using the system: MRPS and Orbis separated.

A factorial ANOVA 2x2x2 was performed in order to evaluate the effect of the organization (MRPS, Orbis), pre-trial (first stage, second stage) and group of users (seniors, caregivers) on the motivation mean score:

- Organization: no principal effect was observed ($F(1,26) = 0.68$, $p = 0.42$).
- Pre-trial: no principal effect was observed ($F(1,26) = 2.03$, $p = 0.17$).
- Group: no principal effect was observed ($F(1,26) = 1.32$, $p = 0.26$).
- No significant interaction effect between the three factors was observed.

Conclusions

A slight improvement of the motivation score (not statistically significant) could be observed in all groups. Nevertheless, at the second stage of the second pre-trial, only 57% of MRPS seniors seems to be motivated in using the system, while all Orbis users appeared to be motivated. MRPS results should be considered as being challenging, at this stage of the project.

According to the project's objectives, motivation of the seniors in using the system should be substantially increased from the beginning till the end of the project, targeting 80%. Based on the quantitative data collected in the first and second pre-trials, this objective has already been achieved in Orbis; while improvements on the scores are expected in MRPS during the trial phase. Finally, note that during the trial phase, the dimensions "Attitude and Intention" of the Almere questionnaire will be administrated, in order to measure the motivation of the users in using the system.

3.5.2 Objective 2: First indicator

Avatar. The emotional understanding of the VSP, and more generally the interaction with the VSP, was measured during the first and second pre-trial (first and second stage), through a questionnaire composed by 8 questions (Likert Scales, from -3 to 3). The mean and the sum on these questions were computed for each participant, allowing to calculate subsequently the general averages on the groups of users. Finally, we estimated the portion of users satisfied by their interaction with the VSP by calculating the proportion of participants who obtained a mean on these items higher than 0.

First approach: MRPS and Orbis users combined

The following table resumes the data collected on the first and second (first and second stage) pre-trials for MRPS and Orbis user combined:

Table 6. Avatar: MRPS and Orbis combined.

Group	*First pre-trial*	*Second pre-trial, first stage*	*Second pre-trial, second stage*
Seniors	Mean = 0.99±1.23 Sum = 7.93±9.86 Good interaction = 71%	Mean = 0.26±1.79 Sum = 2.07±14.36 Good interaction = 60%	Mean = 0.68±1.13 Sum = 5.46±9.06 Good interaction = 79%
Caregivers	Mean = 1.38±0.22 Sum = 11.00±1.73 Good interaction = 100%	Mean = -0.28±0.63 Sum = -1.25±4.50 Good interaction =25%	Mean = 0.96±0.83 Sum = 7.67±6.66 Good interaction = 100%

The mean scores are also represented in the following figure:

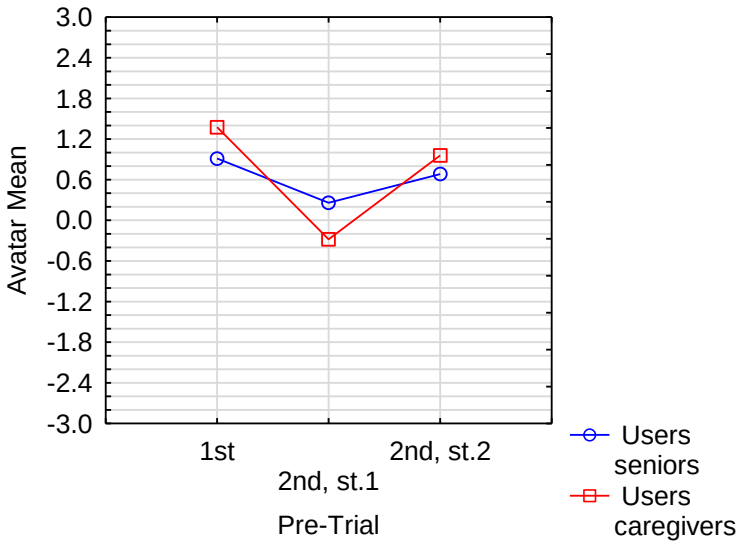

Figure 3. Avatar: MRPS and Orbis combined.

A factorial ANOVA 3x2 was performed in order to evaluate the effect of the pre-trial (first, second stage 1, second stage 2) and group of users (seniors, caregivers) on the avatar mean score:

- Pre-trial: no principal effect was observed ($F(2,45) = 2.22$, $p = 0.12$).
- Group: no principal effect was observed ($F(1,45) = 0.02$, $p = 0.89$).
- Interaction: no significant interaction effect between the two factors was observed ($F(2,45) = 0.45$, $p = 0.64$).

Second approach: MRPS and Orbis users analysed separately

The following table resumes the data collected on the first and second pre-trial (first and second stage), depending on the population and the end-user organization:

Table 7. Avatar: MRPS and Orbis separated.

Institution	*Group*	*First pre-trial*	*Second pre-trial, first stage*	*Second pre-trial, second stage*
MRPS	Seniors	Mean = 1.34±1.22 Sum = 10.71±9.72 Good interaction = 71%	Mean = 0.14±2.04 Sum = 1.13±16.32 Good interaction = 63%	Mean = 0.45±1.04 Sum = 3.57±8.30 Good interaction = 71%
MRPS	Caregivers	Mean = 1.25±NA Sum = 10.00±NA Good interaction = 100%	Mean = -0.33±0.76 Sum = -1.33±5.51 Good interaction = 33%	Mean = 1.50±NA Sum = 12.00±NA Good interaction = 100%

Orbis	Seniors	Mean = 0.64±1.24 Sum = 5.14±9.89 Good interaction = 71%	Mean = 0.39±1.62 Sum = 3.14±12.95 Good interaction = 57%	Mean = 0.96±1.27 Sum = 7.67±10.17 Good interaction = 86%
Orbis	Caregivers	Mean = 1.44±0.27 Sum = 11.50±2.12 Good interaction = 100%	Mean = -0.12±NA Sum = -1.00±NA Good interaction = 0%	Mean = 0.69±0.97 Sum = 5.50±7.78 Good interaction = 100%

The mean scores are also represented in the following figure:

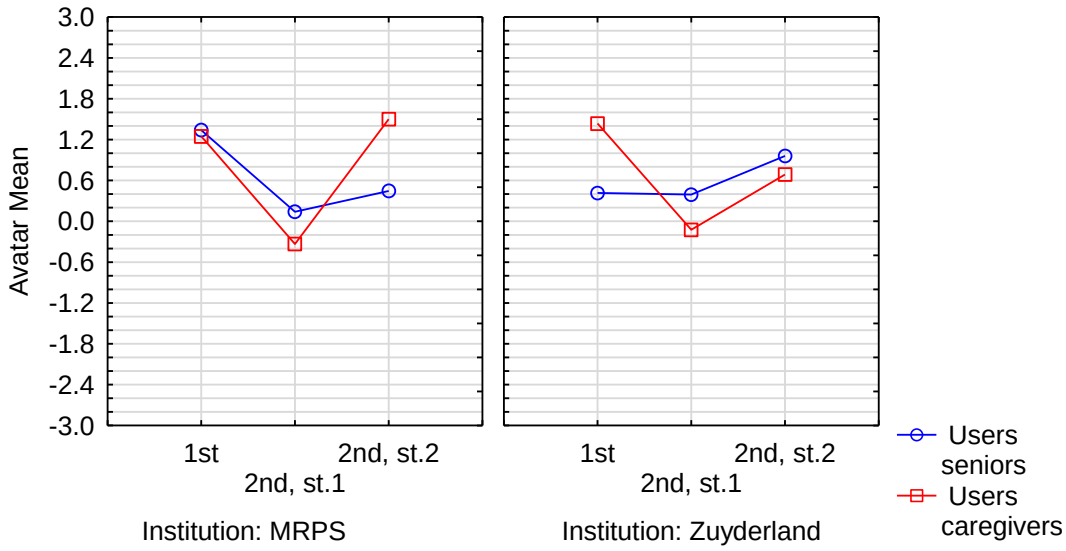

Figure 4. Avatar: MRPS and Orbis separated.

A factorial ANOVA 2x3x2 was performed in order to evaluate the effect of the organization (MRPS, Orbis), pre-trial (first, second stage 1, second stage 2) and group of users (seniors, caregivers) on the avatar mean score:

- Organization: no principal effect was observed ($F(1,39) = 0.03$, $p = 0.86$).
- Pre-trial: no principal effect was observed ($F(2,39) = 1.61$, $p = 0.21$).
- Group: no principal effect was observed ($F(1,39) = 0.05$, $p = 0.82$).
- No significant interaction effect between the three factors was observed.

Conclusions.

Globally, the scores on this scale should be considered as being acceptable at this stage of the project; knowing that we expect to improve this indicator during the trial phase. MRPS seniors seems to be the group less satisfied by their interaction with the VSP. In particular,

MRPS users tend to think that the avatar doesn't act like a real human (D9; see D1.4b for the raw data); enhancing the analysis performed in the first pre-trial (see D6.4a).

According to the project's objectives, the preciseness of elder's emotional understanding should be significantly improved from the beginning till the end of the project; targeting 60%. Based on the quantitative data collected in the first and second pre-trials, this objective has already been achieved in both Orbis and MRPS. It should be kept in mind that the pre-trials were done in a controlled environment in which each participant interacted with the VSP for a relative short time. This emphasis that the perception related to the VSP might change in the trial phase when the users could interact with the VSP in their own home environment for 24/7. Finally, during the trial phase, additional questionnaires will be used in order to inform this indicator: the Almere questionnaire (measuring the perceived enjoyment, the perceived sociability and the social presence) and the Godspeed questionnaire (measuring the anthropomorphism, the animacy, the likeability, the perceived intelligence, and the perceived safety).

3.5.3 Objective 3: First indicator

The third objective of the Miraculous Life project is measured trough two different questionnaires: the "System Usability Scale" and the "User Satisfaction" questionnaire. In addition, the "Ease of Learning" questionnaire was also used during the first pre-trial; but it was excluded in the second and third pre-trial. Thus, results on this questionnaire will be not analyzed on this deliverable. For the assessment of the "Ease of Learning" questionnaire related to the first pre-trial, please refers to D1.4a and 6.4a.

System Usability Scale. The SUS yields a single number representing a composite measure of the overall usability of the system being studied. The overall SUS score has a range of 0 to 100 (where 0 is very bad and 100 is very good usability). Note that the average SUS score from all 500 studies is 68. A SUS score above a 68 should be considered above average and anything below 68 is below average. We estimated thus the portion of users satisfied by their interaction with the system by calculating the proportion of participants who obtained a SUS score higher than 68.

First approach: MRPS and Orbis users combined

The following table resumes the data collected on the first and second (first and second stage) pre-trials for MRPS and Orbis user combined:

Table 8. System Usability Scale: MRPS and Orbis combined.

Group	*First pre-trial*	*Second pre-trial, first stage*	*Second pre-trial, second stage*
Seniors	Mean = 57.26±16.09, Satisfied = 29%	Mean = 51.78±24.25, Satisfied = 33%	Mean = 55.38±14.42, Satisfied = 15%
Caregivers	Mean = 62.92±7.62, Satisfied = 25%	Mean = 49.33±11.58, Satisfied = 0%	Mean = 65.00±13.47, Satisfied = 50%

The mean scores are also represented in the following figure:

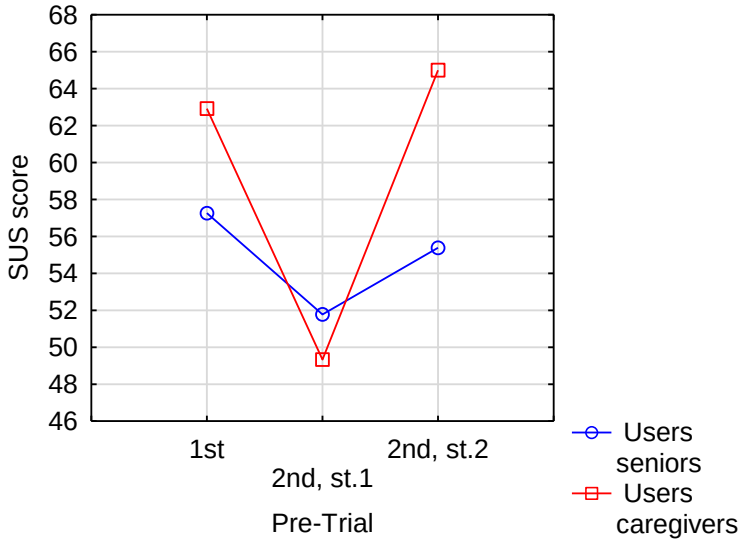

Figure 5. System Usability Scale: MRPS and Orbis combined.

A factorial ANOVA 3x2 was performed in order to evaluate the effect of the pre-trial (first, second stage 1, second stage 2) and group of users (seniors, caregivers) on the SUS mean score:

- Pre-trial: no principal effect was observed ($F(2,49) = 1.37$, $p = 0.26$).
- Group: no principal effect was observed ($F(1,49) = 0.57$, $p = 0.45$).
- Interaction: no significant interaction effect between the two factors was observed ($F(2,49) = 0.42$, $p = 0.66$).

Second approach: MRPS and Orbis users analysed separately

The following table resumes the data collected on the first and second pre-trial (first and second stage), depending on the population and the end-user organization:

Table 9. System Usability Scale: MRPS and Orbis separated.

Institution	*Group*	*First pre-trial*	*Second pre-trial, first stage*	*Second pre-trial, second stage*
MRPS	Seniors	Mean = 63.33±15.06, Satisfied = 43%	Mean = 53.75±22.09, Satisfied = 38%	Mean = 45.24±10.34, Satisfied = 0%
MRPS	Caregivers	Mean = 62.50±12.96, Satisfied = 50%	Mean = 46.11±14.56, Satisfied = 0%	Mean = 65.00±16.50, Satisfied = 50%

Orbis	Seniors	Mean = 51.19±15.74, Satisfied = 14%	Mean = 49.52±28.13, Satisfied = 29%	Mean = 67.22±7.65, Satisfied = 33%
Orbis	Caregivers	Mean = 63.33±2.36, Satisfied = 0%	Mean = 54.17±5.89, Satisfied = 0%	Mean = 65.00±16.50, Satisfied = 50%

The mean scores are also represented in the following figure:

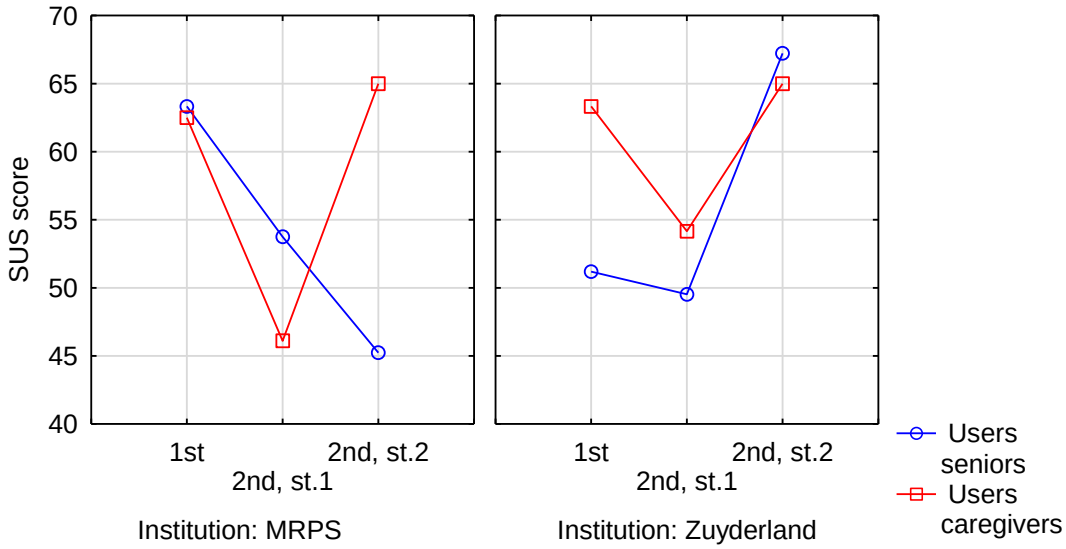

Figure 6. System Usability Scale: MRPS and Orbis separated.

A factorial ANOVA 2x3x2 was performed in order to evaluate the effect of the organization (MRPS, Orbis), pre-trial (first, second stage 1, second stage 2) and group of users (seniors, caregivers) on the mean score on the System Usability Score:

- Organization: no principal effect was observed ($F(1,43) = 0.19$, $p = 0.67$).
- Pre-trial: no principal effect was observed ($F(2,43) = 1.34$, $p = 0.27$).
- Group: no principal effect was observed ($F(1,43) = 0.59$, $p = 0.45$).
- No significant interaction effect between the three factors was observed.

Conclusions.

A SUS score above a 68 should be considered above average and anything below 68 is below average (as the average of 500 studies is a score of 68). The degree of usability of the Miraculous-Life system – as perceived by end-users at the end of the second pre-trial – is below average. Keep in mind that this score of 68 is based on studies on products not projects. In projects we develop a prototypes which should become a product after the project. Note that the mean score on the SUS questionnaire for MRPS seniors progressively decreased from 63.33 ± 15.06 (first trial) to 45.24 ± 10.34 (third trial). Data observed in

specific items of this questionnaire (see D1.4b for the raw data) suggests that, on the second stage of second pre-trial, MRPS users tended to consider that training sessions are needed: (1) technical support is needed to use the system (A4), (2) there are too much inconsistences within the system (A6), (3) most people would not learn to use this system very quickly (A7), (4) the system is cumbersome to use (A8), (5) the user should learn a lot of things in order to use the system (A10). At Orbid we see a slight increase of the SUS score at the end of the second pre-trial.

In MRPS, the external expert also think that the prototype tested in the second stage of second pre-trial needs some improvements to be tested longitudinally – to solve stability and usability issues. Since technology acceptability (motivation in using technologies and actual use of technologies) depends on the perceived ease of use (Davis, 1989), we would recommend to improve the user interface and user interaction design before starting the trial phase.

For the trial, it is important to analyse further if this difference is still seen between the two end user organisations and what causes this difference and see if demographic differences can explain this difference.

Satisfaction. The satisfaction was measured during the first and second pre-trial (first and second stage), through a questionnaire composed by 8 questions (Likert Scales, from -3 to 3). The mean and the sum on these questions were computed for each participant, allowing to calculate subsequently the general averages on the groups of users. Finally, we estimated the portion of satisfied users by calculating the proportion of participants who obtained a mean on these items higher than 0.

First approach: MRPS and Orbis users combined

The following table resumes the data collected on the first and second (first and second stage) pre-trials for MRPS and Orbis user combined:

Table 10. Satisfaction: MRPS and Orbis combined.

Group	*First pre-trial*	*Second pre-trial, first stage*	*Second pre-trial, second stage*
Seniors	Mean = 1.50±0.99 Sum = 12.00±7.91 Satisfied = 86%	Mean = 0.55±1.45 Sum = 4.40±11.62 Satisfied = 73%	Mean = 1.05±1.20 Sum = 8.31±9.30 Satisfied = 79%
Caregivers	Mean = 1.88±0.76 Sum = 15.00±6.06 Satisfied = 100%	Mean = -0.44±1.15 Sum = -3.50±9.19 Satisfied = 50%	Mean = 0.78±1.80 Sum = 6.25±14.38 Satisfied = 75%

The mean scores are also represented in the following figure:

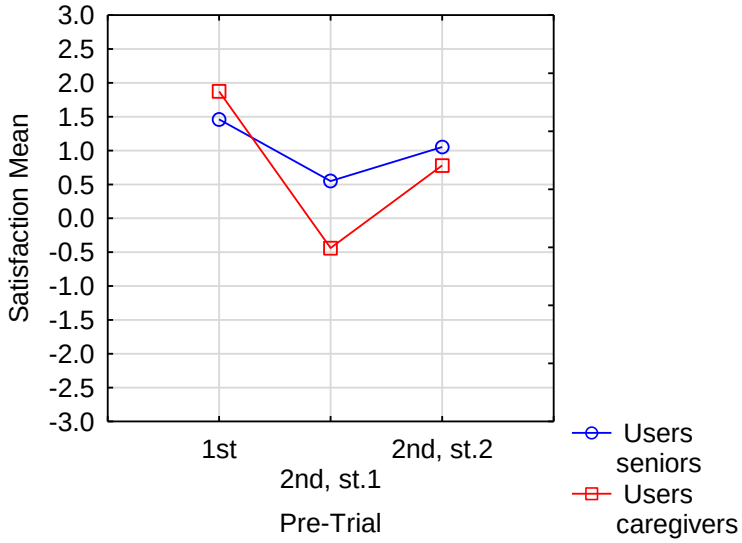

Figure 7. Satisfaction: MRPS and Orbis combined.

A factorial ANOVA 3x2 was performed in order to evaluate the effect of the pre-trial (first, second stage 1, second stage 2) and group of users (seniors, caregivers) on the satisfaction mean score:

- Pre-trial: a principal effect of the group was observed ($F(2,45) = 3.70$, $p = 0.03$). According to the LSD Post Hoc Tests, the score of satisfaction significantly decreased between the first pre-trial and the first stage of the second pre-trial ($p = 0.01$).
- Group: no principal effect was observed ($F(1,45) = 0.37$, $p = 0.55$).
- Interaction: no significant interaction effect between the two factors was observed ($F(2,45) = 0.70$, $p = 0.50$).

Second approach: MRPS and Orbis users analysed separately

The following table resumes the data collected on the second pre-trial (first and second stage), depending on the population and the end-user organization:

Table 11. Satisfaction: MRPS and Orbis separated.

