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D2.3
First report on the usability and acceptability requirements

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3.7	30-11-2012	Fiorella Marcellini, Elisa Felici (INRCA)	Final version to the Coordinator

Table of Contents

List of Tables

List of Figures

Executive summary

The aim of the document is to conduct a preliminary evaluation of the usability and acceptability requirements of the Robot-Era platform, in order to proceed with the development, giving first suggestions to the developers on the older people wishes and preferences. The D2.3 started with the re-evaluation of the Robot Era concept from end-user perspective: a first assessment of acceptability was carried out to collect users reactions and preferences.

The following activities were expected for the Task 2.4 "Study and design for acceptability and usability" (Month 3 - 36).

This task investigates and defines features and requirements that Robot-Era services and systems should satisfy to be usable and acceptable by elderly persons. This work is fundamental for the success of Robot-Era project and for this reasons will be carried out by the two Robot-Era members expert of ageing and elderly people vision, INRCA and YOUSE. To extract this information, some events (i.e. interviews and focus groups) involving end-users will be organized to investigate their perspective on technology and their acceptance behaviour; these data will be analyzed and integrated with the previous experiences of INRCA and YOUSE. This work will be continuously updated and refined during the design stage of the robots considering also results obtained during the first experimental loop. The obtained results will be used in the T2.5 for the definition of metrics and benchmarks for the evaluation of Robot-Era services and platforms and will also condition the development of the control and interaction interfaces of Robot-Era robots and even the design of these systems. This Task will produce two deliverables.

Together with result of D2.1 and D2.2 – these findings give an overview of important issues that have to be considers during the concept stage and have to be tested in the future activities with specific test methods (e.g. user experience tests).

1 Introduction

After the refinement of scenarios and services (see D2.1 and D2.2), the Robot-Era concept will be re-evaluated by end-users, in agreement with the technical partners. Afterwards an analysis of the first usability and acceptability requirements of the Robot-Era platform will be conducted.

In the majority of development projects, usability evaluation and tests take place when a system is already developed. That means normally the usability will be excluded from the first steps of the technical development. Often nearly finalized systems are presented to potential users to improve defined and already fixed functionalities. But this does not allow major refinements and can not turn an useless system into an useful one.
During the Robot-Era Project researchers are working together with elderly people and stakeholders from the very beginning to define services, functions and design of the robotic platform along all human robotic interactions (via speech recognition, touchpad, surface of the robot).
Another challenge for defining usability issues is that a robot acts more independently than other technologies. The field of robotics is new: Robots are not only controlled via screen inputs and act with a high degree of freedom in a physical environment. The system is also much more autonomous than a fixed computer or smaller devices (e.g. mobile phones). Thus, when dealing with usability issues it has to be taken into account, that robots are autonomous systems interacting with their environment and with users at the same time.
The first step to define usability recommendations for designers and technical partners was to present different possible interface designs to a diversity of users (useful methods to get first usability insights are e.g. paper prototyping or cognitive walkthroughs). The given recommendations are based on the survey data and the expertise experience of usability designers. The results were ordered according to different usability criteria regarding the DIN EN ISO 9241-110 (usability principles for dialogue systems).
According to the User-centred design methodology, the use of rapid prototyping techniques represents an intermediate step of the users involvement inside the project: after a first definition of the needs of older people, a preliminary selection on the platform components were discussed among the partners and presented to groups of end-users by means of photos and videos, for testing their first reactions and preferences.

As reported also in the Tinker and McCreadie model for the technology acceptance (McCreadie and Tinker, 2005), the extent to which Assistive Technology can narrow the gap between older people individual capacity and the environment depends on their willingness to use it, which in turn depends on several complex factors: the perceived needs, for example safety; the perceived usefulness of the technological artefact and whether the individual feels that use of the device either supports or undermines their sense of personal identity (Mann et al. 1994; Zimmer and Chappell 1999; Wielandt and Strong 2000; Roelands et al. 2002). The heterogeneity of the older population means a great diversity in terms of their living circumstances and individual preferences and that, of course, will play a strong role in the development of elderly people's attitudes and preferences toward technology.
The study on the design of the Robot-Era platform for this stage of work, is focused on the analysis of the affordance, safety, aesthetics, emotional acceptance, usefulness and dependability of preliminary components, used for generating reactions and opinions from the end-users, driving the development since the beginning.

Moreover , in a field characterized by a majority of Japanese research carried out with elderly people in nursery homes and without a robust experimental methodology (Broekens et all 2009), Robot Era project is giving a new and important value to the European research in robotics considering that:

- respect to other projects, Robot Era will move to a new organisation of the services from "the street to home" supported by robots, finding a new paradigm of home and urban services , oriented to support autonomy and improve quality of life of older people at home.
- A strong methodology is used for the involvement of users in WP 2 "User and town centred design of Robot Era services" and WP 8 "Experiments and evaluation of realistic and real scenarios", involving large sample. In order to provide a preliminary guidelines for designing, developing and validating the Robot-Era systems and services into the WP2, three focus groups have been conducted with 49 elderly recruited in Italy, Germany and Sweden, 12 caregivers and 12 stakeholders in Italy; a brain writing with 6 senior and 5 caregivers and a survey were carried out with 82 elderly in Italy and Germany. In the future, for activities related to WP8, a complex experimental methodology will drive the validation phase: the first loop of experiments will be carried out with at least 70 subject last in realistic environments but in controlled setting. The second experimental loop will be carried with at least 40 users in unassisted real settings.
- A clear framework of the connection between older people needs, usability and acceptance of technology has been refined, confirmed and extended respect to the state of the art. This framework allows the adherence of the technological solutions to the end users' perspective. Until now, an articulated requirement phase as been conducted by combining the users 'characteristics (i.e. needs and impairments) with factors considered as antecedents of usage and acceptance (i.e. perceived usefulness, perceived ease to use). Task 2.4 in particular investigates and defines features and requirements that Robot-Era services and systems should satisfy to be usable and acceptable by elderly persons. This work will be continuously updated and refined also during the design stage of the robots.
- Attitude towards technology, the barriers to its use, and the acceptability determinants have been studied from this preliminary phase and will be continuously investigated also in the coming phases.
- A good synergy between professional designers and gerontology experts is also very new in robotics, carrying out the project work into the interaction of design, evaluated and requested by older people, with development and integration of the system

2 Methodology

2.1 Robot-Era group interviews method, pilot strategies, recruitment and common procedures

For the first evaluation of acceptance and usability requirements, it was decided to conduct group interviews with older people, in Italy (INRCA) and Germany (YOUSE).

A structured questionnaire was prepared and agreed among the partners INRCA, YOUSE and SSSUP, approaching different sections reported below (Table 1).

Table 1: Questionnaire domains

Section(s)	Topic
General information	Socio-demographic characteristics of the sample
Section A - Scenarios	Evaluation of the scenarios and services refined in D2.1 and D2.2 (cleaning, garbage collection, shopping/drug delivery, laundry, food delivery, outdoor walking support, indoor escort at night, surveillance, communication, reminding, objects transportation and manipulation) and of the willingness to buy for assistance in each of them.
Section B - Requirements	Evaluation of aesthetics, shape, color and components of domestic and outdoor/condominium robots. Evaluation of sensors' intrusiveness.
Section C – Usability	Evaluation of primary and tentative interfaces/menus of the robots.
Section D - Acceptance	Evaluation of the system acceptance by means of UTAUT model.
Section E – Demand & Cost information	Evaluation of willingness to buy, sustainability and demand from the users.

The questionnaire is reported in Appendix 1. Moreover, the group interviews have followed the timing and organization presenting in Table 2.

Table 2: Group interviews discussion timing

Timing	Goal	Methods
10 min	Introduction to group interview and presentation of the platform activities	Presentation of the project and activities
30 min	Scenarios presentation	Section A: presentation of video of each scenario and fulfillment of Section A.
30 min	Requirements, usability and acceptance	Section B, C and D: presentation of photos of the robots, sensors and interfaces and fulfillment of the sections.

	evaluation	
20 min	Demand & Cost information	Brief presentation of section E and fulfillment.
10 min	Thanks and completion of General Information	Collection of general info on the participants.

An informed consent was signed by each participant. The subjects' anonymity was guaranteed by a coding method using for the Italian participants (letter "A" followed by a number from 1 to 40) and for the German ones (letter "B" followed by a number from 41).
The only criteria for the recruitment was the age of 65 and more.
The questionnaire was composed of different section, as said before, that required different way of answering:

- Section on General Information contains single and multiple answers questions;
- Section A Scenarios contains detailed questions on each scenario, evaluated on a Liker scale from 1- not agree at all to 5 – completely agree.
- Section B Requirements contains both single answer questions and questions to be evaluated on a Likert scale from 1- not agree at all to 5 – completely agree.
- Section C Usability contains multiple answer questions and questions to be evaluated on a Liker scale from 1- not agree at all to 5 – completely agree.
- Section D Acceptance contains questions to be evaluated on a Liker scale from 1- not agree at all to 5 – completely agree.
- Section E Demand and cost information contains single and multiple answer questions as well as questions to be evaluated on a Likert scale from 1- not agree at all to 5 – completely agree.

2.2 Pilot sites profile

2.2.1 INRCA, Italy

The Italian older people were recruited in the premises of some recreational centres of the Ancona and Osimo municipalities (Marche Region, Italy), that were in touch with INRCA for past research activities.
The opportunity of interviewing elderly inside local structures and recreational centres allowed the researches to have a large variety of elderly points of view and favoured elderly to express their opinions and preferences.
In particular, INRCA conducted 4 Group interviews, involving 40 older people. Some pictures of these meetings are shown in Figure 1. The main characteristics of elderly volunteers involved in group interviews are shown in Table 3.

Figure 1. Some pictures of INRCA group interviews in Ancona (Italy)

Table 3: Details of group interviews carried out by INRCA

INRCA – 1st Group interview	*Number of participants:*	Men = 4 Women = 9
	Average age of participants:	75 years
	Average education of participants:	Secondary level
	Location of group interview:	Recreational centre
INRCA – 2nd Group interview	*Number of participants:*	Men = 2 Women = 5
	Average age of participants:	76 years
	Average education of participants:	Primary level
	Location of group interview:	Recreational centre
INRCA – 3rd Group interview	*Number of participants:*	Men = 6 Women = 3
	Average age of participants:	65 years
	Average education of participants:	Secondary level
	Location of group interview:	INRCA
INRCA – 4th Group interview	*Number of participants:*	Men = 7 Women = 4
	Average age of participants:	65 years
	Average education of participants:	Secondary level
	Location of group interview:	Recreational centre

2.2.2 YOUSE, Germany

The German older people (18 men and 24 women, mean age 68 years) were recruited in a service living institution Berlin and a rehabilitation centre Lübben with the support of the general manager and persons who were responsible for organizations.
Invitation have been distributed over the internal post, so that every visitor was called to take part at the group interview in Lübben. There was a list at the reception to sign up for registration. The on-location clerks were responsible to make sure people selected for the interviews were matching with the selection criteria provided by YOUSE.
In Berlin YOUSE visited the service and care living institution one time and recruited elderly by presenting the project during the lunchtime. Together with a coordinating clerk YOUSE handed out flyer. The appointment procedure was the same like in Lübben. By inviting some younger seniors YOUSE made sure to interview a mix of younger and elder elderly. Figure 2 shows some pictures of group interviews carried out in Berlin. The main characteristics of older volunteers involved in group interviewa are shown in Table 4.

Figure 2. Some pictures of YOUSE group interviews in Berlin (Germany)

Table 4: Details of group interviews carried out by Youse

YOUSE – 1st Group interview Berlin	*Number of participants:*	Men = 8 Women = 14
	Average age of participants:	75 years
	Average education of participants:	50% primary level; 50% tertiary level
	Location of group interview:	Service living institution
YOUSE – 2nd Group interview Lübben	*Number of participants:*	Men = 10 Women = 10
	Average age of participants:	61 years
	Average education of participants:	Secondary level
	Location of group interview:	Rehabilitation centre

2.3 Data analysis

The data analysis was conducted on the total sample, reporting important differences between the two countries when relevant. It was decided to use just descriptive analysis for exploring the answers reported at the questionnaire. Finally, on the Likert scale answers, it was decided to sum the results obtained when it was answered 1 – not agree at all and 2 – not agree, and the results obtained when it was answered 4 – agree and 5 – completely agree.

3 Results

3.1 General information on the subjects

The total sample is composed of 37 men (45% of the total) and 45 women (55%).

With a mean age of 69.5 years (SD= 9.75), in particular 70.2 years (SD= 6.92) for the Italian elderly and 68.8 years (SD= 11.84) for the German ones.

The majority of the Italian sample have reached a secondary level of school education (65%) while for the German sample reached mostly the tertiary level of school education (52%).

Sixty per cent of the total sample is married, in particular 70% of the Italian elderly and 50% of the German ones, while 19% of the total sample is widowed.

The most represented working condition is retirement (78%), while 12% declared to work full time.

