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D 2.3 User-technical cycle (M24)

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Deliverable Summary

This deliverable describes the evaluation activities of the ExCITE project. In particular, the document depicts the twofold approach followed: the *short-term* evaluation carried out involving primary and secondary users who interact with the system for a limited period of time in order to elicit information, expectations and possible changes to implement in the short term. On the other hand, we focus on the report of the *long-term* evaluation, which entails the usage of Giraff in real living environments for long periods of time.
Specifically, the document illustrates (a) the method and the results of the short-term evaluation sessions; (b) the long-term assessment, for which we illustrate the methodology conceived, the management protocol, the history and current status of the test sites together with initial results. In order to show the *user input -> technology refinement -> user assessment* cycle we also describe the improvements made on the robotic platform so far, based on the feedback obtained through these evaluation activities which already allowed a rather important improvement on the robotic telepresence platform.

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1 Introduction

The idea behind the ExCITE project is to assess the robustness and validity of the Giraff telepresence robotic platform as a means to support elderly and to foster their social interaction and participation. In summary the main innovative concepts of the project are the following:

- ***User centered product refinement***, this approach is based on the idea of obtaining users feedback during the time they use the robot and cyclically refine the prototype in order to address specific needs;
- ***User tests outside labs***, rather than testing the system in laboratory setting, the robotic platform is placed in a real context of use. This approach is in line with several research that highlights how systems that work well in the lab are often less successful in real world environments (Sabanovic et al., 2006). The evaluation of robots made in a laboratory environment, even though useful, does not favor the emergence of robotic aid suitability to support elders who are able to stay in their own homes. For this reason an essential step is to assess the technology in the specific contexts in which the technology is supposed to be used (Hutchins, 1995);
- ***Use on a time period long enough***, to allow habituation and possible rejection to appear. Indeed, interviews and survey conducted after a short period of time can be limited and can prevent other effects to emerge. On the contrary, a key aspect of relationship is that it is a persistent construct, spanning multiple interactions (Bickmore and Picard, 2005). In this light, in order to assess the human-robot interaction it is important also to investigate how people interact with robots over long periods of time.
- ***Analysis of cultural and societal differences***, an interesting part of our project stems from the idea of comparing the long-term deployment of the telepresence platform in different countries so as to allow an analysis of cultural and societal differences over European countries.

Figure 1 gives a brief sketch of the whole project idea: several Giraff prototypes are being deployed for long periods of time (at least three months, and possibly 1 year) in three different countries (Italy, Spain and Sweden) in real contexts of use. Feedback obtained from the users (both older users having the robot at home and the clients, that is people connecting and visiting the older) is used to technically improve the robot.
As we will explain later in this report, already three different versions of the prototypes have been realized which include several improvements.
During this first two years of the project we have done specific work to set up and run the different test sites. This allowed us to obtain useful feedback and suggestions for both technological development and human-robot interaction features.

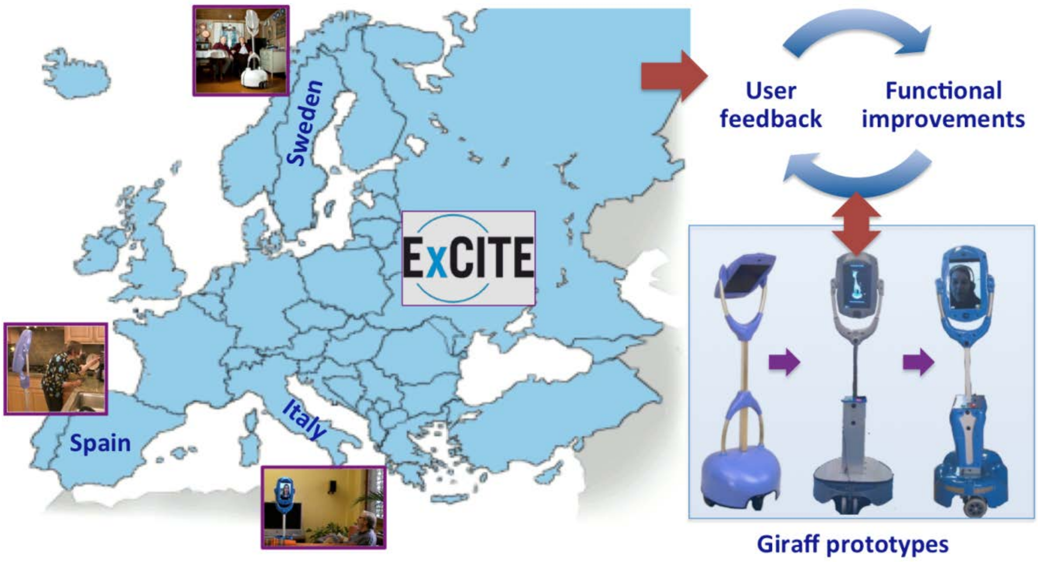


Figure 1 The ExCITE approach

1.1 Scope of the document

Aim of this document is to describe the work performed in WP1 User Evaluations, but also shows how the input form the user evaluation sessions has been used to improve the Giraff platform. The deliverable was not originally planned in the Proposal description, but it clearly emerged as a crucial report in order to highlight the results of the users feedback obtained during the interaction with the Giraff robot. Specifically, this document explains the work done to support the user *input -> technology refinement -> user assessment* cycle that characterizes the project. The document explains in detail the activities performed to assess the Giraff both in short interaction and in the long-term view.
It also reports the status of the test sites and the technical improvements made in response to the users' feedback.

1.2 Deliverable structure

The deliverable presents the user-technical cycle of the ExCITE project for the first half of the project. In the document we summarize the activities done to collect user requirement and evaluation; the user input collected after half time of the project; the improvements to the Giraff platform and concept already done and the improvements planned.

2 Related works

Evaluation of telepresence robots is particularly complex as several types of interactions occur. The first is human-robot interaction, that is the interaction which occurs between the local person and the robot per se. The second is human-computer interaction which is the interaction that occurs between the secondary user and the desktop application used to connect to the teleprecence robot. The last is human-human interaction which occurs between the two users, local and pilot of the system via the robotic device. In order to better situate the user evaluation activities within the ExCITE project, we examined the literature of user evaluation studies in this domain and highlighted a number of techniques used specifically for the evaluation of telepresence robotic systems, also known as Mobile Robotic Telepresence (MRPs) systems. This section outlines the more common measures used in evaluation and details on how they have been applied in litterature. It is worth highlighting that this study also motivated the choice of some of the variables to monitor during the evaluation activities of ExCITE.

2.1 Measures commonly used in user evaluation of telepresence systems

Attentional Measures. To maintain a fluid and natural interaction, it is important to respond appropriately when being addressed. "Attention is fundamental to the flow of face-to-face conversation”, p. 1 (Sirkin et. al., 2011). Each participant projects cues of where their attention is directed. The cues are interpreted by the other participants to maintain an awareness of the specific participant's attention and to understand its’ deictic referencing. In robotic telepresence systems, attention is often measured in studies comparing systems with varied characteristics regarding movability of the screen and/or camera and the camera’s capability of zooming. A comparison of the effects of and attitudes regarding three different kinds of video conferencing systems: (1) Static display, (2) display turning based on mouse pointer and (3) display turning based on head turning in a satellite-hub situation was made in (Sirkin et. al., 2011). The study included sociometric measures, feedback from the pilot of the system, semi-structured interviews and several individually filled questionnaires. The possibility to turn the screen towards the group of local users resulted in a higher conversational engagement, a more accurate response to deictic prompts and a higher trend in user ranking. However the ability to move also came with tradeoffs such as that the local user can be turned away from and feel excluded from discussion. Delays were experienced as the screen was turned towards the speaker and the eye contact was reduced when the display turned based on head turning. Interestingly, the pilots preferred a turning display initiated by the mouse pointer. The analysis of the sociometric data indicates a higher (a) level of activity in the conversation, (b) perceived excitement of the speakers, (c) level of attentiveness and engagement, (d) amount of turns per second between group of local users indicating activity in the conversation and amount of turns in relation to the pilots indicating a more active involvement of the pilot in condition where the display could be turned. The authors noted that the participants rated conditions with a turning display as better for communication by 3:1 over the stationary condition. The study also showed that sociometric measures are more demonstrative than the response on a subjective questionnaire. Also (Tsui et al, 2012) have attempted to find communication performance measure for evaluating mobile robotic telepresence systems (MRP) and provide a list of quantitative measures drawn from fields such as human-computer interaction, computer-supported cooperative work, communication and psychology.

Presence. Presence is a multi-dimensional concept (ISPR 2000) and commonly *social* and *spatial* presence are two dimensions of particular relevance for MRP systems. Shortly described, *spatial presence*, occurs when a person's perception fails to accurately acknowledge the role of technology that makes it appear that s/he is in a remote environment. *Social presence* on the other hand, occurs when a person fail to acknowledge the role of the technology in the communication with others. Forward-backward movement of the camera was found to have significant effects on the social presence when comparing five different conditions: fixed, rotatable, movable but non-rotatable, movable, and automatically moving in (Nakanishi et al, 2008). User-control when moving a robot resulted in a higher social presence than when the robot moved automatically[1]. In order to clarify the effects of a remote camera's zooming and display's movement on social presence, (Nakanishi et al, 2011) performed two experiments comparing; (a) relations between the presenter moving and camera zooming (with or without synchronization) and (b) relations between the presenter moving and display moving (with or without synchronization). Via a specially designed questionnaire, authors found that that in (a), the zoom caused greater feeling of presence when facing, talking with and viewing the presenter synchronized as when the presenter moved. When the presenter was static, the zoom caused reductions in perceived audio and video quality. In (b), the movement of the display increased the social presence whether or not the presenter moved.
Presence has also been evaluated in systems with partial autonomy. A system equipped with a semi-autonomous navigation control, semi-autonomous people tracking and improved situational awareness was compared with a system lacking assisted control in (Riano et al., 2011). Using Witmer and Singer's presence questionnaire (Witmer**,** B.**,** and Singer, M., 1998), they found that the user satisfaction was significantly higher for the system with assisted control.