Institution	*Group*	*First pre-trial*	*Second pre-trial, first stage*	*Second pre-trial, second stage*
MRPS	Seniors	Mean = 1.93±0.89 Sum = 15.43±7.14 Satisfied = 100%	Mean = 0.63±1.17 Sum = 5.00±9.35 Satisfied = 75%	Mean = 0.51±1.43 Sum = 3.86±10.85 Satisfied = 57%
MRPS	Caregivers	Mean = 2.00±1.24	Mean = 0.37±NA	Mean = 1.56±2.03

		Sum = 16.00±9.90 Satisfied = 100%	Sum = 3.00±NA Satisfied = 100%	Sum = 12.50±16.26 Satisfied = 100%
Orbis	Seniors	Mean = 1.07±0.95 Sum = 8.57±7.57 Satisfied = 71%	Mean = 0.46±1.82 Sum = 3.71±14.57 Satisfied = 71%	Mean = 1.69±0.30 Sum = 13.50±2.43 Satisfied = 100%
Orbis	Caregivers	Mean = 1.75±0.35 Sum = 14.00±2.83 Satisfied = 100%	Mean = -1.25±NA Sum = -10.00±NA Satisfied = 0%	Mean = 0.00±1.77 Sum = 0.00±14.14 Satisfied = 50%

The mean scores are also represented in the following figure:

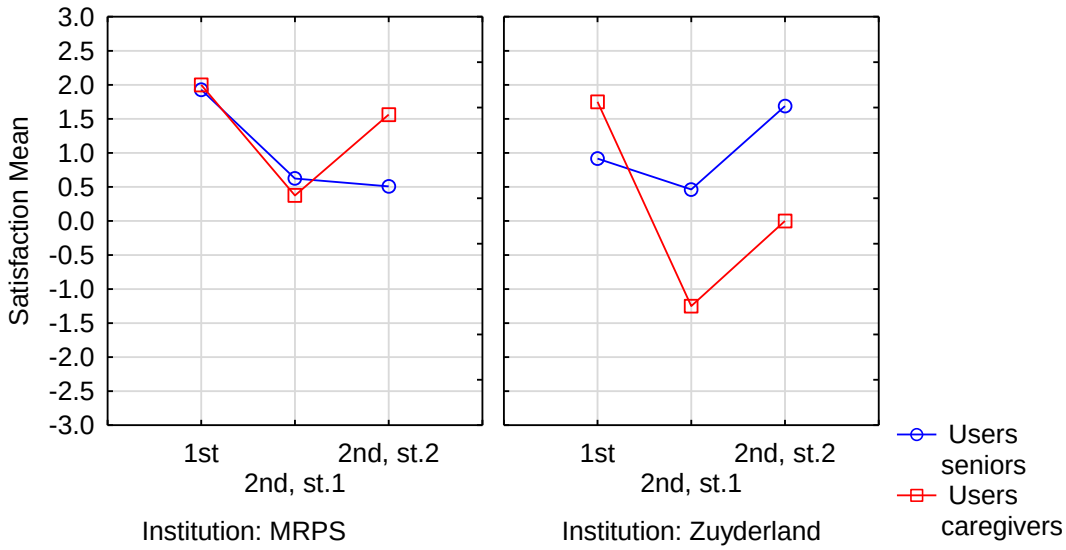

Figure 8. Satisfaction: MRPS and Orbis separated.

A factorial ANOVA 2x3x2 was performed in order to evaluate the effect of the organization (MRPS, Orbis), pre-trial (first, second stage 1, second stage 2) and group of users (seniors, caregivers) on the satisfaction mean score:

- Organization: no principal effect was observed ($F(1,39) = 1.56$, $p = 0.22$).
- Pre-trial: a principal effect of the pre-trial was observed ($F(2,39) = 3.72$, $p = 0.03$). According to the LSD Post Hoc Tests, the score of satisfaction significantly decreased between the first and the second pre-trial ($p = 0.01$).
- Group: no principal effect was observed ($F(1,39) = 0.38$, $p = 0.54$).
- No significant interaction effect between the three factors was observed.

Conclusions.

Globally, the scores on this scale, should be considered as being acceptable at this stage of the project. Orbis caregivers and MRPS seniors seems to be the group less satisfied by the Miraculous Life solution. For the trial it is important to analyse further if this difference is still seen between the two end user organisations and what causes this difference and see if demographic differences can explain this difference.

According to the project's objectives, the elderly satisfaction in interacting with the system should be increased from good at month 24 (initial target 45%), to very good at the end of the project (final target 75%). Based on the quantitative data collected in the first and second pre-trials, this objective – as measured by the System Usability Scale and the Satisfaction questionnaire – this objective has been reached at month 24; knowing that the general satisfaction of the users is expected to increase during the trial phase. Nevertheless, based on the results on the SUS, we would recommend to improve the user interface and the user interaction design before starting the trial phase – see also chapter 4.3 for the general recommendation, 4.4 and 4.5 for the recommendations related to the use cases tested during the first and second stage.

3.5.4 Objective 6: First indicator

Usefulness. The usefulness was measured during the first and second pre-trial (first and second stage), through a questionnaire composed by 12 questions (Likert Scales, from -3 to 3). The mean and the sum on these questions were computed for each participant, allowing to calculate subsequently the general averages on the groups of users. Finally, we estimated the portion of users who perceived the system as being useful by calculating the proportion of participants who obtained a mean on these items higher than 0.

First approach: MRPS and Orbis users combined

The following table resumes the data collected on the first and second (first and second stage) pre-trials for MRPS and Orbis user combined:

Table 12. Usefulness: MRPS and Orbis combined.

Group	*First pre-trial*	*Second pre-trial, first stage*	*Second pre-trial, second stage*
Seniors	Mean = 1.21±0.85 Sum = 14.57±10.23 Useful = 86%	Mean = -0.44±1.59 Sum = -5.27±19.12 Useful = 53%	Mean = 0.28±1.84 Sum = 2.62±21.54 Useful = 57%
Caregivers	Mean = 1.92±0.14 Sum = 23.00±1.63 Useful = 100%	Mean = 1.10±1.20 Sum = 12.20±15.12 Useful = 80%	Mean = 1.50±1.13 Sum = 18.00±13.54 Useful = 75%

These scores are also represented in the following figure:

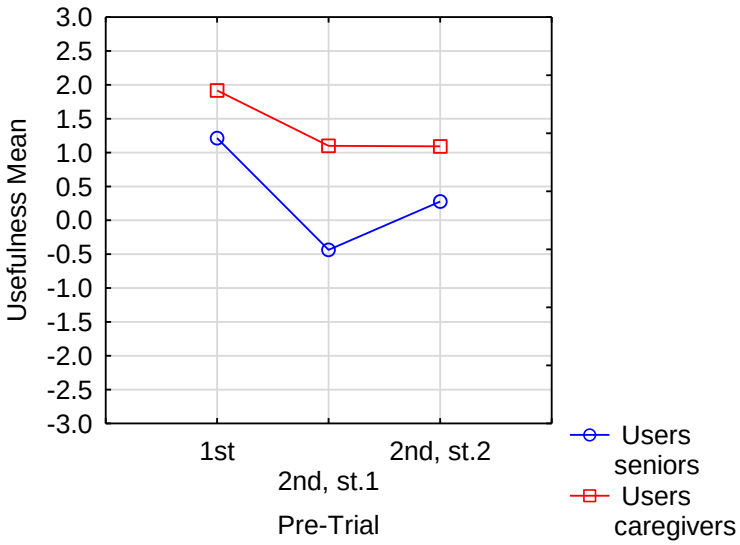

Figure 9. Usefulness: MRPS and Orbis combined.

A factorial ANOVA 3x2 was performed in order to evaluate the effect of the pre-trial (first, second stage 1, second stage 2) and group of users (seniors, caregivers) on the usefulness mean score:

- Pre-trial: a marginal effect of the pre-trial was observed ($F(2,49) = 2.72$, $p = 0.08$). According to the LSD Post Hoc Tests, the score of perceived usefulness significantly decreased between the first pre-trial and the first stage of the second pre-trial ($p < 0.01$).
- Group: a principal effect of the group was observed ($F(1,49) = 5.17$, $p = 0.03$). According to the LSD Post Hoc Tests, caregivers perceived the Miraculous Life solution as being more useful than seniors ($p = 0.03$).
- Interaction: no significant interaction effect between the two factors was observed ($F(2,49) = 0.36$, $p = 0.70$).

Second approach: MRPS and Orbis users analysed separately

The following table resumes the data collected on the second pre-trial (first and second stage), depending on the population and the end-user organization:

Table 13. Usefulness: MRPS and Orbis separated.

Institution	*Group*	*First pre-trial*	*Second pre-trial*	*Third pre-trial*
MRPS	Seniors	Mean = 1.37±0.92 Sum = 16.43±11.03 Useful = 86%	Mean = -0.11±1.89 Sum = -1.38±22.68 Useful = 63%	Mean = -0.31±2.00 Sum = -5.00±22.35 Useful = 43%

MRPS	Caregivers	Mean = 2.00±0.12 Sum = 24.00±1.41 Useful = 100%	Mean = 1.19±0.67 Sum = 12.67±10.69 Useful = 100%	Mean = 1.25±1.89 Sum = 15.00±22.63 Useful = 50%
Orbis	Seniors	Mean = 1.06±0.82 Sum = 12.71±9.84 Useful = 86%	Mean = -0.81±1.21 Sum = -9.71±14.49 Useful = 43%	Mean = 0.96±1.53 Sum = 11.50±18.39 Useful = 71%
Orbis	Caregivers	Mean = 1.83±0.12 Sum = 22.00±1.41 Useful = 100%	Mean = 0.96±2.18 Sum = 11.50±26.16 Useful = 50%	Mean = 1.75±0.12 Sum = 21.00±1.41 Useful = 100%

The mean scores are also represented in the following figure:

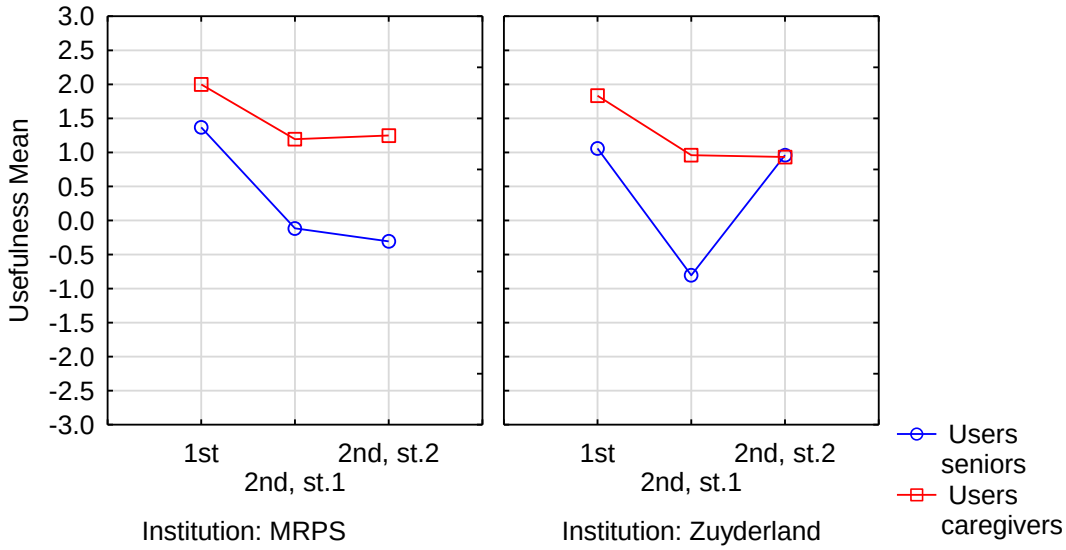

Figure 10. Usefulness: MRPS and Orbis separated.

A factorial ANOVA 2x3x2 was performed in order to evaluate the effect of the organization (MRPS, Orbis), pre-trial (first, second stage 1, second stage 2) and group of users (seniors, caregivers) on the usefulness mean score:

- Organization: no principal effect was observed ($F(1,43) = 0.03$, $p = 0.87$).
- Pre-trial: a marginal effect of the pre-trial was observed ($F(2,43) = 2.62$, $p = 0.08$). According to the LSD Post Hoc Tests, the score of perceived usefulness significantly decreased between the first pre-trial and the first stage of the second pre-trial ($p < 0.01$).
- Group: a principal effect of the group was observed ($F(1,43) = 4.71$, $p = 0.04$). According to the LSD Post Hoc Tests, caregivers perceived the Miraculous Life solution as being more useful than seniors ($p = 0.03$).

- No significant interaction effect between the three factors was observed.

Conclusions.

Caregivers perceived the Miraculous Life solution as being more useful than seniors (p = 0.03), confirming the results already observed in the cost-benefit analysis (see D1.2b REV). Note that at the second stage of the second pre-trial, only 43% of MRPS seniors perceived the Miraculous Life system as being useful. Interestingly Orbis seniors, at the first stage of the second pre-trial tended to perceive the system as being not particular useful (Mean = -0.81, SD = 1.21), while in the second stage of the second pre-trial the score on this indicator significantly increased (Mean = 0.96, SD = 1.53). Both MRPS and Orbis users slightly tend to think that the system will not reduce their demand for care (B11) and save time (B12; see D1.4b for the raw data); corroborating the analysis performed in the first pre-trial (see D6.4a). Several studies also show that elderly perceive innovative solutions for elderly as useful for their neighbor but don't feel they need it for themselves although caregivers think they also need these solutions for themselves.

According to the project's objectives, elder's rating of usefulness of the system should be substantially increased from the beginning till the end of the project; targeting 75%. Based on the quantitative data collected in the first and second pre-trials, this objective has already been achieved in Orbis; while improvements on the scores are expected in MRPS during the trial phase.

4 Analysis of qualitative data

4.1 Introduction

In this chapter, we will present qualitative data gathered during the second pre-trial – in both first and second stage. In chapter 4.2, we will present the results on the open questions asked at the end of the user testing phase. In chapter 4.3, the general recommendations – in terms of system, virtual support partner (VSP), interface, navigation, feedback – will be described. Finally, in chapter 4.4, we will present the recommendations related to the use cases tested. Note that not all the recommendations presented in this document were intended to be implemented for the prototype designed for the trial phase. Importantly, part of the recommendations will be taken into consideration by business partners for exploitation proposes; in particular to convert a prototype in a business product.

4.2 Open question analysis

Four open questions were asked to both seniors and caregivers at the end of the user testing phase (in both first and second stage) aiming to investigate their general appreciation within the system and the VSP. The results are shown here below, accompanied by significant citations. Taken together, this data suggest that general motivation and satisfaction about the system and the VSP increased between the first and second stage of the second pre-trial; corroborating quantitative data results.

(1) Is the system complex? Yes/no and why? How can we improve?

- First stage, Seniors: No = 7, Yes = 8
  - “It’s not too complex, but it’s difficult to delete activities from the agenda. There is also an inconsistence between the way you delete objects in the object assistance and in the agenda”.
  - “For me it’s not complex, but it could be too complex for other residents. Maybe they can learn to use it”.
  - “It’s easy to use”.
  - “An independent person can use it”.
  - “The system should work better. I expect improvements. It should be more reliable”.
  - “The system didn’t do what I want. Mary didn’t recognize what I was saying. There were lot of bugs”.
  - “It’s difficult to enter a new activity in the agenda. The system is also too slow and there are bugs”.
- Second stage, Seniors: No = 10, Yes = 2
  - “The system is not too complex. But there are some inconsistencies. There are some progress, but the system should be improved”.
  - “I think that everyone can learn to use it. But there are bugs…”
  - “No, it’s not complex.... but I think it’s too slow”.
  - “It’s not complex… but training instructions are needed”.
  - “It’s logical and easy to use”.

  - "After short instructions it's easy to use".
  - "It's quite complex, especially for someone who never used a tablet. But I think I will learn to use it. The text is very readable".
  - "I think that the system is too complex for persons who never used technologies. It's not easy to read the text".
- First stage, Caregivers: No = 3 , Yes = 2
  - "It's not too difficult to use for a young population. People with cognitive difficulties cannot use it. It would be too complex for them".
  - "It's relatively easy, compared to computers and Windows".
  - "Speech recognition and ergonomic aspects should be improved".
  - "No, a lot of clients are degrading psychologically and have troubles concentrating for a long time. There need to be less steps. It needs to be understandable".
  - "Yes, the system doesn't respond quickly enough which makes it difficult. But it's better than it was before".
- Second stage, Caregivers: No = 2, Yes = 1
  - "It's easy to use the system. It will be easier for persons who already used a computer. Maybe the text is too small".
  - "The residents will be very critical if the system doesn't work correctly".

(2) Are you motivated to use the system? Yes/no and why?

- First stage, Seniors: No = 7, Yes = 8
  - "The tablets projects are fun activities, I like new technologies".
  - "Yes, if the system work better".
  - "Yes, but without the Kinect".
  - "Yes, but I need to learn to use it".
  - "Yes, if it's for testing it. I am curious to see if it will work…"
  - "At this moment no".
  - "Not yet right now, but possibly when I get more dependent in the future. At this moment no, cause I am too intelligent".
  - "I don't like the concept of having an avatar at home. This system is an intrusion in my private life".
  - "I don't want to hear Mary all the day. Her voice irritate me. I would prefer a solution in which Mary is less intrusive".
  - "Mary is not an answer to the loneliness of older people".
- Second stage, Seniors: Yes = 9, No = 3
  - "I am motivated in participating. I am a very independent person. I think I can provide you valid feedback to improve the program".
  - "Yes, I am motivated to participate in the next phase, but the content should better fit according to my situation, needs".
  - "Yes… If I can be useful in the project… I am at your disposal".
  - "Yes, it works well and reacts properly on speech".
  - "Yes, it's a nice system which is very helpful".

  - "Maybe later. For the times being, I want to do this things myself without help".
  - "I don't want to depend on a machine. But I will participate because I think this system allow me to get in contact with others residents".
  - "No, because of Mary. I don't accept that an avatar looks what I am doing at home. I cannot accept that a robot monitor me".
- First stage, Caregivers: No = 3, Yes = 2
  - "Yes, the concept is interesting".
  - "Yes, but I feel I have to learn before using it".
  - "The system should work better".
  - "No, the larger group of the clients not, they will not use the system. It gives me too much stress".
  - "Not if the system doesn't respond well".
- Second stage, Caregivers: No = 1, Yes = 2
  - "Yes, I like innovation. We need innovation in healthcare".
  - "Should work even better than now to really use daily".

(3) Do you think the system is useful? Yes/no and why?

- First stage, Seniors: No = 6, Yes = 7, Not sure = 2
  - "I hope that! My first impression is good! Social activity is a good idea. I hope it will work because lot of persons suffers from solitude in MRPS…"
  - "Especially reminders and agenda".
  - "I think the system is more meaningful for people who live in the city, not in an institution. In MRPS we have caregivers".
  - "I have to test it. I will tell you after the trial phase".
  - "The system is not ready yet, I don't think I will use it".
  - "Not at this moment, in the future probably".
- Second stage, Seniors: No = 4, Yes = 8
  - "Yes, but probably it will be more useful for the next generation of seniors. Seniors today are not used to use technologies".
  - "Yes, I think so. Recipes are not needed. But messages and Contact list are interesting".
  - "Yes, I think so".
  - "Yes, it makes me more independent."
  - "Yes, especially the safety services for those who live alone".
  - "Not for me. I am very independent. But could be useful for more dependent people".
  - "I think it would be useful for my neighbours, but I am not sure I need it".
  - "I am not sure. The system is slow… I think it's faster to do things without it".
  - "It's not needed yet for me but it's a good system when needed".
- First stage, Caregivers: No = 2, Yes = 3
  - "Yes it's useful… but the system should be adapted to each participant. Each resident has different needs. For instance, if the user is completely

independent to take the medicines… medication reminders should not be provided. The avatar should help the user structuring his thinking. The system should not think for them! Otherwise the senior will not make a cognitive effort, and will became dependent from the system".
    - "No, I am not a client"
- Second stage, Caregivers: No = 1, Yes = 2
    - "Yes, the services are useful. But every senior has different needs. You should adapt the machine accordingly".

(4) Are you satisfied with the services? If not what should we change?

- First stage, Seniors: No = 3, Yes = 10, Not sure = 2
    - "Yes both Agenda and Object location answer to my needs".
    - "Object location is a good service".
    - "I am completely independent. Not sure that the system answers to my needs".
    - "I am not sure that this system is adapted to my needs. Maybe when I will be older".
    - "It is too privacy sensitive".
- Second stage, Seniors: Yes = 11
    - "Yes there are lot of services. Good work".
    - "Yes especially agenda, message system, and physical activity program. I was surprised to see that the fall detection worked… I am impressed".
    - "Yes especially the program physical activity".
    - "Yes, reminders are a good idea".
    - "Yes, overall I am".
    - "Yes, but yoga and cooking instruction video would be helpful".
    - "Yes, but I don't need all the services".
- First stage, Caregivers: No = 1, Yes = 3
    - "Periodic advices are really good. They will save us a lot of time!"
    - "Agenda, safety services and appointments reminders are useful".
- Second stage, Caregivers: No = 1, Yes = 1

Are you satisfied with the look of the avatar? If not what should we change?

- First stage, Seniors: No = 4, Yes = 9, Not sure = 2
    - "Mary improved a lot. She's better than the first workshop!"
    - "Yes, she's good. But from time to time, dialogues could be improved"
    - "She improved, she's nice. From time to time her expressions are quite strange" (probably she was referring to the emotion 'worried').
    - "She's nice. She doesn't bother me".
    - "She has improved. Now she's more human".
    - "She has no expressions and she do too much movement".

  - "She's very nice".
  - "I focused my attention on the programs, not on the avatar".
  - "For me the avatar is not important. I don't care of her look".
  - "The avatar is a just a toy. She's not an added value for the system. I feel she is an object. She lacks of sensitivity. She's not a human being".
  - "The voice of Mary annoyed me a lot. She has a monotone voice. She should speak better".
  - "I doubt if she is real, she looks like a doll".
- Second stage, Seniors: No = 3, Yes = 10
  - "Yes, she's really nice, but she has a very synthetic voice. I would prefer man voice. I would better understand a male voice".
  - "She's not bad. She's more than a cartoon. She is a 3D model".
  - "She is friendly. The human brain becomes quickly accustomed… I think Mary will became rapidly my partner".
  - "Overall I am satisfied".
  - "She give me the impression she's a nurse. That does not bother me, however".
  - "From time to time, she doesn't stand right" (probably she was referring to the emotion 'worried')
  - "I would prefer an avatar less robot and more human-like".
  - "I would prefer a man, instead of Mary. Do you have George Clooney?"
  - "She's very robot-like. She could be more human".
  - "Her movements are good. Her hairs are weird. Is it possible to change her dresses?
- First stage, Caregivers: No = 4, Yes = 1
  - "Speech recognition should be improved and the speech of the avatar should be improved".
  - "The movements of the avatar seems redundant".
  - "The avatar seems too stiff. She should move more like a human. She needs to talk louder. I have the feeling I need to shout to her".
- Second stage, Caregivers: No = 2, Yes = 1
  - "She's nice. It seems like that she has short beard when she's not moving. From time to time she did not pronounce correctly. Is good that the avatar formally address the senior".
  - "The speech of the avatar is unclear. Shorter and clearer command are needed".