3.2 Section A – Scenarios

The results for each scenarios are reported below. The researchers showed videos of robots operating in indoor and outdoor context, in order to give a concrete idea of the potential use of the robots.

3.2.1 Cleaning (kitchen, dusting)

Fifty-seven per cent of the sample would like the robot will clean also when they are not present during the day, while 61% of them declares that they don't like the robot will clean while they are sleeping. Eighty-six per cent of the sample would like the robot will clean in places that are too difficult to reach. Finally, 68% of the elderly thinks that they would need support for the cleaning activity in the future and 80% of the sample thinks that they would use the robot for cleaning, if necessary (see Figure 3).

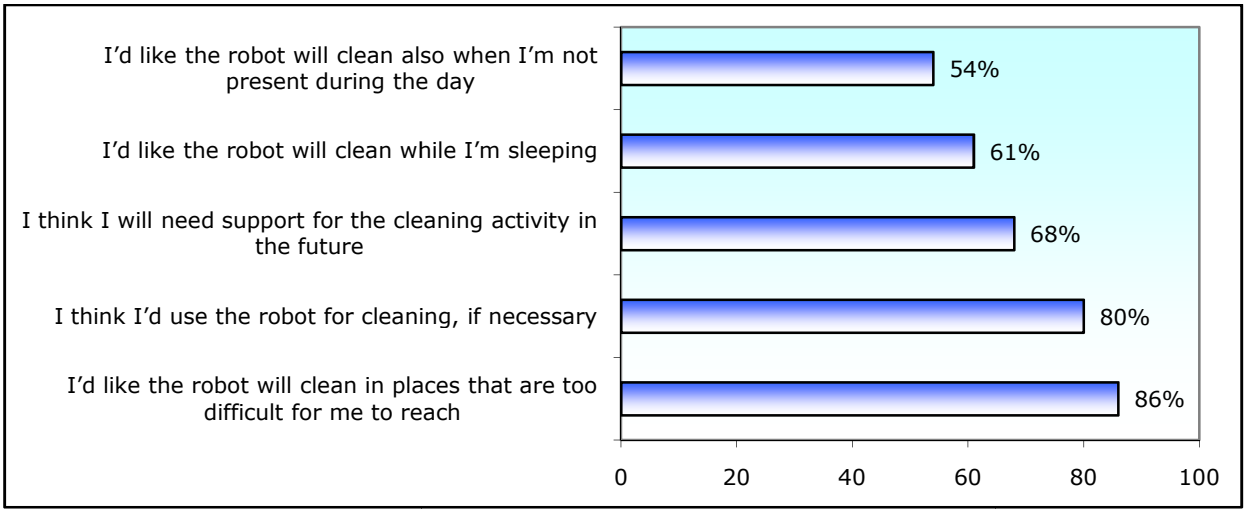


Figure 3. Cleaning

3.2.2 Garbage collection

Fifty-two per cent of the sample declares that they would like that the robot will do garbage collection also when they are not present, while 57% of the sample declares that they will

need support for the garbage in the future and they would use the robot for doing garbage collection if necessary (75%) (see figure 4).

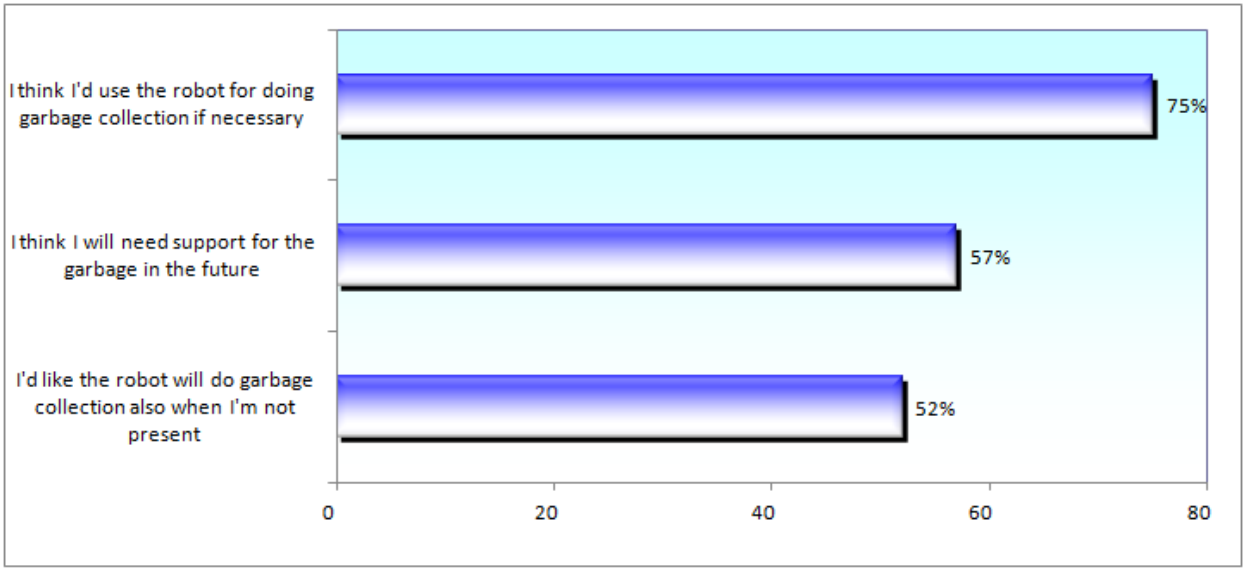


Figure 4. Garbage collection

3.2.3 Shopping/drug delivery

Fifty per cent of the sample declares that they would prefer having a fix list of item to buy, while 63% thinks that they would prefer to choose the goods/drugs to buy every time.

Forty-nine per cent prefers the robot will come with them to have shopping while 21% is partially agree and partially disagree. Fifty-nine per cent of the sample declares that they would like the robot will take the shopping bags for them, if they are not at home.

Finally, the opportunity of transporting medicine from pharmacy if they can not move from the house was liked by 68% of the total sample.

In the future, 60% declares that they will need support for the for the shopping/drug delivery activity and 62% would use the robot for shopping/drug delivery, if necessary (see figure 5).

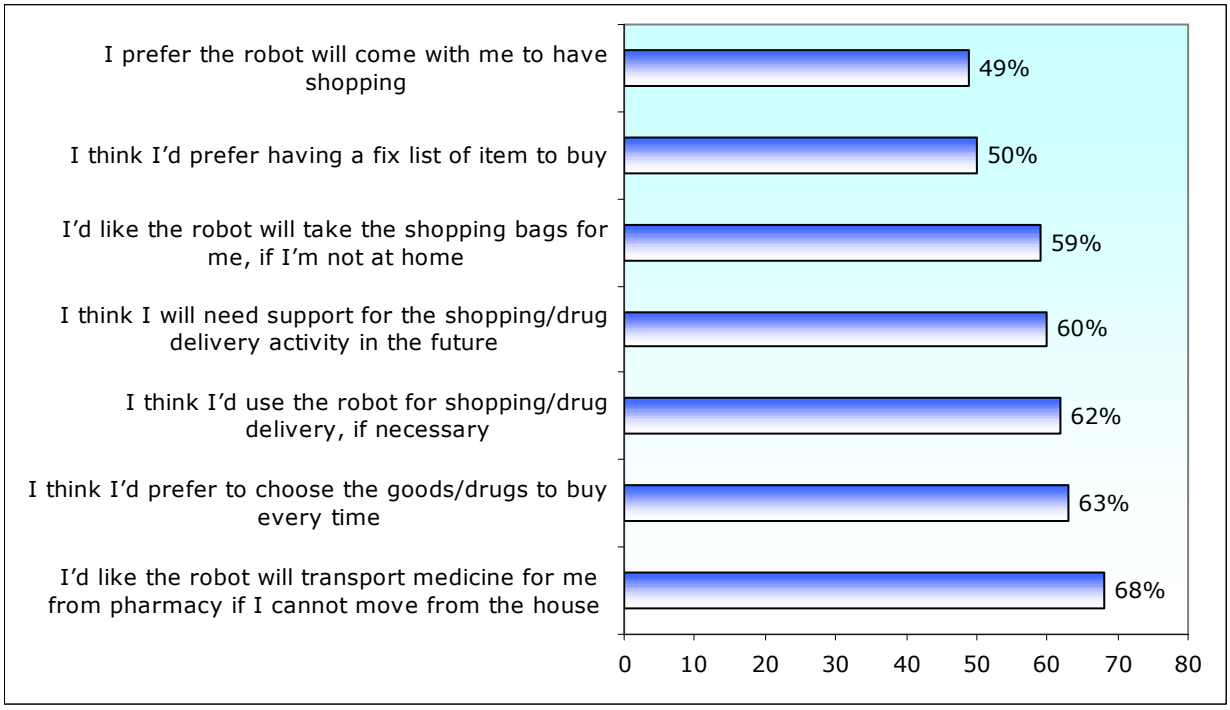


Figure 5. Shopping/drug delivery

3.2.4 Laundry support

Forty-eight per cent of the total sample would not like the robot will program the washing machine even if they are not present while 39% of the sample would like it. Fifty- two per cent of the total sample thinks that they will need support for the laundry activity in the future, if necessary, and 70% thinks they would use the robot for doing laundry, if necessary (see figure 6)

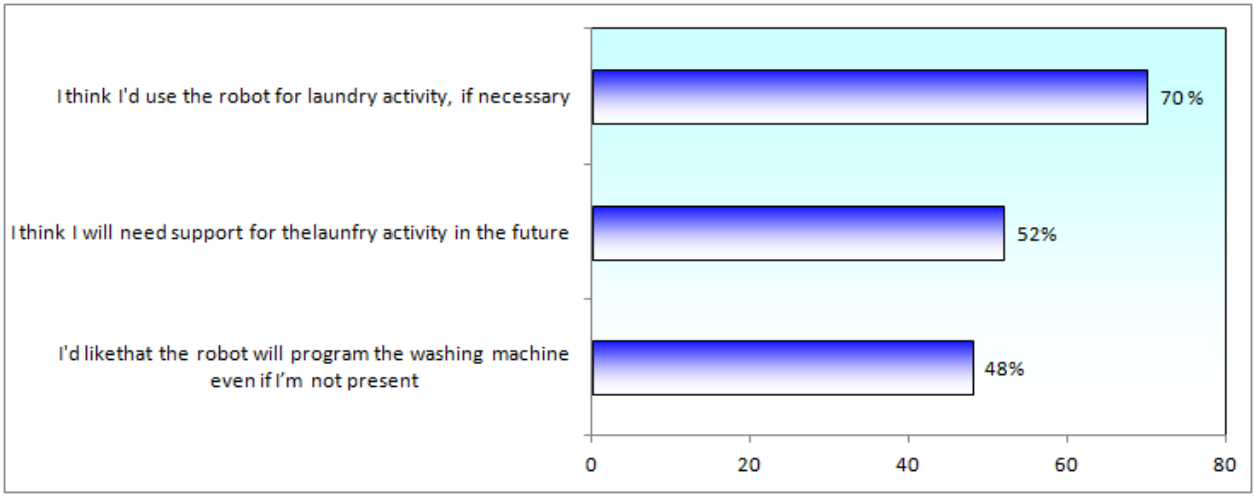


Figure 6. Laundry support

3.2.5 Food delivery

Fifty three per cent of the sample think that they will need support for the food delivery at home and they think that would use the robot for food delivery, if necessary (67%) (see figure 7)

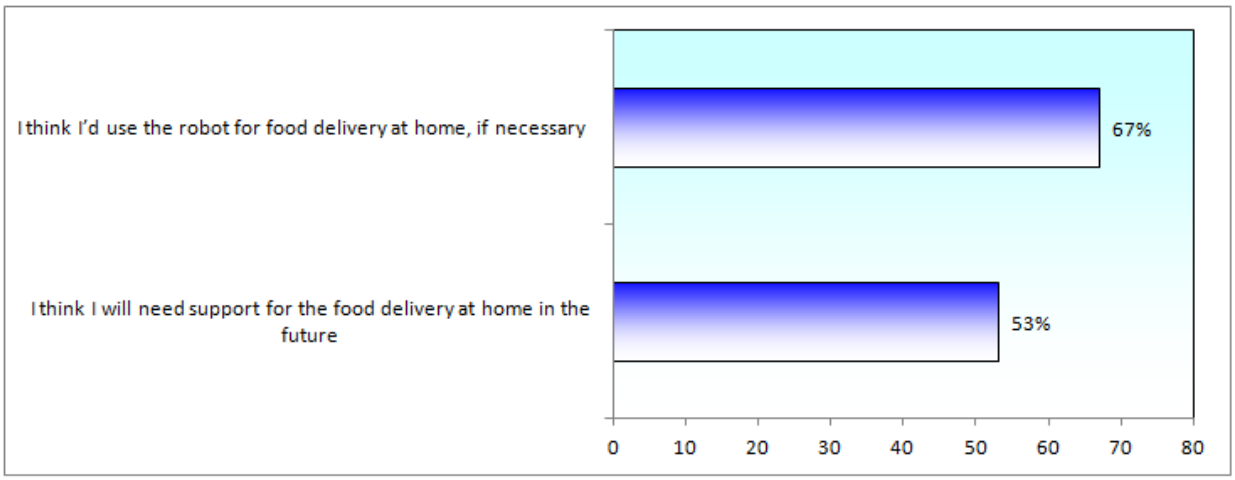


Figure 7. Food delivery

3.2.6 Outdoor walking support

Sixty-one per cent of the sample prefer that the robot will walk near them, in particular 77% of the Italian participants, while only 12% of the sample prefer the robot walk behind them. Thirty-nine of the sample would like to use a joystick for piloting the robot, while 37% would not. Sixty-nine per cent of the sample would like to have a forearm support, if they need to stop or being supported and they like that the robot can detect/alert when there are obstacles along the path (83%). Fifty-six per cent of the sample thinks they will need support for walking outside in the future and 72% of the sample would use the robot for moving outdoor, if necessary (see Figure 88).