Attitudes Measures. Attitude measures to robotics have been studied in a variety of domains to uncover differences in attitudes relating to specific technical solutions, or to cultural effects. The applicability of NARS[2] on MRP systems was studied in (Tsui et al. 2011). By performing three different studies: (1) video evaluation, (2) pilot a MRP system and (3) interact with a MRP system, the authors found that NARS may be applied in the MRP system domain. However, (Tsui et al. 2011) suggested that the NARS-S3, which regards the perceived emotions when talking to robots in general may need to be modified towards less general terms. Also culture, gender and prior experience to robots were found to influence the NARS score and participants being generally positive to robots were more positive to the MRP systems. The need to complement scaled questionnaires with ethnographic methods such as observations and interviews was emphasized in (Tsui et al. 2011) as numbers alone can only highlight issues but not explain the reason for them.
Also when measuring attitudes, other parameters have been used as indicators. The distance kept and how subjects varied distance when meeting Mobi Sr. (175 cm, two-way video) and Mobi Jr. (112 cm, one-way video) during interaction at an arts and technology festival was studied in (van Oosterhout, T., Visser, A., 2008). Results suggest that eye contact and height are important factors which impact attitudes, and further children chose a significantly shorter distance to Mobi Jr. (26.8 cm) than Mobi Sr. (70.4 cm). There were also significant differences between genders in the

[1] A small experiment where sliding movements resulted in similar effects on social presence as the forward-backward motion is also reported on in (Nakanishi et al, 2008).
[2] NARS (Negative Attitude toward Robots Scale) was originally presented in (Nomura et al., 2006).

teenager and adult groups. Females chose an in average longer distance to the robots than men. The importance of showing the face of the pilot was demonstrated in (Kuzuoka et al., 2007) that presents an experiment in which a robot guided smaller groups of people (1-3 persons) in an exhibition room at a museum. The participants faced the robot and interacted longer with the robot when it showed the face of the pilot and subjectively rated the robot with a face higher. The effects of varying the visual framing (decoration vs. no decoration) of a MRP system and the verbal framing of the pilot (interdependent vs. independent performance) in a desert task study was examined in (Rae et al., 2012). They found that participants who were informed that their performance would be evaluated as a team with the pilot were producing more in-group behaviors. Contrary to their expectations, they found that visual framing of the MRP system weakened the team cohesion. The dynamics found in the study was found to be different to the one in human-computer and computer-mediated communication.
A closed loop methodology including prototyping, field-testing in residential care settings, assessment on e.g. satisfaction and further development was proposed in (Deegan et al., 2008). The authors reported on focus groups within the ASSIST project that were given a demonstration on a proposed system via video[3] before discussing cost, functionality, interface complexity and special- versus general purpose. The elder focus group was positive to video communication technology and stated that impairment would overrun concerns about privacy. They further seemed less afraid of technologies they did not understand when believing the technology could be a benefit to them. Specially appreciated with the methodology was the access to the researchers and their willingness to respond to questions and concerns. This implies that a closed-loop methodology as proposed in ASSIST might improve early adoption.

Societal and Ethical Issues*.* There has been a subset of works that are concerned with measuring and reporting on general concerns on the uptake of MRP systems when applied in homes or at hospitals. These issues as well as ethical concerns, typically are reported when MRP systems are first introduced or presented to a focus group. For example, (Tsui, K. M. and Yanco, H.A., 2007) examined the awareness among medical and health care professionals regarding robot applications. Concerns raised were loss of human interaction, replacement of professionals and staff, costs and health care coverage. The authors wrote that applications could be eased in acceptance by being cost effective in design and implementation, appropriately defining tasks, increasing knowledge about on-going research and appropriate human-robot interaction. They also discussed how to educate medical and health care students/professionals and suggested cross publishing in different communities and coverage of both the medical/health and the robotics field at conferences. Similar concerns (i.e. loss of human interaction and replacement of professionals and staff) were found in a video-based evaluation regarding the Giraff system with different groups of primary health care organizations (Kristoffersson et al., 2011). In this study, the teachers were more positive than students (as in Smith C.D. and Skandalakis J.E., 2005), demonstrating that a greater exposure to technology does not necessarily increase the acceptance. However, there were large variances between different categories of primary caregivers in this study. The study also provides a number of suggestions with respect to increasing the acceptance of technology for elderly, e.g. early introduction to technology during the education. In an attempt to determine motives for implementing and barriers for impeding the acceptance and maintenance of robotic telemedicine programs in emergency and critical care

[3] In the study, the robot uBot-4, primarily a research robot was used as a prototype for mobile manipulation. The uBot-4 and the later version uBot-5 had a LCD screen which is non-existing on the uBot-6.

in North America and Europe, a web-based survey was performed and presented in (Rogove et al., 2012). The results indicate that there are no cultural issues creating barriers. Factors perceived to impede the progress relate to regulations and costs. Motives for implementing and maintaining a program are improved quality, filling service gaps, immediate access to patients, provision of clinical support and addressing patient satisfaction. Results from the conduction of focus groups with health care professionals and elderly while as well as individual interviews with a set of users (e.g. engineers, physiotherapists and physicians) from an owner's view were presented in (Michaud et al., 2007). Potential applications for MRP systems included monitoring of autonomy loss and patient abilities, rapid access when released from hospital and remote training of caregivers. Ethical issues regarding the camera and privacy as well as usability issues regarding size and cost of robot were reported in (Michaud et al., 2008).
An interesting pre-study to examine in order to understand cultural differences that could be present regarding MRP systems whose results should be used prior to deployment of a system was performed in (Beer, J. and Takayama, L., 2011) that examined how elderly reacted to the Texai. When being asked with whom they would like to interact, family was the number one motivation for using the system. Concerns raised were mainly due to etiquette privacy and misuse of the system.

2.2 Technical Evaluation Studies

A number of studies have evaluated the technical aspects connected to the robot and the pliot interface. The pilot interface is critical with respect to usability of the system and has been evaluated in terms of effectivness and security of operations, navigation strategies and mental workload. In addition specific technical aspects have been studied to assess if and how much they contribute to usability. In particular semi-autonomy, manipulation and gesturing have been studied in several settings and using different platforms. Finally an important and yet unresolved issue is the problem of lost wifi connection and what to do if this is the case.

Pilot Interface Design. Interfaces used to connect to the robot are as critical as the robot design for creating conditions for successful interaction. A number of studies focus primarily of evaluation and interface design for the pilot users. Efficiency and security of operation were limited by interface design in a pilot study on two MRP systems in (Labonté et al., 2006). The visual information and the control mechanisms impacted performance. In a further study (Labonté et al., 2010), novice pilots performed six different tasks in home-like conditions using three different navigation systems. The compared systems were: (1) Video-Centric Display (VC2D), (2) Augmented Reality Display (AR3D) and (3) Mixed Perspective Exo-centric Display (ME3d). Particularly for women, people over 30 years of age and those working less than 22h a week with computers, the ME3D was the most effective in terms of completion time and quality of commands in moving tasks. The AR3D was preferable in precise navigation tasks. The perceived ease of use and perceived performance was highest for ME3D and lowest for VC2D. The results corroborate previous research findings, e.g. (Baker et al., 2005; Bruemmer et al , 2005; Drury et al., 2003; Keyes et al., 2006; Ricks et al., 2004).
Navigation strategies were studied with ten rehabilitation professionals when performing a set of navigation tasks in unknown, home-like environments 2-3 weeks after receiving training on a user interface (Michaud., et al., 2010; Boissy et al, 2011). It was found that the pilots who were

performing worst used more commands and drove closer to obstacles in comparison with the best pilots. Further, the worst pilots needed less assistance due to keeping a lower speed in general. Also the gaze behavior during the navigation was analyzed and the pilots mostly gazed at the radar area. The authors conclude that the radar area seems to have provided the users with useful feedback on distance to objects.
Another way to measure the quality of a pilot interface design is to measure the mental workload with the NASA TLX test (Hart, 2006). This measure was used together with the USE Questionnaire (Lund, 2001) in (Kiselev and Loutfi, 2012) that describes a study in which 10 partipiants navigated the Giraff by following a dotted path on the floor via different checkpoints and performing a task received along the track of checkpoints.

Semi-autonomy*.* How semi-autonomous functionalities could be used in assisting driving was examined in (Takayama et al. 2011). A number of concrete technical solutions were implemented: 1) create a map of recent obstacles 2) create a trajectory of the free path. 24 users were selected to pilot the Texai through an obstacle course. Measured parameters were time of task (completing obstacle course) and number of errors/collisions. It was found that while the assisted teleoperation helped people to avoid obstacles, also the time to complete an obstacle course increased. A guiding principle is to have two different video profiles: one dynamic used during movement and one for stationary use where a higher resolution might be more desired (Desai et al., 2011). If sensor information is available, it must be correct and provided with timing. In order not to overwhelm the pilot, only the readings relevant for the pilot should be provided. Most users rquested a map in the user interface and a view angle web cam that could be panned or tilted. To safely use the robot, autonomous behaviours, such as follow person and go to a specified location were found to be necessary. This in combination with the ability to pan the camera would aid the pilot in walking conversations, a need that is highlighted in (Guizzo, 2010) where the robot is used in office environments and could be expected to walk at the same speed as local persons.
Semi-automous functionalities particularly for the home environment have also been studied. This is particularly useful for novice pilot users such as health care professionals with little exposure to ICT technologies. Three preliminary studies conducted during the production of the first prototype of Telerobot were reported on in (Michaud et al., 2007). As homes have many physical constraints, e.g. doorsteps, doorframes and carpets, a set of trials were performed exploring different means of navigation. It was noted that position point navigation worked better for untrained pilots while waypoint navigation worked better for trained pilots. Also within the ExCITE project, efforts presented in (González-Jiménez et al., 2012) are made to apply semi autonomous functions. Based on user feedback via questionnaires and interviews from 15 people having driven at least two different Giraffs multiple times, the authors describe algorithmic solutions to automatic docking, detecting obstacles and self-localization on a map.

Manipulation and Gestures*.* As several MRP systems have the ability to provide simple gestures, studies regarding how to provide manipulation and the effect of manipulation have been made both assessing how gesturing is perceived by the local but also how gesturing is enabled on the pilot's side. Pros and cons with hand-gesturing in comparison with control by a mouse or a joystick was discussed in (Ito, 2011). Many of the problems were associated with the need to wear a data glove but it was also found that hand-gestures were more tireding and required the pilot to remember a set of possible gestures. On the contrary, it was found more easy to use for operations such as grasping. The Collabo-Bot, a MRP system with manipulation functionalities under development was also presented in (Ito, 2011).