4.3 General recommendations

In this chapter the general recommendations – in terms of system, VSP, user interface, navigation, and feedback – are presented. These recommendations are based both on the expert and user-based evaluation outcomes.

4.3.1 System

Similarly to the first pre-trial (see results on D6.4a), the general impression of experts, investigators and end-users related to the system is positive, especially in the second stage. In fact, during the first stage of the second pre-trial, investigators experienced stability problems: the system stopped several times and investigators had to restart it. In the second stage, the performance problems experienced during the first stage were solved. The system appeared to be more stable and performant. This may explain why in the second stage we obtained better results than the first stage (see both quantitative and qualitative data). In both stages we observed that end-users were happy to have the possibility to interact by both touch and speech. MRPS users tended to choose the touch interaction. It was described by participants as being more direct, reliable and fast. The recommendations concerning the general functioning of the system are described in the following paragraphs.

Firstly, in both first and second stage of the second pre-trial, both experts and users perceived the Miraculous-Life prototype as being too slow. On the first stage, MRPS external experts suggested that there is the risk that users will not use the system during the trial because of the lack of responsiveness. Interestingly, both MRPS and Orbis seniors (on both first and second stage) tended to disagree with the items “I think that the system could help me to complete my daily activities/tasks quickly” (B4) and “I think that the system could save me time when I use it” (B12); corroborating the results obtained on the first pre-trial (see D6.4a). We would recommend to improve the responsiveness of the system before starting the trial phase.

Secondly, due to limitations in speech recognition technologies, the system triggers – from time to time – services that were not requested by the user. This was especially the case for the “configure the speech” and the “call for help” use cases. For the trial phase, two measures were and will be taken in order to reduce the problems linked to speech recognition:

(1) Based on the results of the first stage of the second pre-trial, we recommended to remove the “configure the speech” button from the service screens. This recommendation was implemented by technical partners before the starting of the second stage. During the second stage, we observed with pleasure that the “configure the speech” wasn’t wrongly triggered by the system anymore.

(2) More specific vocal commands will be used to trigger the “call for help” use case.

Thirdly, in the version of the prototype tested in both first and second stage, the speech recognition module is activated once the video of the VSP is completed. Now, there is a delay between the end of the avatar speech and the activation of the speech recognition module due to the VSP non-verbal behaviour at the end of the video. This delay lasts for 2-4 seconds. According to the external experts, users will tend to talk immediately to the VSP (i.e. before the end of the video and thus before the actual activation of the speech recognition module). This was also largely observed during the first and second stage and represent one of the most important usability issues of the system related to the speech recognition module. For the prototype used in the trial phase, we would recommend to activate the speech recognition module at the end of the VSP speech, and not at the end of the VSP video.

Fourthly, the speech recognition could potentially let the user interact with the system remotely. Consider the following situation: the user is on the couch, the tablet is far away. The user wants to know his activities of tomorrow. The user starts an interaction with the system by saying “Open agenda”. The avatar open the service, and says "how can I help you?". The user doesn't remember the vocal commands... and cannot interact with the system. According to external experts the user should be able to ask the VSP to enumerate selected vocal commands that are available in each step. In the agenda, the VSP could say something like: "the vocal commands available are... ‘Activity 1 play cards’... ‘Activity 2 poker’... ‘See previous day’... ‘See next day’... ‘Close agenda’. How may I help you?” This functionality could potentially be implemented and tested for the Miraculous-Life business product (after the project).

Finally, a testing phase over a longer period of time is needed before the starting of the trial phase in order to test all use cases and the stability of the final prototype.

4.3.2 Virtual support partner

End-users tended to appreciate the VSP solution proposed in the Miraculous-Life project (see also chapter 4.2 for qualitative data). The recommendations concerning the virtual partner are described in the following paragraphs.

Firstly, on the first stage, MRPS external experts proposed to design two modalities of the VSP: dynamic and static. In the dynamic modality, the videos of the VSP are shown on the UI; while in the static modality only images of the VSP are shown on the UI. According to the external experts, if the user is far away from the system, he/she interacts with the system by speech. On the contrary, if the user has the tablet in his hands he/she will probably interact with the system by touch (in a more direct and faster way). External experts think that the expectations of the user are different: if the user interact by speech, the VSP should answer by speech (dynamic modality), allowing the 'remote' interaction with the system; if the user interact by touch, he/she probably want to interact with the system in a more instrumental way (the user want to find immediately the information he/she's looking for). In this situation, external experts think that a static VSP would make sense. Since the main objective of the Miraculous-Life project is to ensure a natural interaction via speech between the user and the VSP, this suggestion made by external experts was invalidated by the consortium to develop within the project.

Secondly, on the first stage, external experts proposed to add a new functionality allowing the user to ask help to the VSP for guidance purposes (e.g. the VSP explains to the senior how the Agenda works). This functionality could potentially be implemented and tested for the Miraculous-Life business product.
In order to maximising the mutual understanding between the VSP and the users, in the revision version of the D1.1a, it was suggested to enable an easy way to make the VSP repeat its last sentence, when requested by the end-user. This suggestion was also implemented with the vocal commands: “repeat last sentence”, “repeat”, “repeat it”; which are available in all the states of the dialogue management.

4.3.3 Interface design and feedbacks

Based on the first pre-trial acceptance evaluation results, significant improvements were provided on the design of the UI (see also D6.4a and D1.2b). The main recommendations in D6.4a also included:

1. VSP is too big in main screen
2. VSP is too small in service screen
3. Bigger texts required
4. Fresher colours for more positive feelings
5. Better contrasts between texts and backgrounds
6. Add instruction on the main menu: “Open…”
7. Add feedbacks to inform the user of the system's current state

All these recommendation gave birth to a refined design of the UI which was tested during both first and second stage of the second pre-trial. The general impressions concerning this new design were positive: in general, experts, investigators and end-users perceived the UI as being more adapted and efficient than the design tested in the first pre-trial. The recommendations concerning the interface design and feedbacks are described in the following paragraphs.

During the first stage, investigators observed that some seniors tended to press the buttons for long time. This behaviour was associated with the selection of the background and not with the on click action of the button. This was also one of the biggest usability problems related to the touch interaction with the system. Investigators also suggested to disable the background selection in buttons. This issue has been solved before the starting of the second stage.

After the first pre-trial, we recommended to provide feedbacks on the UI (“Processing, please wait…”, “I am listening to you”, “I am speaking”, see D6.4a). These feedbacks were tested during both first and second stage of the second pre-trial with both experts and users. During both stages, we observed that participants used these feedback in order to identify the state of the system. Moreover, MRPS investigators had the impression that the feedback related to the state of the system distracts too much the attention of the user and they proposed to move this feedback next to the VSP. This option was discussed within the consortium and it was decided to keep the actual solution: the area for the service-view VSP is already limited, it might be difficult to place it in a way that VSP is not hidden.

On the first stage, external experts also suggested to add a colour code in the feedbacks: the feedback “I am listening to you” should be surrounded by a green background, while the feedback “I am speaking, please wait” should be surrounded by a red background. This solution was discussed internally, and it was decided to keep the actual solution because of two main reasons: (1) a red background could catch too much attention of the user and is too much associated with emergency and (2) a red background could cause contrast problems.

On the second stage, experts from both end-user organizations suggested to identify a better strategy to align the buttons and the content in the service screens. The UI design was significantly improved after the second stage accordingly.

On the second stage, external experts suggested to add an icon next to the “Mary, open” (e.g. a loudspeaker), in order to inform the user that this label is part of the vocal command and should be used to open the different services. This could potentially be implemented and tested for the Miraculous-Life business product.

Finally, external experts proposed to change the feedback “Processing, please wait…” in “Please wait…” which is supposed to be more simple and clear for seniors. We suggest to change the label of this feedback before the starting of trial phase.

4.3.4 Navigation

Similarly to the first pre-trial (see results on D6.4a), we noticed that participants learned quickly the tree structure of the Miraculous-Life system, especially in the second stage. In general, participants encountered navigability difficulties on the first scenarios: the further they interacted with the system, the better they performed. At the end of the testing phase, participants could navigate throughout the system without asking for external help. The recommendations concerning the navigation are described in the following paragraphs.

After the first pre-trial, it was suggested to implement a “go back” button, in order to come back on the previous step of the dialogue flow (see D6.4a). After having been tested on the first stage, external experts proposed to remove this button from the UI: “the go back action make the dialogue flow not linear, and is difficult to be understood”. During the user-based evaluation of the first stage, investigators also noticed that end-users don’t use this button. We chose thus to remove this button from the UI.

In the deliverable D1.2b, it was proposed to implement two buttons on the menu of the service screen in order to improve the navigability within the system: (1) a “Return to the main service screen” button to allow quick navigation when this needed, (2) a “Close the service” button to return to the main VSP screen. Both buttons were tested during the first and second stage. In both stages, we noticed that both external experts and users had difficulties to identify the behaviour of the “Return to…” button. External experts proposed to remove this button or replace it with a “come back” action. After having discussed this issue within the consortium, we recommend to implement the following solution before the starting of the trial phase:

1. The “return to the main service screen” button will be available only in the services of the system characterized by a complex “tree structure”: (1) the contact list, (2) message system, (3) shopping assistance, (4) agenda, (5) group activities, (6) object location assistance, (7) meal preparation, and (8) physical activity. The “return to the main service screen” button should be removed for in the screen of the others services: (1) medication reminder, (2) wake-up calls, (3) periodic advice, (4) mode of the system, (5) configure the VSP speech, (6) fall detection, (7) dangerous object adviser, (8) dangerous situation adviser, (9) call for help, (10) windows reminder, (11) sleeping reminder, (12) appointment reminder, (13) notification service, (14) motivation for physical activity, (15) social bonding.

2. The “close the service” button should be available in all the 29 use cases. Moreover, this button should behave in different ways: in the services characterized by a complex “tree structure” (see list above), this button should simply close the active service and come back to the main menu; while in the other fifteen services (see list above), two behaviours are possible: (1) if no service was previously activated by the user, this button should close the service and come back to the main menu, (2) if a service was previously activated by the user, this button should close the service and come back to the previous service.

Based on the recommendations made after the first pre-trial, in the first stage of the second pre-trial we tested the button “Skip this video”; which was designed in order to interrupt the VSP; allowing thus to interact rapidly with the system. During the first stage of the second pre-trial, we observed that end-users don’t use it. Some of the elderly expected to interrupt the VSP by vocal command (which is not feasible from a technical point of view), others by clicking on the different buttons on the UI. Based on the results observed in the first stage, we recommended to (1) delete the “skip this video” button and (2) allow the user to interrupting the VSP by clicking on buttons on the UI. This was implemented and tested in the second stage of the second pre-trial. This solution worked well with end-users. Moreover, if the user want to skip the video of the VSP, two actions were needed: (1) a first click to stop the video, (2) a second click to choose the relevant action. According to external experts, one action should be sufficient: when the user press a button in the dialogue management while the VSP is speaking, the video should stop and the action of the button executed directly. We recommend to implement this functionality before the starting of the trial phase.

4.4 First stage: Recommendations on the use cases tested

4.4.1 Use case: Agenda (Agenda Service – Care & Wellness Service)

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 14. Agenda: data from user-needs interview.

Question	*Answer*	*Action taken*
Use Case Agenda: When you invite a person to an activity and he accepts or rejects would you like to be notified? When yes, how would you like to be notified? (mail, avatar confirms in speech, or both)	MRPS: Not surprisingly, all the seniors, without exceptions, mentioned that a feedback is needed. Most of them suggested that Mary (VSP) should inform them about the answer of the invited friend. Two seniors would prefer to receive an SMS. ORBIS: Also the Orbis users all indicated that feedback is necessary. The majority of the elderly preferred if Mary (VSP) would tell them this. Only one elderly would like to have the message in writing	A feedback system based on messages was proposed in the refined use case and implemented in the system.

	and one elderly would like to receive the feedback personally.	
Use Case Agenda: What kind of activities (not organisation but private activities that elderly organise themselves) should be in the activity system of the avatar as standard?	MRPS: The following activities were proposed by both group of end-users: Invite friends for coffee/tea, invite friend at home, walk in the park, do the laundry, go to the theatre, go to the cinema, go to the restaurant, go to the swimming pool, play cards, meet new people, board games (scrabble is often mentioned), group reading, go in the city, go shopping, gourmet coffee, play chess, do physical activity together, bike riding. ORBIS: Remembering appointments like pedicure, watering the plants, activities that are not daily, the tasks that are not daily, e.g., watering the plants, safety, e.g., turning of the tap or the stove, pedicure and other private appointments and medication and physiotherapy.	These list of activities will be proposed as a default activities in the system at the starting of the trial phase.

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 15. Agenda: data from user and expert based evaluation.

Recommendation	*Action taken*
The input fields and buttons are too small for the elderly. The expert suggests using a bigger font and increasing the size of the button before the pre-trial.	This issue was solved and implemented in the system. The size of input fields and buttons were increased before the stating of the second stage of the second pre-trial.
The screen invite friends needs several changes: (1) Not all text fits the screen. It is important to make it fitting. (2) You can invite 2 persons max. The expert suggests making this unlimited. (3) The contrast with colour of the active button is unclear. It is important for the elderly to have a better contrast.	The UI design and the dialog flow were refined; allowing also to invite more than two persons on an activity (new functionality).
When adding a new event the activity is not shown immediately after returning to the overview of activities. It appears when you select next day and then previous day. Experts recommend having it appear immediately	This issue will be further investigated and solved before the trial when feasible.
Lack of feedback for invitation confirmations: Debora invited Susan to the social activity drinking coffee. Susan accepts the invitation. The system	This issue was solved and implemented in the system. 4 messages have been integrated in the accept/refuse invitation mechanism. See example here below:

doesn't confirm to Debora whatever Susan accepted the invitation, or not. External experts recommend adding this functionality.	Situation: Debora invite Donato for a social activity. Donato accept or refuse the invitation. 4 messages could be sent: • Message sent to Donato if he accepted the activity Subject: New invitation from Debora: activity 'Play card' Message text: Dear Donato [senior name], Debora invited you on the social activity 'play card' planned for Tuesday 20 August at 16:00. You confirmed your presence for this activity! Well done! Have fun together! Have a nice day! • Message sent to Donato if he refused the activity Subject: New invitation from Debora: activity 'Play card' Message text: Dear Donato [senior name], Debora invited you on the social activity 'play card' planned for Tuesday 20 August at 16:00. Unfortunately, you cannot participate in this activity! Maybe next time! Have a nice day! • Message sent to Debora if Donato accepted the activity Subject: Invitation to Donato: activity 'play card' Message text: Dear Debora [senior name], you invited Donato on the social activity 'play card' planned for Tuesday 20 August at 16:00. Donato confirmed his presence for this activity! Well done! Have fun together! Have a nice day! • Message sent to Debora if Donato refused the activity Subject: Invitation to Donato: activity 'play card' Message text: Dear Debora [senior name], you invited Donato on the social activity 'play card' planned for Tuesday 20 August at 16:00. Unfortunately, Donato cannot participate in this activity! Maybe next time! Have a nice day!
Problem with activities created at midnight. If the activity is created at 00:00 am (for example 01/06/2015) of a certain day, this activity will be stored on the following day (i.e. 02/06/2015).	This issue was solved and implemented in the system.
The default date of new activities. Situation: Today is 01/06/2015. The user goes in the agenda in order to add an activity for tomorrow (02/06/2015). The user changes the day (show the next day) and create a new activity. In this screen the date (Year/month/day) is by default set to today (01/06/2015). Experts expected to see the current date of the agenda as a default value (i.e. in this example 02/06/2015).	This issue was solved and implemented in the system.
Missing dialogue. If the user, in state 30a, chose the option "I will not participate",	This issue was solved and implemented in the system.

the VSP should conclude the interaction by saying “Okay, as you like” and changes to a neutral expression	
Cancel the process of creating a new activity. Experts suggest adding a button in the “new activity” screen in order to cancel the process of creating a new activity. The VSP should conclude the interaction by saying “Alright Debora. What can I do for you?”	This issue was solved and implemented in the system.
Some words aren’t spoken correct by Mary: (1) word ‘‘oké’’ is spoken like ok, (2) word 'item' is not pronounced correct.	This issue was solved and implemented in the system.
Personal vs social activities. According to some of the elderly, the user should add “personal” (go to the doctor) and “social” activities (drink a coffee). Two functionalities should be discriminated in the main screen of the agenda: “Add personal activity”, “Add social activity”. If the user adds a personal activity, the VSP will not propose to invite persons.	This was discussed within the consortium. This proposition made by MRPS resident was not validated by experts. The actual solution is perceived as being more simple and efficient.
Remove an activity. We noticed that most of the users experienced difficulties in finding the way to delete an activity. We recommend to add a new vocal command (and button) on the main menu of the Agenda service (“Remove an activity”) allowing the user to remove activities – similarly to the prototype tested in the first pre-trial. Two seniors suggested explicitly this solution.	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product.
Thank you button (detail of an appointment). The meaning of this button was misunderstood by several seniors. We recommend change the label in “Come back to the Agenda”.	This issue was solved and implemented in the system.
Guidance: dialogues in the Agenda. Some of the elderly expected to be more guided by the VSP in the details of an appointment (dialogue: “Okay, here it is”) and in the screen allowing to add a new activity (dialogue: “Okay Debora”), and after the “come back” button (dialogue: “Okay”). We recommend to change these two dialogues in (1) “at the screen you can check the details of the activity [name.activity]” and respectively (2) “Okay, Debora! Use the following form to add a new activity in your agenda”, (3) Alright Debora. How can I help you?	This issue was solved and implemented in the system.

Introduce the name of the activity. Most of the users encountered difficulties in finding the way to enter the name of a new activity. A better (and more visible) solution should be designed.	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product. During the trial, users will be trained to introduce the name of the activity (to use the tablet keyboard)
Introduce the date of the activity. Participants were confused by Months and Days in the form 'add a new activity'. Recommendations: (1) Months should not displayed in form of numbers; please change [1;12] to [January,…December], (2) Year, Month and Day should be displayed one below the other.	This issue was solved.
Introduce the location of a new activity. Several elderly and caregivers suggested that the user should be able to enter a new location.	This issue should be taken into consideration for the business product. For the trial phase, we will test the actual solution: each participant will be provided with a default list of locations (which can be in any case updated during the trial in the KB).
The distance between buttons and boxes in the "add a new activity" screen is insufficient. We observed a lot of interaction problems in this screen due to the proximity of the different elements	This issue was solved. A new design of the user interface was provided for this screen.
Adding a new activity in the past should be avoided. This remark was made by an elderly and a caregiver. This makes sense and will prevent errors.	This issue will be further investigated and solved before the trial when feasible.
Add repeated activities. Some of the elderly mentioned that the system should allow the user to introduce repeated activities ("go to the church every Sunday").	This new functionality was added in the use case.
Add a button to close the keyboard and selection boxes. Users don't know how to close the keyboard in the agenda. They had to be instructed systematically by investigators. We suggest adding a button in order to close the keyboard and selection boxes.	This issue could potentially be taken into consideration for the business product. During the trial, users will be trained to close both keyboard and selection boxes.

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

State 1: Debora asks: "Open Agenda, please". *Go to the next state*.

State 2: The VSP is on the right, showing the agenda (i.e., a list of the appointments and activities of the elderly planned for today). The VSP continues the interaction: "Welcome to the agenda. On the screen you can see you appointments and activities planned for today. How can I help you?" *Go to state 3, 15, 42, 47, 49 or 51.*

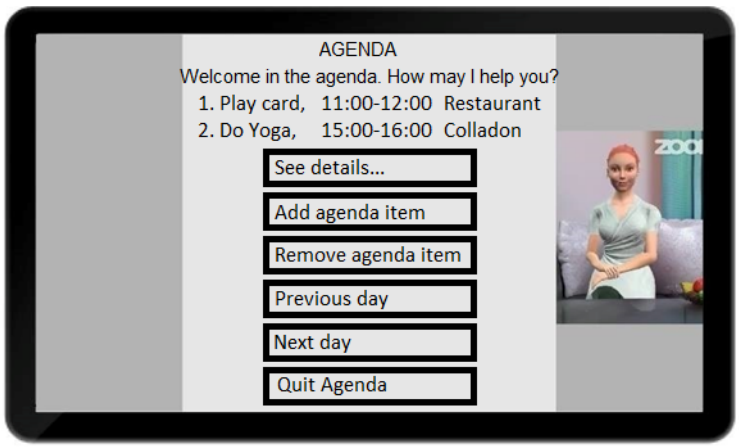

Figure 11: The agenda of the Miraculous-Life system

Situation: See the details of an Agenda Item

State 3: Debora asks: “See activity 1” or “play card”. *Go to the next state.*

State 4: The VSP says: “Okay, at the screen you can check the details of the activity play cards” while the list at the left side is now changed into a detailed overview of the activity asked by the user. If the user requested the details of an event/group activity, in the detailed overview she/he sees (1) the date of the activity, (2) the time, (3) the location, (4) remark, (5) the price, (6) the accessories needed and (7) the participants (e.g., the creator of the agenda item and the persons who accepted his/her invitation)

Activity: Card Games

Date: 13.11.2014

Time: 11:00-12:00 hrs.