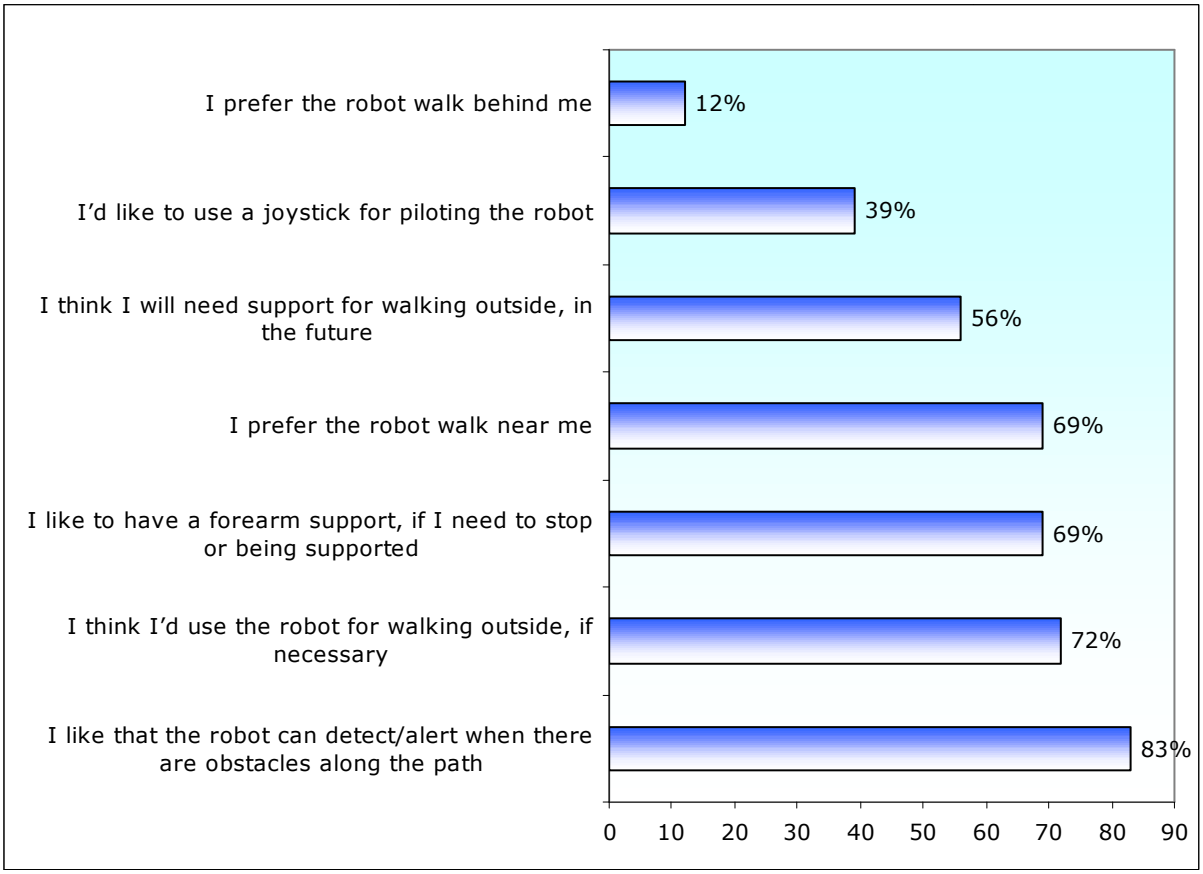


Figure 8. Outdoor walking support

3.2.7 Indoor escort at night

Sixty-eight per cent of the sample thinks they like the robot drives them to the bathroom during the night. Moreover, they think that it is important that the robot has a handle support for helping in moving (72%), in particular for the Italian sample (90%). Eighty-three per cent of the sample thinks it is useful that the robot will switch on/off the light while moving and also it is useful that the robot will have lights on the base, for lighting the floor during the path (65%). Finally, 52% of the sample thinks that they will need support for moving inside home at night, in the future and 71% thinks that they would use the robot for this activity, if necessary (see figure 9).

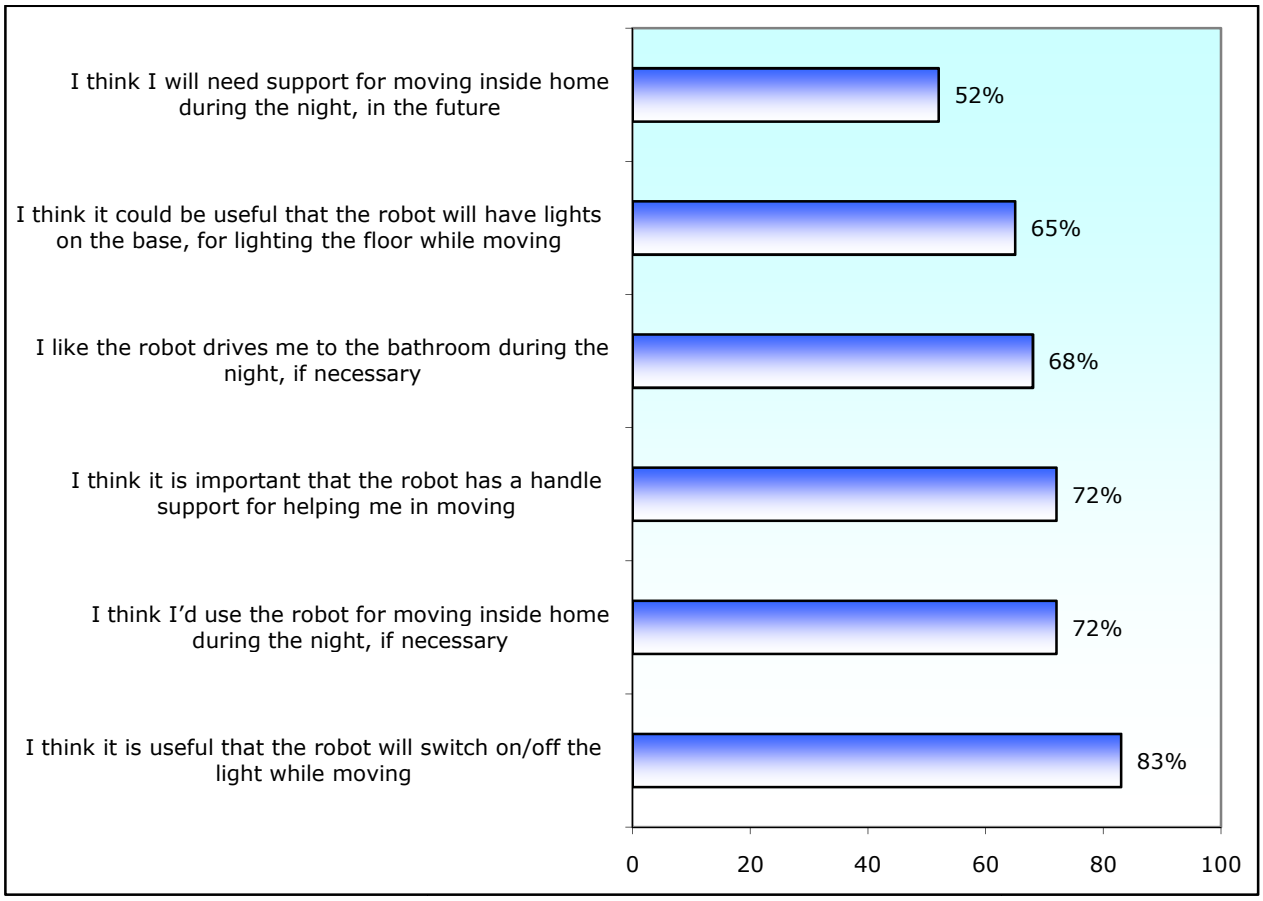


Figure 9. Indoor escort at night

3.2.8 Surveillance

Seventy-nine per cent of the sample declares that they will feel more secure if the robot will alert them in case of unknown person in the building and they think that it is useful that the robot will have a camera for monitoring the situation in the building (70%). Fifty per cent of the sample thinks that they will need support for surveillance in the future while 21% declares that they will not, in particular 29% for the German elderly. At the contrary, 73% of the sample would use the robot for the surveillance if necessary (see figure 10).

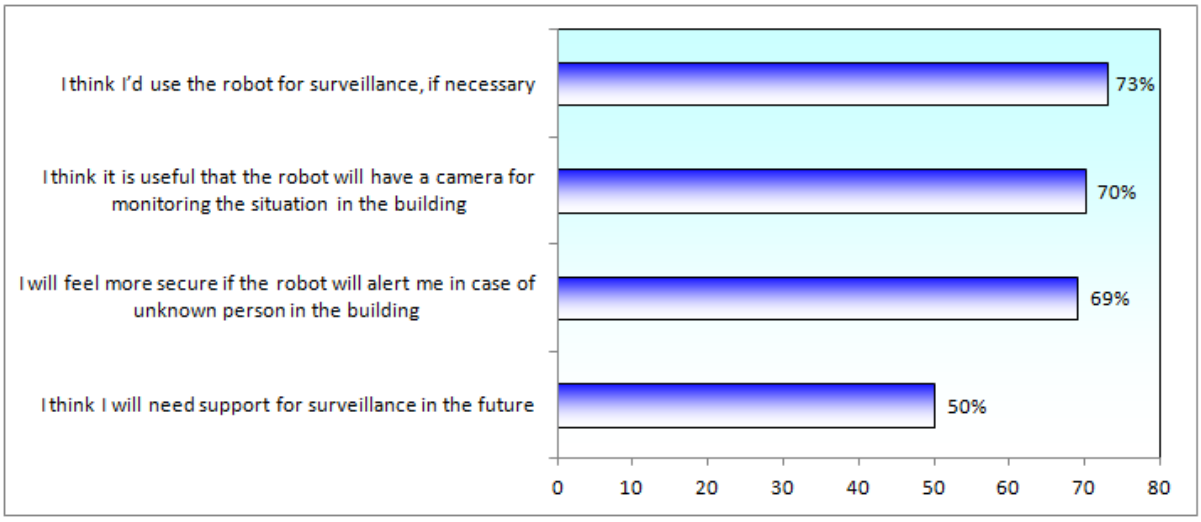


Figure 10. Surveillance

3.2.9 Communication with friends, family, caregivers and service providers

Eighty-six per cent of the sample thinks that they will feel more secure if the robot can alert automatically their family in case they feel sick/hurt themselves, while 47% declares that the use of a sensors network for monitoring their health condition (and eventually advice someone in case of accident), it is not too intrusive for their privacy. The majority of the participants (80%) declares that they will feel more secure if they can start a phone call to their family. Moreover, seventy-seven per cent of the sample declares that they will feel more secure if they can start a phone call to the first aid service/home physician in case of need.

Finally, half of the sample thinks that they will need support for communicating with important people (family, carers, services) in the future, while 68% thinks that they would use the robot for communicating with important people (family, carers, services), if necessary (see Figure).