In (Jouppi, 2002), several factors are needed to experience a location immersive including amoung which manipulation of objects was one[4] were outlined. With the goal to provide benefits of physical travel in an immersive way, (Jouppi, 2002) described a mutually-immersive MRP system equipped with arms that would allow pilots to participate in meetings in remote locations. Using the MeBot platform, (Adalgeirsson and Breazeal, 2010) measured social presence, trust, cooperation and engagement and illustrated that social expressions were ranked higher with a MeBot with a non-static pose among the study participants. In an effort to analyze the interpretability of gestures, facial expressions and perception of a group discussion, (Sirkin and W. Ju, 2011) performed two video studies where they found that facial expressions combined with supportive gestures resulted in more correct interpretations of the expressions, a higher confidence in having understood the expressions and a larger impact of the message than for the case of only facial expressions. The participants considered the collaborator embodied in a static screen without supportive gestures as being less involved in the conversation than a collaborator who could support the facial expressions with gestures. The participants also perceived both the embodied collaborator and the colleagues involved in the interaction as being more composed and involved when the embodied collaborator took a leadership role in the interaction. Spatial location recalling with a similar type of system as MeBot making use of Skype and arms was investigated in (Cabibihan et al., 2012). It was found that participants facing a system with verbal location descriptions being accompanied by robotic pointing gestures remembered more locations in comparison with participants facing a system that only provided verbal descriptions when the locations were presented non-sequentially.

Communication and Robustness*.* When using a MRP system, the pilot of the system is not at the location of the system and as such the pilot cannot push the system back into areas with Wi-Fi coverage in case of a lost connection. Neither can the pilot ask the local users to push the system back as the connection is lost. This issue was discussed in (Jouppi et al., 2004) with the claim that it needs to be addressed before real deployments can be made possible. This is important both due to limitations in range of Wi-Fi but also because metal objects such as elevators can cause invisible network shadows. The solution discussed to overcome the problem is reversing the motion in slow speed until sufficient access to the Wi-Fi is recovered. However, the MRP system needs to halt in case it cannot acquire the connection after a limited amount of seconds as the reason may be due to the network. This solution does not work if new obstacles (i.e. doors) have just closed behind them. The authors further suggested that a light or backup beep could be used to indicate the robot’s intention particularly when it is being unoccupied.

A number of measures of audio and video quality are suggested in (Tsui et al., 2012). These include the ITU-T Recommendation P.805 (ITU-T Recommendations, 2007) for subjectively measuring the quality of speech, P.910 (ITU-T Recommendations, 2008a) for subjectively testing the multimedia content and the PEVQ (Perceptual Evaluation of Video Quality) (ITU-T Recommendations, 2008b) for objectively measuring video signal quality using simulation tests.

[4] According to (Jouppi, 2002), several factors are needed to experience a location immersive including; a wide visual high resolution visual field with colors provided with accuracy, preserved gaze and life-like appearances (i.e. having the same horizontal and vertical visual angles when seen from remote), high-dynamic range of audio with a directional sound field, the ability to move around in the environment and to manipulate it's objects.

3 The User Evaluation Activities in ExCITE

The main objective of the User Evaluation within ExCITE is to gather and analyze continuous data from the user experience with Giraff in a systematic and reliable fashion.

During the project activities we conceived a twofold path for evaluating the Human-Robot Interaction gathering both feedback from short interactions between potential users and the Giraff robot and also focusing on a long-term assessment plan.

More specifically we identified two tracks for our effort:

- ***Short Term Evaluation***, that consists of a collection of immediate feedback of users (both robot users and remote client users) on the Giraff platform, connected to different aspects of the interaction mainly related to the users opinion judgments and expectation on the Giraff platform and the interaction with it. This is in line with the current state of the art analysis and is based on evaluation sessions made after small periods of interaction between Giraff and the users to gather immediate feedback on some aspects identified as relevant. The measures considered for this evaluation are deeply inspired by the analysis of the state-of-the art previously introduced.
- ***Long Term Evaluation***, which is an attempt to go beyond the state-of-the-art in evaluation by studying the long-term impact of the telepresence robot after a long period of usage. In this respect we are studying the influence of Giraff on older users using the system for long periods of time in their natural living environments.

The short term evaluation effort provides immediate feedback that has been used to quickly improve the technological development, to eventually add functionalities to the system or to simply confirm the validity of some technological choice. In addition it helped giving valuable guidance to the long-term assessment. For this reason we adopted a combined approach and we are currently involving participants representative of both types of users: both for the client side and the end user side. The short-term analysis therefore complements but is also necessary for the long term analysis. Specifically, it enables us to obtain significant sample sizes to validate the long-term analysis. As the long-term analysis method in ExCITE is deploying a few number of robots there is a risk that the evaluation – development cycle is lax (less rigid), resulting in a technological changes that oscillates. Said differently, one set of user feedback may directly contradict another set. The short-term evaluation reduces this effect by injecting more significant sample size when validating specific hypotheses.

Different initiatives have been carried out to cover this twofold approach. This document presents the main results from this effort and highlights the technical improvement made to the robot, based on this feedback. In fact, both evaluations have given important input to the GiraffAB company and have contributed to improve the robot, the general Giraff concept and the business plan. Some of these results have also been presented in several scientific articles (see Sections 4.2.1.2, 4.2.3.1, 4.2.4.1).

4 Short Term Evaluation

The objective of this evaluation is to study the user's opinions on different aspect of Giraff robot. Different metrics have been considered for the assessment. Specifically, the variables considered are *usability*, *quality of communication*, *emotional response*, *physical aspect*, *acceptance*, *social presence*, *spatial presence*.

4.1 General Method

Each short-term evaluation session has followed a specific approach that will be described more in detail in the next subsections. However we here describe the general method that we agreed upon in order to perform this type of assessment. The procedure used usually entailed a practical session during which the interested users (both end users and clients) could try the Giraff robot. After the practical session different alternative methods were used to gather feedback on the above mentioned metrics: *focus groups*, *interview*, and *questionnaires*. The best-suited method has been chosen according to the time availability, the number of participants and the specific situation presented in each evaluation session. The following table lists the short-term evaluation sessions in a synthetic way, with a short description of the aspects investigated, and the method and material used. All the evaluation sessions have been conducted till now involving different users from different countries to obtain useful feedback on the Giraff and its applicability. Other sessions are also envisaged in order to increase the number of involved participants and also to obtain a balanced sample of subjects with respect to age, sex, and expertise with technology. Where necessary, specific questionnaires have been created and shared in the intranet of the project and the results of the evaluations have been delivered to the Giraff AB partner to allow improvements.

Short term evaluation sessions			
Evaluation session (Measures)	**Short Description**	**Evaluation Session**	**Participants**
Session 1 *Physical Aspect*, *Usability* and *Communication* (Italy)	A specific questionnaire of 60 items has been designed and administered to participants in order to investigate the physical aspects, ease of use, quality of communication	July 19th 2011 CNR-ASL (Feedback reported to Giraff AB)	44 participants (nurses)
Session 2 *Expectations* and *Desired Functionalities* (Italy)	12 questions aimed at understanding the nurses expectations on the Giraff functionalities and possible applicative uses have been administered to participants	July 19th 2011 CNR-ASL (Feedback reported to Giraff AB)	44 participants (nurses)
Session 3 *Expectations* and *potentialities* of Giraff (Italy)	A 2 hours focus group on the potential of Giraff as an additional means for the operator of Comunità di Sant' Egidio to assist people	April 27th 2011 CNR- Comunità di Sant'Egidio. Feedback form the operator reported in Report: CNR Report Training at the Comunita' di Sant' Egidio (April 2011)	10 operators of Comunità di Sant' Egidio

Session 4 *Ease of use* and *sense of presence* for secondary caregivers and alarm personnel when using Giraff for the first time. Assessment of *spatial configurations*. (Sweden).	Tutorial sessions with alarm operators and health care staff connected to the Swedish test sites	Sep 15th-17th, Oct 2010 at Örebro University Analysis reported in HCI International paper and Int J of Social Robotics	21 alarm operators from alarm company and 11 health care professionals from Örebro municipality.
Session 5 Evaluation of *usability* and *sense of presence* when using Giraff for the first time. (Italy)	Tutorial Session and Usability test with 4 students and 1 professor of the high School - ITIS Archimede of Catania (Ististuto Tecnico Industriale -- Electronics)	On September 16th 2011 at CNR a tutorial on Giraff has been given to 5 people with expertise in Electronics. General feedback has also been gathered through an interview at the end of the usability session. The Q1 questionnaire has also been administrated	4 students (high school) and 1 teacher in Electronics from a high school in Italy
Session 6 Evaluation of *Caregiver attitude* in video-based studies (Sweden)	Video-evaluations with current and future practitioners in different fields within healthcare. Questionnaires varied depending on type of caregiver used.	April and May 2010 at School of Health and Medical Science, Örebro University. An analysis presented at Conference on Medicine and Technology 2010, and Journal of Technology of Human Services.	In total 150 participants (22 nursing teachers, 13 health subjects teachers, 79 nursing students, 25 occupational therapy students and 11 audiology students)
Session 7 *Mobility and driving experience evaluation* (Spain)	A first impressions test about performance and mobility aspects of the Giraff platform	Test done in 5 different houses in Spain	15 people with a high technological profile. Average age 28 (range 24-36), both men and women.
Session 8 Evaluation of *ease of use*, *sense of presence* and *expectations* with alarm operators (Sweden)	Tutorial sessions with alarm operators connected to a Swedish test site	April 27-28 2012 in Örebro, Sweden.	In total 38 participants, 26 filled a questionnaire.
Session 9 Mobility and usability evaluation (Sweden)	Measuring Usability, collisions and Task load	May 4th 2012	10 participants
Session 10 Expectation on and potentialities of the Giraff robot (Italy)	Tutorial and Focus group with medical doctor and operators of the Istituto Oncologico Marchigiano (IOM)	May 18th 2012 in Ancona, Italy	2 medical doctors, 1 psychologist and 1 engineer

Session 11 Spatial configurations. How is the Giraff perceived. (Sweden)	Assessment on how different spatial configurations (Kendon F-formations or not) are perceived by and affects elderly. Guiding tour, retrospective interview on the tour followed by oral questionnaire how Giraff is perceived. At Ängen, Örebro, Sweden.	June 5th and 7th 2012 in Örebro, Sweden	10 elderly (3 men, 7 women)

Table 1 List of the short-term evaluation sessions

A complete report on the evaluation session was not explicitly planned in the original proposal. However we recognize that a more informative document reporting the interesting feedback obtained during both from these sessions and from the test site is useful not only for the development team but also to the whole community. For this reason we list the various feedbacks obtained till now in the next subsection together with more details on each of the evaluation session. It is worth highlighting how these practical sessions often formed the basis for the short-term evaluation and provided a means to gather additional data into the project during the running of the test sites.

A specific effort has been dedicated to systematically gather the feedback from the sessions. It is worth highlighting how some of the results of these sessions are also described in scientific papers (see Section 4.2.1.2, Section 4.2.2.1, Section 4.2.3.1).
The results from this evaluation have been shared among the partners and used by the technological partners to start improving the robotic platform. Specifically, suggestions and feedback on the technical problems, usability problems have been considered for new releases of the Giraff software and changes of the Giraff hardware. These studies have also given important indicators of the acceptance of Giraff by caregivers and health professional.