Location: Restaurant

Remark: Today we will play bridge

Price: 0

Accessories: Cards

Participants: Cindy, Rachelle, Inge

If the user requested the details of an agenda item created by him or her, in the detailed overview she/he sees (1) the date, (2) the time and (3) the location of the activity.

Activity: Doctor

Date: 13.11.2014

Time: 16:00-17:00 hrs.

Location: Sittard

Finally if the user requested the details of an event created by another primary user of the Miraculous Life system, in the detailed overview he/she sees (1) the date, (2) the time of the activity, (3) the location and (4) the participants (e.g., the creator of the agenda item and the persons who accepted his/her invitation).

Activity: Poker

Date: 13.11.2014

Time: 19:00-20:00 hrs.

Location: Restaurant

Participants: Donato, Debora, Susan

Go to the state 5, 7 or 13.

State 5: Debora asks: “Read me the details”. *Go to the next state.*

State 6: The VSP reads the activity details shown on the screen aloud and concludes by saying: “What else can I do for you?” *Go to the state 5, 7 or 13.*

State 7: Debora asks: “Remove this activity”. *Go to the next state*.

State 8: The VSP: “Debora, are you sure you want to remove the appointment Poker from Sunday, December 6, 2015 at 4:00 PM?” *Go to the stage 9 or 11*.

State 9: Debora: “Yes”. *Go to the next state*.

State 10: The VSP is on the right, showing the list of the appointments and activities of the elderly planned for the date of the appointment that has just been removed by the user. The VSP: “Ok Debora, the appointment Poker has been removed from the list. How can I help you further?” *Go to state 3, 15, 42, 47, 49 or 51.*

State 11: Debora: “No”. *Go to the next state*.

State 12: The VSP: “Ok Debora, the appointment Poker has not been removed from the list. How may I help you?” *Go to the state 5, 7 or 13.*

State 13: Debora now sees where she has to be, at what time and knows all she wanted to know. Debora says: “Come back to my Agenda”. *Go to the next state.*

State 14: The VSP says: “Alright Debora. How can I help you?” and returns to the main screen of the Agenda. *Go to state Go to state 3, 15, 42, 47, 49 or 51.*

Situation: Add Agenda Items and Inviting persons

State 15: Debora asks: “I’d like to add a new activity”. *Go to the state 16 or 17*.

State 16: The VSP continues the interaction: “Ok, Debora. Use the following form in order to add a new activity in your agenda”. The Agenda disappears; while a text-input form appears on the screen, allowing Debora to add manually the new event (via the keyboard of the tablet) by specifying: (1) the nature of the activity (what), (2) the date, (3) the time, e and (4) the location of the activity (where) . Note that the system proposes standard activities (like going for a walk, apero in the restaurant, birthday party, etc.). Through the interface the user is also able to set the periodicity of the activity to Once, Daily, Weekly, Monthly, Yearly. Debora confirms the new appointment by saying “Add to my Agenda” to the VSP. *Go to the state 19.*

State 17: Debora stop the process by saying: “Cancel”. *Go to next state*.

State 18: The VSP says: “Alright Debora. What can I do for you?” and returns to the main screen of the Agenda. *Go to state 3, 15, 42, 47, 49 or 51.*

State 19: The VSP says: “I added the item in your agenda” while a detailed overview of the activity is shown on the left side. *Go to the state 20a or 20b*.

Activity: Shopping

Date: 13.11.2014

Time: 16:00-17:00 hrs.

Location: Center

State 20a (Conditional): If Debora often invites “Emilia” for the activity “Shopping”, the VSP will suggest to invite her to this activity when created. It says “You often invite Emilia to activity “Shopping”. Would you like to invite Emilia again?” *Go to the state 21 or 22.*

Component	Action
Memory	Person often invited to activity “Shopping”

State 20b (Conditional): 20a is false. The VSP propose to invite someone to the activity: “Would you like to invite someone to this activity?”. *Go to the state 24 or 25*.

State 21: Debora: “No”. *Go to state 23a.*

State 22: Debora: “Yes”. *Go to state 23b.*

State 23a: The VSP: “Would you like to invite someone else to this activity?” *Go to the state 24 or 25.*

State 23b: The VSP becomes happy that Debora is socially active, sends an invitation to Emilia and says “That’s great! An invitation for the activity “Shopping” has been sent to Emilia. Would you like to invite someone else to this activity?” *Go to the state 24 or 25.*

Component	Action
Emotion	The avatar looks happy

State 24: Debora: “No”. *Go to state 28.*

State 25: Debora: “Yes”. *Go to the next state.*

State 26: The VSP becomes happy that Debora is socially active and asks then “Who would you like to invite then?” *Go to the next state.*

Component	Action
Emotion	The avatar looks happy

State 27: Debora: “Susan”. *Go to the state 23b.*

State 28: The system returns back to the Agenda screen and VSP concludes the interaction by saying “Alright Debora. How can I help you?”. *Go to state 3, 15, 42, 47, 49 or 51.*

Situation: Susan received an invitation

State 29: Immediately after Debora created the social event, a notification is sent to Susan. The VSP: “Susan, Debora invited you for a social activity. Do you want to see it?” *Go to state 30, 32.*

State 30: Susan answers “Show me the activity” *Go to the next state.*

State 31: The VSP says: “Okay, here it is”. A detailed overview of the agenda item created by Debora is shown on the screen. In this detailed overview the user sees the date, the time of the activity, the location and the participants (e.g., the creator of the agenda item and the persons who accepted his/her invitation)

Activity: Shopping

Date: 13.11.2014

Time: 16:00-17:00 hrs.

Location: Center

Participants: Debora

Go to state 32, 34, 36 or 41.

State 32: Susan: “Remind me later”. *Go to the next state*.

State 33: The VSP: “I will remind you again in **30 minutes**”. *After 30 minutes, go to state 31*.

State 34: Susan: “I will participate”. *Go to the next state*.

State 35: The VSP: “Susan, this social activity was added in your agenda. I will also send a message to Debora to confirm your presence”. The social activity is added in her agenda. A new notification is sent to Debora:

> From: Susan
>
> Notification: “Susan confirmed her presence to the activity “Shopping on 13 November at 16:00 hrs o’clock in the center”

Additionally, a message is stored in the Message System of Susan:

> Subject: New invitation from Debora: activity 'Play card'
>
> Email Text: Dear Susan [senior name], Debora invited you on the social activity shopping planned for 13 November at 16:00. You confirmed your presence for this activity! Well done! Have fun together! Have a nice day, Mary [VSP name].

Additionally, a message is stored in the Message System of Debora:

> Subject: Invitation to Susan: activity 'play card'
>
> Email Text: Dear Debora [senior name], you invited Susan on the social activity shopping planned for 13 November at 16:00. Susan confirmed his presence for this activity! Well done! Have fun together! Have a nice day, Mary [VSP name].

STOP.

Component	Action
Emotion	The avatar looks happy

State 36: Susan: “I will not participate”. *Go to the next state*.

State 37a (Conditional): The VSP realizes that Susan already is socially active and is ok with it that she does not want to participate. *Go to the state 40.*

Component	Action
Memory	Frequency of Susan being social active over one week
Emotion	The avatar looks neutral

State 37b (Conditional): The VSP becomes sad that Susan is not socially active and says: “What a pity! I hope you will change your mind”. *Go to the next state*.

Component	Action
Memory	Frequency of Susan being social active over one week
Emotion	The avatar looks compassionate

State 38: Susan: “OK, I will participate”. *Go to state 28*.

State 39: Susan: “I do not want to participate”. *Go to the next state*.

State 40: The VSP says: “Okay, as you like!” and changes to a neutral expression. A new notification is sent to Debora:

From: Susan

Notification: “Unfortunately, Susan will not participate to the activity “Shopping on 13 November at 16:00 hrs o’clock in the center”

Additionally, a message is stored in the Message System of Susan:

Subject: New invitation from Debora: activity 'Play card'

Email Text: Dear Susan [senior name], Debora invited you on the social activity shopping planned for 13 November at 16:00. Unfortunately, you cannot participate in this activity! Maybe next time! Have a nice day, Mary [VSP name].

Additionally, a message is stored in the Message System of Debora:

Subject: Invitation to Susan: activity 'play card'

Email Text: Dear Debora [senior name], you invited Susan on the social activity shopping planned for 13 November at 16:00. Unfortunately, Susan cannot participate in this activity! Maybe next time! Have a nice day, Mary [VSP name].

STOP.

Component	Action
Emotion	The avatar looks neutral

State 41: Susan did not answer to the VSP. A new notification will be triggered 30 minutes later. **STOP**.

Situation: Remove an Agenda Item

State 42: Debora answers to the VSP: “Remove an activity”. *Go to the next state.*

State 43: The VSP: “Which activity would you like to remove?”. *Go to state 44 or 45*

State 44: The list of available activities is shown on the screen. Debora: “Activity 3” or “yoga”. *Go to the state 46.*

State 45: Debora stop the process by saying: “Cancel”. Go to state 7.

State 46: The VSP: “The appointment two hasn’t been removed from the list. How may I help you?” *Go to state 3, 15, 42, 47, 49 or 51.*

Use cases:

1. *The user ABC subscribes to a group activity (in the Group Activity service). After doing that, the user ABC deletes this agenda item from his/her agenda. The user ABC still can find this activity on the service “Group Activity” and, potentially, re-subscribe.*
2. *The user ABC creates an agenda item and invites the users GHI and XYZ. The users GHI and XYZ accept the invitation made by the user ABC. After doing that, the user ABC or XYZ (creator or participant) deletes this agenda item from his/her agenda. The agenda item is removed exclusively on the ABC or XYZ agenda.*

Situation: Debora changes the day

State 47: Debora: “Show me activities of previous day”. *Go to the next state*.

State 48: The VSP is showing the list of the activities for the asked day at the left side of the screen and says: “At the screen you see a list with the activities of [yesterday].” *Go to state 3, 15, 42, 47, 49 or 51.*

State 49: Debora: “Show me activities of the next day”. *Go to the next state*.

State 50: The VSP is showing the list of the activities for the asked day at the left side of the screen and says: “At the screen you see a list with the activities of [*tomorrow*]”. *Go to state 3, 15, 42, 47, 49 or 51.*

Situation: Debora quits the Agenda service

State 51: Debora answers: “I want to quit the agenda”. The Agenda Service is now closed and the VSP is on the “full screen mode”. **STOP**.

4.4.2 Use case: Events/Group activities (Agenda Service - Care & Wellness Service)

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 16. Events/Group activities: data from user and expert based evaluation.

Recommendation	*Action taken*
Add remark on group activities. Experts proposed to add the field remarks in the group activities, in which caregivers can provide additional information related to the current activity	This issue was solved and implemented in the system.
When too many activities in screen it isn’t clear you can scroll.	A feedback showing that scrolling is available should be provided on the UI. This issue will be further investigated and solved before the trial when feasible.
Dissociating Group activities and Agenda. Users tend to be confused in the group activities list; because of the flow similarity with the agenda service. We recommend to locate the button “Show me the group activities” in the main menu of Miraculous-Life system and remove it from the agenda service. We propose thus to have two different services on the main menu of the UI	This issue was solved and implemented in the system.
Register to an activity. We noticed that most of the users experienced difficulties in finding the way to register an activity. We recommend to add a new vocal command on the main menu of the group activities service (“Register to an activity”) allowing the user to directly register to an activity – similarly to the prototype tested in the first pre-trial. The flow will be identical to the workflow of ‘removing an appointment’ in the Agenda.	This issue was solved and implemented in the system.
Guidance: dialogues in the Group Activities. Some of the elderly expected to be more guided by the VSP in the details of a group activity (dialogue: “Okay, here it is”). We recommend changing this dialogue in (1) “Okay, on the screen you can check the details of the activity [name.activity]. How can I help you?”	This issue was solved and implemented in the system.

Action after having registered to an activity. When the user registers to an activity, the system comes back to the group activities. Most of the seniors were surprised to be redirected in this screen. They expected to switch directly in the agenda (on the day of the activity just registered): "Mary should show me that she record the group activity in my personal agenda".	After discussions within the consortium, the following solution was selected and implemented in the DM: once registered, the user will be redirected to the agenda of the day of the group activity.
Thank you button (detail of a group activity). The meaning of this button was misunderstood by several seniors. We recommend change the label in "Come back to the Group Activities".	This issue was solved and implemented in the system.

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

Situation: Debora wants tknow which events/group activities are proposed today

[Daily schedule]:

State 1: Debora asks: "Open Group Activities, please". *Go to the next state*.

State 2: The VSP is on the right, showing the agenda (i.e., a list of the appointments and activities of the elderly planned for today). The VSP continues the interaction: "Welcome to the Group Activities. On the screen you can see the list of activities planned for today." *Go to the state 3a, 3b, 3c or 3d.*

State 3a (Conditional): The VSP realises that today's activity list contains an activity from the category "social activities" and knows that Debora did not participate in any "social activity" for more than a week and says "You haven't participated to any social activity for more than a week. I see that today the social activity "drinking coffee" is organised. Would you like to register to this activity?" *Go to state 4 or 10.*

Component	Action
Memory	Get categories of activities where user did not participate for more than a week

State 3b (Conditional): The VSP realises that one of Debora's favourite activities is in the list and says "I see that your favourite activity "drinking coffee" is today. Would you like to register to this activity?" *Go to state 4 or 10.*

Component	Action
Memory	Get top 5 activities where the user participated most

State 3c (Conditional): The VSP knows that Debora often participates in activities of the category "social activities" and suggests to Debora to participate to an activity of the same category by asking her "I know that you like social activities, what do you think of the activity "drinking coffee" of today? Would you like to register to this activity?" *Go to state 4 or 10.*

State 3d (Conditional): 3a, 3b and 3c are false. The VSP continue the dialogue: "How can I help you further?" *Go to state 11, 13, 17, 23, 25 or 27.*

Component	Action
Memory	Get the category of events where the user participated most

State 4: Debora answers: “Yes please”. Go *to next state.*

State 5: The VSP becomes happy that Debora participates to activities and answers “You are registered for drinking coffee at 10:00 hrs. I also added this activity on your personal agenda. What do you want to do now?” *Go to state 6 or 8.*

Component	Action
Emotion	The avatar looks happy

State 6: Debora: “Come back to the list of activities”. *Go to the next state.*

State 7: The main screen of the activity service appears on the screen. The VSP: “Alright Debora. How can I help you?”. *Go to state 11, 13, 17, 23, 25 or 27.*

State 8: Debora: “See this activity in my Agenda”. *Go to the next state*.

State 9: The Group Activity service is now closed and the Agenda is displayed at the screen on the day in which the new group activity will take place. The VSP: “Welcome in your Agenda. At the screen you can see the activity planned for […]. As you can see, I added the activity drinking coffee in your Agenda. How can I help you further?”. Go to the Agenda use case. **STOP**.

State 10: Debora answers: “No thanks”. *Go to the state 7.*

Situation: Debora ask to the VSP tread the group activities

State 11: Debora asks: “Read me the group activites”. *Go to the next state.*

State 12: The VSP says: ”Activity one is drink coffee and is at 10:00 hrs., activity two is play card games and is at 11:00 hrs., and activity three is do yoga and is at 15:00 hrs. Let me know if you would like to register to an activity or to see more details about it”. *Go to state 11, 13, 17, 23, 25 or 27.*

Situation: Debora want to register tan activity

State 13: Debora: “Register for an activity”. *Go to the next state.*

State 14: The VSP becomes happy that Debora participates to activities and answers “Which activity?” *Go to the state 15 or 16.*

Component	Action
Emotion	The avatar looks happy

State 15: The list of available activity is shown on the screen. Debora: “Activity 2” or “drink coffee”. *Go to the state 5.*

State 16: Debora stop the process by saying: “Cancel”. Go to state 7.

Situation: Debora wants tsee the details of one particular activity

State 17: Debora says: “Detail of activity 1” or “Detail of drink coffee”. *Go to the next state.*

State 18: The VSP says: “Okay, on the screen you can check the details of the activity drink coffee. How can I help you?” while the list at the left side is now changed into a detailed overview of the activity “drink coffee”. In this detailed overview you see the time of the activity, the location, the remark, the price, the accessories needed and the participants (e.g., the end-users who subscribes to this group activity)

Activity: drink coffee

Time: 10:00-11:00 hrs.

Location: Coffee corner department 1

Remark: this is only for department 1

Price: 0

Accessories: No

Participants: Cindy, Rachelle, Inge

Go to the state 19, 21 or 22.

State 19: Debora asks: “Read me the details”. *Go to the next state.*

State 20: The VSP reads the activity details shown on the screen aloud and concludes by saying: “What else can I do for you?”. *Go to the state 19, 21 or 22.*

State 21: Debora asks: “Register for this activity”. *Go to the state 5.*

State 22: Debora now sees where she has to be, at what time and knows all she wanted to know. Debora says: “Come back to the list of activities”. *Go to the state 7.*

Situation: Debora changes the day

State 23: Debora: “Show me previous day”. *Go to the next state*.

State 24: The VSP is showing the list of the activities for the asked day at the left side of the screen and says: “At the screen you see a list with the activities of [yesterday].” *Go to state 11, 13, 17, 23, 25 or 27.*

State 25: Debora: “Show me the next day”. *Go to the next state*.

State 26: The VSP is showing the list of the activities for the asked day at the left side of the screen and says: “At the screen you see a list with the activities of [tomorrow]”. *Go to state 11, 13, 17, 23, 25 or 27.*

Situation: Debora quit the Activity service

State 27: Debora: “Close Group activity, please”. **STOP**.

4.4.3 Use case: Object Location Assistance and Reminder (Guidance Service)

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 17. Object localization assistance: data from user and expert based evaluation.

Recommendation	*Action taken*
Syntax in the Object Location Assistance. Experts proposed to improve the syntax of the location object service (i.e. try to make some phrase), or to find another	This issue was solved and implemented in the system.

strategy to present the information related to position of the objects.	
Validation / Invalidation of a new item. In the actual version of the prototype, the user can only validate the object created. During the usability inspection, experts suggested to add a button allowing the user to modify or cancel the item just added.	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product.
Lack of consistence between Agenda and Object Location for removing items. External experts suggested that the “remove” functionality is integrated differently in the Agenda and in the Object Localization service. In the Agenda, the user should access to the agenda item, while in the Object Localization service the user can directly remove the objects in the main menu. They suggested being consistent across the different services.	This issue was solved and implemented in the system.
Change of sentences. (1) For speech recognition you need to say "open objecten vinder" this needs to be changed to "zoek object”. (2) ‘Sla je je sleutels op' sounds weird in Dutch, needs to be changed to ‘Sla de locatie voor je sleutels op’.	This issue will be addressed before the starting of the trial phase.
The list of objects is too long. There are too many strange objects (like air conditioner) to search for int this list. These can be deleted to make the list shorter	On the trial phase, meaningful objects will be added per each user.
Syntax in the Object Finder. The seniors often complained about the syntax errors in this service made by the VSP – which are also dues to the complexity of the French grammatical rules. For the French version of the dialogues, we recommend to use an easiest way to suggest the position of the objects.	A better solution was implemented in the DM.
Seniors get lost on the main menu of the Object Finder. In the version of the ML prototype tested in the second pre-trial, the number of buttons in the main screen of the Object Finder depends on the number of objects stored by the user: if four objects are stored by the user, nine buttons are shown in the menu. During the trial, investigators had the impression that users get lost on the main menu of this service; especially when lots of items were introduced in the system. Recommendation: similarly to the prototype tested during the first pre-trial, a limited number of vocal command (and thus buttons) should be available on the main menu of the Object Finder: (1) Find an object, (2) Add an object, (3) Remove an object.	This issue was solved and implemented in the system.
Use the dialogues of the VSP to provide additional suggestions. In this actual version of the system, if the user doesn’t find the object, the VSP concludes the interaction by saying “I am sorry, but I can’t help you more than this. I hope you will find your object soon”. According to a caregiver and an elderly, the VSP could potentially suggest general strategies to find the object (for example, “Thinking the context of when you saw it	This issue could potentially be taken into consideration for the business product.

last time" or "did you check in yours pockets?"). It is potentially a good improvement for this service.	

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

Situation: The elderly opens the object localisation service

State 1: Debora tells the VSP: "Open object localisation". *Go to the next state*.

State 2: VSP: "Welcome to the object localisation service. How can I help you?" In the dialogues, Debora sees the 3 main actions she can do in this service: (1) Find an object, (2) Add an object, (3) Remove an object. *Go to state 3, 11, 14 or 20*.

Situation: Debora can't find her hat

State 3: Debora: "Find an object" *Go to state 3a*

State 3a: The VSP: "Which object would you like to find?" The list of objects also appeared on the screen. *Go to state 3b*.

State 3b: Debora: "The hat". *Go to state 4 or 6*.

State 4: The system detects the hat on her couch. The VSP says: "I think your hat is on your couch. Did you found it?". Go to state 5 or 9.

State 5: Debora says: "No". Go to the next state.

State 6: The system scans the room but can't find the hat (or this object – by its nature – could not be found via the Kinect). The system now automatically switches over to the object location reminder. The VSP tells: "normally, you store your hat in the table of your living room. Did you find your hat?". *Go to state 7 or 9.*

State 7: Debora says: "No". *Go to the next state*.

State 8: The VSP looks sorry: "I'm sorry, but I can't help you more than this. I hope you will find your hat soon" *Go to the state 3b, 11, 14 or 20*.

Component	Action
Emotion	The avatar looks compassionate

State 9: Debora says: "Yes". *Go to the next state*.

State 10: The VSP: "I am glad to hear that! Anything else?" *Go to the state 3, 11, 14 or 20*.

Component	Action
Emotion	The avatar looks happy

OBJECT LOCATION ASSISTENCE AND REMINDER

Situation: Debora adds a new object tthe list of stored objects

State 11: Debora: "I'd like to add an object". *Go to the next state*.

State 12: VSP: "Ok, Debora". A form appears on the screen, allowing Debora to add manually the new object by (1) choosing the object from a list previously created and (2) specifying the room and the location of the object (from a predefined list created by the administrator). Note that the system proposes standard rooms (like bathroom, living room, etc.) and locations (like table, couch, etc.). (3) Debora confirms the new object by saying "Validate it" to the VSP or cancel the process by saying "Cancel". *Go to the next state*.