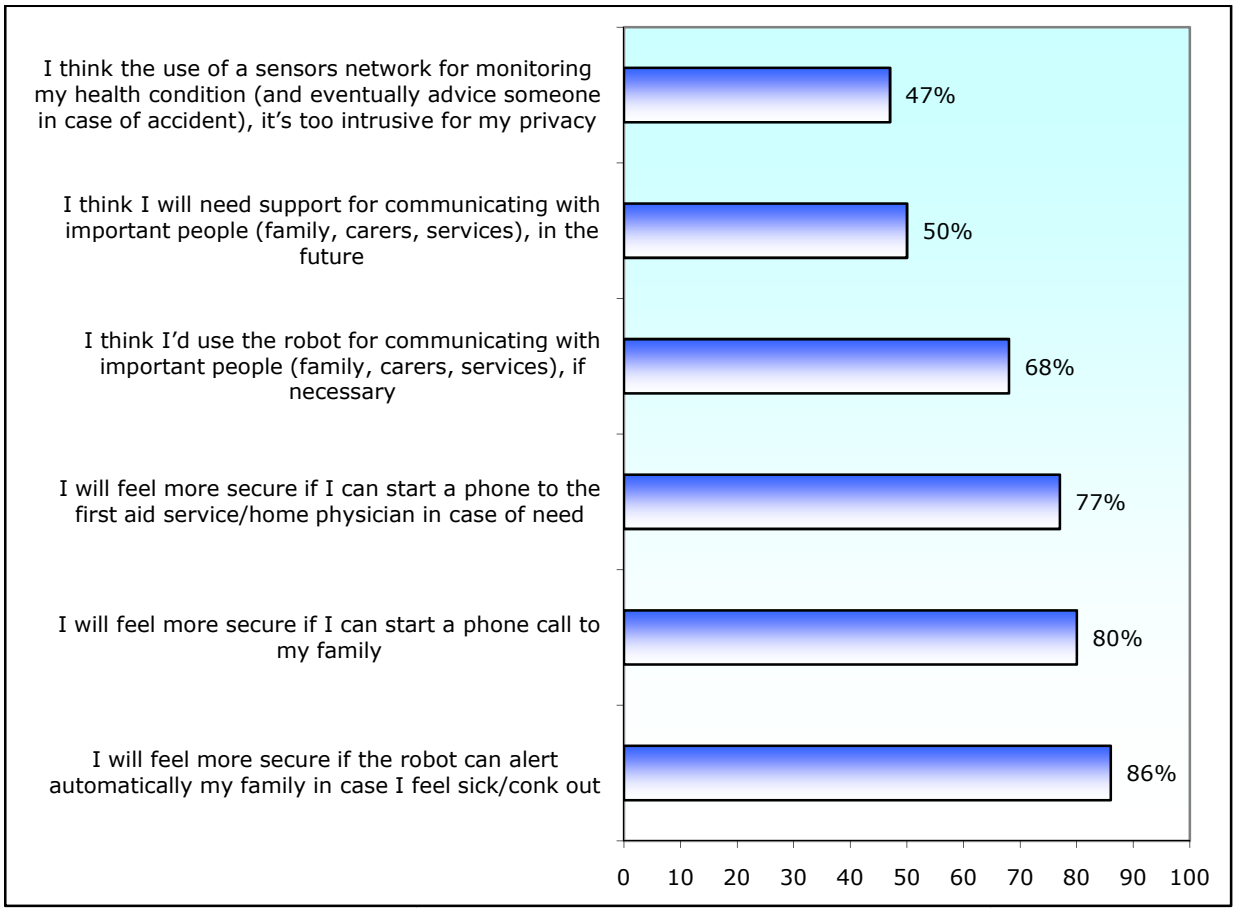


Figure 11. Communication with family, carers and service providers

3.2.10 Reminding (tasks, events and medication to take)

Eighty per cent of the sample likes that the robot will remind them to take medicine, while 60% likes the robot will bring them medicine, not just advice them when it is time to take them, in particular 87% for Italian sample. Sixty-eight per cent of the sample thinks that the robot should inform their caregivers if they did not take the medicine or they have taken them at the wrong moment. Among the percentage of elderly that likes the robot will advice them if they have taken the wrong medicine (81%), the Italian elderly are the most represented (95%). Forty-five per cent of the people thinks that receiving updating/warnings on tasks (i.e. cooking, drinking) to do is not too intrusive. Seventy-one per cent of the sample would like that the robot will remind them appointments and social events, receiving reminding through vocal messages (78%) or write messages (30%). Sixty-three per cent of the sample thinks they will need support for reminding tasks, medicine and events, in the future and 72% would use the robot for this activity, if necessary (see figure 12).

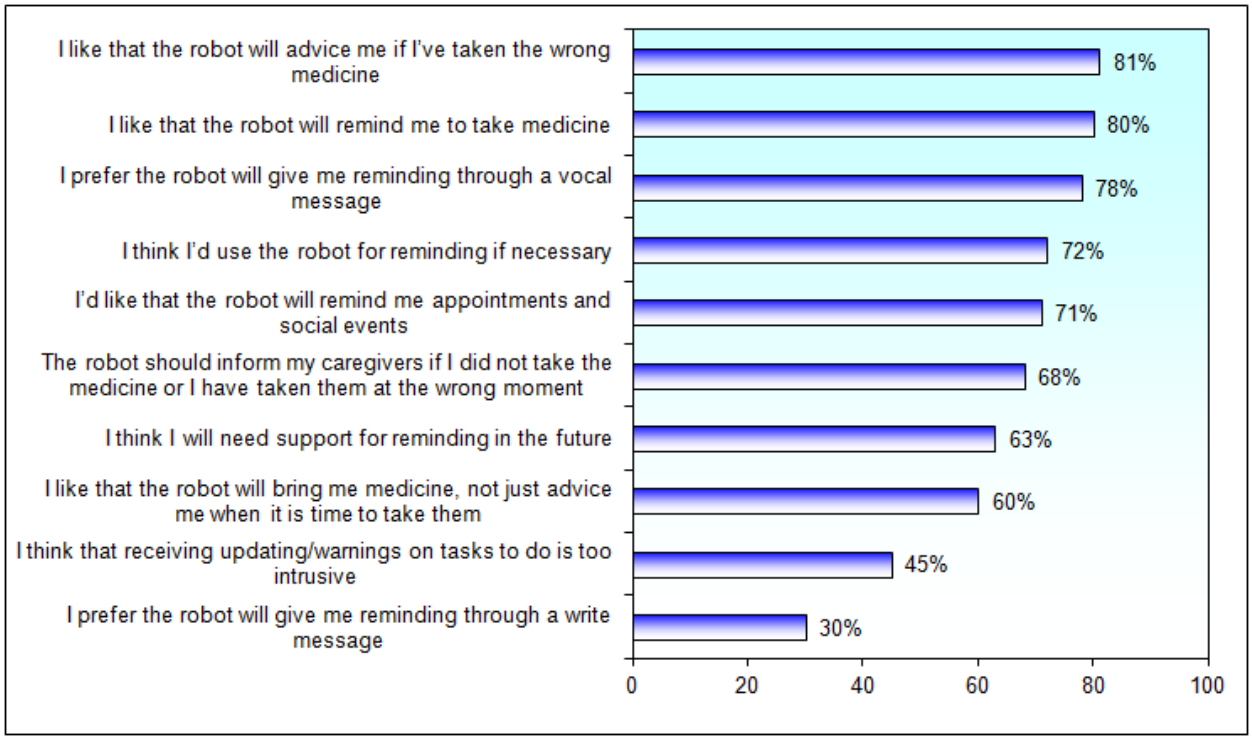


Figure 12. Reminding (tasks, events and medication to take)

3.2.11 Objects transportation and manipulation (at home)

Seventy-two per cent of the sample would like that the robot will take domestic tools for them, especially food and objects if they are sick in bed (82%). Sixty-five per cent of the sample would like the robot will clean the table after meals, while 66% thinks they will need support for transporting objects in the future, and, finally, 82% think they would use the robot for transporting objects, if necessary, in particular the German older people (81%) (see figure 13).

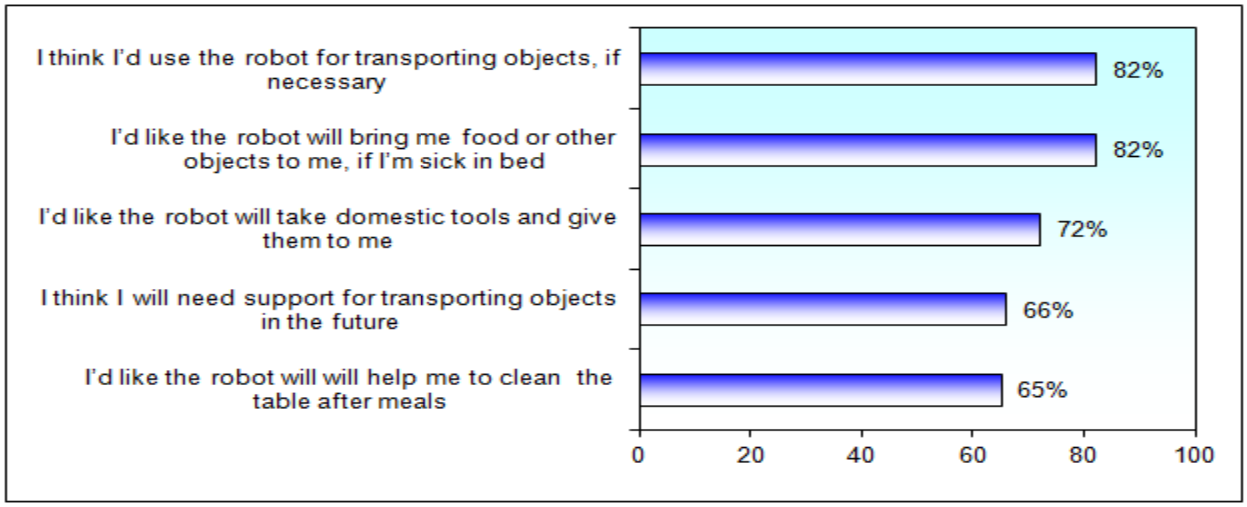


Figure 13. Objects transportation and manipulation (at home)

Regarding the willingness to pay, 5 shows the monthly expenditure that the participants are available to pay for each service.

Table 5: Willingness to pay for each service (mean values)

Activity	Italy Euro/month	Germany Euro/month	Total sample
Cleaning the apartment as often as necessary	152	77	115
Collecting garbage bags from the apartment as often as necessary	30	17	24
Buying the drugs and/or going for shopping as often as necessary	58	40	50
Helping you in doing laundry	18	20	19
Delivering food at home as often as necessary	37	43	40
Support in walking outdoor, giving aid for avoiding obstacles and support if the person is tired	83	24	57
Helping in moving during the night inside the home, as often as necessary	157.5	12	101
Monitoring the environment and the building for the safety	28	15	22
Helping in communicating with family or with the services, in case of need or just to talk	39	17	30
Reminding events and activities to do	15	8	12
Bringing objects, as often as necessary	36	25	31

It general, it could be said that the participants would spend more, on a monthly basis, for being supported in cleaning the apartment, moving at home during the night, and moving outdoor. In particular, the Italians participants would spend more for being supported in moving at home during the night (157.5 € monthly), cleaning the apartments as often as necessary (152 € monthly) and being supporting while moving/walking outdoor (83 € monthly). On the other side, the German participants would spend more for cleaning the apartment (77 € monthly), delivering food at home (43 €) and buying the drugs and/or going for shopping as often as necessary (40 €).
In general, it could be said that Italian older people are available to spend a little more for receiving help in the daily activities.

3.3 Section B – Requirements (domestic and outdoor/condominium robots)

The results of the requirements are reported below. The researchers showed photos of robot in order to give a concrete idea of the robots and the elderly expressed their preference about colour, dimensions, shape and heads.

3.3.1 Indoor robot requirements

On the domestic robot, most of subjects prefer it was similar to a person (57%), in terms of dimensions and similar to an electronic appliance in terms of shape (45%).
The chosen colours for the domestic robot are red (18%), white (17%) and green (15%).

Among the presented photos, the participants reported to like more the heads for the domestic robot shown in Figure 14.

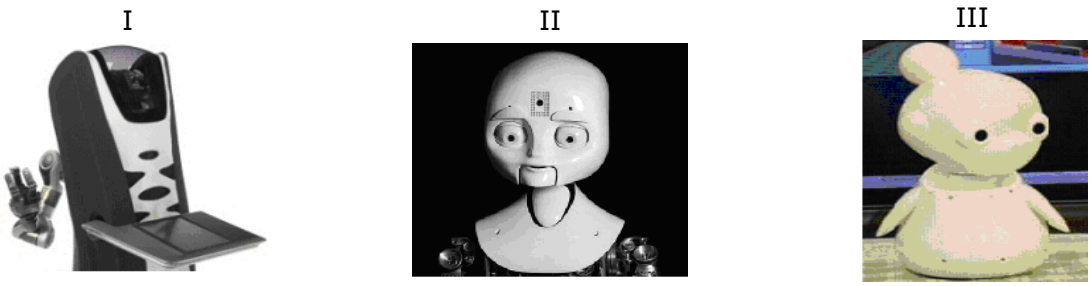


Figure 14. The main preferences about the possible head of domestic robot

Moreover, the participants think that the indoor robot could look more friendly and safety if it its cover could have soft parts (69%), and that it could be easy to use (52%) and not intrusive (56%). Regarding the impact in the home, 45% of the sample thinks that it could be modified by the presence of the robot (for 40% of the Italian respondents and 50% of the German ones). So, particular attention should be given to this issue during the development of the indoor robots, taking also into account the small dimensions of the older people apartment, especially in the Mediterranean area.
Finally, 73% of the sample thinks that the mechanical arm is appropriate for a robot that should support them in daily activities.

3.3.2 Outdoor and Condominium robot requirements

On the outdoor/condominium robot, the subjects prefer it was similar to a person (72%), in terms of dimensions and similar to a human or to electronic appliances, in terms of shape (38%).
The chosen colours for the outdoor/condominium robot are red (21%), grey (17%) and white (16%).
Among the presented photos, the participants reported to like more the heads for the outdoor/condominium robot shown in Figure 1515.