4.1.1 Usability and Communication: method

In order to assess usability issue of the Giraff robot and quality of communication we run Session 1 and Session 9 already mentioned in Table 1. We briefly explain the method used for both the sessions.

Session 5: we combined an observational technique and a usability questionnaire. Specifically, we relied on the *Thinking Aloud* evaluation technique (Nielsen, 1993), which consists of asking the users to verbalize their thoughts while performing certain tasks and interacting with the system. The experimenter observes silently the interaction session, and records user's actions and thoughts, focusing on the difficulties and problems encountered. In addition, the System Usability Scale (SUS) (Sauro and Lewis, 2012) was also administered.
The SUS instrument is a reliable tool for measuring the usability of a wide variety of products and services. It is composed of 10 statements that are scored on a 5-point scale of strength of agreement. Final scores for the SUS can range from 0 to 100 where scores above 70 indicate products that are at least passable. Scores in the high 70s to upper 80s guarantee products with a good acceptability. Greatly superior products score better than 90.

Five participants took part in our usability experiment (see Figure 2).

Figure 2 Pictures from the "Thinking Aloud" evaluation session: (a) Driving Task; (b) Reading task

Four of them were male students (with a mean age of 18,4) and one was their teacher (male, age 54). The specific choice of this sample was motivated by the fact that the participants were somehow representative of the secondary users we had contacted for the long-term test sites in Italy. Specifically, the main secondary users were: a man with experience in using PC and technology in general and young boys with skill in both computer usage and video games. Our plan is however to enlarge the sample size also considering other age brackets.

All the participants had experience in software and computer and received training prior to the test consisting of a tutorial presentation of 20 minutes and a practical session. After the tutorial each participant received written instructions on specific tasks and how to carry them out. Four main tasks have been considered that can be grouped as the following: (a) *make a video call;* (b) *navigate in the environment;* (c) *read a text through the robot;* (d) *perform the docking.*

During the sessions participants were encouraged to "think aloud" to verbalize their opinions while completing the assigned tasks. The sessions were recorded and the experimenter took notes during the session.

At the end of the test, the SUS questionnaire was administered and a final interview was conducted to understand opinions with respect to the telepresence system experience and to discover further problems and take note of additional advices. Also this interview was recorded. The recordings have been analyzed and experiment results have been written in the form of Usability Aspect Reports (UARs). The detailed UARs are not reported for the sake of space. They have been analyzed and grouped into four main categories of results presented in 4.2.1.

Session 9. The experiment was conducted in the "Ängen intelligent home" for elderly between 3rd and 4th of May 2012.

In this experiment the performance of novice users' in performing some typical tasks was measured. The measurements were done by analysing the time spent by subjects to drive the robot between checkpoints, and the number of collisions made on each part of the path. The performance measurements were supplemented with a mental workload analysis, which was measured with the NASA TLX test (Hart, 2006; Rubio et al. 2004). Although interactions with local users is a typical task for a Giraff system, pure driving performance is vital for pilots to successfully accomplish more sophisticated interaction tasks.

Additionally experimenters use a profiling questionnaire that collects demographical data such as age, gender, education, and usage experience with communication and electronic products (phone, computer, DVD, Skype, video games, cameras, and other). The education level was obtained according to the ISCED 2011 (ISCED, 2011) in order to allow conducting further comparative experiments in other countries with different standards of education levels.

Ten subjects participated in the experiment, six males and four females; average age was 40.7, SD 15.2. Subjects represent different user groups, have different exposure to technology, but none of them have prior experience with using Giraff pilot's interface.

The 35-meter path was drawn in the apartment with bright blue dashed line with arrows. The path had several key points: *docking station (DS)*, *bedroom checkpoint (B), kitchen checkpoint (K)*, *fridge checkpoint (F)*, *goal (G)*. The scheme and a photo of the path can be found in Figure 3.

Subjects start from the docking station, and then they visit bedroom checkpoint and kitchen checkpoint. At the fridge checkpoint they have to read a task. The task for this experiment is to find a circle with number 1 inside the home located on the floor in the living room. This is the goal checkpoint. Its position is the same for all subjects and its main role is to be a reference point for docking performance measurements.

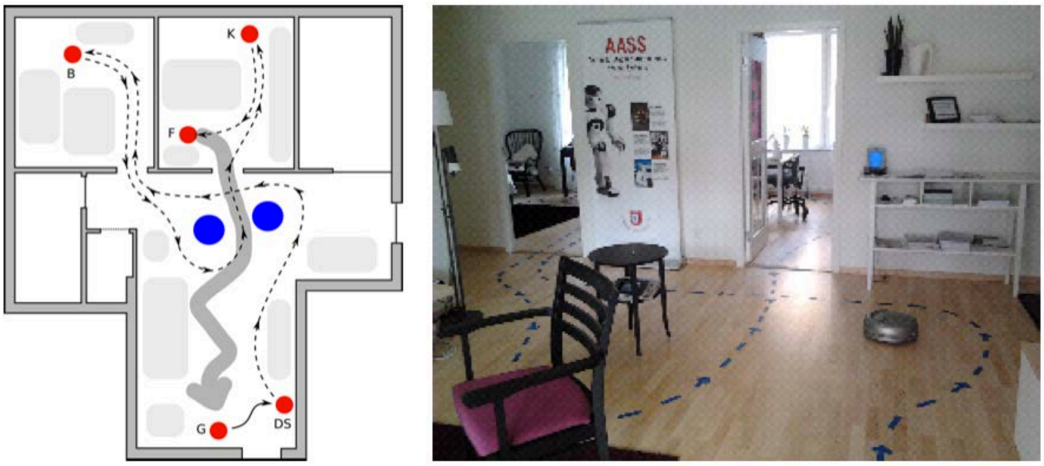


Figure 3 Usability session: experimental settings.
Left: Outline of the Ängen apartment. Dashed line shows a path on the floor which subjects had to follow. Medium gray path-free driving which searching the object on the living room. Red circles - checkpoints: DS - docking station; B - bedroom checkpoint; K - kitchen checkpoint; F - fridge checkpoint; G - goal. Blue circles - artificial obstacles (coffee table, iRobot Roomba); light gray - other obstacles in the environment. Right: An example of the real environment.

The complete procedure of the experiment for each participant consists of several stages. First, each participant was shown a short introductory film about the Giraff system and pilot's GUI. The total length of the film is 2:12 minutes. Then, each participant was given verbal instruction supplemented by a screenshot about how to drive Giraff and which controls should they use. After that the driving section began.

During the driving section each subject had to drive through all checkpoints until they reach the fridge checkpoint. There they had to read their task ("Go to 1") written on the fridge. Then they had to find the G checkpoint in the living room and dock robot from that point back to the docking station. Driving sections were filmed for further analysis. At each part time to approach checkpoint and number of collisions were calculated.

At the final part of the experiment, subjects were asked to fill questionnaires: first NASA TLX, then profiling and finally the USE Questionnaire. All the questionnaires were administered through a web-page[5].

4.1.2 **Secondary User Expectations: method**

An important aspect of the Giraff adoption is the understanding of secondary users expectations on the robot ability to help them in their role of caregivers as well as its ability to improve the communications with the primary users.
During **Session 1** and **Session 2**, we carried out a specific assessment aimed at measuring the mentioned aspects. During both sessions, representatives of the potential visitors of the elderly users were recruited among caregivers, nurses, health workers, and were interviewed. In total forty-four health workers from different specialist areas were contacted for this study. The interviewed sample was composed by 26 women and 18 men with a mean age of 42 years (SD= 12.2) (see Figure 4 and Figure 5).

Figure 4 Photo with secondary users driving the robot at ASL Roma A, Italy

Figure 5 Evaluation session on secondary user expectations: ASL Roma A, Italy

[5] Giraff Pilot User Interface Evaluation Questionnaire. Temporary located at: http://hej-hej.tw1.ru/

The meeting entailed a tutorial presentation of 20 minutes to describe features and functionalities of the Giraff robot. After this tutorial, a practical session allowed participants to operate the system and experience the different functionalities.
Following the tutorial, a focus group was conducted and a final questionnaire was administrated to assess possible applications of the telepresence robot, the perceived advantages and disadvantages of the system, the patient profile best suited to benefit from the use of an aid-based on telepresence.

Similarly we performed **Session 3** with operators (people providing 24h assistance to elderly) of Comunità di Sant'Egidio, a religious community that carries on several initiatives to support poor population.
To this purpose we have performed a training session for the operators. Around 10 operators took part in the study.

We have organized the session as follows:

- *Introduction*: a brief introduction on the main objectives of the ExCITE project
- *Tutorial*, an oral presentation that showed the instructions to operate both Giraff and the client software
- *Practical use*: during a practical session operators had the possibility to operate the Giraff
- *Focus group*: in order to assess the operators' opinion and judgment on the possible use of Giraff for their work, as well as the needed changes to the robot to be considered useful and suitable for their case.

4.1.3 Ease of use and sense of presence: Method

Two tests sites in Sweden have been also inspiring the evaluation of ease of use and sense of presence, plus an additional evaluation session has investigated the spatial configurations through the Giraff robot. Specifically during **session 4** an evaluation was done during a training session preparing pilots of the Giraff system for Testsite 1 – Sweden. In total 32 people received training following a certain script of actions to test the different capabilities of Giraff in a realistic scenario. After the training, a questionnaire assessing the perceived social and spatial presence as well as ease of use was filled by the participants.

Similarly, **session 8** enabled a second evaluation during a training session preparing pilots of the Giraff system for Testsite 5 – Sweden. In this case, a total 38 people received training following a certain script of actions to test the different capabilities of Giraff in a real environment. After the training, a questionnaire assessing the perceived social and spatial presence, ease of use and expectations was filled by 26 of the participants.

Session 11. The experiment was conducted in the "Ängen intelligent home" for elderly on June 5th and 7th 2012. In this experiment, we followed up on the results from Session 4 in which 7/21 chose to look-away while talking to an elder about a medical matter. The main objective with Session 11 was to assess whether this behaviour would be acceptable by the intended local users of Giraff or whether they would prefer the Kendon F-formation vis-a-vis (Kendon, 1990). The Session 4 also served the purpose to collect local user input regarding the design of Giraff.

There were ten participants in the experiment, three male and seven women (age range: 61-82, mean age: 72, SD=7.36).