State 13: The main menu of the object localisation service is now shown on the screen. The VSP continues the interaction: "I added the new object in the database. And now, what do you want to do?" *Go to the state 3, 11, 14 or 20.*

Situation: Debora removes an object from the list of stored objects

State 14: Debora answers to the VSP: "Remove an object". *Go to the state 14a.*

State 14a: The VSP: "Which object would you like to remove?" The list of objects also appeared on the screen. *Go to state 14b*.

State 14b: Debora: "The glasses". *Go to state 15*.

State 15: The VSP: "Debora, are you sure you want to delete the glasses from the list?". *Go to state 16 or 18.*

State 16: Debora: "Yes". *Go to the next state.*

State 17: The VSP: "Ok, the glasses have been removed from the list. How may I help you?" *Go to state 3, 11, 14 or 20.*

State 18: Debora: "No". *Go to the next state.*

State 19: The VSP: "The glasses haven't been removed from the list. How may I help you?" *Go to state 3, 11, 14 or 20.*

Situation: Debora quits the Object Localisation Service

State 20: Debora answers: "I want to quit the object localisation service". The Object Location Service is now closed and the VSP is on the "full screen mode". **STOP**.

4.4.4 Use case: Medication Reminder (Medication Service – Care & Wellness Service)

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 18. Medication reminder: data from user-needs interview.

Question	*Answer*	*Action taken*
Use Case Medication reminder: What is a good timing for reminders when you forget your medication?	MRPS: According to four users (2 seniors, 2 caregivers), the time interval between successive medication reminders should be set to 15-20 minutes. According to two seniors, this interval should be increased to 30 minutes; while a caregiver would prefer to reduce this interval to 10 minutes.	Based on these results, the time interval between successive medication reminders should be set to 15 minutes.

	ORBIS: The users indicated that for now the medication reminder is not necessary for them, however, they also indicated it would be useful if they would turn more forgetful. Moreover, one reminder approximately an hour after forgetting their medication would be sufficient. Furthermore, the initial reminder should be set at 10 minutes before the dedicated time to take the medication	
Use Case Medication reminder: Do you want to share the information that you do not take your medication? With Whom would like to share this information?	MRPS: The opinions of the seniors were divided. According to three seniors, notifications related to missed medications should not be sent: “I am independent”, “I can manage my medications”, “Maybe when I will be older”. On the contrary, three seniors would prefer to alert (automatically) caregivers in case of missed medications. MRPS caregivers would like as well to receive notifications for missed medications. Interestingly, according to the care coordinator of the institution, the primary end-user should also be able to call caregivers through the system if he / she doesn’t want to take a particular medication. This functionality could be useful if the primary end-user need more information related to a specific medication or he/she is experiencing secondary effects. ORBIS: Also for Orbis’s elderly the opinions were divided. However, according to the results all elderly would prefer to warn the caregivers in case they forget their medication. Two respondents mentioned to also alarm family members.	Based on these results, we think that it could be interesting to test situations in which caregivers are alerted if the seniors don’t take the medications. This functionality has been designed in the revised version of the use case. Nevertheless, this recommendation has not be identified as being critical; and could potentially be taken into consideration for the business product.
Use Case Medication reminder: How would you like to be notified when the elderly does not take his medication?	MRPS: The SMS appeared to be the best solution for MRPS caregivers – mentioned by 2 caregivers. ORBIS: no opinion	Based on these results, we suggest to provide a feedback using SMS. Nevertheless, this recommendation has not be identified as being critical; and could potentially be taken into consideration for the business product.
Use Case Medication reminder: Is it necessary to distinguish in the alarm between what medication is important or not so important?	MRPS: According to two caregivers, this could be a useful functionality: important missed notifications should be provided by SMS, while unimportant missed notifications could be sent by email. ORBIS: no opinion	This recommendation has not be identified as being critical; and could potentially be taken into consideration for the business product.

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 19. Medication reminder: data from user and expert based evaluation.

Recommendation	*Action taken*
Add remarks on the medications. It could be nice to have additional information for each medication reminder. Example: "Medication Actos. Remark: Take the medication with water. Time: 10:00 A.M. Dose: 2 pills.	This issue was solved and implemented in the system.
Standardize the vocal commands related to notifications, appointments reminder, medication reminder and periodic advices. All these services should have similar dialogues pattern. External experts suggested standardizing the vocal commands as much as possible in all these services. This will facilitate the learning phase of the primary end-user.	This recommendation was discussed within the consortium and was invalidated. Medication reminder are significantly different from appointment reminders, notifications and periodic advices.
Order of buttons. Experts think that it is important to highlight the button allowing to delete the reminder. The latter should be used by the end-users most of the time. It's expected that end-users will use less the command "postpone the reminder". The button related to the action "delete the reminder" should thus precede the button related to the action "postpone the reminder"	This issue was solved and implemented in the system.
Close medication reminder. Is not clear which action is associated to the command "close medication reminder" (a dialogue is missing here). For the first two medication reminders, the action related to the button "close medication reminder" should be the same as "postpone medication reminder" (i.e. a new dialogue should be added after having closed the reminder). For the last medication reminder the action related to the button "close medication reminder" should be the same as "delete medication reminder" (i.e. a new dialogue should be added after having closed the reminder).	This issue was solved and implemented in the system.
Avoid the question "did you already taken the medication"? This is an outcome from an informal discussion with the MRPS care coordinator. According to him, medication reminders for seniors should avoid the question "did you already taken your medication?" In fact, senior could potentially be confused by this question (i.e. make them doubt about their medication intake). Following this result, MRPS experts proposes to remove this question on the second and third reminder. The dialogue flow of the second and third reminder should thus be similar to the dialogue flow of the first reminder.	A new dialogue solution was proposed in the refined version of this use case. This issue has not be identified as being critical and could potentially be taken into consideration for the business product.
Dialogue: "a notification will be sent to your caregivers". According to a caregiver, we are punishing the user in this use cases: "If you don't take your medication, I will warn the caregivers". The user is passive in this use case. The caregivers propose thus to change "I don't	This new functionality (put me in touch with caregivers) was proposed in the refined version of this use case. Moreover, this issue was not considered as being critical. This issue could

want to take the medication" in "Put me in touch with caregivers", this vocal command will allow the user to establish a phone call with a caregiver – new functionality that could potentially be designed in the system	potentially be taken into consideration for the business product.
Medication reminders should be implemented only for people really need it. This was mentioned by a caregiver. If a person manages his/her medication and it's completely independent, should not receive medications reminders: "Medication reminders could make an independent person more dependent".	During the trials, medication reminders will be provided only to the seniors who really need it: "the avatar should help the user structuring his thinking. The system should not think for them" (Caregiver, MRPS).
Users use pillboxes. If they see the details of a medication, it should be written "pillbox" instead of the medicine to take. Example: "Medication: please refer to your pillbox. Remark: your box includes 1 Norvasc pill, 1 Citalopram pill and 1 Torasemid pill. Please take all these medications with water. Time: 10:00 A.M. Dose: 3 pills in total".	This strategy will be used by caregivers during the trials. The field medication will be used in order to refer to the pillbox while the field remark will be used to specify the pills that are in the box (if needed).
Deleting medication reminder. According to the MRPS care coordinator, the primary end-user should not be able to delete medication reminders or to communicate to Mary that "I don't want to take it" before having accessed on their content (i.e. on the state 1: "Debora, you have a medication reminder. What would you like to do with it?").	This issue was solved and implemented in the system.

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

Situation: First medication reminder at 10:00 hrs

State 1: The VSP says: "Debora, you have a medication reminder. What would you like to do with it?" *Go to the state 2, 6, or 23.*

State 2: Debora answers "Show me the reminder". *Go to the next state.*

State 3: The VSP answers: "It's 10:00 hrs, Debora. You should take the medicine Actos". At the same time a text bubble on the screen is showing the following text:

Medication: Actos.

Remark: Take the medication with water

Time: 10:00 hrs.

Dose: 2 pills.

Go to state 4, 6, 8 or 23.

State 4: Debora: "I took this medication". *Go to the next state.*

State 5: The VSP is happy that Debora took the medication and says: "OK, I will delete this reminder". **STOP**.

Component	Action

Emotion	The avatar looks happy

State 6: Debora: "Remind me later". *Go to the next state.*

State 7: The VSP: "I will remind you again in **15 minutes** to check if you took it". **STOP**.

State 8: Debora: "I don't want to take it". *Go to the next state.*

State 9: The VSP: "Debora, are you sure you don't want to take your medication? Maybe, it would be wise to discuss this with your caregivers". *Go to state 4, 10, 12 or 23*.

Component	Action
Emotion	The avatar looks worried

State 10: Debora: "Yes, I don't want to take it". *Go to the next state*.

State 11: VSP: "Ok, Debora. I just informed the caregivers." The following notification is sent to a selected caregiver by email (for not important medications) or by SMS (for important medications):

Date: 21/08/2015, Time: 10:00 am. Debora De Jong didn't want to take the medication "Actos" planned for 10:00 am. Call or visit Debora, if your think it's necessary. The Miraculous Life System. **STOP**.

State 12: Debora: "Put me in touch with caregivers". *Go to the step 13a*.

State 13a: The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: "Do not worry, Nicole. I am putting you in contact with Sylvie Rousseau" (i.e. the first caregiver contacted by the ML system). *Go to state 14.*

State 13b*:* The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: "Sylvie Rousseau cannot assist you at the moment. Do not worry, Nicole. I am putting you in contact with Cindy Wings" (i.e. the next caregiver contacted by the ML system). *Go to state 14.*

State 14: Sylvie Rousseau (Or Cindy Wings) answers the call of the Miraculous Life system. An automatic audio message is trigged: "This is a pre-recorded message provided by the Miraculous Life system: "Debora de Jong didn't want to take the medication "Actos" planned for 10:00 am and asked to talk with a caregiver. Please press 1 to establish a call with Debora, press 2 if you will call Debora later or press 0 if you can't assist Debora." *Go to the state 15, 17 or 20*.

State 15: The caregiver presses 1 (''yes''). *Go to the next state.*

State 16: A new pre-recorded message is trigged by the system: "Thank you, I will now put you in contact with Debora De Jong". A phone call is established and the caregiver speaks with Debora. After talking to Debora and the call ended Sylvie decides if she needs to go to Debora's apartment (if needed) to assist her or the phone call already solved the problem. *Go to state 22***.**

State 17: The caregiver presses 2 (''I will call Debora later''). *Go to the next state.*

State 18: A new pre-recorded message is trigged by the system: "You have confirmed that you will contact Debora later. Thank you." Go to the next state.

State 19: The VSP concludes the interaction**:** "Sylvie Rousseau cannot assist you at the moment, but she will contact you in a short term. Thank you for your patience!" Go to state 22.

State 20: The caregiver presses 0 ("No"). *Go to the next state.*

State 21: A new pre-recorded message is trigged by the system: "You aren't able to assist Debora De Jong. Don't worry, I will call someone else. I will inform you as soon as possible via sms when assistance is provided". The next contact in the predefined list will be called by the system. *Go to the state 13b*.

State 22: Each caregiver contacted by the Miraculous Life system will receive a SMS informing about the issue of the whole process. Three different messages could be sent by the system depending on the recipient:

- SMS sent to the caregiver who pressed 1 in state 15: "Date: 21/08/2015, Time: 10:00 am. Debora De Jong didn't want to take the medication "Actos" planned for 10:00 am and asked to talk with a caregiver. I have put you in contact with Debora. Thank you for your collaboration. The Miraculous Life System."
- SMS sent to the caregiver who pressed 2 in state 15: "Date: 21/08/2015, Time: 10:00 am. Debora De Jong didn't want to take the medication "Actos" planned for 10:00 am and asked to talk with a caregiver. You have confirmed that you will contact Debora later. Thank you for your collaboration. The Miraculous Life System.
- SMS sent to the caregiver(s) who pressed 0 in state 17: "Date: 21/08/2015, Time: 10:00 am. Debora De Jong didn't want to take the medication "Actos" planned for 10:00 am and asked to talk with a caregiver. I have put Debora in contact with Sylvie Rousseau [i.e. the name of the caregiver who pressed 1 in state 9]. Thank you for your collaboration. The Miraculous Life System."
- SMS sent to all the caregivers in the case none of them pressed 1 in state 15: "Date: 21/08/2015, Time: 10:00 am. Debora De Jong didn't want to take the medication "Actos" planned for 10:00 am and asked to talk with a caregiver. I tried to put Debora in touch with the predefined list of caregivers without success. The caregivers contacted were: [insert here the list of the caregivers]. I ask you to coordinate your efforts in order to provide support to Debora if needed. Thank you for your collaboration. The Miraculous Life System."

State 23: Debora did not answer to the VSP. A new reminder will be triggered **15 minutes** later. **STOP**.

Situation: Second medication reminder, later at 10:15 hrs

State 1: The VSP says: "Debora, you have a medication reminder. What would you like to do with it?" *Go to state 2, 6, or 23.*

State 2: Debora answers "Show me the reminder" *Go to the next state.*

State 3: The VSP answers: "It's 10:15 hrs, Debora. You should take the medicine Actos". At the same time a text bubble on the screen is showing the following text:

Medication: Actos.

Remark: Take the medication with water

Time: 10:15 hrs.

Dose: 2 pills.

Go to state 4, 6, 8 or 23.

State 4: Debora: "I took this medication". *Go to the next state.*

State 5: The VSP is happy that Debora took the medication and says: "OK, I will delete this reminder". **STOP**.

Component	Action
Emotion	The avatar looks happy

State 6: Debora: "Remind me later". *Go to the next state.*

State 7: The VSP: "I will remind you again in **15 minutes** to check if you took it". **STOP**.

State 8: Debora: “I don’t want to take it”. *Go to the next state.*

State 9: The VSP: “Debora, are you sure you don’t want to take your medication? Maybe, it would be wise to discuss this with your caregivers”. *Go to state 4, 10, 12 or 23*.

Component	Action
Emotion	The avatar looks worried

State 10: Debora: “Yes, I don’t want to take it”. *Go to the next state*.

State 11: VSP: “Ok, Debora. I just informed the caregivers.” The following notification is sent to a selected caregiver by email (for not important medications) or by SMS (for important medications):

Date: 21/08/2015, Time: 10:15 am. Debora De Jong didn’t want to take the medication “Actos” planned for 10:00 am. Call or visit Debora, if your think it’s necessary. The Miraculous Life System. **STOP**.

State 12: Debora: “Put me in touch with caregivers”. *Go to the step 13a*.

State 13a: The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: “Do not worry, Nicole. I am putting you in contact with Sylvie Rousseau” (i.e. the first caregiver contacted by the ML system). *Go to state 14.*

State 13b*:* The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: “Sylvie Rousseau cannot assist you at the moment. Do not worry, Nicole. I am putting you in contact with Cindy Wings” (i.e. the next caregiver contacted by the ML system). *Go to state 14.*

State 14: Sylvie Rousseau (Or Cindy Wings) answers the call of the Miraculous Life system. An automatic audio message is trigged: “This is a pre-recorded message provided by the Miraculous Life system: Debora De Jong didn’t want to take the medication “Actos” planned for 10:00 am and asked to talk with a caregiver. Please press 1 to establish a call with Debora, press 2 if you will call Debora later or press 0 if you can’t assist Debora.” *Go to the state 15, 17 or 20*.

State 15: The caregiver presses 1 (‘’yes’’). *Go to the next state.*

State 16: A new pre-recorded message is trigged by the system: “Thank you, I will now put you in contact with Debora De Jong”. A phone call is established and the caregiver speaks with Debora. After talking to Debora and the call ended Sylvie decides if she needs to go to Debora's apartment (if needed) to assist her or the phone call already solved the problem. *Go to state 22***.**

State 17: The caregiver presses 2 (‘’I will call Debora later’’). *Go to the next state.*

State 18: A new pre-recorded message is trigged by the system: “You have confirmed that you will contact Debora later. Thank you.” Go to the next state.

State 19: The VSP concludes the interaction: “Sylvie Rousseau cannot assist you at the moment, but she will contact you in a short term. Thank you for your patience!” Go to state 22.

State 20: The caregiver presses 0 (“No”). *Go to the next state.*

State 21: A new pre-recorded message is trigged by the system: “You aren’t able to assist Debora De Jong. Don’t worry, I will call someone else. I will inform you as soon as possible via sms when assistance is provided”. The next contact in the predefined list will be called by the system. *Go to the state 13b*.

State 22: Each caregiver contacted by the Miraculous Life system will receive a SMS informing about the issue of the whole process. Three different messages could be sent by the system depending on the recipient:

- SMS sent to the caregiver who pressed 1 in state 15: “Date: 21/08/2015, Time: 10:15 am. Debora De Jong didn’t want to take the medication “Actos” planned for 10:00 am and asked to talk with a

caregiver. I have put you in contact with Debora. Thank you for your collaboration. The Miraculous Life System."

- SMS sent to the caregiver who pressed 2 in state 15: "Date: 21/08/2015, Time: 10:15 am. Debora De Jong didn't want to take the medication "Actos" planned for 10:00 am and asked to talk with a caregiver. You have confirmed that you will contact Debora later. Thank you for your collaboration. The Miraculous Life System.
- SMS sent to the caregiver(s) who pressed 0 in state 17: "Date: 21/08/2015, Time: 10:15 am. Debora De Jong didn't want to take the medication "Actos" planned for 10:00 am and asked to talk with a caregiver. I have put Debora in contact with Sylvie Rousseau [i.e. the name of the caregiver who pressed 1 in state 9]. Thank you for your collaboration. The Miraculous Life System."
- SMS sent to all the caregivers in the case none of them pressed 1 in state 15: "Date: 21/08/2015, Time: 10:15 am. Debora De Jong didn't want to take the medication "Actos" planned for 10:00 am and asked to talk with a caregiver. I tried to put Debora in touch with the predefined list of caregivers without success. The caregivers contacted were: [insert here the list of the caregivers]. I ask you to coordinate your efforts in order to provide support to Debora if needed. Thank you for your collaboration. The Miraculous Life System."

State 23: Debora did not answer to the VSP. A new reminder will be triggered **15 minutes** later. **STOP**.

Situation: Third medication reminder, later at 10:30 hrs

State 1: The VSP says: "Debora, you have a medication reminder. This is the last reminder. I would suggest you to have a look on it." *Go to state 2 or 21.*

State 2: Debora answers "Show me the reminder" *Go to the next state.*

State 3: The VSP answers: "It's 10:30 hrs, Debora. You should take the medicine Actos". At the same time a text bubble on the screen is showing the following text:

Medication: Actos.

Remark: Take the medication with water

Time: 10:30 hrs.

Dose: 2 pills.

Go to state 4, 6 or 21.

State 4: Debora: "I took this medication". *Go to the next state.*

State 5: The VSP is happy that Debora took the medication and says: "OK, I will delete this reminder". **STOP**.

Component	Action
Emotion	The avatar looks happy

State 6: Debora: "I don't want to take it". *Go to the next state.*

State 7: The VSP: "Debora, are you sure you don't want to take your medication? Maybe, it would be wise to discuss this with your caregivers". *Go to state 4, 8, 10 or 21*.

Component	Action
Emotion	The avatar looks worried

State 8: Debora: “Yes, I don’t want to take it”. *Go to the next state*.

State 9: VSP: “Ok, Debora. I just informed the caregivers”. The following notification is sent to a selected caregiver by email (for not important medications) or by SMS (for important medications):

Date: 21/08/2015, Time: 10:30 am. Debora De Jong didn’t want to take the medication “Actos” planned for 10:00 am. Call or visit Debora, if your think it’s necessary. The Miraculous Life System. **STOP**.

State 10: Debora: “Put me in touch with caregivers”. *Go to the step 11a*.

State 11a: The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: “Do not worry, Nicole. I am putting you in contact with Sylvie Rousseau” (i.e. the first caregiver contacted by the ML system). *Go to state 12.*

State 11b*:* The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: “Sylvie Rousseau cannot assist you at the moment. Do not worry, Nicole. I am putting you in contact with Cindy Wings” (i.e. the next caregiver contacted by the ML system). *Go to state 12.*

State 12: Sylvie Rousseau (Or Cindy Wings) answers the call of the Miraculous Life system. An automatic audio message is trigged: “This is a pre-recorded message provided by the Miraculous Life system: Debora De Jong didn’t want to take the medication “Actos” planned for 10:00 am and asked to talk with a caregiver. Please press 1 to establish a call with Debora, press 2 if you will call Debora later or press 0 if you can’t assist Debora.” *Go to the state 13, 15 or 18.*

State 13: The caregiver presses 1 (‘’yes’’). *Go to the next state.*

State 14: A new pre-recorded message is trigged by the system: “Thank you, I will now put you in contact with Debora De Jong”. A phone call is established and the caregiver speaks with Debora. After talking to Debora and the call ended Sylvie decides if she needs to go to Debora's apartment (if needed) to assist her or the phone call already solved the problem. *Go to state 20***.**

State 15: The caregiver presses 2 (‘’I will call Debora later’’). *Go to the next state.*

State 16: A new pre-recorded message is trigged by the system: “You have confirmed that you will contact Debora later. Thank you.” Go to the next state.

State 17: The VSP concludes the interaction: “Sylvie Rousseau cannot assist you at the moment, but she will contact you in a short term. Thank you for your patience!” Go to state 20.

State 18: The caregiver presses 0 (“No”). *Go to the next state.*

State 19: A new pre-recorded message is trigged by the system: “You aren’t able to assist Debora De Jong. Don’t worry, I will call someone else. I will inform you as soon as possible via sms when assistance is provided”. The next contact in the predefined list will be called by the system. *Go to the state 11b*.