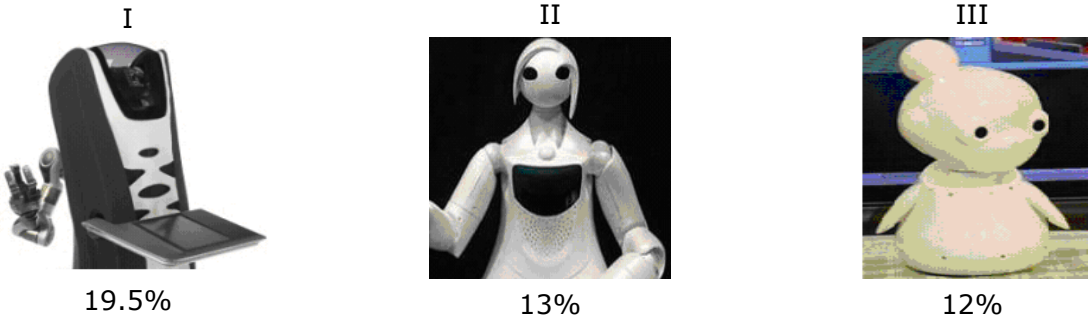


Figure 15. The main preferences about the possible head of condominium and outdoor robots

Moreover, the participants think that the outdoor/condominium robot could look more friendly and safety if it its cover could have soft parts (57%), and that it could be easy to use (46%) and not intrusive (50%).

3.3.3 On the sensors network – AmI infrastructure

Finally, the following photos of sensors were presented to the participants (see Figure 6), that have considered them not intrusive (68%) and that their dimensions are appropriate (82%).

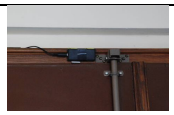
 *Sensor mat to monitor chair, sofa and bed*	 *Sensor monitoring posture*	 *Sensor monitoring doors, windows, etc.*	 *Sensor for localization*

Figure 16. Examples of possible sensors that could be used in Robot-Era project

3.4 Section C – Usability

The participants have reported to prefer a speech command from user to robot (89%), a vocal reply from robot to users (46%) and a remote controller (29%) for interacting and controlling the robots. Finally, fifty-six per cent of the elderly think that they would like to receive messages from a female voice, while only 21% think that they would like to receive messages from a male voice.
About possible visual interfaces of the robots, a comparison between two possible menu screen, the first having eight options and the second having four options (see Figure 47), at the usability evaluation was carried out. Results are shown in Figure 58.

First menu

Second Menu

Figure 47. Possible menus of visual interfaces of Robot-Era robots

3.4.1 First menu

Eighty-three per cent of the sample thinks that the menu is easy to use and that information is easy to read. Seventy-eight per cent of the sample thinks that the information is written in a style that suits them and that they can get information quickly from the display (84%). The screen has the right amount of information for 74% of the sample and it is clear how screen elements work (77%).
Twenty-eight per cent of the sample reported that the support of a technical person would be necessary to be able to use the interface.
Finally, 57% of the sample imagines that the most of the older people would learn to use this system very quickly, while only 10% thinks they would not.

3.4.2 Second menu

Forty-three per cent of the sample thinks that the menu is easy to use, in contrast with 26% that thinks it is not. Forty-six per cent of the sample thinks that the information are easy to read and that it is written in a style that suits them (38%).
Thirty-seven per cent of the sample thinks that the information is written in a style that suits them, and that they can get information quickly from the display (45%), while the screen has the right amount of information for the 42% of the sample and it is clear how screen elements work (39%).
Thirty-nine per cent of the sample declares that the support of a technical person would be necessary to be able to use the interface while 38% declared they would not.
Finally, 35%imagines that the most of the older people would learn to use this system very quickly and the same percentage thinks they would not, while 15% of them are partially agree and partially disagree.

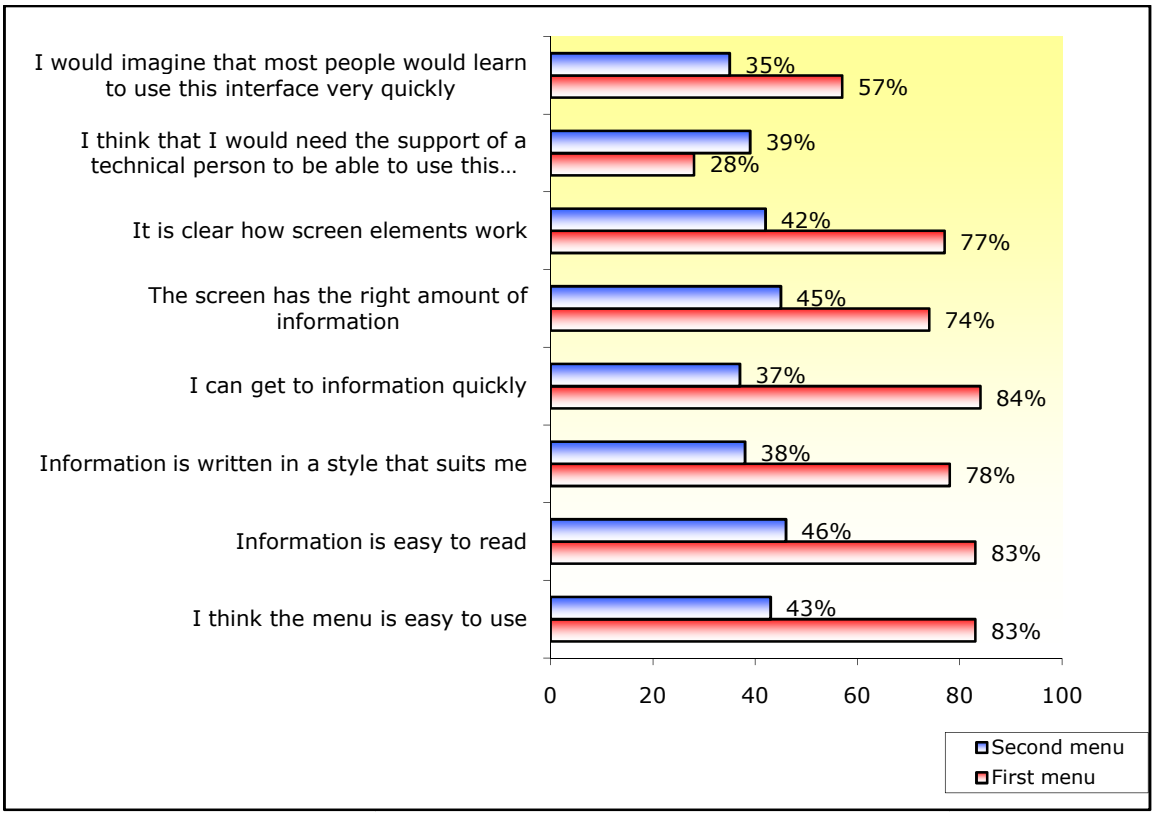


Figure 58. Comparison of usability between the first and the second menu

3.5 Section D – Acceptance

The section of the questionnaire used for measuring the acceptance of technology is built around the Unified Theory of Acceptance and Use of Technology.

Table 6: UTAUT constructs, scales and items

Code	Construct	Definition	Items
ANX	Anxiety	*Evoking anxious or emotional reactions when using the system.*	If I should use the robot, I would be afraid to make mistakes with it; If I should use the robot, I would be afraid to break something; I find the robot scary; I find the robot intimidating.
ATT	Attitude	*Positive or negative feelings about the appliance of the technology.*	I think it's a good idea to use the robot; The robot would make my life more interesting; It's good to make use of the robot.
FC	Facilitating conditions	*Objective factors in the environment that facilitate using the system.*	I have everything I need to make good use of the robot; I know enough of the robot to make good use of it.
PAD	Perceived adaptability	*The perceived ability of the system to be adaptive to the changing needs of the user.*	I think the robot can be adaptive to what I need; I think the robot will only do what I need at that particular moment; I think the robot will help me when I consider it to be necessary.
PENJ	Perceived enjoyment	*Feelings of joy or pleasure associated by the user with the use of the system.*	I enjoy the robot talking to me; I enjoy doing things with the robot; I find the robot enjoyable; I find the robot fascinating; I find the robot boring.
PEOU	Perceived ease of use	*The degree to which the user believes that using the system would be free of effort.*	I think I will know quickly how to use the robot; I find the robot easy to use; I think I can use the robot without any help; I think I can use the robot when there is someone around to help me; I think I can use the robot when I have a good manual.
PU	Perceived usefulness	*The degree to which a person believes that using the system would enhance his or her daily activities*	I think the robot is useful to me; It would be convenient for me to have the robot; I think the robot can help me with many things.
SI	Social influence	*The user's perception of how people who are important to him think about him using the system*	I think the staff would like me using the robot; I think it would give a good impression if I should use the robot.
Trust	Trust	*The belief that the system performs with personal integrity and reliability.*	I would trust the robot if it gave me advice; I would follow the advice the robot gives me.

Tab. 6 shows the constructs and the items that constitute the scales in details.
While mean value and standard deviation of each item are reported in 7, it was considering interesting to report also the mean value of each scale, to better understand what is the construct that received more importance, after the first knowledge of the Robot-Era platform components.

Table 7: UTAUT items; N: number of respondents, Mean: mean values, SD: standard deviation

Scale	Items	N	Mean	SD
ANX	If I should use the system, I would be afraid to make mistakes with it	75	3.23	1.45
	If I should use the system, I would be afraid to break something	73	3.01	1.50
	I find the system scary	75	2.40	1.55
	I find the system intimidating	72	2.29	1.53
ATT	I think it's a good idea to use the system	74	4.27	1.04
	The system would make my life more interesting	76	3.92	1.24
	It's good to make use of the system	77	4.19	1.05
FC	I have everything I need to make good use of the system	72	3.76	1.32
	I know enough of the system to make good use of it	73	3.18	1.50
PAD	I think the system can be adaptive to what I need	71	3.89	1.29
	I think the system will only do what I need at that particular moment	70	4.10	1.17
	I think the system will help me when I consider it to be necessary	77	4.36	0.97
PENJ	I enjoy the system talking to me	74	4.27	1.15
	I enjoy doing things with the system	73	4.00	1.28
	I find the system enjoyable	75	3.92	1.31
	I find the system fascinating	75	4.31	1.00
	I find the system boring	71	1.79	1.23
PEOU	I think I will know quickly how to use the system	75	3.83	1.21
	I find the system easy to use	72	3.67	1.23
	I think I can use the system without any help	75	3.33	1.43
	I think I can use the system when there is someone around to help me	74	3.46	1.47
	I think I can use the system when I have a good manual	77	4.69	5.91
PU	I think the system is useful to me	74	4.16	1.11
	It would be convenient for me to have the system	71	3.79	1.34
	I think the system can help me with many things	73	4.16	1.04
SI	I think the staff would like me using the system	69	3.97	1.25
	I think it would give a good impression if I should use the system	72	3.36	1.49
Trust	I would trust the system if it gave me advice	77	3.86	1.17
	I would follow the advice the system gives me	76	4.08	1.09

As regard Likert scales, they are presented in a 1-to-5 ranking; in these cases weighted averages have been processed and their results have been compared with the median value of the scale (i.e. 3). In this way if the mean value is above 3, this means that subjects in general show a positive attitude towards the question; if the value is under 3, the attitude tends to be negative.

The mean value and the standard deviations of each scale of UTAUT were calculated too. Each scale has a different range of scores, depending from the number of the items
The constructs that received more importance are

- Perceived adaptability (M= 12.46, SD= 3.03, Range= 3-15),
- Attitude (M= 12.32, SD= 2.90, Range= 3-15),
- Trust (M=7.93, SD= 2.08, Range= 2-10), and
- Perceived usefulness (M= 12.07, SD= 3.15, Range= 3-15).

Secondary importance was given to Perceived enjoyment (M= 18.24, SD= 3.95, Range= 5-25) and Perceived ease of use (M= 18.13 , SD= 4.17, Range= 5-25), followed by Facilitating condition (M= 6.89, SD= 2.59, Range= 2-10) and Social influence (M= 7.37, SD= 2.45, Range= 2-10). Finally, Anxiety (M= 10.87, SD= 4.90, Range= 4-20) has received a significant lower score, meaning that the participants have had not feeling of discomfort or anxiety analyzing the robot.