The elderly were guided around in the Ängen intelligent home by a pilot either choosing a look-away formation or a vis-a-vis formation. Upon completing the guiding tour consisting of four steps, a second researcher asked the elder to follow to an adjacent room in which a retrospective interview was performed. The researcher started audio recording the interview and showed the elder a movie of the first step in the guiding tour. After the movie, the elder was asked to respond to a few questions regarding the first step. The interview continued with the same procedure for step two, three and four. After having seen all movies and responded to all questions regarding the steps, the elder was asked to respond to a set of questions regarding how they perceived the Giraff itself.

4.1.4 Caregiver attitude in video-based studies: Method

During **Session 6** a video-based evaluation, using the "Hello Pat" video was performed at the School of Health and Medical Science at Örebro University, Sweden. The evaluation focus lay on the perspectives of primary healthcare organizations and collected the feedback from different categories of healthcare professionals. In total, the study included 150 participants (students at the Audiology, Nursing and Occupational Therapist programs and teachers at the different programs) and yielded unexpected results with respect to the acceptance of the Giraff system. The study procedure was that the participants watched the video after which they were asked to respond to a questionnaire.

4.1.5 Giraff mobility assessed by technological users: Method

An evaluation of the driving experience of the "visitors" using the current version of the Pilot software has also been performed.
During **Session 7**, we have deployed Giraff robots in 5 different houses in the province of Malaga (Spain) which were teleoperated by a total of 15 people (both genders), see Figure 6 as an example of driving task in one of the apartment.

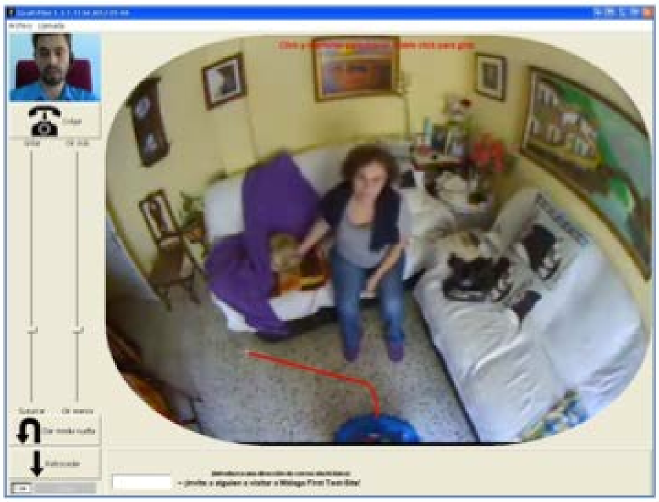


Figure 6 Assessing the driving experience

The average age of the drivers was 34 years (from 24 to 49 years), and they had different technological skills. All of them used the Pilot application for the first time and experienced several driving sessions with at least two different Giraff robots (and therefore places).

4.2 Results

4.2.1 Usability and Communication: Results

4.2.1.1 Analysis of users feedback

Session 1: overall the interface was judged usable, even though some specific problems emerged. The detailed UARs have been examined and organized according to four main categories:

1. ***Video and audio***: the control and audio quality were judged overall very good. The video instead has been considered not completely satisfactory. The quality seems, in fact, sufficient to allow for general navigation in the environment but not entirely satisfactory in case you need to perform specific visual inspections such as reading a text or recognize the state of some specific objects within the environment. One solution would be to improve the quality of the camera and also to provide it with a zoom feature.
2. ***Navigation***: the navigation in the environment was generally satisfactory. Some difficulties were encountered when the robot had to move in extremely narrow spaces or with obstacles. A suggestion from participants regards the possibility to insert a map and an indicator that gives hints on the position of the robot within the environment. This feature could possibly be superfluous in case the secondary user is a son or a person who knows the environment in which the elderly live. On the contrary, it would be particularly useful if the secondary user were a person less familiar with the explored environment (e.g. a formal caregiver or a health professional). In addition some autonomy for helping the remote operator of the robot, when the driving is more critical could ease the navigation.
3. ***Client Interface***: the client interface was satisfactory. The commands for the control of the robot have been judged as clear and easily identifiable. A possible improvement concerns the indicator of the level of charge that could be implemented with a more visible color or through a flashing signal that would attract the attention when the battery is reaching a critical level.
4. ***Docking***: this was the most critical functionality from the point of view of usability. At least half of the participants had difficulties with the docking. This is both because of poor video quality, and the manual docking conducted without visual aids. Possible solutions to this problem are: implementation of an automatic docking functionality or alternatively, providing the base with more visible indicators (e.g. colored) and simultaneously put directional indicators in the interface which can “guide” during manual docking.

As for the SUS usability questionnaire, results show that the Giraff Pilot application scored 77 of 100 points. This result can be interpreted as an index of a good acceptability and ease of use. Therefore, the general usability assessment was quite good, though some aspects could still be improved.

Some common aspects emerged also from the analysis of the content of semi-structured interview. Specifically, referring to the experience of use, participants were asked to judge the interaction through the robot relying on a semantic differential with six adjective pairs on 6 point scale. The participants agreed in judging the telepresence experience as active, participatory and exciting. The Giraff's height was judged adequate but its base was considered cumbersome.

Session 9: Observing user behaviours along with collecting user reports and opinions is an important step in UI evaluation. The analysis of video and conversations with the participants highlighted the following main findings:

1. ***Video resolution / quality***: It was clearly seen while setting up the experiment that when our task is written by pen or pencil it can not be recognized by remote users. Experimenters had to use more contrast black marker and large font in order to make the task visible.
2. ***Control over robots behaviour***: Two subjects, who have experience with computer games, reported that they would want to have more control over robot's behaviour and using keyboard seems to be more convenient for them. At the same time other participants reported that they are happy with current mouse-based control, as it does not require any specific skills to control the robot.
3. ***Pointing at objects of interest***: One of the most important observations shows that all subject tend to at least initially click at the point of interest (e.g. docking station or checkpoint) by mouse pointer when they start driving.

It was clearly observed, that screen tilt functionality should be implemented in a different way. In fact, the mouse is used to control both the robot and tilt movements, then, interfering sometime one with each other. Nevertheless, the current user interface is easy to learn and use, which is clearly seen from the results of the USE questionnaire and supported by mental workload analysis and users' reports. Although the proposed method looks promising in principle, we are interested in adding objective mental workload or either user satisfaction measurements into the current procedure. Also the USE questionnaire must be refined as well to overcome its known bias problem and applicability.

4.2.1.2 Publications

The results of this evaluation are part of the two following papers:

- Cesta, G. Cortellessa, A. Orlandini and L. Tiberio. *Into the Wild: Pushing a Telepresence Robot Outside the Lab*. Submitted to the Ro-man 2012 Workshop on Social Robotic Telepresence, Paris, France.
- Kiselev and A. Loutfi. *Using a Mental Workload Index as a Measure of Usability of a User Interface for Social Robotic Telepresence.* Submitted to the Ro-man 2012 Workshop on Social Robotic Telepresence, Paris, France.

4.2.2 **Secondary User Expectations: Results**

Session 1 and **Session 2**: Results have been grouped according to the following categories:

1. ***General assessment***: a first analysis of the results showed a positive reaction of the participants to the system. In particular 66% of participants would be willing to use Giraff as an aid support in his/her profession and no one opposes to the use of robots (see Figure

7 left). In addition most of them judge the telepresence robot as a better tool with respect to traditional teleconference system like Skype (see Figure 7 right).

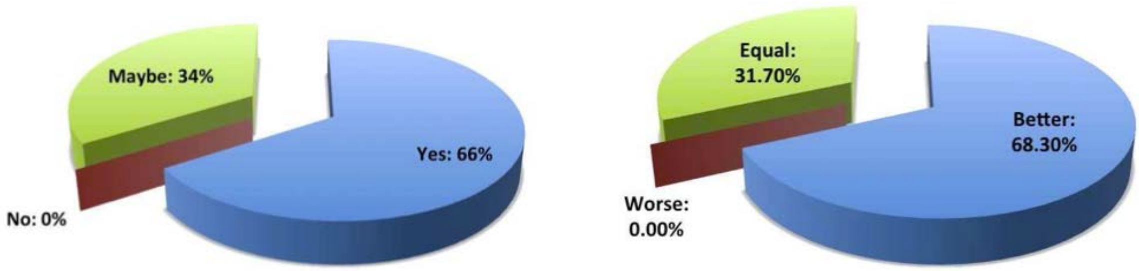


Figure 7 General assessment of the Giraff system
(a) Willingness to adopt it; (b) qualitative comparison with traditional teleconference systems like skype

2. ***Profile of potential users***: results also identify the categories of people who could benefit from the use of telepresence robots: specifically, the category "self-sufficient or semi-autonomous elderly living alone" has been mentioned by 35% of respondents; 25% of the subjects also indicates "adults and elderly patients in home care and with special needs", such as patients in isolation for infection, dialysis patients or with chronic diseases such as Chronic Obstructive Pulmonary Disease (COPD) or diabetes. A 20% of the responses were grouped into the category "older adults with early or mild dementia". Two other categories were "adults or older adults with physical disabilities" (17%) and "young people and adults with intellectual disabilities" (7%).

3. ***Application domains***: the participants are in favor of the use of robots to train the family caregiver to small nursing tasks and to maintain constant contact with assisted older adult. The possibility of continuous monitoring (see Figure 8) of the patient at home is considered the most useful application (59% of participants were in favor of this kind of application). The support application follows at 23%, while the companionship and communication applicative domains seem less suitable. More specifically, 45.5% of the health workers advocate the use of the robot to train a family caregiver to perform small nursing tasks (e.g., treat a bedsore, administer an enema, measuring of vital signs) and to maintain a constant contact with the patient and his family (75% of participants). Finally 60% of participants also says that the robot could alleviate the workload of the family caregiver, but not that of the health workers themselves (50% of people admit to be uncertain about the real possibility of the robot to diminish their daily workload).

4. ***Advantages and Disadvantages***: among the advantages in using the robot, participants listed the following: a) ability to monitor remotely via visual communication the physical state of health; b) possibility to follow the management of medication and certain health practices (e.g., control of vital parameters such as level of blood glucose for diabetic patients, supervision of practices related to their care and medication like deep breathing exercises for patients with COPD); c) the possibility for the operator to improve his/her night surveillance activity in hospital and home care cases. Among the disadvantages they reported the poor quality of the video, the bulky size of the base unit, the fact that the robot might not be suitable for all patients, issues related to cost and privacy.