State 20: Each caregiver contacted by the Miraculous Life system will receive a SMS informing about the issue of the whole process. Three different messages could be sent by the system depending on the recipient:

- SMS sent to the caregiver who pressed 1 in state 15: “Date: 21/08/2015, Time: 10:15 am. Debora De Jong didn’t want to take the medication “Actos” planned for 10:00 am and asked to talk with a caregiver. I have put you in contact with Debora. Thank you for your collaboration. The Miraculous Life System.”
- SMS sent to the caregiver who pressed 2 in state 15: “Date: 21/08/2015, Time: 10:15 am. Debora De Jong didn’t want to take the medication “Actos” planned for 10:00 am and asked to talk with a caregiver. You have confirmed that you will contact Debora later. Thank you for your collaboration. The Miraculous Life System.
- SMS sent to the caregiver(s) who pressed 0 in state 17: “Date: 21/08/2015, Time: 10:15 am. Debora De Jong didn’t want to take the medication “Actos” planned for 10:00 am and asked to talk with a

caregiver. I have put Debora in contact with Sylvie Rousseau [i.e. the name of the caregiver who pressed 1 in state 9]. Thank you for your collaboration. The Miraculous Life System."

- SMS sent to all the caregivers in the case none of them pressed 1 in state 15: "Date: 21/08/2015, Time: 10:15 am. Debora De Jong didn't want to take the medication "Actos" planned for 10:00 am and asked to talk with a caregiver. I tried to put Debora in touch with the predefined list of caregivers without success. The caregivers contacted were: [insert here the list of the caregivers]. I ask you to coordinate your efforts in order to provide support to Debora if needed. Thank you for your collaboration. The Miraculous Life System."

State 21: Debora did not answer to the VSP. The interaction is completed. The reminder will be triggered on the next interaction with the user (i.e., when the user will approach to the system).

4.4.5 Use case: Appointment Reminder (Agenda Service - Care & Wellness Service)

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 20. Appointment reminder: data from user-needs interview.

Question	*Answer*	*Action taken*
Use Case Appointment Reminder: The reminder for the activity is triggered 1 hour before, then 30 minutes before and last reminder 10 minutes before the activity. Is this okay?	MRPS: According to five users (4 seniors and 1 caregiver), the timing of the appointment reminder should depend on the habits of the users and on the location of the activity (far vs. near). A caregiver suggested that the ideal time interval between successive appointment reminders should be identified during the trial itself. Finally, different solutions were proposed by end-users: • 1h30, 1h00, 40min before the activity (caregiver) • 1h30, 1h00, 45min, 30min, 15min before the activity (caregiver) • 1h30, 20min before the activity (elderly) • if the activity is far away, the first reminder should be triggered 2h00 before the activity (elderly) ORBIS: The elderly of Orbis are used to receiving only one reminder and activities are all nearby. The timing of the appointment reminder needs to differ per user and it should be possible to set it individually. Most of these elderly (N=3) say that one reminder 10 minutes before the activity is enough but also 30 minutes before is preferred by 2 users. One elderly	Given the diversity of the answers, we would suggest – for the business product of the system – to give to the senior the possibility to choose the timing aspects in the appointment reminder, but also in medication, periodic advices, wake-up-calls. For the version tested during the trial phase, we would suggest to keep it the actual solution (1h00, 30 minutes and 10 minutes before the activity).

	preferred to have 15 minutes and 1 user 60 minutes.	

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 21. Appointment reminder: data from user and expert based evaluation.

Recommendation	*Action taken*
Change the caption. ''Appointment Notification'' in ''Appointment reminder''	This issue was solved and implemented in the system.
Standardize the vocal commands related to notifications, appointments reminder, medication reminder and periodic advices. All these services should have similar dialogues pattern. External experts suggested standardizing the vocal commands as much as possible in all these services. This will facilitate the learning phase of the primary end-user. The commands suggested by experts are: (1) Show me the reminder, (2) Delete the reminder, (3) Postpone the reminder	Vocal commands were standardized in appointments reminders, notifications and periodic advices.
Order of buttons. Experts think that it is important to highlight the button allowing deleting the reminder. The latter should be used by the end-users most of the time. It's expected that end-users will use less the command "postpone the reminder". The button related to the action "delete the reminder" should thus precede the button related to the action "postpone the reminder".	This issue was solved and implemented in the system.
Vocal commands on the third reminder. In the third (and last) reminder; the user can still postpone it. In the third medication reminder the user should only (1) show the reminder or (2) delete the reminder.	This issue was solved and implemented in the system.
Close appointment reminder. If the user clicks on the button "close appointment reminder", a new remainder is triggered immediately by the system. For the first two appointment reminders, the action related to the button "close appointment reminder" should be the same as "postpone appointment reminder" (i.e. a new dialogue should be added after having closed the reminder). For the last appointment reminder the action related to the button "close appointment reminder" should be the same as "delete appointment reminder" (i.e. a new dialogue should be added after having closed the reminder).	This issue was solved and implemented in the system.
Deleting appointment reminder. According to the MRPS care coordinator, the primary end-user should not be able to delete appointment reminders before having accessed on their content (i.e. on the state 1: "Debora you have an appointment reminder. What would you like to do with it?").	This issue was solved and implemented in the system.

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

Situation: Later today at 10:00 hrs.

State 1: The VSP says: “Debora you have an appointment reminder. What would you like to do with it?” *Go to state 2, 6 or 8.*

State 2: Debora answers “Show me the reminder”. *Go to the next state.*

State 3: The VSP answers: “In **one hour** your activity card games starts in the restaurant. “Do not forget to bring your cards.” “This activity is for free.” At the same time a text bubble in the screen is shown the following text:

Activity: Card games

Time: 11:00-12:00 hrs.

Location: Restaurant

Price: 0

Accessories: Cards

Go to state 4, 6 or 8.

State 4: Debora: “Delete the reminder”. *Go to the next state.*

State 5: The VSP: “This reminder is deleted now”. **STOP**.

State 6: Debora: “Remind me later”. *Go to the next state.*

State 7: The VSP: “I will remind you again at **10:30**”. **STOP**.

State 8: Debora did not answer to the VSP. A new reminder will be triggered **30 minutes** later. **STOP**.

Situation: Later at 10:30 hrs

State 1: The VSP says: “Debora you have an appointment reminder. What would you like to do with it?” *Go to state 2, 6 or 8.*

State 2: Debora answers “Show me the reminder”. *Go to the next state.*

State 3: The VSP answers: “In **30 minutes** your activity card games starts in the restaurant. “Do not forget to bring your cards.” “This activity is for free.” At the same time a text bubble in the screen is shown the following text:

Activity: Card games

Time: 11:00-12:00 hrs.

Location: Restaurant

Price: 0

Accessories: Cards

Go to state 4, 6 or 8.

State 4: Debora: “Delete the reminder” *Go to the next state.*

State 5: The VSP: “This reminder is deleted now”. **STOP**.

State 6: Debora: “Remind me later”. *Go to the next state.*

State 7: The VSP: "I will remind you again at **10:50**". **STOP**.

State 8: Debora did not answer to the VSP. A new reminder will be triggered 20 minutes later. **STOP**.

Situation: Later at 10:50 hrs

State 1: The VSP says: "Debora you have an appointment reminder. This is the last reminder. What would you like to do with it?" *Go to state 2 or 6.*

State 2: Debora answers "Show me the reminder" *Go to the next state.*

State 3: The VSP answers: "In **10 minutes** your activity card games starts in the restaurant. "Do not forget to bring your cards." "This activity is for free." At the same time a text bubble in the screen is shown the following text:

Activity: Card games

Time: 11:00-12:00 hrs.

Location: Restaurant

Price: 0

Accessories: Cards

Go to state 4 or 6.

State 4: Debora: "Delete the reminder" *Go to the next state.*

State 5: The VSP: "This reminder is deleted now". **STOP**.

State 6: Debora did not answer to the VSP. The interaction is completed. After 15 minutes, the reminder will be automatically deleted. **STOP**.

4.4.6 Use case: Periodic Advice (Agenda Service – Care & Wellness Service)

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 22. Periodic advice: data from user-needs interview.

Question	*Answer*	*Action taken*
Use Case Periodic Advice: Are there other reminders than to drink and agenda that you would like to have?	MRPS: The following advice was mentioned by both group of end-users: MRPS housekeeping (once every 2 week), drink reminder (hydration), remember to check the group activities, remember to use specific services of the ML system, remember to the user to close the door (every evening), vaccination reminders (every year), watering plants reminder, eating time (at midday), remember to change the incontinence pads, remember to look for the correspondence in the box mail, remember to avoid being in sun during peak times when the sun's rays are strongest.	These list of activities will be proposed as a default activities in the system at the starting of the trial phase.

	ORBIS: The elderly of Orbis indicated the following advice that the system should be able to give. First of all reminders about pedicure appointments and second watering the plants or other activities that are not daily. Next periodic advice which was mentioned was turning off the tap of the stove. Moreover, reminders for medication and physiotherapy appointments would be appreciated. Finally, one elderly indicated that he did not need any periodic advice.	

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 23. Periodic advice: data from user and expert based evaluation.

Recommendation	*Action taken*
Periodic advice vs notifications. According to experts there is no need to make a distinction between a periodic advice and a notification on the front-end interface. The period advices could be presented by the avatar as being 'notifications'.	This issue was solved and implemented in the system.
Postpone a periodic advice. In the actual version of the prototype, period advices could not be postponed by the user. External experts think that – potentially – it could be interesting for the end-users having the possibility to postpone this kind of advice (depending on the nature of the advice); at the same way he/she can postpone notification and reminders.	This issue was solved and implemented in the system.
Close periodic advice. If the user clicks on the button "close periodic advice", a new advice is triggered immediately by the system. The action related to the button "close periodic advice" should be the same as "postpone a periodic advice" (proposed in the previous point). A new dialogue should be added after having closed the reminder accordingly.	This issue was solved and implemented in the system.
Standardize the vocal commands related to notifications, appointments reminder, medication reminder and periodic advices. All these services should have similar dialogues pattern. External experts suggested to standardize the vocal commands as much as possible in all these services. This will facilitate the learning phase of the primary end-user. The commands suggested by experts are: (1) Show me the notification, (2) Delete the notification, (3) Postpone the notification.	Vocal commands were standardized in appointments reminders, notifications and periodic advices.
Change of word. Dehydrated is too difficult for several elderly they suggest to use the Dutch word ''uitdrogen''.	This issue will be addressed before the starting of the trial phase.

Deleting periodic advice. According to the MRPS care coordinator, the primary end-user should not be able to delete periodic advices before having accessed on their content (i.e. on the state 1: "Debora, you have a new advice from François Fournier. What would you like to do with it?").	This issue was solved and implemented in the system.

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

Situation: The elderly receives a periodic advice (in this case a 'drink reminder')

State 1: It's 15:00 hrs. A periodic advice it's triggered by the system. The VSP says: "Debora, you have a new notification from François Fournier. What would you like to do with it?" *Go to state 2, 6 or 8.*

State 2: Debora answers "Show me the notification" *Go to the next state.*

State 3: The VSP reads the text previously written by François Fournier: "Dear Debora, the weather has been so hot lately. It's important to stay adequately hydrated. Don't forget to drink a glass of water from time to time, even if you don't perceive it necessarily". At the same time a text bubble in the screen is shown the following text:

> *From:* François Fournier
>
> *Advice: "*Dear Debora, the weather has been so hot lately. It's important to stay adequately hydrated. Don't forget to drink a glass of water from time to time, even if you don't perceive it necessarily"
>
> *Time:* 15:00 hrs.

Go to state 4, 6 or 8.

State 4: Debora: "Delete the notification" *Go to the next state.*

State 5: The VSP: "Ok, this notification is deleted now". **STOP**.

State 6: Debora: "Remind me later". *Go to the next state.*

State 7: The VSP: "I will remind you again in X [minutes/hours]". Note that the X value will be specified by caregivers in the back-end interface for each period advice. **STOP**.

State 8: Debora did not answer to the VSP. The interaction is completed. The reminder will be triggered on the next interaction with the user (i.e., when the user will approach to the system). If no interaction with the user occurs in the waiting configured period, the advice will be automatically deleted. **STOP**.

Note: All the periodic advices are stored in the message system (see use case "Messages").

4.4.7 Use case: Notification Service (Co-Net Service)

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 24. Notification service: data from user-needs interview.

Question	*Answer*	*Action taken*

Use Case Notification Service: The reminder of this service is after 1 hour. Is this acceptable for you?	MRPS: According to three end-users (2 caregivers and a senior), the time interval between successive notifications should depend on (1) the nature of the notification itself and (2) the habits of the user. A caregiver also suggested that the ideal time interval between successive notifications should be identified during the trial itself. Finally, two seniors proposed to set this interval to 30 minutes while a caregiver proposed 15 minutes. ORBIS: Three of the end-users of Orbis indicated that they would not need a notification reminder, as it was not necessary. Three elderly indicated they would like a notification. However, two of them preferred this notification after an hour and one elderly indicated this was not sufficient.	Given the diversity of the answers, we would suggest – for the business product of the system – to give to the caregiver the possibility to choose the delay between successive notifications (or periodic advices) through the caregiver interface. For the version tested during the trial phase, we suggest to keep the actual solution (1 hour between successive notifications).

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 25. Notification service: data from user and expert based evaluation.

Recommendation	*Action taken*
Specify who wrote the notification. Contrary to the periodic advice, no information is provided related to who wrote the notification. Please change “Debora, you have a new notification” in “Debora, you have a new notification from François Fournier”	This issue could potentially be taken into consideration for the business product. During the trial, caregivers will be trained to specify their names directly in the text read by the VSP.
Standardize the vocal commands related to notifications, appointments reminder, medication reminder and periodic advices. All these services should have similar dialogues pattern. External experts suggested to standardize the vocal commands as much as possible in all these services. This will facilitate the learning phase of the primary end-user. The commands suggested by experts are: (1) Show me the notification, (2) Delete the notification, (3) Postpone the notification.	Vocal commands were standardized in appointments reminders, notifications and periodic advices.
Order of buttons. Experts think that it is important to highlight the button allowing deleting the notification. The latter should be used by the end-users most of the time. It’s expected that end-users will use less the command “postpone the notification”. The button related to the action “delete the reminder” should thus precede the button related to the action “postpone the reminder”.	This issue was solved and implemented in the system.

Close notification. If the user clicks on the button “close notification”, a new notification is triggered immediately by the system. The action related to the button “close notification” should be the same as “postpone the notification”. A new dialogue should be added after having closed the reminder accordingly.	This issue was solved and implemented in the system.
Bug in sentences: (1) sometimes mix from English/Dutch speech, (2) incorrect Dutch word "meldig" instead of " melding"	This issue was solved and implemented in the system.
Deleting notifications. According to the MRPS care coordinator, the primary end-user should not be able to delete notifications before having accessed on their content (i.e. on the state 1: “Debora, you have a new notification from François Fournier. What would you like to do with it?”).	This issue was solved and implemented in the system.

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

Situation: A package is delivered at the reception of Orbis Hoogstaete for Debora

State 1: Immediately, after the receptionist sends the notification, the VSP says: “Debora, you have a new notification from Lotta de Graaf. What would you like to do with it?”. *Go to state 2, 6 or 8.*

State 2: Debora answers “Show me the notification”. *Go to the next state.*

State 3: The VSP reads the text previously written by Lotta de Graaf: “A package is waiting for you at the reception. Please pick it up before 5:00 PM.” At the same time a text bubble in the screen is shown the following text:

Notification: “A package is waiting for you at the reception. Please pick it up before 5:00 PM.”

Go to state 4, 6 or 8.

State 4: Debora: “Delete the notification” *Go to the next state.*

State 5: The VSP: “This notification is deleted now”. **STOP**.

State 6: Debora: “Remind me later”. *Go to the next state.*

State 7: The VSP: “I will remind you again in X [minutes/hours]”. Note that the X value will be specified by caregivers in the back-end interface for each notification. **STOP**.

State 8: Debora did not answer to the VSP. The interaction is completed. The notification will be triggered on the next interaction with the user (i.e., when the user will approach to the system). **STOP**.

Note: All the notifications are stored in the message system (see use case “Messages”).

4.4.8 Use case: Mode of the system: Active vs Passive Mode

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 26. Mode of the system: data from user-needs interview.

Question	*Answer*	*Action taken*
Mode of the system: Which services should be de-activated in the passive mode?	MRPS: According to three caregivers, the only services that should not be deactivated in the passive mode are: the wake-up calls, the safety services and the medication reminders. A caregiver suggested that important notifications and advice should be triggered even if the system is in the passive mode. ORBIS: The system should not give any reminders anymore in the passive mode according to the caregivers of Orbis. Moreover, the time/day/date should not be shown anymore.	Based on the users, the wake-up calls and the safety services should not be deactivated in the passive mode. This solution will be implemented before the trial. .
Mode of the system: Services related with safety are activated in the passive mode now. Is this enough?	MRPS: According to three caregivers, the only services that should not be deactivated in the passive mode are: the wake-up calls, the safety services and the medication reminders. ORBIS: Most of the caregivers indicated the safety measures, e.g. emergency call, notifications and reminders, were sufficient.	

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 27. Mode of the system: data from user and expert based evaluation.

Recommendation	*Action taken*
New label for this service. They suggest the label of the system to be standby	This issue will be addressed before the starting of the trial phase.
Dissociating the “mode of system” functionality in (1) enable/disable speech recognition, (2) enable/disable reminders/notifications (see D1.4b for more details).	The solution proposed by MRPS external experts was discussed within the consortium and was invalidated. Disassociating the mode of the system in two functionalities would make the system too complex for seniors. The actual solution was preferred.
Visual feedback for reminders, notifications when the system is disabled. External experts think that when the VSP is disabled (i.e. the avatar doesn't initiate a new interaction with the user); the system should provide a visual feedback informing the user when there are new notifications/reminders/advices (like 'flashing screen')	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product.

Dialogues in the service. The dialogues of the VSP related to system activation and deactivation (i.e. “Ok Nicole. The appointment reminders, notifications and periodic advices are now disabled” and “Ok Nicole. The appointment reminders, notifications and periodic advices are now enabled.”) should be improved and simplified. In fact, participants often didn’t understand these dialogues.	The following dialogues were proposed and implemented: (1) “Ok Debora. The system is now in the passive mode. In this mode, you will not receive reminders and notifications”, (2) “Welcome back Debora! I am happy to see you!”

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

Situation: Debora switches the system in the Passive mode

State 1: Debora: “Switch to the Passive Mode”. *Go to the next step.*

State 2: The VSP: “Ok Debora. The system is now in the passive mode. In this mode, you will not receive reminders and notifications” Reminders and notifications will be postponed until the user switches the system back to the Active mode. **STOP**.

Situation: Debora switches the system in the Active mode

State 1: Debora: “Switch to the Active Mode”. *Go to the next step.*

State 2: The VSP looks happy to see Debora: “Welcome back Debora! I am happy to see you!” **STOP**.

Component	Action
Emotion	The avatar looks happy

4.4.9 Use case: Configure the VSP Speech (Dialogue Management)

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 28. Configure VSP speech: data from user-needs interview.

Question	*Answer*	*Action taken*
Configure the VSP Speech: Is the speech of the avatar correctly changed when you ask to change like example speed, louder, softer, volume?	MRPS: Several seniors mentioned that this functionality completely meets their needs. Some of the seniors who tested this functionality suggested that (1) the difference between the options “faster” and “slower” is too pronounced, (2) the difference between the options “louder” and “softer” should be more important (this was especially the case for the seniors with hearing problems).	Based on the users, we recommend to reduce the differences between the options “faster” and “slower”, decreasing thus differences in speech rate. This issue will be further investigated and solved before the trial when feasible.

	Interestingly, two seniors suggested that the VSP should speak slower (as a default value). ORBIS: The opinions of the elderly were very diverse. Some elderly preferred the slower voice, some preferred a quicker voice. However, most of the elderly found it very handy that the speed and the volume of the voice were adaptable to the user.	

Table 29. Configure VSP speech: data from user and expert based evaluation.

Recommendation	*Action taken*
Change order of the buttons. The order of the buttons is different from the text and what the system spoke. This should be in line.	This issue will be addressed before the starting of the trial phase.
Speech rate. External experts suggested that differences in the speech rate are too much important (please speak faster/slower). It could be great to have more choice related to the speech rate of the VSP.	This issue will be further investigated and solved before the trial when feasible.
Access to the functionality "Configure the VSP speech". Since this service will be used only few times by the user, external experts suggested to show the button of this service only in the main menu (and not in the service screens). User should access on this service only from the main menu of the system.	This issue was solved and implemented in the system.
The VSP should conclude the dialogue (state 14). According to the experts, the VSP should conclude the dialogue when the user quit the service after having changed the VSP speech parameters.	This issue was solved and implemented in the system.
Additional button to close the service. Most of the users felt forced to change the speech of the user. They expected to have a button in the dialogue allowing them to close the service without changing the speech of the VSP. We recommend adding a new button (with the same action than the button 'close configure speech') with the label "Cancel".	This issue has not be identified as being critical since the user can still close the service thought the "close configure speech" button and could potentially be taken into consideration for the business product.
Dialogue: did you understanding me? Some of the user suggested finding a better dialogue. The option "Do you want still to change my voice" was also suggested by MRPS professionals.	This issue was solved and implemented in the system.

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

Situation: Debora does not understand the VSP because the VSP talks tofast/slow/soft/loud

State 1: Debora says “I did not understand you” or clicks on the “Configure VSP Speech” button to configure the avatar speech parameters. *Go to the next state.*

State 2: The VSP asks: “Do you want me to speak louder, softer, faster or slower?” *Go to state 3, 4, 5, 6 or 7.*

State 3: Debora answers: “Slower”, or the slider shown in the screen can be used. *Go to state 8.*

State 4: Debora answers: “Faster”, or the slider shown in the screen can be used. *Go to state 9.*

State 5: Debora answers: “Louder”, or the slider shown in the screen can be used. *Go to state 10.*

State 6: Debora answers: “Softer”, or the slider shown in the screen can be used. *Go to state 11.*

State 7: Debora answers: “Cancel”. *Go to state 15*.

State 8: The VSP adapts its speed according to Debora’s answer and asks: “Ok. I will speak slower from now on. Do you want still to change my voice?” *Go to state 12 or 13.*

State 9: The VSP adapts its speed according to Debora’s answer and asks: “Ok. I will speak faster from now on. Do you want still to change my voice?” *Go to state 12 or 13.*

State 10: The VSP adapts its volume according to Debora’s answer and asks: “Ok. I will speak louder from now on. Do you want still to change my voice?” *Go to state 12 or 13.*

State 11: The VSP adapts its volume according to Debora’s answer and asks: “Ok. I will speak softer from now on. Do you want still to change my voice?” *Go to state 12 or 13.*

State 12: Debora answers: “Yes”. *Go to state 2.*

State 13: Debora answers: “No”. Go to next state.