3.6 Section E – Demand & Cost information

In this section there are some questions concerning the factors that could influence the choice of purchasing a robot.
On the demand and cost information section, the 61% of the sample declared to have not purchased an assistive device previously. The information about assistive technology were taken from TV, newspapers and other media (75%), internet (44%), family members (32%), or from the physician (22%) and from social service organizations (16%). Among the factors that can influence the purchase of any technology/assistive device, the most relevant was the opportunity of trying out the device by myself (33%), having a recommendation from my physician or other trusted health care (22%) and seeing someone demonstrates the use of the device (21%).
The factors that can mostly influence the participants in the decision of purchasing a robot are (in order of importance): the state of the own health (M= 4.66, SD= 0.86), the ease of use (M= 4.57, SD= 0.73), whether insurance scheme/welfare system provision will pay for part or all of the cost (M= 4.53, SD= 0.93), the cost (M= 4.32, SD= 1.09), the level of comfort with technology (M= 4.20 , SD= 0.94), the perceived value (M= 4.00, SD= 1.13), the caregiver's support (M= 3.99, SD= 1.12), the recommendation of the physician (M= 3.96, SD= 1.23), the easy to buy/availability (M= 3.91, SD= 1.29) and the aesthetic appearance (M= 3.27, SD= 1.44) (see Figure 69).
On the availability to pay an additional amount for a robot to remain independent at home, 15% of the sample declared that would spend an amount within 1001-1300, while 11% would spend within 701-1000 Euros, and 9% within 401-700 Euros. Differently, 10% would not be willing to pay any additional amount for a robot. Finally, 28% of the sample doesn't like that the children will pay any amount for a robot to support them, while 10% thought their children would spend within 1-400 Euros.

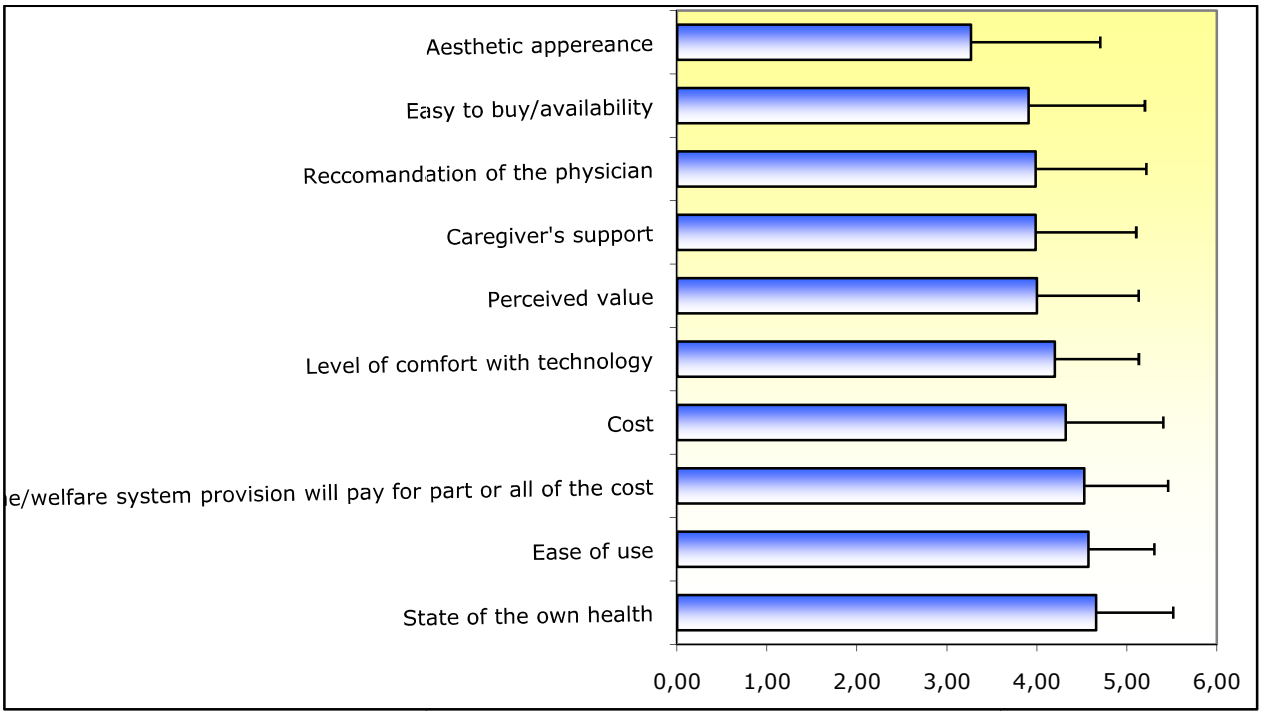


Figure 69. Factors that influence the purchase of a robot

4 Conclusion

These findings give an overview of important issues that have to be considers during the concept stage and have to be tested in the future activities with specific test methods (e.g. user experience tests). The main results, useful for the development of the system, are here described in details.

On the scenarios and willingness to buy

The data have confirmed the relevance of the planned scenarios, providing a detailed description of the activities to be implemented. In general, it could be said that a positive predisposition and willingness to use the robot for the reported activities was detected.
In fact, the item "I think I'd use the robot for XXX, if necessary" received high scores, indicating an overall high agreement to use the robot in case of need for transporting/manipulating objects at home (82%), for cleaning (80%), for garbage collection (75%), for surveillance (73%), for outdoor walking support, indoor escort at night and reminding events, tasks (72%), for laundry support (70%), for communicating with important persons (68%), for food delivery (67%) and for shopping/drug delivery (62%).
The scenarios that received more attention from the participants (and higher scores for what concerns the detailed activities) are Indoor escort at night, Surveillance, Communication with relevant persons, Outdoor walking support and Reminding.
Reading to the results, it is possible to draw some suggestions for some activity:

Indoor	**Outdoor-condominiun**
• the robot should not be noisy because the older people would like it will clean also while they are sleeping • the robot should have lights on the basis and should be able to switch on/off the lights during the navigation inside the home, for supporting the indoor escort at night • the robot and the AmI should be equipped for starting a phone call in case of need and it could have a communication software to carry out and receive video calls with friends, carers, families and care providers • the robot should bring the drugs to the elderly people not just to give them an advice, but it has to alert if they have taken the wrong one (as well as to inform their caregiver) of if they missed to take it	• the robot should be able to exchange the garbage bag between the domestic and condominium robot also when the user is not present • the robot should walk near (and not behind) the older people and it has to be provided of a forearm support • joystick for piloting the robot is not so requested by the older people (different solution can be found) • the robot must be able to detect any kind of obstacle on the walking path
• indoor and outdoor robots should be able to transport objects of different size, from the pills box if the user is in bed, to the shopping bags if they are walking outside	

As regards willing to pay for each services, it could be said that the participants would spend more, on a monthly basis, for being supported in cleaning the apartment, moving at home during the night and moving outdoor.

On the usability requirements

These results are only a first impression on statements and/or figures about robots and they represent expectations on usability requirements.

The results of analysing usability requirements have shown a large variety of opinions and preferences among the sample, obviously due to the high number of options presented during the interviews. In this sense, the results should be interpreted just like general tendencies to be taken into account during the development.

Particularly for elderly users who are often not used to novel technologies it can be difficult to predict their own behaviour in relation to new products and services. Thus, only tests with first prototypes can really create feedback on concrete designs and usability issues in detail.

Physical requirements:

Regarding the physical requirements of the different robots (domestic, outdoor/condominium), a majority of users prefers dimensions that are similar to persons. A technical look/appearance of the robots seems to be more acceptable from a German perspective, while the Italian sample preferred a human appearance for the robots.

Interestingly, the results suggested that particular attention should be given to the impact on the home environment for the indoor robot, taking into account the small dimensions of the older peoples apartments, especially in the Mediterranean area. The most liked heads were shown in Figure 14 and Figure 15.

Finally, all the presented sensors were considered appropriate and not too intrusive.

Interface:

Regarding the interfaces, the participants reported a clear preference of the first menu with many options on the first menu level due to an expected higher degree of ease-of-use. The reason why the sample showed a marked preference for the first menu can be the size of the images and icons and the tangibility of the menu for performing different tasks: the activities, in fact, are clearly shown and not grouped into a restrict number of domains, in addition to the confusion created by the use of many images in the same icon.

Interaction with the robot:

Also, interviewees preferred the speech command/vocal reply for interacting with robots. A female voice was liked most. Besides, the speech control should be combined with gesture control and the use of the touch screen – depending on the tasks to fulfil.

Also, a nonverbal communication can be relevant, particularly when people get used to interact with robots in their everyday life. This might be realized by the use of lights, movements or face and body gestures.

General recommendations on usability aspects regarding Robot-Era System:
Software:

The User Interface should obey existing usability standards like they were summarized in the DIN EN ISO 9241.

Regarding the target group of elderly people the "Suitability for learning" (see paragraph 5 DIN EN ISO 9241-110) should be considered as one of the most important points while using a new interfaces and technologies. There should be a continuous Feedback about done actions and further steps to do. Sometimes a double feedback would be helpful e.g. using a text which appears on the screen and at the same time a sound signal will be given.

Another important point regarding the usability for elderly people is the "Suitability for individualization" (see paragraph 6 DIN EN ISO 9241-110). That means that there should be enough space for defining different levels of interactions- maybe the user could decide his own level (beginner, medium, advanced user) for using the robot and the number of

supporting feedback will reduce while the level increases. Also lighter options of individualization like wallpapers and the size of the menu should be given.

In general the statements related to Service Robotics during the interviews were quiet positive. We have to face those positive expectations by supplying a comprehensive usability for the Robot-Era Platform. The fourth paragraph of DIN ISO 9241-110 describes the "Conformity with user expectations" which means that "the dialogue conforms with user expectations when it is consistent and corresponds to the user characteristics, such as task knowledge, education, experience, and to commonly accepted conventions" has to be taken into account as well. That indicates that to keep in mind that the majority of elderly people are not advanced in using complex technologies.

Another standards dealing with usability are the DIN 33402-2 on ergonomics and body measures of human. This standard describes body dimensions and is relevant for designing robots that fit both smaller and taller seniors.

The ISO IEC Draft Guide 71 „Guidelines for standardization to address the needs of older persons and people with disabilities" takes into account especially the requirements of older users and thus should be used as input for Robot-Era developments too.

Hardware:

Not just the dimension of the robot is important, also the perceived image of the whole robot is – at least partly - a hardware issue. If elderly people perceive a robot as a nice accessory they could be proud of, the user experience and usability will be higher. Also, stigmatization by using assistive technology could be reduced by good design. Accordingly, the design needs to be modern and technical and should make use of novel materials and technical details.

On the acceptance

The study of the determinants of acceptance of any technological solution is a crucial issue for future advancement of the system (also in terms of market analysis) and should investigated also in a preliminary phase, as it has been carried out in Robot Era project. Nowadays, there are a lot of devices that are available on the market but the majority of them were not adopted by the older people and their caregivers, mostly for their difficulty in including them into their daily life activities. In other terms, they were not accepted. For the Robot-Era platform, the acceptance of the system was measured on the basis of the UTAUT model that takes into consideration different forces that intervene in the definition of the acceptance.

The UTAUT questionnaire has shown a high level of acceptance, after the exposure to the photos and videos of the platform. Even if a more realistic analysis of the acceptance should be derived after a prompt use of the robotic mock-up, it could be said that this preliminary evaluation has highlighted the perceived adaptability and the positive attitude toward the platform, as well as, the perceived ease of use and enjoyment.

This positive attitude towards enjoyment suggests a good empathy with the robots and not a feeling of fear of a so novelty technology, as robots.

The only scale that has received a lower score is Anxiety, meaning that the participants have perceived as not intimidating the proposed technology.

On the demand and cost information

Among the factors that are considered most important in the decision of purchasing a robot, the cost resulted not so important if compared to the state of the own health and the ease of use, even if the opportunity of being economically supported by the insurance scheme/welfare system provision can play an important role in the purchase. This

suggestion should be taken into account during the business model elaboration, considering different venues to the market and to the users, such as renting the robot just in case of need, or shared the robot with other older people.

Interestingly, the role of mediators as the caregiver and the physician seems to be underestimated by the sample, in favour to some characteristics of the robot as the level of comfort and the perceived value. An hypothesis to explain this result could be found in the relatively young age of the participants, that were mostly engaged in recreational activities, showing a greater sense of independence and autonomy during the daily activities. This could be also evinced from their answer at the opportunity that their children will pay for the robot: about one third of the respondents reported they don't like that the children will pay any amount. The additional amount they would like to spend to remain independent is 1300 Euros at maximum.

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Appendix 1 – Common questionnaire and informed consent sampe

Robot-Era acceptability and usability evaluation phase

Participant Code_____

General information

1. Date of birth: _____/_____/_____

2. Sex:
   ☐ 1 M
   ☐ 2 F

3. Educational Level:
   ☐ 0 No education
   ☐ 1 Primary education
   ☐ 2 Secondary education
   ☐ 3 Tertiary education
   ☐ 98 Don't known
   ☐ 99 Refused

4. Total years of education _____
5. Please specify what is your marital status at present:

Married (living with the spouse/wife)	☐ 1
Full time relationship	☐ 2
Separated (married, but living separately)	☐ 3
Divorced	☐ 4
Single	☐ 5
Widowed	☐ 6
Don't know	☐ 98
Refused	☐ 99

6. Please indicate your present working situation (multiple answers possible):

6.1 Retired	□ 1
6.2 Still working full time	□ 1
6.3 Still working part time	□ 1
6.4 Unemployed	□ 1
6.5 Work inside the home	□ 1
6.6 Don't know	□98
6.7 Refused	□99

7. Please specify your current work or, if retired, the last work you done _____

8. Who lives in your home with you? (multiple answers possible)

Category	Code	Number of…
8.1 No one	☐ 1	N.A.
8.2 Spouse/partner	☐ 1	N.A.
8.3 Sons and daughters	☐ 1	
8.4 Grandchildren	☐ 1	
8.5 Children's spouses	☐ 1	
8.6 Brothers/Sisters	☐ 1	
8.7 Mother/Father	☐ 1	
8.8 Paid caregiver (not relative)	☐ 1	
8.9 Others	☐ 1	
8.10 Refused	☐99	N.A.