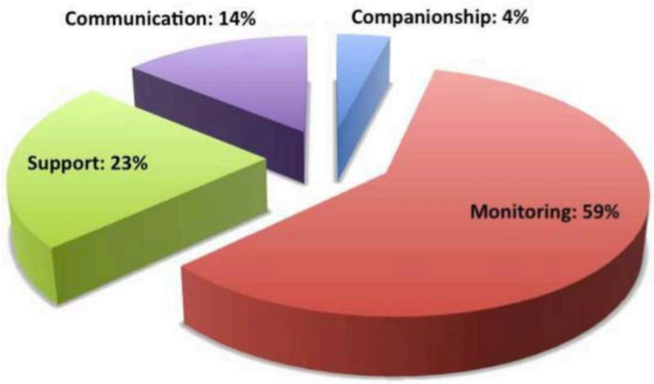


Figure 8 Favourite Giraff's domains of application

5. ***Suggested improvements***: The focus group conducted at the end of this analysis, highlighted some aspects considered as particularly relevant for using the platform in the healthcare domain for long-term period. These aspects specifically refer to improvements and integration of additional functionalities. Specifically, the need exists to improve the video quality, as well as to consider the *night vision* capability; it would be useful to add the zoom functionality to the webcam; the battery duration and recharging modality should be improved (e.g., it would be better if the robot could reach autonomously the docking station); the safe navigation of the robot should be guaranteed. In addition it would be beneficial to enable the call transfer if the client is not connected to the robot via the PC. Finally the transmission of vital parameters to the doctor should be supported.

Session 3: Results from the focus group conducted with operators of Comunità di Sant'Egidio highlights a list of improvements that the Giraff robot would need in order to be more suitable for their specific case.
In the following we list a set of suggested improvements:
Power on / off with one pressure: Operators suggested that for elderly people the push and pull lever currently used might be a bit counterintuitive. A better solution according to them would be a simple push button to switch the Giraff both off and on.

Emergency call on cell phone: Operators reported that the current implementation of the emergency call (from the end user to the client) entails that the operator is always in front of a PC. In their specific case, this might not be always guaranteed. To this purpose they judge as extremely useful a service that sends the call also to their cell phone (e.g., through a text message or a pre-recorded message).

Transfer the authorization of emergency calls: A suggestion from the operators is the possibility for the system to transfer the "rights" to make an emergency call (from the client side to the end user). It may happen for instance that a family member is not able to make an emergency call (e.g., he/she is driving a car) but still needs/wants to do it. The idea would then be to enable her/him to transfer her/his permission to the operator or to another person who usually can only make normal calls.

Navigation Safety (obstacles avoidance): All operators were particularly worried about the safety issue during navigation. Obstacles avoidance is a key functionality to implement for them.

Automatic search of the elderly: Operators suggested that a useful functionality would be the ability of Giraff to automatically search for the elderly. If for instance the operator suspects that the elderly is not feeling well and wants to quickly check visually, he/she can make an emergency call and asks Giraff to quickly search for the elderly.

Automatic docking to the charging station: Operators suggested that a useful functionality would be the ability of Giraff to autonomously go to the charging station

Webcam zoom: Operators suggested that it would be very useful to have zooming functionality of the webcam.

4.2.2.1 Publications

These results are contained in the following two papers:

- Cesta, G. Cortellessa, A. Orlandini and L. Tiberio: *Addressing the Long-term Evaluation of a Telepresence Robot for the Elderly*. ICAART (1) 2012: 652-663.
- Cesta, G. Cortellessa, A. Orlandini and L. Tiberio: Evaluating Telepresence Robots in the Field. In J.Felipe, A. Fred (Eds). Agents and Artificial Intelligence. ICAART 2012 Revised Selected Papers. CCIS Series. Springer (To appear 2013).

and the already mentioned:

- Cesta, G. Cortellessa, A. Orlandini and L. Tiberio. *Into the Wild: Pushing a Telepresence Robot Outside the Lab*. Submitted to the Ro-man 2012 Workshop on Social Robotic Telepresence, Paris, France.

4.2.3 **Ease of use and sense of presence: Results**

Session 4: The participants had a realistic spatial presence and did not try to reach or touch people in the Giraff environment, yet felt spatially there. They felt the interaction was socially rich, e.g. it was more immediate than remote, more responsive than non-responsive etc. Summarizing, the different dimensions of presence assessed had high internal consistencies indicating that the Temple Presence Inventory (Lombard et al. 2009) and the Networked Minds Social Presence Inventory (Biocca and Harms, 2002) are suitable for use in the social robotic telepresence systems setting. The Giraff pilot and its navigation system was perceived as easy to use.

Additionally, 21 of the participants, alarm operators at Tunstall were more thoroughly assessed via video recordings which is reported in Kristoffersson et al. (2012). Here, the focus lays on analyzing to spatial formations occurring during the training and how these related to the perceived presence and ease of use. During the different steps in the script we expected different spatial formations to occur based on what is normally observed in human-human interaction. Indeed most, but not all, chose these spatial formations. However, in a situation where it would be natural to face each other, 7 out of 21 pilots chose not to turn the Giraff towards the person they were "visiting", coded as look-away. The results of the study show that there exist relations between the spatial formations and the perceived presence. In the cases of existing relations, the perceived presence was higher when doing the "normal" spatial formation. We further found that pilots, whose behaviors deviated from the hypothesized, often correlated to a decreased perception in terms of ease of use. We believe a reason for deviating behaviors may be that the communication is somewhat distorted, for example the Giraff's camera provides the pilot with a wide angle view. Some of the pilots with a deviating behavior were also observed navigating the system with more difficulty. We further believe that, improving the user interface to allow easier rotation of the robot in order to choose the right spatial formation could increase the perceived comprehension of thoughts and intentions of the other would increase the quality of the interaction for users of social robotic telepresence systems. However, the system has two simultaneous users and the primary user's perception of the quality of the interaction needs to be studied as well. A follow up study doing that will be described in the Section describing the user evaluations planned within ExCITE.

4.2.3.1 Publications

- Annica Kristoffersson, Silvia Coradeschi, Kerstin Severinson-Eklundh & Amy Loutfi (2011): Sense of Presence in a Robotic Telepresence domain, In Proceedings of HCI (6)'2011, 479-487
- Annica Kristoffersson, Sivlia Coradeschi, Amy Loutfi & Kerstin Severinson-Eklundh (2011): Towards Evaluation of Social Robotic Telepresence based on measures of Social and Spatial presence, In Proceedings of 1st Workshop on Social Robotic Telepresence held at HRI'11.
- A. Kristoffersson, K. Severinson Eklundh and A. Loutfi: *Measuring the Quality of Interaction in Mobile Robotic Telepresence: A Pilot's Perspective.* In International Journal of Social Robotics, DOI: 10.1007/s12369-012-0166-7.

Session 8: Repeating the results of the study described in Session 4, the internal consistency values for the TPI dimensions show good to high internal consistencies. The perceived presence in the different dimensions were also almost identical. During Pearson correlation analysis we found several dependencies, surprisingly there was no differences between the ones who also took part of the teaching reported in Session 4 and the true beginners. The pilots who were not observed having problems with moving were perceiving a lower social richness during the use of the Giraff. They also had higher expectations on the use of the Giraff, similarly to the ones having a habit of playing computer/video games. Those who had habit of using video communication seemed to feel a little more present and have higher expectations. The ones who were not observed having problems docking showed a higher engagement (Mental immersion). Although there were few men in this study they thought it was easier to do a u-turn and felt as if they were in the environment visited to a higher extent than the females. Checking for what hand is used for typing the right handed (N=22) thought it was easier to do windows related tasks (start application, log in and connect to robot) than the left handed (N=3). They also thought the experience was more exciting. The ones who reported they had problems with sight had less problem knowing they were docked than the ones who reported no problems with sight.
Some problems with the interface were noted in the questionnaire data. Only 7.7% could tell where the battery status icon was situated and 23.1% responded it was not given in the system. 53.8% chose the "I don't know" option. Troublesome is also the confusion on how to adjust the pilot and the Giraff volume. When asked to adjust the local user's volume during the training most participants didn't notice they had buttons beside the videofeed and generally chose the right

slider (adjust pilot volume) when finally trying to adjust the volume of the Giraff (left slider). Yet 23.1% stated you should use the right slider to adjust the volume of the Giraff. Only 53.8% answered correctly, left slider. When asked how to adjust their own volume 46.2% said you should use the left slider but only 34.6% the correct, right slider.
The observing experimenter noted other problems occurring in the showcase apartment containing many more items, e.g. a vacuum cleaning robot. When asked to dock, many tried to dock the adjacent Roomba instead of the grey Giraff docking station. The problem is likely due to the visibility of the docking station. As can be seen in Fig. 9, there are many items present including two Giraff docking stations (one white not connected to power and one functional grey) and a black vacuum cleaning robot. Although being in a room with good lighting conditions, the item which is the least visible is the functioning docking station. The problem is not due to obstacles, the path towards the docking station was cleared. Additionally, several participants asked how they should direct the camera (facing the wall or the room) when docking.

Session 11: From the interview transcriptions it is clear that the Giraff needs to be turned towards the elderly, as in Ex.1 – 3.

- Ex. 1 "[…] it should be turned towards me. The contact is needed."
- Ex. 2 "The eye contact was there, I think that part is important."
- Ex. 3 "I almost had to move myself so that I could see her. […] I should see the one I talk to."

The look-away formation could also cause an insecurity on where to stand for the elderly, see Ex.4.

- Ex. 4 "[…] I tried to move myself to see better and then it turned out that I should have stayed where I was because the object in front of me was what she would talk about."

Further, the male participants expressed concerns about seeing the Giraff from the back:

- Ex. 5 "It felt a bit strange when she had turned towards the table in the kitchen. I was instructed to go there but it felt weird to see her from the back so to say."
- Ex. 6 "She turns the back on me when leaving the bedroom. I do not know if she could possibly back out and keep interacting with me on the way out. Technically it should not really be so difficult huh so that we can keep the eye contact.
- Ex. 7 "I was sort of insecure whether I should go ahead of or follow her when she was going to the bedroom.

Also an analysis of the video data was performed that revealed that elderly being welcomed by a pilot using the look-away formation moved themselves towards a vis-a-vis formation while interacting. When the pilot described different objects, the elderly tended to shift their focus towards the objects both by turning the head and at times moving towards the objects.

The Giraff height was at times perceived as too high, it should be adjustable to better fit sitting conversations. The bottom of the Giraff was seen as being too big although the elderly had an understanding of the size being needed for stability. There is no consensus regarding what colour Giraff should have; white, metallic, grey, yellow, green, red, blue are all mentioned. The

Giraff screen should not be smaller, rather maybe a bit bigger so that the entire face of the pilot fits. The majority of the elderly thought the Giraff looked steady. They were not worried about Giraff potentially driving into objects. There was a mixed perception on whether the Giraff's movement was shaky of soft, the shakiness was mostly noted when passing thresholds.