State 14: The main menu of the Miraculous Life system is now shown on the screen. The VSP concludes the interaction: “My voice has changed as requested. How can I help you?”

State 15: The main menu of the Miraculous Life system is now shown on the screen. The VSP concludes the interaction: “Alright Debora. May I do something for you?”

4.4.10 Use case: Fall Detection (Safety Service)

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 30. Fall detection: data from user-needs interview.

Question	*Answer*	*Action taken*
Use Case Fall Detection: When the elderly does not answer after a fall detected by the avatar should the caregiver warned after a second warning of the avatar (what is a good timing between the warnings?).	MRPS: • 2 caregivers: 5 minutes • 1 caregiver: 10 minutes In any case, the caregivers when they will receive an automatic notification will call the elderly before go to the apartment (false alarm prevention). • 1 caregiver: minimal 5 minutes • 1 caregiver: one minute	Based on these answers we recommend to use a timing of 5 minutes.

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 31. Fall detection: data from user and expert based evaluation.

Recommendation	*Action taken*
Go back to fall detection shouldn't be possible. When a new service is opened after the fall detection is used the system says go back to fall detection. Fall detection isn't a service to go back to. It should be the service before the fall detection to go back to.	The behaviour of the button "return to…" will be redesigned before the starting of the trial according to chapter 4.3.4, navigation.
Close fall detection. Is not clear which action is associated to the command "close fall detection" (a dialogue is missing here). The action related to this button should be the same as the vocal command "No, I am ok now". Please add a dialogue here accordingly.	This issue was solved and implemented in the system.

REVISED VERSION OF THE USE CASE

Remark: *This use-case is active whether the system is in "active mode" or "passive mode".* The system will always collect and process data from sensors for safety concerns.

CAREGIVER AND ELDERLY ASPECTS

State 1: In the middle of the night, Nicole wakes up to go to the toilet. She stumbles and falls on the floor. *Go to the next state.*

State 2: The Miraculous Life system detects the figure of the elderly on the floor. The VSP becomes worried and asks Nicole: "Nicole, it seems that you fell down. Shall I ask help from your caregivers?". *Go to state 3, 5 or 6.*

Component	Action
Emotion	The avatar looks worried

State 3: Nicole stands up. She feels good and answers: "No, I am ok now". *Go to the next state.*

State 4: The VSP appears relieved and says: "Ok, Nicole. Let me know if you will need support from your caregivers". **STOP**.

Component	Action
Emotion	The avatar looks relieved

State 5: Nicole answers: "Yes" or "Call for help". *Go to state 7a.*

State 6: Nicole is lying on the ground and she doesn't answer to the VSP. After 2 minutes, a new dialogue is triggered by the system: "Nicole, it seems that you fell down. Shall I ask help from your caregivers?". *Go to state 3, 5, 6.1 or 6.2.*

Component	Action
Emotion	The avatar looks worried

State 6.1 (Conditional, preferred solution): During the trial the system will not trigger an important number of false alarms. Nicole is still lying on the ground and she doesn't answer to the VSP. *After 2 minutes, go to state 7a*.

State 6.2 (Conditional): During the trial the system will trigger an important number of false alarms. Nicole is still lying on the ground and she doesn't answer to the VSP. **STOP***.*

State 7a: The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: "Do not worry, Nicole. I am putting you in contact with Sylvie Rousseau" (i.e. the first caregiver contacted by the ML system). *Go to the state 8a or 8b.*

State 7b: The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: "Sylvie Rousseau cannot assist you at the moment. Do not worry, Nicole. I am putting you in contact with Cindy Wings" (i.e. the next caregiver contacted by the ML system). *Go to the state 8a or 8b.*

State 8a (Conditional): In the state 5 the user answered "Yes", and thus confirmed the need for help. Sylvie Rousseau (or Cindy Wings) answers the call of the Miraculous Life system. An automatic audio message is trigged: "This is a pre-recorded message provided by the Miraculous Life system: I detected a fall in the apartment of Nicole Framboise. I asked to Nicole if everything is fine, and Nicole explicitly asked for care assistance. Nicole needs help immediately. Please press 1 to establish a call with Nicole or press 0 if you can't assist Nicole." *Go to the state 9 or 11*.

State 8b (Conditional): In the state 6 and 6.1 the user didn't answer to the system, and thus did not confirm the need for help. Sylvie Rousseau (or Cindy Wings) answers the call of the Miraculous Life system. An automatic audio message is trigged: "This is a pre-recorded message provided by the Miraculous Life system: I detected a fall in the apartment of Nicole Framboise. I asked to Nicole if everything is fine, but Nicole did not answer to me. There are chances that Nicole needs help. Please press 1 to establish a call with Nicole or press 0 if you can't assist Nicole." *Go to the state 9 or 11*.

State 9: The caregiver presses 1 (''yes''). *Go to the next state.*

State 10: A new pre-recorded message is trigged by the system: "Thank you, I will now put you in contact with Nicole." A phone call is established and the caregiver speak with Nicole. After talking to Nicole and the call ended Sylvie goes to Nicole's apartment (if needed) to assist her. *Go to state 13a or 13b***.**

State 11: The caregiver presses 0 ("No"). *Go to the next state.*

State 12: A new pre-recorded message is trigged by the system: "You aren't able to assist Nicole Framboise. Don't worry, I will call someone else. I will inform you as soon as possible via sms when assistance is provided". The next contact in the predefined list will be called by the system. *Go to the state 7b*.

State 13a (Conditional): In the state 5 the user answered "Yes", and thus confirmed the need for help. Each caregiver contacted by the Miraculous Life system will receive a SMS informing about the issue of the whole process. Three different messages could be sent by the system depending on the recipient:

- SMS sent to the caregiver who pressed 1 in state 9: "Date: 22/08/2015, Time: 12:00 am. I detected a fall in the apartment of Nicole Framboise. I asked to Nicole if everything is fine, and Nicole explicitly asked for care assistance. I have put you in contact with Nicole. Thank you for your collaboration. The Miraculous Life System."
- SMS sent to the caregiver(s) who pressed 0 in state 11: "Date: 22/08/2015, Time: 12:00 am. I detected a fall in the apartment of Nicole Framboise. I asked to Nicole if everything is fine, and Nicole explicitly asked for care assistance. I have put Nicole in contact with Sylvie Rousseau [i.e. the name of the caregiver who pressed 1 in state 9]. Thank you for your collaboration. The Miraculous Life System."

- SMS sent to all the caregivers in the case none of them pressed 1 in state 9: “Date: 22/08/2015, Time: 12:00 am. I detected a fall in the apartment of Nicole Framboise. I asked to Nicole if everything is fine, and Nicole explicitly asked for care assistance. I tried to put Nicole in touch with the predefined list of caregivers without success. The caregivers contacted were: [insert here the list of the caregivers]. Nicole needs help immediately. I ask you to coordinate your efforts in order to provide help to Nicole. Thank you for your collaboration. The Miraculous Life System.”

State 13b (Conditional): In the state 6 and 6.1 the user didn’t answer to the system, and thus did not confirm the need for help. Each caregiver contacted by the Miraculous Life system will receive a SMS informing about the issue of the whole process. Three different messages could be sent by the system depending on the recipient:

- SMS sent to the caregiver who pressed 1 in state 9: “Date: 22/08/2015, Time: 12:00 am. I detected a fall in the apartment of Nicole Framboise. I asked to Nicole if everything is fine, but Nicole did not answer to me. I have put you in contact with Nicole. Thank you for your collaboration. The Miraculous Life System.”
- SMS sent to the caregiver(s) who pressed 0 in state 11: “Date: 22/08/2015, Time: 12:00 am. I detected a fall in the apartment of Nicole Framboise. I asked to Nicole if everything is fine, but Nicole did not answer to me. I have put Nicole in contact with Sylvie Rousseau [i.e. the name of the caregiver who pressed 1 in state 9]. Thank you for your collaboration. The Miraculous Life System.”
- SMS sent to all the caregivers in the case none of them pressed 1 in state 9: “Date: 22/08/2015, Time: 12:00 am. I detected a fall in the apartment of Nicole Framboise. I asked to Nicole if everything is fine, but Nicole did not answer to me. I tried to put Nicole in touch with the predefined list of caregivers without success. The caregivers contacted were: [insert here the list of the caregivers]. There are chances that Nicole needs help. I ask you to coordinate your efforts in order to provide help to Nicole. Thank you for your collaboration. The Miraculous Life System.

4.4.11 Use case: Clock and Wake-up Calls (Agenda Service – Care & Wellness Service)

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 32. Clock and Wake-up Calls: data from user-needs interview.

Question	*Answer*	*Action taken*
Use Case Alarm Clock: How would you prefer to wake up?	MRPS: Five seniors would prefer to be wake up with music (note that classical music is the most mentioned), two seniors would prefer the “classic” wake-up tone, a senior would like to be wake up by Mary (VSP) and finally a senior would prefer the birds’ chirping solution. ORBIS: The answers of the elderly concerning the waking up varied. Five elderly indicated that they would like to wake up with music, of which two elderly wanted to wake up with only music. Four elderly preferred not to see an image when waking up.	Based on these answers, we would suggest to use a classical music tone for the trial phase as a default tone. Note that the user will not be able to choose from a set of sounds. Nevertheless, during the trial phase, the tone could be changed manually per user when requested.
Use Case Alarm Clock: Do you like to snooze? Should	MRPS: Five seniors would like to have the snooze option on the alarm clock, while	Based on these answers we propose to design a snooze system

we implement this functionality on the alarm clock?	two seniors think that this feature is not necessary. ORBIS: The majority of the elderly in Orbis (N=5) does not want to have the snooze option. Only two respondents indicated they would like to be able to snooze.	in the wake-up call (see refined version of the use case). This issue has not be identified as being critical; and could potentially be taken into consideration for the business product.

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 33. Clock and Wake-up Calls: data from user and expert based evaluation.

Recommendation	*Action taken*
Integration of the service in the clock. Experts suggested that the set alarm clock functionality should be integrated in the clock service.	This issue was solved and implemented in the system.
Lack of feedback. When the user set up the wake-up alarm time, the VSP says "The alarm has been set and will sound at the time selected." There is no feedback related to the choice of the user. This feedback should be given in the dialogue of the VSP. In addition, the user should find this information in the "clock screen".	This issue was solved and implemented in the system.
Remove a wake-up call. According to MRPS experts, the user should be able to remove a wake-up call which was previously added in the system.	This issue was solved and implemented in the system.
New requirement: safety service. During a presentation in MRPS (in which all the tested services where mentioned by the main MRPS researcher), a senior proposed that if the user doesn't react to the alarm clock in the morning, probably he/she needs help or assistance.	This was discussed within the consortium and the suggestion made by MRPS senior was invalidated. This functionality risk to trigger too many false alarms.
Chose the time of the alarm manually. Most of the users mentioned that they would like to select the alarm of the clock manually. The choices provided by default by the system (7.00 am, 7.30 am, 8.00 am, 8.30 am, 9.00 am, 9.30 am, 10.00 am) are not sufficient; especially for the seniors who are used to take a short nap in the afternoon.	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product.
The tone alarm is too soft. According to both elderly and caregivers.	A vigorous tone (classical music, according to D1.1b) will be used for the trial phase.

REVISED VERSION OF THE USE CASE

ELDERLY ASPECTS

Situation: The elderly access the clock

State 1: The VSP is in the "full screen mode". Debora approaches the device and starts an interaction with the VSP: "Open clock". *Go to the state 2a or 2b.*

State 2a (Conditional): the user did not specify an alarm clock yet. The VSP welcomes the user in the clock service: "Here you are Debora. It's twenty-five past six o' clock." A big analog clock is shown on the screen. *Go to state 3a or 13.*

State 2b (Conditional): the user already specified an alarm clock. The VSP welcomes the user in the clock service: "Here you are Debora. It's twenty-five past six o' clock. You set an alarm at fifteen past seven o' clock". A big analog clock is shown on the screen. Just below the clock, the user could find a visual feedback related to the chosen clock alarm: "alarm clock: 7:15 a.m." *Go to state 3b, 8 or 13.*

Situation: The elderly set or modify the alarm clock

State 3a (Conditional): the user did not specify an alarm clock yet. Debora: "Set the alarm clock". *Go to the state 4.*

State 3b (Conditional): the user already specified an alarm clock. Debora: "Modify the alarm clock". *Go to the state 4.*

State 4: The VSP continues the interaction: "This is a good idea. At what time do you want to get up?" *Go to state 5 or 7.*

State 5: Debora selects the time through a box-selection field and validates by saying: "Save the alarm clock". *Go to the next state.*

State 6: The system come back on the main menu of the clock service. VSP: "Debora, the alarm has been set and will sound at fifteen past seven o' clock. Anything else?". *Go to state 3b, 8 or 13.*

State 7: Debora stops the process by saying: "Cancel". *Go to the state 2a or 2b.*

Situation: The elderly remove the alarm clock

State 8: Debora: "Remove the alarm clock". *Go to the next state.*

State 9: VSP: "Debora are you sure you want to remove the alarm clock?" *Go to the state 10 or 12.*

State 10: Debora: "Yes". *Go to the next state*.

State 11: The system come back on the main menu of the clock service. VSP: "Debora, the alarm clock has been removed. Anything else?". *Go to state 3a or 13.*

State 12: Debora "No". *Go to the state 2b.*

Situation: The elderly quit the service

State 13: Debora answers: "I want to quit the clock please". The Clock Service is now closed and the VSP is on the "full screen mode". **STOP**.

Situation: The elderly wakes-up with the avatar

State 1: It's 7.15 am in the morning. The alarm clock is triggered by the system. *Go to state 2, 3, 4 or 5.*

State 2: Debora click on the button "Stop it". The elderly wakes up and heads to the device in order to turn off the alarm. The system knows that the elderly just woke up and the avatar starts the first interaction of the day.

State 3: Debora click on button: "Snooze 5 minutes". The alarm clock is temporarily deactivated. *After 5 minutes, go to the state 1.*

State 4: Debora click on button: "Snooze 15 minutes". The alarm clock is temporarily deactivated. *After 15 minutes, go to the state 1.*

State 5: Debora click on button: “Snooze 30 minutes”. The alarm clock is temporarily deactivated. *After 30 minutes, go to the state 1.*

4.4.12 Use case: Call for Help (Safety Service)

The following table illustrates the actions taken by the consortium based on the answers gathered on the user-needs interview – see D1.1b for the raw data.

Table 34. Call for help: data from user-needs interview.

Question	*Answer*	*Action taken*
Use Case Call for Help: A sensor will be installed in the bathroom of the seniors. When this sensor detects that the user is in the bathroom and not moving for more than 45 minutes, the system will automatically trigger the use case “call for help”. Is this 45 minutes range okay?	MRPS: According to three MRPS caregivers, the system should alert caregivers if the user is detected on the bathroom and he / she is not moving for more than 5-10 minutes. ORBIS: The caregivers of Orbis indicated that a time between 30 and 45 minutes would be acceptable.	After having discussed with the consortium, it was decided not to implement this use case. This be taken into consideration for the business product.

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 35. Call for help: data from user and expert based evaluation.

Recommendation	*Action taken*
Overlapping dialogues and ring. The dialogues of the VSP and the ring of the phone are overlapped. Please find a better solution.	This issue was solved and implemented in the system.
Direct speech contact with caregiver would be preferable. Users suggest Mary calls the caregiver that he/she can speak with the elderly and ask what the problem is. This saves time.	This was discussed within the consortium and the suggestion was invalidated. This situation risk to trigger too much false alarms.
Designing new dialogues to understand the reason of the emergency call. One caregiver proposed to add new dialogues to understand the nature of the urgency: “is a psychological problem? Is a security issue? Is a medical problem? Or… Is this ‘just’ solitude?” If the avatar know the reasons behind the call, the system can get in touch the senior with the right person; meaning that different persons will be contacted depending on the problem of the elderly. Orbis did not validate it.	This was discussed within the consortium and the suggestion was invalidated. Potentially there is an infinite list of reasons that could make a person feeling bad (emotionally, physically,…). Thus, this suggestion will be difficult to implement in the DM and difficult to be accepted by the end-users.
“Au secours”. New vocal command proposed to be tested	This issue was solved and implemented in the system.

REVISED VERSION OF THE USE CASE

ELDELRY ASPECTS

State 1: Nicole doesn't feel good. She has strong headache and stomach-ache. She asks for help by saying: "Mary, help me", "Mary, this is an emergency" or "Mary, I am not feeling well". *Go to the next state.*

State 2: The VSP became worried and asks for a confirmation: "Hey Nicole. Apparently you need help. Shall I call your caregivers?" *Go to state 3, 5 or 6.*

Component	Action
Emotion	The avatar looks worried

State 3: Nicole: "No, I am ok now". *Go to the next state.*

State 4: The VSP appears relieved and says: "Ok, Nicole. Let me know if you will need support from your caregivers". **STOP**.

Component	Action
Emotion	The avatar looks relieved

State 5: Nicole answers: "Yes" or "Call for help". *Go to state 7a.*

State 6: Nicole doesn't answer to the VSP. After 2 minutes, a new dialogue is triggered by the system: "Nicole, some minute ago you asked for help. Shall I call your caregivers?". *Go to state 3, 5, 6.1 or 6.2.*

Component	Action
Emotion	The avatar looks worried

State 6.1 (Conditional, preferred solution): During the trial, the system will not trigger an important number of false alarms. Nicole doesn't answer to the VSP. *After 2 minutes, go to state 7a.*

State 6.2 (Conditional): During the trial, the system will trigger an important number of false alarms. Nicole doesn't answer to the VSP. **STOP**.

State 7a: The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: "Do not worry, Nicole. I am putting you in contact with Sylvie Rousseau" (i.e. the first caregiver contacted by the ML system). *Go to state 8a or 8b.*

State 7b*:* The Miraculous Life system automatically makes a call to predefined contacts (in a predefined order of priority). While the system is calling, the elderly hears a ringing tone and sees who is being called in the UI. This is shown and heard to keep the elderly informed that help is being called. The VSP continues the interaction: "Sylvie Rousseau cannot assist you at the moment. Do not worry, Nicole. I am putting you in contact with Cindy Wings" (i.e. the next caregiver contacted by the ML system). *Go to state 8a or 8b.*

State 8a (Conditional): In the state 5 the user answered "Yes", and thus confirmed the need for help. Sylvie Rousseau (or Cindy Wings) answers the call of the Miraculous Life system. An automatic audio message is trigged: "This is a pre-recorded message provided by the Miraculous Life system: Nicole Framboise is in her apartment and she explicitly asked for care assistance. Nicole needs help immediately. Please press 1 to establish a call with Nicole or press 0 if you can't assist Nicole." *Go to the state 9 or 11*.

State 8b (Conditional): In the state 6 and 6.1 the user didn't answer to the system, and thus did not confirm the need for help. Sylvie Rousseau (or Cindy Wings) answers the call of the Miraculous Life system. An automatic audio message is trigged: "This is a pre-recorded message provided by the Miraculous Life system: Nicole Framboise is in her apartment and asked for care assistance. I asked a confirmation to Nicole, but Nicole did not answer to me. There are chances that Nicole needs help. Please press 1 to establish a call with Nicole or press 0 if you can't assist Nicole." *Go to the state 9 or 11*.

State 9: The caregiver presses 1 (''yes''). *Go to the next state.*

State 10: A new pre-recorded message is trigged by the system: "Thank you, I will now put you in contact with Nicole". A phone call is established and the caregiver speak with Nicole. After talking to Nicole and the call ended Sylvie goes to Nicole's apartment (if needed) to assist her. *Go to state 13a or 13b***.**

State 11: The caregiver presses 0 ("No"). *Go to the next state.*

State 12: A new pre-recorded message is trigged by the system: "You aren't able to assist Nicole Framboise. Don't worry, I will call someone else. I will inform you as soon as possible via sms when assistance is provided". The next contact in the predefined list will be called by the system. *Go to the state 7b*.

State 13a (Conditional): In the state 5 the user answered "Yes", and thus confirmed the need for help. Each caregiver contacted by the Miraculous Life system will receive a SMS informing about the issue of the whole process. Three different messages could be sent by the system depending on the recipient:

- SMS sent to the caregiver who pressed 1 in state 9: "Date: 22/08/2015, Time: 12:00 am. Nicole Framboise is in her apartment and she explicitly asked for care assistance. I have put you in contact with Nicole. Thank you for your collaboration. The Miraculous Life System."
- SMS sent to the caregiver(s) who pressed 0 in state 11: "Date: 22/08/2015, Time: 12:00 am. Nicole Framboise is in her apartment and she explicitly asked for care assistance. I have put Nicole in contact with Sylvie Rousseau [i.e. the name of the caregiver who pressed 1 in state 9]. Thank you for your collaboration. The Miraculous Life System."
- SMS sent to all the caregivers if none of them pressed 1 in state 9: "Date: 22/08/2015, Time: 12:00 am. Nicole Framboise is in her apartment and she explicitly asked for care assistance. I tried to put Nicole in touch with the predefined list of caregivers without success. The caregivers contacted were: [insert here the list of the caregivers]. Nicole needs help immediately. I ask you to coordinate your efforts in order to provide help to Nicole. Thank you for your collaboration. The Miraculous Life System."