(Note for the interviewer: Sign the exact number of people that live with the elder _____)

9. If "other", please specify _____

SECTION A – Scenarios

Please, rate your opinion at the items, following the Likert scale from 1= not agree at all, to 5= completely agree. You can check "DK" if you think you don't know the answer to choose or "R" if you refused to answer.

Cleaning (kitchen, dusting)	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
1. I'd like the robot will clean also when I'm not present during the day	☐	☐	☐	☐	☐	☐	☐
2. I'd like the robot will clean while I'm sleeping	☐	☐	☐	☐	☐	☐	☐
3. I'd like the robot will clean in places that are too difficult for me to reach	☐	☐	☐	☐	☐	☐	☐
4. I think I will need support for the cleaning activity in the future	☐	☐	☐	☐	☐	☐	☐
5. I think I'd use the robot for cleaning, if necessary	☐	☐	☐	☐	☐	☐	☐
Garbage collection	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
6. I'd like the robot will do garbage collection also when I'm not present	☐	☐	☐	☐	☐	☐	☐
7. I think I will need support for the garbage collection in the future	☐	☐	☐	☐	☐	☐	☐
8. I think I'd use the robot for doing garbage collection, if necessary	☐	☐	☐	☐	☐	☐	☐
Shopping/drug delivery	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
9. I think I'd prefer having a fix list of item to buy	☐	☐	☐	☐	☐	☐	☐
10.I think I'd prefer to choose the goods/drugs to buy every time	☐	☐	☐	☐	☐	☐	☐
11.I prefer the robot will come with me to have shopping	☐	☐	☐	☐	☐	☐	☐
12.I'd like the robot will take the shopping bags for me, if I'm not at home	☐	☐	☐	☐	☐	☐	☐
13.I'd like the robot will transport medicine for me from pharmacy if I cannot move from the house	☐	☐	☐	☐	☐	☐	☐
14.I think I will need support for the shopping/drug delivery activity in the future	☐	☐	☐	☐	☐	☐	☐
15.I think I'd use the robot for shopping/drug delivery, if necessary	☐	☐	☐	☐	☐	☐	☐
Laundry support	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
16.I'd like that the robot will program the washing machine even if I'm not present	☐	☐	☐	☐	☐	☐	☐
17.I think I will need support for the laundry activity in the future	☐	☐	☐	☐	☐	☐	☐
18.I think I'd use the robot for laundry activity, if necessary	☐	☐	☐	☐	☐	☐	☐

Food delivery	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
19.I think I will need support for the food delivery at home in the future	☐	☐	☐	☐	☐	☐	☐
20.I think I'd use the robot for food delivery at home, if necessary	☐	☐	☐	☐	☐	☐	☐
Outdoor walking support	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
21.I prefer the robot walk near me	☐	☐	☐	☐	☐	☐	☐
22.I prefer the robot walk behind me	☐	☐	☐	☐	☐	☐	☐
23.I'd like to use a joystick for piloting the robot	☐	☐	☐	☐	☐	☐	☐
24.I like to have a forearm support, if I need to stop or being supported	☐	☐	☐	☐	☐	☐	☐
25.I like that the robot can detect/alert when there are obstacles along the path	☐	☐	☐	☐	☐	☐	☐
26.I think I will need support for walking outside, in the future	☐	☐	☐	☐	☐	☐	☐
27.I think I'd use the robot for walking outside, if necessary	☐	☐	☐	☐	☐	☐	☐
Indoor escort at night	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
28.I like the robot drives me to the bathroom during the night, if necessary	☐	☐	☐	☐	☐	☐	☐
29.I think it is important that the robot has a handle support for helping me in moving	☐	☐	☐	☐	☐	☐	☐
30.I think it is useful that the robot will switch on/off the light while moving	☐	☐	☐	☐	☐	☐	☐
31.I think it could be useful that the robot will have lights on the base, for lighting the floor while moving	☐	☐	☐	☐	☐	☐	☐
32.I think I will need support for moving inside home during the night, in the future	☐	☐	☐	☐	☐	☐	☐
33.I think I'd use the robot for moving inside home during the night, if necessary	☐	☐	☐	☐	☐	☐	☐
Surveillance	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
34.I will feel more secure if the robot will alert me in case of unknown person in the building	☐	☐	☐	☐	☐	☐	☐
35.I think it is useful that the robot will have a camera for monitoring the situation in the building	☐	☐	☐	☐	☐	☐	☐
36.I think I will need support for surveillance in the future	☐	☐	☐	☐	☐	☐	☐
37.I think I'd use the robot for surveillance, if necessary	☐	☐	☐	☐	☐	☐	☐
Communication with friends, family, caregivers and service providers	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
38.I will feel more secure if the robot can alert automatically my family in case I feel sick/conk out	☐	☐	☐	☐	☐	☐	☐

39.I think the use of a sensors network for monitoring my health condition (and eventually advice someone in case of accident), it's too intrusive for my privacy	☐	☐	☐	☐	☐	☐	☐
40.I will feel more secure if I can start a phone call to my family	☐	☐	☐	☐	☐	☐	☐
41.I will feel more secure if I can start a phone to the first aid service/home physician in case of need	☐	☐	☐	☐	☐	☐	☐
42.I think I will need support for communicating with important people (family, carers, services), in the future	☐	☐	☐	☐	☐	☐	☐
43.I think I'd use the robot for communicating with important people (family, carers, services), if necessary	☐	☐	☐	☐	☐	☐	☐
Reminding (tasks, events and medication to take)	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
44.I like that the robot will remind me to take medicine	☐	☐	☐	☐	☐	☐	☐
45.I like that the robot will bring me medicine, not just advice me when it is time to take them	☐	☐	☐	☐	☐	☐	☐
46.The robot should inform my caregivers if I did not take the medicine or I have taken them at the wrong moment	☐	☐	☐	☐	☐	☐	☐
47.I like that the robot will advice me if I've taken the wrong medicine	☐	☐	☐	☐	☐	☐	☐
48.I think that receiving updating/warnings on tasks (i.e. cooking, drinking…) to do is too intrusive	☐	☐	☐	☐	☐	☐	☐
49.I'd like that the robot will remind me appointments and social events	☐	☐	☐	☐	☐	☐	☐
50.I prefer the robot will give me reminding through a vocal message	☐	☐	☐	☐	☐	☐	☐
51.I prefer the robot will give me reminding through a write message	☐	☐	☐	☐	☐	☐	☐
52.I think I will need support for reminding (tasks, medicine, events), in the future	☐	☐	☐	☐	☐	☐	☐
53.I think I'd use the robot for reminding (tasks, medicine, events), if necessary	☐	☐	☐	☐	☐	☐	☐
Objects transportation and manipulation (at home)	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
54.I'd like the robot will take domestic tools and give them to me	☐	☐	☐	☐	☐	☐	☐
55.I'd like the robot will bring me food or other objects to me, if I'm sick in bed	☐	☐	☐	☐	☐	☐	☐
56.I'd like the robot will will help me to clean the table after meals	☐	☐	☐	☐	☐	☐	☐
57.I think I will need support for transporting objects in the future	☐	☐	☐	☐	☐	☐	☐
58.I think I'd use the robot for transporting objects, if necessary	☐	☐	☐	☐	☐	☐	☐

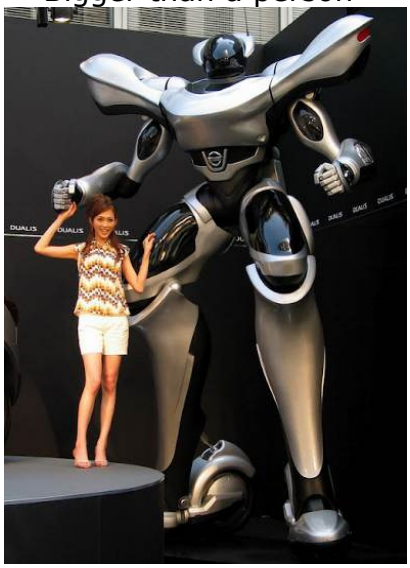
59. Imagine to be physically restricted when being older or after an accident or a surgery. How much money could you imagine to pay for a service that:

	Euro/ month	None	DK	Re
59.1 cleans your appartment as often as necessary		☐	☐	☐
59.2 collects your garbage bags from your appartment as often as necessary		☐	☐	☐
59.3 buys the drugs you need or can go shopping for you as often as necessary		☐	☐	☐
59.4 helps you in doing laundry		☐	☐	☐
59.5 delivers foods at home as often as necessary		☐	☐	☐
59.6 walks with you outdoor, giving aid for avoiding obstacles or if you are tired		☐	☐	☐
59.7 helps you in moving during the night in your home, as often as necessary		☐	☐	☐
59.8 monitors the environment and the building for your safety		☐	☐	☐
59.9 can help you in communicate with your family or with the services, in case of need or just to talk		☐	☐	☐
59.10 reminds you to events/activities to do		☐	☐	☐
59.11 can bring objects to you, as often as necessary		☐	☐	☐

SECTION B – Requirements

Indoor robot

1. Which are the more appropriate dimensions for indoor robot, in your opinion?

Smaller than a person	Similar to a person	Bigger than a person
		
1.1 ☐	1.2 ☐	1.3 ☐

2. Which shape is more appropriate?

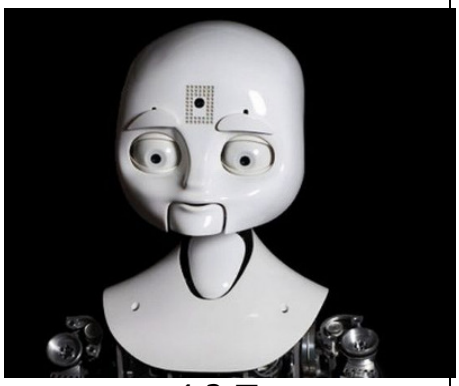
Similar to electonic appliances	Similar to human	Not so different from human
		
2.1 ☐	2.2 ☐	2.3 ☐

3. Which colours are more appropriate for the indoor robot?

3.1 blue	3.2 yellow	3.3 green	3.4 red	3.5 orange	3.6 violet
3.7 white	3.8 black	3.9 azure	3.10 brown	3.11 lilac	3.12 grey

4. Which head is the more appropriate for indoor robot?

4.1 ☐



4.2 ☐

4.3 ☐

4.4 ☐

4.5 ☐

4.6 ☐

4.7 ☐

4.8 ☐

4.9 ☐

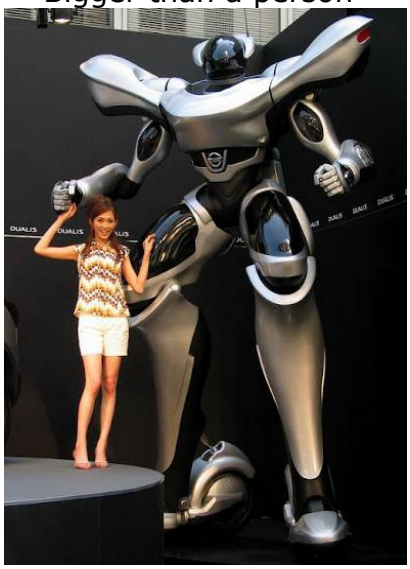
 4.10 ☐	 4.11 ☐	 4.12 ☐

Please, rate your opinion at the items, following the Likert scale from 1= not agree at all, to 5= completely agree. You can check "DK" if you think you don't know the answer to choose or "R" if you refused to answer.