The perceived audio- and video-quality leave room for improvements. The video image needs to be sharper and the entire face of the pilot needs to fit in the image. The elderly noted a certain delay in the sound and an echo. One elder expressed it as similar to what is typical in an empty room.

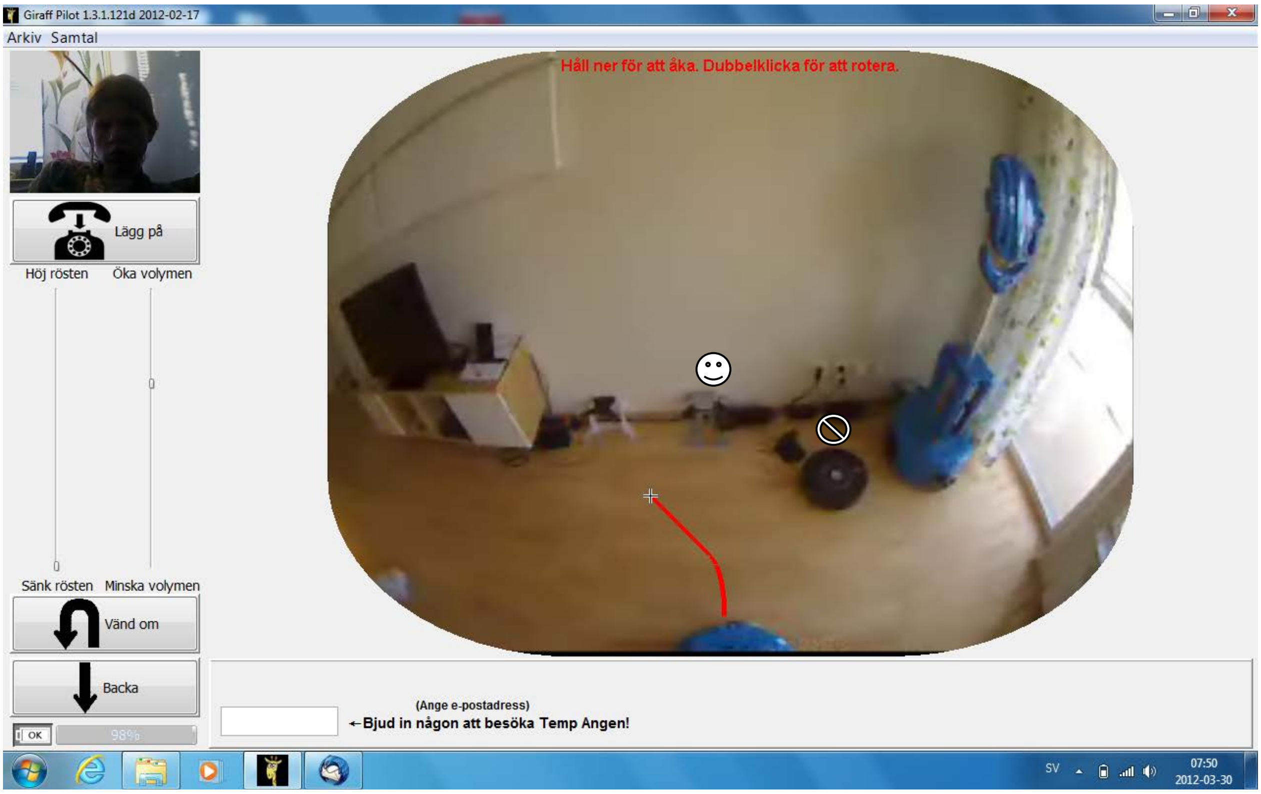


Figure 9 The docking station denoted by the smiling face and the vacuum cleaner with the forbidden sign.

It was also noted that you can apparently turn when you are moving backwards. Many chose to back on the video screen instead of using the button. It could be that they didn't see the button since surprisingly many chose to turn manually instead of using the button in a very narrow area in the kitchen. The tilting functionality was not obvious; almost everyone asked how to look up. A second problem with the tilting functionality related to the office environment at Tunstall was that they instead of using a mouse use a rolling bar as a pointing device, see Fig. 10. Built in to this feature is that the users can push the "left mouse button" by pushing the bar while moving it. This featured caused several of movements in a forward direction while trying to tilt the Giraff screen.

Figure 10 - Example of rolling bar mouse

4.2.4 **Caregiver attitude in video-based studies: Results**

Session 6: The results of this study showed that a great exposure to technology does not necessarily increase acceptance. There were large variances between different categories of health professionals. The nursing teachers and teachers in occupational therapy were more positive to the technology than their students indicating that the teachers could play a large role in introducing new technologies to students with their experience and attitude. A consistent concern in this study was that the technology would be used to replace people suggesting it is difficult to obtain objective feedback if not addressing the underlying concerns.

4.2.4.1 Publications

- Annica Kristoffersson, Silvia Coradeschi, Amy Loutfi & Kerstin Severinson-Eklundh (2011): An Exploratory Study of Health Professionals' Attitudes about Robotic Telepresence Technology, Journal of Technology in Human Services, 29:4, 263-283
- Annica Kristoffersson, Silvia Coradeschi, Maria Lindén & Amy Loutfi (2010). Robotic telepresence – a healthcare professionals' perspective, In abstractproceedings from Medicinteknikdagarna 2010

4.2.1 **Giraff mobility assessed by technological users: Results**

Session 7. The driving experience of the Giraff robot has been assessed by a group of technological users. In the experiences, we have deployed Giraff robots in 5 different places in the province of Malaga (Spain) which were teleoperated by a total of 15 people (both genders). The average age of the participants was 34 years (from 24 to 49 years), and they had different, but in general high, technological skills. All of them used the Pilot application for the first time and experienced several driving sessions with at least two different Giraffs (and therefore places). We collected their opinions regarding several aspects, which were evaluated from 1 (poor/difficult) to 5 (good/easy) (see Table 2).

Analyzing the results, aspects like the impression about the driving experience, the appearance of the interface, and the learning curve, received the higher marks, which highlight the ease of teleoperating the robot. On the other hand, the lowest mark is for the camera image quality, which hampers the visitor to be aware of obstacles in the surroundings, and limits some maneuvers like the docking operation, which has been also identified as a tricky task.

Questions	Evaluation
Giraff general driving	4
Difficulty of moving in a straight line	4
Difficulty for turning	3,75
Camera image quality	3,375
Screen tilt movement	3,625
Pilot Interface	4,25
Learning curve	4,75
First general impression	4,25
Difficulty for docking	3,375

Table 2 Results of the evaluation of some aspects of the Giraff driving experience Scale 1-5 where 1= poor/difficult and 5=good/easy.

Additionally, personal interviews with end-users have revealed that, in spite of the utility of the Giraff telepresence robot, some of the issues raised in this evaluation, e.g. difficulty for docking, may hinder the communication and interaction with the elder person, which is the ultimate aim of the system. Concretely, users have identified three possible points to increase the autonomy and improve the interaction experience with Giraff, namely 1) Automatic docking, 2) Obstacle detection and warning, and 3) Information about the Giraff position (localization).

5 Long-Term evaluation

5.1 Design of a common methodology

One of the original features of the EXCITE project consists of realizing long-term experiments involving elderly using Giraff in their normal environment both to communicate with other persons and to receive assistance services. In this perspective, the project entails the instantiation of several case studies in three countries and the creation of an evaluation plan, based on interviews and questionnaires to be administered to the elderly (end users) and to the family members, friends and caregivers (clients).
Designing the evaluation with different types of users and situations entailed an effort to prepare materials and adjust the procedure according to the specific case. For this evaluation we distinguish among situations in which the elderly interacts with a health care institution (formal care giver), a family member caring for the elderly (informal caregiver), and a family member or friend who interacts solely for social purposes. The three situations have been distinguished because the type of questions for both the client and the end user depends upon the type of interaction for which Giraff is used.

Figure 11 gives a general idea of the designed method to evaluate features over time. The evaluation entails a period of N months (with $3 \leq N \leq 12$) during which the end user has the robot at home and the clients can visit him/her through it. Assessment happens at milestones S_i.

Specifically, after an initial assessment (S_0 in figure) at the beginning of the experimentation (baseline), the variables of interest are measured at regular intervals (S_{1-3}) to observe changes over time. At the last month the Giraff is removed from the end user apartment and the same variables are assessed again after 2 months from this removal (S_4). The general idea is to use a repeated measures method to see changes over time during the long term usage of the robot.

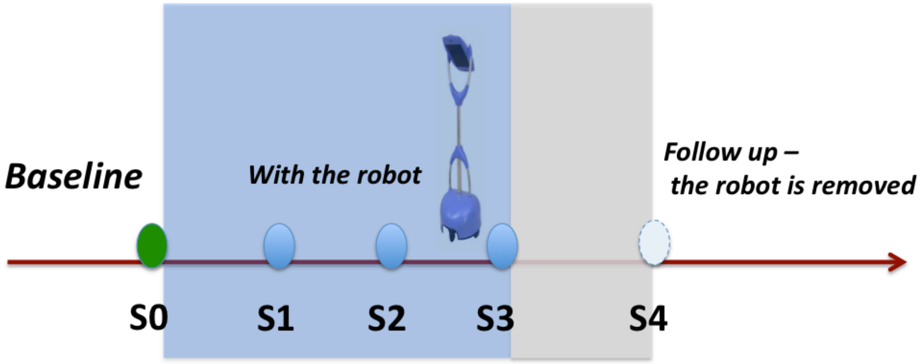


Figure 11 The Long Term Evaluation timeline

5.1.1 Participants and Procedure

As already mentioned three different cases have been identified to cover different situations in which the robot can be deployed. Specifically, for the secondary user typology we considered (a) a formal caregiver belonging to a Health care organization; (b) a family member (informal caregiver); (c) other relatives or friends who may visit the elderly person through the robot. The type of material used in the long-term evaluation for both the client and the end user depends upon the type of interaction for which the telepresence is used. For this reason, for each of the three mentioned situations we had developed (or selected) a set of questionnaires (almost all validated in the three languages of the involved countries) aimed at monitoring specific variables and to be administrated at specific time both to end users and to clients.

5.1.2 Material

Table 3 lists in detail the different variables and the related instruments to be used to measure the variables over time.