State 13b (Conditional): In the state 6 and 6.1 the user didn't answer to the system, and thus did not confirm the need for help. Each caregiver contacted by the Miraculous Life system will receive a SMS informing about the issue of the whole process. Three different messages could be sent by the system depending on the recipient:

- SMS sent to the caregiver who pressed 1 in state 9: "Date: 22/08/2015, Time: 12:00 am. Nicole Framboise is in her apartment and asked for care assistance. I asked a confirmation to Nicole, but Nicole did not answer to me. I have put you in contact with Nicole. Thank you for your collaboration. The Miraculous Life System."
- SMS sent to the caregiver(s) who pressed 0 in state 11: "Date: 22/08/2015, Time: 12:00 am. Nicole Framboise is in her apartment and asked for care assistance. I asked a confirmation to Nicole, but Nicole did not answer to me. I have put Nicole in contact with Sylvie Rousseau [i.e. the name of the caregiver who pressed 1 in state 9]. Thank you for your collaboration. The Miraculous Life System."
- SMS sent to all the caregivers in the case none of them pressed 1 in state 9: "Date: 22/08/2015, Time: 12:00 am. Nicole Framboise is in her apartment and asked for care assistance. I asked a confirmation to Nicole, but Nicole did not answer to me. I tried to put Nicole in touch with the predefined list of caregivers without success. The caregivers contacted were: [insert here the list of the caregivers]. There are chances that Nicole needs help. I ask you to coordinate your efforts in order to provide help to Nicole. Thank you for your collaboration. The Miraculous Life System.

Note Optionally: *A sensor will be installed in the bathroom of the seniors. When this sensor detects that the user is in the bathroom and not moving for more than 45 minutes, the system will automatically trigger the use case "call for help".*

4.5 Second stage: Recommendations on the use cases tested

4.5.1 Use case: Contact list (Co-Net Service)

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 36. Contact list: data from user and expert based evaluation.

Recommendation	*Action taken*
No photos are displayed in the contact list service. According to the use case, a photo of contacts should be displayed in the user interface, when available. Please add some photos before the starting of the user pre-trial.	This issue was solved and implemented in the system.
Text in screen not aligning. Experts suggest aligning to the left.	The UI design was significantly improved after the second stage accordingly.
Contact information. According to the use case, the following fields should be displayed: address, city, telephone number, email, and birthday. The field "Telephone" is missing on the contact detail screen. Note that this field shouldn't be understood as being the internal number of the system, but rather the "private number" of the contact (fixed or mobile phone). According to the experts, the field "Skype" (which is not used in ML) is not relevant and could be removed.	The telephone issue was explained by the fact that no telephone number was inserted in the KB. This first issue was thus invalided. The field Skype was removed from the UI.
Home button. In the contact details, the button with the label "Home" appears if a particular contact has an internal phone number. By pressing this button, the user establishes an internal call with this contact. The action related to this button is not clear for the expert. Please change the label of this button in "Call François", which is also consistent with the button "Write a message to François".	The actual solution also allow to add more than a number for each contact (mobile, home). This functionality will not be used during our trial phase (we will only use internal numbers); but make totally sense for a business product. This issue was thus invalidated.
Hide the internal telephone number. The internal phone number is also shown on the system, nearly to the "Home" button. According to experts, this piece of information should be hided, since is not useful for the end-user.	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product.
Write a new message: consistency between the message system and the contact list. Primary end-users can send messages to others users by using the message system or the contact list. Captions, dialogues and label buttons in the 'Write a new message' screen diverge depending on the service used by the user (contact list vs message system). According to external experts, captions,	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product.

dialogues and labels should be standardized across the two services. In order to ensure the principle of consistency, we propose to: (1) rename the caption of the screen in “Write a new message”, (2) the dialogue of the VSP in “Please use the following boxes to write a new message to Susan Invite”, (3) rename the button that delete the message in “Cancel message”, (4) rename the button that send the message in “Send message”.	
The color of the button “Save data” in inconsistent. The button ‘Save data’ (send message) is green, while other buttons are blue. External expert suggested changing the color of this button, to ensure the interface uniformity.	This issue will be addressed before the starting of the trial phase.
Anniversary date format. The format of the anniversary date shown on the screen is “day/month/year 00:00”. Please remove the time (“00:00”), which make no sense in this context.	This issue was solved and implemented in the system.
Possibility to add data manually in the user interface. Some seniors would like to modify themselves the data contained in this application (add, modify and remove contacts). They don’t want to depend on others to do tasks that they think are able to do.	At this stage of the project, this functionality cannot be developed in time for the trial phase; but could potentially be taken into consideration for the business product.
Guidance: dialogues in the Contact List. Caregivers expected to be more guided by the VSP in the main screen of the service (dialogue: “Debora, vous voilà. Comment puis-je vous aider?”) and in the details of a contact (dialogue: “Debora vous voilà”). We recommend to change these two dialogues in (1) “Welcome to your contact list Debora. On the screen you can see yours contacts. How may I help you?” and respectively (2) “Okay. On the screen you can see the details of the contact you asked me for”.	This issue was solved and implemented in the system.
How to write a message? In order to bring up the keyboard (and thus write the text of a message), the user has to touch on text input field. According to a caregiver, seniors risk to forget this procedure. The caregiver proposed to bring up automatically the keyboard when loading this page.	This issue will be further investigated and solved before the trial when feasible. The text input field should be more visible on the UI, suggesting to the primary end-users to touch it in order to make the keyboard appear on the screen.

4.5.2 Use case: Message system (Co-Net Service)

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 37. Message system: data from user and expert based evaluation.

Recommendation	*Action taken*
Input boxes. According the experts, the size of the input boxes “subject” and “message” is too small. The size of	This issue will be further investigated and solved before the trial when feasible.

the text inserted by end-users risks also to be too small for seniors.	
In screen answer back ‘’send’’ is missing. In the screen answer back you only have the options ‘’cancel’’ and ‘’save’’. ‘’Save’’ should be changed to ‘’send’’ according to the experts.	This issue was solved and implemented in the system.
Bugs reported: (1) Part of the text on the button is missing, (2) State 5 ‘’send’’ doesn’t work via speech, (3) state 11 doesn’t work via speech only via buttons	The first bug was solved. In addition, all missing vocal commands will be added before the starting of the trial phase.
Write a new message: consistency between the message system and the contact list. Primary end-users can send messages to others users by using the message system or the contact list. Captions, dialogues and label buttons in the ‘Write a new message’ screen diverge depending on the service used by the user (contact list vs message system). According to external experts, captions, dialogues and labels should be standardized across the two services. In order to ensure the principle of consistency, we propose to: (1) rename the caption of the screen in “Write a new message”, (2) the dialogue of the VSP in “Please use the following boxes to write a new message to Susan Invite”, (3) rename the button that delete the message in “Cancel message”, (4) rename the button that send the message in “Send message”.	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product.
Position of buttons. The buttons “cancel message” and “send message” should be one next to the other	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product
The color of the button “Save data” in inconsistent. The button ‘Save data’ (send message) is green, while other buttons are blue. External expert suggested changing the color of this button, to ensure the interface uniformity	A code colour for buttons was designed: blue buttons can be activated via speech recognition, while greens buttons cannot. The colour of the button “Save data”, which cannot be activated by speech, is adapted. This issue is thus invalid.
Call a friend who wrote an email. When the user access to a message written by a friend, 3 actions could be performed by the senior: (1) answer back, (2) call and (3) delete the message. The option “Call” should be available only if the person who writes the email has an internal number phone registered in the DB. If this person doesn’t have an internal number phone, actions for the senior should be limited to: (1) answer back, (2) delete the message.	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product
Where is the message? I don’t see it. According to both caregivers, the text of the message received is not sufficiently visible (it’s difficult to be perceived). The message should be highlighted in the user interface	This issue will be addressed before the starting of the trial phase.
Seniors should consult the message they send. In this version of the prototype, seniors can access to the message received, but they cannot consult the messages	At this stage of the project, this functionality cannot be developed in time for the trial phase;

sent. According to a caregiver, this option should be provided: users should be able to access to the messages received and sent, “like in a normal email”.	but could potentially be taken into consideration for the business product.
The input keyboard and the input text field are too small. This was suggested by a caregiver.	The size of the box as well as the font used was increased. The keyboard issue has not be identified as being critical; and could potentially be taken into consideration for the business product.
The input text field is not sufficiently visible on the UI. A caregiver suggested increasing the width of the text field borders.	This issue will be addressed before the starting of the trial phase.
French dialogue. According to caregivers, the dialogue « Ecrire un nouveau message à François Fournier » should be improved. A more guiding French dialogue should be provided. They suggested changing this dialogue in: « Utilisez la zone de saisie ci-dessous afin d’envoyer un message à François Fournier ».	This issue will be addressed before the starting of the trial phase.
Could Mary read the messages to the seniors? This was proposed by a caregiver, and should be taken into consideration for further implementation. This functionality is already implemented in the meal preparation service (read aloud the ingredients) and in the agenda (read me the details); suggesting that Mary could potentially read the messages received by the senior.	At this stage of the project, this functionality cannot be developed in time for the trial phase; but could potentially be taken into consideration for the business product.

4.5.3 Use case: Call for Help (Safety Service)

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 38. Call for help: data from user and expert based evaluation.

Recommendation	*Action taken*
Text after hanging up incorrect. When the users ends the call by hanging up Mary says she couldn’t reach anybody. This is incorrect as the user stopped the call by himself. Expert suggests using the correct text that the elderly ended the call himself.	This issue will be addressed before the starting of the trial phase.
Go back after call for help. When you just had the call for help and then open another service you see go back to call for help. This is strange for call for help service. You should go back to the service before the call for help	The behaviour of the button “return to…” will be redesigned before the starting of the trial according to chapter 4.3.4, navigation
Bug reported: (1) when the call start the speech is stopped/interrupted, (2) SMS contains incorrect name of elderly.	Both bugs were solved.
The call functionality doesn’t work systematically. During the user testing phase, we encountered difficulties with	The bug in the call functionality was solved.

the call functionality. From time to time, calls are not initiated by the system. This was not observed during the expert analysis. On the contrary, SMS are received systematically.	
Adding microphones on the rooms of the apartment. According to a caregiver, this service is limited by the fact that the user must be next to the Kinect or the tablet in order to ask for help by speech. The caregiver suggested adding microphones in each room. These microphones should be used only to recognize words that are related to safety issues ("help me", "I need caregivers"). Detection of cries, moaning and groaning could be also interesting since this verbal behavior could be potentially be related to a fall or other safety issues.	At this stage of the project, this functionality cannot be developed in time for the trial phase; but could potentially be taken into consideration for the business product.
Stopping a call. If the user stops an emergency call, a call to the second caregiver should not be initiated.	This issue will be addressed before the starting of the trial phase.

4.5.4 Use case: Fall detection (Safety Service)

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 39. Fall detection: data from user and expert based evaluation.

Recommendation	*Action taken*
2 minutes waiting to call is too long. When you don't move for 2 minutes the system should call. According to the experts this is too long and this needs to be 30 seconds.	This will be changed before the trial.
No confirmation when fallen. Experts suggest when a senior falls Mary doesn't need to ask if you need help (no confirmation) but Mary should directly start calling the caregivers. Also the seniors shouldn't have a possibility to stop the call in case of a fall.	This was discussed within the consortium and the suggestion was invalidated. This situation risk to trigger too much false alarms.
Send an image from the Kinect to caregivers. According to the external expert, the system could potentially send an image to caregivers; showing the fall detection event. By doing this, caregivers can easily discriminate false positive from true positives.	At this stage of the project, this functionality cannot be developed in time for the trial phase; but could potentially be taken into consideration for the business product; knowing that data protection and user privacy should be also ensured.
The call functionality doesn't work systematically. During the user testing phase, we encountered difficulties with the call functionality. From time to time, calls are not initiated by the system. This was not observed during the expert analysis. On the contrary, SMS are received systematically.	The bug in the call functionality was solved.

4.5.5 Use case: Dangerous object advisor (Safety Service)

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 40. Dangerous object advisor: data from user and expert based evaluation.

Recommendation	*Action taken*
Action after option "It is ok. I just put it there myself". If the use communicate to Mary that a certain object is not dangerous, the system should understand this as being a false positive and recognize this object as being not dangerous; meaning that no additional . Now, it is unclear if it's the case, since this use case is continuously and wrongly triggered by the system.	This issue will be addressed before the starting of the trial phase.
"Undefined label". On the screen of the dangerous object, there are two buttons with the label "Return to undefined" and "Close undefined", which should be replaced by "Return to object", "Close object".	This issue will be addressed before the starting of the trial phase.
Close dangerous object. Is not clear which action is associated to the command "close dangerous object" (a dialogue is missing here). The action related to this button should be the same as the vocal command "It is ok. I just put it there myself". Please add a dialogue here accordingly.	This issue will be addressed before the starting of the trial phase.
What object should I move in my apartment? A huge number of users suggested that a feedback should be provided in order to know which object is detected as being dangerous by the system. They suggested displaying an image in the UI, showing the object that should be removed in the apartment.	This issue will be addressed before the starting of the trial phase.

4.5.6 Use case: Danger Situations Adviser (Safety Service)

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 41. Dangerous situation advisor: data from user and expert based evaluation.

Recommendation	*Action taken*
Problems recognizing certain voice commands: (1) the voice command open recipes are not often recognized by the system. Experts suggest to use another word for ''recipes'', (2) The voice command ''add all ingredients'' isn't understood is always understands ''ad an ingredients''	(1) The vocal command "open recipes" was changed in "open meal preparation" (open kookrecepten, open kookrubriek in Dutch). (2) In Dutch and French this problem doesn't appear and these are the languages of the system which will be used in the trial.

Oven/stove reminder appearance. According to the expert the oven/stove reminder should appear 1 hour after you close the meal preparation service both when you use another system or have no interaction with the system at all. In the current system this reminder only appears when you use no other service.	This issue was solved and implemented in the system.
Dissociate ingredients list from preparation. The VSP welcome the user in the recipe by saying "ON the screen, you can see the ingredients needed for the recipe [name of the recipe]. How can I help you? Below, the procedure of the recipe and the ingredients are shown. Please delete the preparation of the recipe from this screen. The user can consult it by asking "show preparation procedure". This will also make this screen less heavy, by removing some content.	This issue was solved and implemented in the system.
Content disappear when the user ask to add all ingredients in the shopping list. On the screen, the user should see the ingredients of the recipe selected.	This issue was solved and implemented in the system.
Speech command unnecessary long. The words to use as speech command are too long. It would e.g. be better to say show ''preparation'' instead of ''preparation method.	This will be changed before the trial.
Word recipes were confusing for seniors. With the word recipes seniors thinks of recipes from the doctor. They suggest using the name meal preparation.	This issue was solved and implemented in the system.
Cooking instruction video. One senior suggested adding a cooking instruction video as he prefers visual information beside only text.	At this stage of the project, this functionality cannot be developed in time for the trial phase; but could potentially be taken into consideration for the business product.
Could Mary read me the preparation of the recipe? This was asked by two seniors. It could be a nice improvement.	At this stage of the project, this functionality cannot be developed in time for the trial phase; but could potentially be taken into consideration for the business product.

4.5.7 Use case: Physical Activity Service (Guidance Service)

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 42. Physical activity service: data from user and expert based evaluation.

Recommendation	*Action taken*
Bug reported. Mary starts speaking when video is showing. It looks like Mary responds to the voice on the video.	This bug has not been reproduced. This issue was considered as being invalid.

There is a big volume difference between speech of Mary and video volume. The video volume is very low in comparison to volume of Mary. Experts suggest having the same volume. Otherwise the user needs to keep on changing the volume when watching the video.	This issue can't be fixed: since it's possible to adjust the volume of the VSP by the user, it's not possible to have both type of videos adjusted to the same volume all the time. That's a technical restriction.
Word category can be deleted. The word category in the screen can be deleted.	This issue was solved and implemented in the system.
Too many steps between opening physical motivation video and watching video. According to the experts it takes to many steps after opening this service till you actually watch the video. They suggest to have a look at the dialogue and see were to shorten or delete some steps.	This problem is explained by the fact that each category is composed by only a video; creating thus inadequate steps in the dialogue flow. For the trial version, each category of the physical activity service will be composed by 2 or more videos.
Length of the videos. According to the experts, the length of the videos should be expressed in minutes and seconds. I.e. "334 seconds" should change in "5 minutes and 34 seconds".	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product
Problem of visualization of MRPS videos. The resolution of the videos needs to be fixed.	This issue will be addressed before the starting of the trial phase.
Name change of the service. Both elderly and caregivers suggest to name the service ''fysio'' in Dutch. As these exercises are at Orbis given by the physiotherapist.	This issue will be addressed before the starting of the trial phase.
Speech command not always clear. It isn't clear to most elderly for opening the video you should use the word ''select'' video instead of ''open''. The word ''open'' should be added to the speech commands for opening the video.	This issue will be addressed before the starting of the trial phase.
Bug reported. Speech command ''close videos'' is missing, only ''close service'' works.	Add speech command close videos. This is already solved.
How can I stop the video? Some of the senior didn't notice the "exit button" allowing stopping the video and coming back on the list of videos. We would recommend to design a larger button.	This issue will be addressed before the starting of the trial phase.

4.5.8 Use case: Social Bonding

The following table illustrates the actions taken by the consortium based on the qualitative data gathered on the users and experts testing phase – see D1.4b for the raw data.

Table 43. Social bonding: data from user and expert based evaluation.

Recommendation	*Action taken*
Change the text ''close social''. The text on the button ''close social'' is strange according to the experts. They suggest to change it to ''close service'' or ''close first interactions of the day''.	This issue will be addressed before the starting of the trial phase.

Missing dialogues. The dialogues of the VSP are missing in the “user come back after an activity” use case.	This issue will be addressed before the starting of the trial phase.
Call persons. In the social bonding use cases related to emotion recognition (reaction on anger/disgust, fearful/stressful, sadness) the VSP propose to the user to call secondary end-users. In the actual prototype, the VSP could propose to call contacts that don’t have an internal phone number. This should not be the case. The VSP should propose to call only caregivers who have an internal phone number. If the contact has only an email, the VSP could potentially suggest to the senior to write a message to him/her (instead of calling).	This issue will be further investigated and solved before the trial when feasible.
Inviting persons: error in the dialogues. (1) When Debora chose to “Invite someone else”, after suggestion of the VSP (reaction on anger/disgust, reaction on sadness) the VSP says: “Ask at the reception, if you don’t know where Debora lives”. This is an error, since this dialogue should be provided only to persons who received the invitation. (2) The workflow of the use case “Invite François” and “Invite someone else” is different. This should not be the case.	This issue was solved and implemented in the system.
Sadness caption. The sadness caption is: “Make a call”. Please, change it in “Social” to ensure coherence with the others use cases related to emotion recognition.	This issue was solved and implemented in the system.
Change sentence of start pain video. Start pain video: sentence with explanation should not end with Debora, name Debora should be removed.	This issue will be addressed before the starting of the trial phase.
When the emotions ‘’bezorgd’’ in Dutch is recognized in the conversation Mary says ‘’gestresst’’. Use also the word ‘’bezorgd’’ in the dialogue as ‘’gestresst’’ is confusing for the elderly.	This issue will be addressed before the starting of the trial phase.
When the emotion recognition service is completed, no buttons in service screen appear to answer and it is unclear for the elderly how to proceed.	Solution is for Mary to say ‘’Thank you, you can close this service now’.’’ This issue will be addressed before the starting of the trial phase.
The system should directly call my contacts. In the social bonding use cases related to emotion recognition (reaction on anger/disgust, fearful/stressful, sadness) the VSP propose to the user to call secondary end-users. In the actual version of the prototype, if the user chose to call a secondary end-user, the system access on the contact details of the person. Seniors suggested that the system should directly call the person without showing his/her details.	This is not feasible. The system was designed to handle the case where a contact has several phone numbers (and thus have to choose which number to call)
Inviting persons. The users who decided to invite persons (“Invite François” or “Invite someone else”) after suggestion of the VSP (reaction on anger/disgust, reaction on sadness) were confused: they cannot chose the date and the time for this activity. User would like to	This issue has not be identified as being critical; and could potentially be taken into consideration for the business product

specify the day and the time, like normal activities in the agenda.	

5 Conclusions

The main aim of this deliverable was to assess the acceptance of the Miraculous-Life system based on experiences and evaluation data gathered by the two pilots on the first and second pre-trial (which is composed by two successive rounds/stages); with the aim of validating and refining the user requirements and the use cases, evaluating factors such as robustness, usability and acceptability and suggesting recommendations for the further development. For each recommendation, we also described the actions taken by the consortium to improve the system.

Four objectives of the projects were assessed at this stage of the project, through relevant measurements and indicators:

- Motivation in using the system: based on the quantitative data collected in the first and second pre-trials, this objective has already been achieved in Orbis; while improvements on the scores are expected in MRPS during the trial phase.
- Satisfaction within the VSP: based on the quantitative data collected in the first and second pre-trials, this objective has already been achieved in both Orbis and MRPS
- Satisfaction within the system: based on the quantitative data collected in the first and second pre-trials, this objective – as measured by the System Usability Scale and the Satisfaction questionnaire – this objective has been reached at month 24. The general satisfaction of the users is also expected to increase during the trial phase.
- Perceived usefulness: Based on the quantitative data collected in the first and second pre-trials, this objective has already been achieved in Orbis; while improvements on the scores are expected in MRPS during the trial phase.

Differences between MRPS and Orbis users were also analyzed; showing in general better results in Orbis. These differences could be potential explained by the socio-economical level of seniors (which is could be higher in MRPS seniors) or by cultural aspects. At this stage of the project, due to the limited number of users, is not feasible to establish cause-and-effect relations between sociodemographic variables and dependent variables. Note that this approach will be used in order to analyze the data collected during the trial phase.

The results on the SUS were particular low. A series of recommendations were proposed in order to improve both the system (chapter 4.3) and the use cases (chapters 4.4 and 4.5). For each recommendation, we mentioned the actions taken by the consortium to improve the system. A big number of recommendations was already taken into account by technical partners and implemented in the system. Part of the recommendations will be implemented before the starting of the trial phase; knowing that at the time of writing, technical partners are finalizing the system that will be used during the trial phase. Finally, a third part of suggestions was perceived as being less critical, and could be implemented for the business product – i.e. after the project.

References

[1] C. Wharton, J. Rieman, C Lewis, P. Polson, “The cognitive walkthrough method: A practitioner’s guide”. Usability inspection methods, p. 105-140 (1994).

[2] C. Lewis, J. Rieman, “Task-Centered user interface design. A Practical Introduction”, 1993.