	1	2	3	4	5	DK	Re
5. I think the indoor robot could look more friendly and safety if its cover has some soft parts	☐	☐	☐	☐	☐	☐	☐
6. I think the indoor robot could be easy to use	☐	☐	☐	☐	☐	☐	☐
7. I think the robot is intrusive	☐	☐	☐	☐	☐	☐	☐
8. I think the robot could modify the home environment	☐	☐	☐	☐	☐	☐	☐
9. I think the mechanical arm is appropriate for a robot that should help me in daily life	☐	☐	☐	☐	☐	☐	☐

Outdoor/Condominium robot

10. Which are the more appropriate dimensions for the outdoor robot, in your opinion?

Smaller than a person	Similar to a person	Bigger than a person
		
10.1 ☐	10.2 ☐	10.3 ☐

11. Which shape is more appropriate?

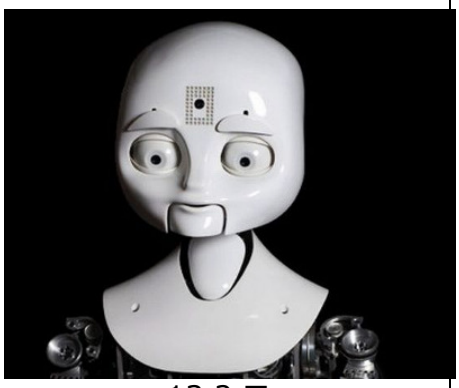
Similar to electonic appliances	Similar to human	Not so different from human
		
11.1 ☐	11.2 ☐	11.3 ☐

12. Which colours are more appropriate for the outdoor robot?

12.1 blue	12.2 yellow	12.3 green	12.4 red	12.5 orange	12.6 violet
☐ 12.7 white	12.8 black	12.9 azure	12.10 brown	12.11 lilac	12.12 grey

13. Which head is the more appropriate for the outdoor robot?

13.1 ☐



13.2 ☐

13.3 ☐

13.4 ☐

13.5 ☐

13.6 ☐

13.7 ☐

13.8 ☐

13.9 ☐

 13.10 ☐	 13.11 ☐	 13.12 ☐

Please, rate your opinion at the items, following the Likert scale from 1= not agree at all, to 5= completely agree. You can check "DK" if you think you don't know the answer to choose or "R" if you refused to answer.

	1	2	3	4	5	DK	Re
14. I think the outdoor robot could look more friendly and safety if its cover has some soft parts	☐	☐	☐	☐	☐	☐	☐
15. I think the outdoor robot could be easy to use	☐	☐	☐	☐	☐	☐	☐
16. I think the outdoor robot is intrusive	☐	☐	☐	☐	☐	☐	☐

Sensors network – AmI infrastructure

To improve the ability and the intelligence of robot and services could be necessary to set sensors inside the house like the following ones:

 Sensor mat to monitor chair, sofa and bed	 Sensor monitoring posture	 Sensor monitoring doors, windows, etc.	 Sensor for localization

Please, rate your opinion at the items, following the Likert scale from 1= not agree at all, to 5= completely agree. You can check "DK" if you think you don't know the answer to choose or "R" if you refused to answer.

	1	2	3	4	5	DK	Re
17. I think the dimensions are appropriate	☐	☐	☐	☐	☐	☐	☐
18. I think the sensors are intrusive	☐	☐	☐	☐	☐	☐	☐

19. if you consider intrusive one sensor of these, please specify which and how could be improved _____

SECTION C – Usability (interfaces)

1. Which are the best ways to interact and control the robots? (please sign also more options)

Speech command (from user to robot) 1.1 ☐	Vocal reply (from robot to user) 1.2 ☐	Video message (images and writing) 1.3 ☐	Touch screen 1.4 ☐
Mobile phone 1.5 ☐	Gesture recognition 1.6 ☐	Remote controller 1.7 ☐	

Here there are some examples of graphical interfaces/menu having many and few items. Please, rate your opinion at the items, following the Likert scale from 1= not agree at all, to 5= completely agree. You can check "DK" if you think you don't know the answer to choose or "R" if you refused to answer.

First menu

First menu	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
2. I think the menu is easy to use	☐	☐	☐	☐	☐	☐	☐
3. Information is easy to read	☐	☐	☐	☐	☐	☐	☐
4. Information is written in a style that suits me	☐	☐	☐	☐	☐	☐	☐
5. I can get to information quickly	☐	☐	☐	☐	☐	☐	☐
6. The screen has the right amount of information	☐	☐	☐	☐	☐	☐	☐
7. It is clear how screen elements work	☐	☐	☐	☐	☐	☐	☐
8. I think that I would need the support of a technical person to be able to use this interface	☐	☐	☐	☐	☐	☐	☐
9. I would imagine that most people would learn to use this interface very quickly	☐	☐	☐	☐	☐	☐	☐

Second menu

Second menu	**1**	**2**	**3**	**4**	**5**	**DK**	**Re**
10. I think the menu is easy to use	☐	☐	☐	☐	☐	☐	☐
11. Information is easy to read	☐	☐	☐	☐	☐	☐	☐
12. Information is written in a style that suits me	☐	☐	☐	☐	☐	☐	☐
13. I can get to information quickly	☐	☐	☐	☐	☐	☐	☐
14. The screen has the right amount of information	☐	☐	☐	☐	☐	☐	☐
15. It is clear how screen elements work	☐	☐	☐	☐	☐	☐	☐
16. I think that I would need the support of a technical person to be able to use this interface	☐	☐	☐	☐	☐	☐	☐
17. I would imagine that most people would learn to use this interface very quickly	☐	☐	☐	☐	☐	☐	☐

	1	**2**	**3**	**4**	**5**	**DK**	**Re**
18. I'd like to receive messages from a female voice	☐	☐	☐	☐	☐	☐	☐
19. I'd like to receive messages from a male voice	☐	☐	☐	☐	☐	☐	☐

SECTION D – System acceptance

Technology Acceptance – Unified Theory of Acceptance and Use of Technology

Please, rate your opinion at the items, following the Likert scale from 1= not agree at all, to 5= completely agree. You can check "DK" if you think you don't know the answer to choose or "R" if you refused to answer.

	1	2	3	4	5	DK	Re
1. If I should use the robot, I would be afraid to make mistakes with it	☐	☐	☐	☐	☐	☐	☐
2. If I should use the robot, I would be afraid to break something	☐	☐	☐	☐	☐	☐	☐
3. I find the robot scary	☐	☐	☐	☐	☐	☐	☐
4. I find the robot intimidating	☐	☐	☐	☐	☐	☐	☐
5. I think it's a good idea to use the robot	☐	☐	☐	☐	☐	☐	☐
6. The robot would make my life more interesting	☐	☐	☐	☐	☐	☐	☐
7. It's good to make use of the robot	☐	☐	☐	☐	☐	☐	☐
8. I have everything I need to make good use of the robot	☐	☐	☐	☐	☐	☐	☐
9. I know enough of the robot to make good use of it	☐	☐	☐	☐	☐	☐	☐
10. I think I'll use the robot during the next few days	☐	☐	☐	☐	☐	☐	☐
11. I am certain to use the robot during the next few days	☐	☐	☐	☐	☐	☐	☐
12. I'm planning to use the robot during the next few days	☐	☐	☐	☐	☐	☐	☐
13. I think the robot can be adaptive to what I need	☐	☐	☐	☐	☐	☐	☐
14. I think the robot will only do what I need at that particular moment	☐	☐	☐	☐	☐	☐	☐
15. I think the robot will help me when I consider it to be necessary	☐	☐	☐	☐	☐	☐	☐
16. I enjoy the robot talking to me	☐	☐	☐	☐	☐	☐	☐
17. I enjoy doing things with the robot	☐	☐	☐	☐	☐	☐	☐
18. I find the robot enjoyable	☐	☐	☐	☐	☐	☐	☐
19. I find the robot fascinating	☐	☐	☐	☐	☐	☐	☐
20. I find the robot boring	☐	☐	☐	☐	☐	☐	☐
21. I think I will know quickly how to use the robot	☐	☐	☐	☐	☐	☐	☐
22. I find the robot easy to use	☐	☐	☐	☐	☐	☐	☐
23. I think I can use the robot without any help	☐	☐	☐	☐	☐	☐	☐
24. I think I can use the robot when there is someone around to help me	☐	☐	☐	☐	☐	☐	☐
25. I think I can use the robot when I have a good	☐	☐	☐	☐	☐	☐	☐

manual							
26. I think the robot is useful to me	☐	☐	☐	☐	☐	☐	☐
27. It would be convenient for me to have the robot	☐	☐	☐	☐	☐	☐	☐
28. I think the robot can help me with many things	☐	☐	☐	☐	☐	☐	☐
29. I think the staff would like me using the robot	☐	☐	☐	☐	☐	☐	☐
30. I think it would give a good impression if I should use the robot	☐	☐	☐	☐	☐	☐	☐
31. I would trust the robot if it gave me advice	☐	☐	☐	☐	☐	☐	☐
32. I would follow the advice the robot gives me	☐	☐	☐	☐	☐	☐	☐

SECTION E – Demand & cost information

1. Have you ever purchased an assistive device previously?
   Yes ☐ 1
   No ☐ 0 (Go to question 3)

2. If Yes, would you say that the device has been:

Extremely useful/helpful	☐ 4
Fairly useful/helpful	☐ 3
Only slightly useful/helpful	☐ 2
Not all at useful	☐ 1
Not applicable	☐ 97
Don't know	☐ 98
Refused	☐ 99

3. Where do you find information about assistive devices or technologies to help you with activities of daily life? (multiple answers possible)

3.1 From newspapers, TV, other media	☐ 1
3.2 From the Internet	☐ 1
3.3 From family members	☐ 1
3.4 From social service organisations	☐ 1
3.5 From my physician	☐ 1
3.6 Other	☐ 1
3.7 Don't know	☐ 98
3.8 Refused	☐ 99

4. If "other", please specify _____

5. What would help you most to decide whether or not to purchase an assistive device or technology?

Trying out the device myself	☐ 1
Having a recommendation from a friend or family member	☐ 2
Seeing someone demonstrate the use of the device	☐ 3
Having a recommendation from my physician or other trusted health care worker	☐ 4
Other	☐ 5
Don't know	☐ 98
Refused	☐ 99

6. If "other", please specify _____

7. Rate the following factors in terms of their importance when you think about whether or not to purchase a robot for assisting you. Rate your opinion using a scale from 1 = not important at all to 5 = very important.

Factor	**1**	**2**	**3**	**4**	**5**	**DK 98**	**Ref. 99**
7.1 State of my health	☐	☐	☐	☐	☐	☐	☐
7.2 Ease of use	☐	☐	☐	☐	☐	☐	☐
7.3 Cost	☐	☐	☐	☐	☐	☐	☐
7.4 Level of comfort with technology	☐	☐	☐	☐	☐	☐	☐
7.5 Perceived value	☐	☐	☐	☐	☐	☐	☐
7.6 Whether insurance scheme/welfare system provision will pay for part or all of the cost	☐	☐	☐	☐	☐	☐	☐
7.7 Aesthetic appearance of the device	☐	☐	☐	☐	☐	☐	☐
7.8 Easy to buy/availability	☐	☐	☐	☐	☐	☐	☐
7.9 Recommendation from my physician	☐	☐	☐	☐	☐	☐	☐
7.10 How much support I receive from caregivers	☐	☐	☐	☐	☐	☐	☐

7.11 Other	☐	☐	☐	☐	☐	☐	☐

8. If "other", please specify _____

9. If you could live at home on your own longer, what amount would you be willing to pay for the robot?

1-400	☐ 1
401-700	☐ 2
701-1000	☐ 3
1001-1300	☐ 4
1301-1600	☐ 5
1601- 1900	☐ 6
1901- 2200	☐ 7
2201- 2500	☐ 8
2501-2800	☐9
2801-3100	☐10
3101 or more	☐11
I would not be willing to pay additional amounts for such devices	☐ 12
Don't know	☐98
Refused	☐99

10. If it would enable you to live at home on your own longer, what amount would your children be willing to pay for the robot (in €)?

1-400	☐ 1
401-700	☐ 2
701-1000	☐ 3
1001-1300	☐ 4
1301-1600	☐ 5
1601- 1900	☐ 6
1901- 2200	☐ 7
2201- 2500	☐ 8
2501-2800	☐9
2801-3100	☐10
3101 or more	☐11
I would not be willing to pay additional amounts for such devices	☐ 12
Don't know	☐98
Refused	☐99

Project title:		
Principal Investigators:		
Background: (provide short summary of what project involves for participants, including the procedures to be carried out and the assurance of confidentiality)		
Participant Declaration: (This should be written in the first person and include agreement that I (i.e. the participant):		
Have read or have had the information sheet read to me and that I understand the contents.	Yes	No
Have been given an opportunity to ask questions and am satisfied with answers.	Yes	No
Consent to take part in the study.	Yes	No
Understand that participation is voluntary and that I can withdraw at any time.	Yes	No
Understand that withdrawal will not affect my access to services or legal rights.	Yes	No
Consent to possible publication of results.	Yes	No
I (the participant) give my permission to: Use the data obtained from you in other future studies without the need for additional consent.	Yes	No
Researcher Declaration: (This should be written in the first person and include agreement that I (i.e. the researcher):		
Have explained the study to the participant	Yes	No
Have answered questions put to me by the participant about the research	Yes	No
Believe that the participant understands and is freely giving consent	Yes	No
Participant's Statement: I have read, or had read to me, this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights. I understand I may withdraw from the study at any time. I have received a copy of this consent form. **Participant's Name:** **Contact Details:** **Participant Signature:** (where participant is over the age of 18) **Date:** The form needs to be signed by the consenter (or a parent or guardian in the case of the participant being unable to understand the scope, nature or significance of the study or in the case of the participant being under 18 years) and dated. **Name of consenter, parent or guardian:** **Signature relation to participant:** **Date:**		
Researcher's Statement: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent. **Signature:** **Date:**		