5.1.2.1 Client side

Specifically on the client side, during the initial step (S0), we use: (a) an informed consent form describing the aim and procedure of the study; (b) the socio-demographic data form to gather some relevant information on the user; (c) we developed on purpose a questionnaire aimed at assessing the client expectation on the Giraff's ability to ease the support (Support Expectation). It is worth highlighting that we developed two slightly different types of questionnaires for the formal and informal caregivers, while for the other relatives and friends category we designed a questionnaire (Influence on Relationship Expectation) on the expectation on Giraff as a means to ease and support the remote communication and consequently the social relationship.
During the following step (S1), for all three types of secondary users introduced above we use: (a) questionnaires based on the SUS inventory (Sauro and Lewis, 2012) to assess the usability of the

client software; (b) we ask participant to keep a diary to register the "salient" events of the visit through telepresence in terms of encountered problems, good features and so on.
During the subsequent step (S2), in addition to the diary that clients have to keep along the whole experience with the robot, we make a first assessment of the Giraff's to ease the support (or the communication) between the client and the end user through the Support Assessment and Impact on Relationship Assessment questionnaires. In addition, during this phase we also use the Temple Presence Inventory (Lombard 2009) that is a tool to measure dimensions of (tele)presence and the Networked Minds Social Presence Inventory (NMSPI).
At step S3 we use the Positive Affect Negative Affect Scale, PANAS, (Terracciano et al, 2003), the Psychosocial Impact of Assistive Devices Scale, PIADS, (Jutai, 2002) and a final structured interview to assess the overall experience in terms of the most relevant variables considered in the study. After two months from the robot removal, S4 allows assessing the impact of its absence through the Support Assessment questionnaire.

5.1.2.2 End user side

For the end user receiving the robot we followed a similar approach, but we focused on some additional variables that is worth dwelling on (see Table 3). Specifically, we measure: (a) the perceived loneliness through the UCLA Loneliness Scale (Russell et al., 1980), which was developed to assess subjective feelings of loneliness or social isolation; (b) the perceived health status through the Short Form Health Survey (SF12) (Ware et. al., 1996); (c) the Multidimensional Scale of Perceived Social Support (Zimet, 1988); (d) Geriatric Depression Scale (Yesavage et. al., 1983): a modified version of the Health Service Satisfaction Inventory. Finally the Almere (Heerink et al., 2010) model that allows assessing dimensions of technology acceptance.
In Table 3, measures highlighted in bold ensure the repeated measures thus allowing to observe the Giraff's influence by changes in response over time. In fact, it is worth underscoring how this evaluation plan allows monitoring the human-robot interaction over time, thus contributing to understand the long-term impact of a fully deployed robotic solution.

Table 3 Long-term evaluation: variables measured along the phases (S0-S4) and related material

Phases	S0	S1	S2	S3	S4
			Client		
Health Professional	**Consent Form**, **Socio-Demographics Data Form**, **Support Expectation**, **Diary**	**Usability**, **Diary**	**Support assessment**, Temple Presence Inventory, Networked Minds Social Presence Inventory, **Diary**,	**PANAS**, **PIADS**, **Final Interview**, **Diary**	**Support Assessment**
Family member	**Consent Form**, **Socio-Demographics Data Form**, **Support Expectation** (informal carer), **Diary**	**Usability**, **Diary**	**Support assessment** (informal carer), Temple Presence Inventory, Networked Minds Social Presence Inventory, **Diary**	**PANAS**, **PIADS**, **Final Interview**, **Diary**,	**Support Assessment** (informal carer)
Relatives friends	**Consent Form**, **Socio-Demographics**	**Usability**, **Diary**	**Influence on Relationship**	**PANAS**, **PIADS**,	**Influence on Relationship**

	Data Form, **Influence on Relationship Expectation**, **Diary**		**assessment** (informal carer), Temple Presence Inventory, Networked Minds Social Presence Inventory, **Diary**	**Final Interview**, **Diary**	**Assessment**
End User					
Elderly	**Consent Form**, **Socio-Demographics Data Form**, Loneliness (UCLA), Short Form Health Survey (SF12), **Multidimensional Scale of Perceived Social Support**, Geriatric Depression Scale, **Almere model**, **Health Service Satisfaction Inventory** (if applies)	Loneliness (UCLA), **Multidimensional Scale of Perceived Social Support**, Geriatric Depression Scale, **Attitude Acceptance**, **Health Service Satisfaction Inventory** (if applies)	Temple Presence Inventory, **Almere model**	Loneliness (UCLA), Short Form Health Survey (SF12), **Multidimensional Scale of Perceived Social Support**, Geriatric Depression Scale, **Almere model**, **PANAS**, **PIADS**, **Final Interview**	Loneliness (UCLA), Short Form Health Survey (SF12), **Multidimensional Scale of Perceived Social Support**, Geriatric Depression Scale, **Health Service Satisfaction Inventory** (if applies)

5.2 Setting Up and running the test sites

A specific task of the project has been dedicated to find users groups representative of different realities (e.g. healthcare professional, healthy and not healthy elderly, nurses, relatives, friends, etc.) in the three countries involved in the project. Test sites for each country have been selected and the chosen test sites have been used to start gathering qualitative and quantitative data on the interaction between Giraff and the users (both the end users, i.e. the elder at home and the client, i.e. the family members or caregivers visiting the elderly).
This activity has required a huge amount of work due also to unexpected problems experienced in the different countries. This Section describes the test site protocol that we have identified to carry out the test sites.

5.2.1 Test site protocol

A test site protocol has been created in order to be used as a reference point in each country to select and conduct a test site properly and in a uniform way. While the test site protocol is included as an appendix (See Appendix A), it will be briefly summarized here.

The test site protocol reflects the observations of the researchers when implementing the test sites and consists of several forms:

- **Potential Test site Physical Description and Short description of Elderly Users**.
  Prior to establishing a test site, it is important to collect basic information about the test site and to consider a number of aspects that could significantly impact the successful

running test of sites. The description should include a physical description as well as a description of all likely users participating at the test site. The form should be used to decide if a test site is to be started or not.

- **How to provide training and Introduction to all Users**
  After a test site is selected, the project, the Giraff robot and the pilot interface need to be properly introduced to all potential users and in some cases training needs to take place. The form contains steps that need to be taken.

- **How to prepare a test site for installation**
  The form contains steps that need to be taken when preparing a test site.

- **Deployment and Installation of the Giraff**
  Basic information about the deployment of the Giraff. This phase includes steps to assess whether there are blind wifi spots in the test site, map drawing, making a test call etc. It also includes a checklist on what questionnaires need to be filled in conjunction with the deployment.

- **Running of test sites**
  A monthly summary of each test site should be filled with some specific information.

- **Conclusion of a test site**
  All the steps need to be taken when concluding a test site, like for example cancelling Internet connection if it was required to set up the test site, fillings of final questionnaires etc.

- **Regular questionnaires**
  The primary and secondary users should fill a set of questionnaires regularly. A checklist on which questionnaires and when to fill in them is included in the test site protocol.

5.3 Test sites history

The implementation of the test sites has been a rather challenging activity due to several unexpected events that occurred during the implementation that also contributed to design and strengthen the implementation protocol. Specifically, before achieving a steady state in running the complete series of planned test sites several attempts were necessary. In this section we provide the whole picture of the work listing all the test sites from the beginning of the project so far. Specifically, for each country (Sweden, Spain and Italy) we report the following information:

Name of the test site: Test sites are denoted by TestSite_X_Y(z), where X refers to the country and Y is the test site ID. In case of interrupted test sites, z is used as an additional indicator.

Type: one among *Private residence*, *Rehabilitation Center, Elderly residential home*

Start Date: the start date of the test site

End Date: the end date of the test site (if closed)

Location: the country and the area

Status: the status of the test sites

- Prematurely ended due to some problems -- red
- On going successfully -- yellow
- Successfully ended -- green

Primary End user: A description of the primary end user

Secondary End user: A description of the secondary end user

Additional Comments: An additional explanation of the test sites status

In the rest of this section we list the tables of the test sites in each country.

5.3.1 Test Sites in Sweden

In Sweden we have till now a total of 7 test site attempts of which, 3 *prematurely ended* and replaced, 1 *successfully ended* and 3 still *on going* following the evaluation plan. In the following we report a table for each test site explaining the main features. Section 5.4.1 reports the initial feedback gathered from each test site.

TestSite_Sweden_1(a)				
Type	**Start Date**	**End Date**	**Location**	**Status**
Private Residence	November 2010	March 2011	Rural area, Örebro Sweden	**Prematurely Ended** (replaced by TestSite_Sweden_1(b))
Primary End User	The first test site in Sweden was the home of an elderly couple in Örebro. The wife received assistance from professional home help and her home was equipped with an alarm service. She was the intended user of the Giraff.			
Secondary End User	The Giraff was used by her city council, Örebro City Council, and alarm central company (Tunstall AB) to contact the couple. A total of 32 persons that could be contacting the couple via Giraff received a short course on how to use the Giraff. They also filled questionnaires after the trials to collect their first impressions of the Giraff.			
Additional Comments	The test site was started in November 2010 and unfortunately the wife passed away in March 2011. The husband did not want to keep anything that reminded him of the wife.			

TestSite_Sweden_1(b)				
Type	**Start Date**	**End Date**	**Location**	**Status**
Rehabilitation center	March 2011	November 2011	city, Örebro Sweden	**Successfully Ended**
Primary End User	People in need of rehabilitation after e.g. strokes visit the rehabilitation center regularly (1-2 times per week).			
Secondary End User	Occupational therapist connects to the Giraff and interacts with the elderly.			
Additional Comments	Interaction takes place during coffee breaks as well as during actual training. A questionnaire based on the Almere model was used to evaluate the elderly's perception of the Giraff at the rehabilitation center.			

TestSite_Sweden_2				
Type	**Start Date**	**End Date**	**Location**	**Status**
Elderly residential home	March 2011	March 2012	Töre (rural area North of Sweden)	**Successfully Ended** (Continued by TestSite_Sweden_2PersonA
Primary End User	Elderly resident in the building			
Secondary End User	Relatives and organization supporting the residential home			
Additional Comments	The robot was installed in Töre in March 2011. This was the first testsite in a larger living facility in Sweden and therefore, a decision was made to include an early installation of the Giraff robot to allow a longer familiarization to the robot. This was particularly necessary in order to ensure that the robot would be exposed to the tenants. An information trip was made to Töre in August 2011 in which the project was. Töre is physically located far from Örebro and while this was a driving motivation to use this testsite as it justified the placement of the Giraff, technical problems which arose were difficult to support. Töre is also the first testsite in which the Giraff could be used to transverse very large space – as the living complex is very large and contains a number of interlinked buildings each with individual apartments.			

TestSite_Sweden_2PersonA				
Type	**Start Date**	**End Date**	**Location**	**Status**
Elder living at the residential home (test site 2)	March 2012	June 2012	Töre (rural area North of Sweden)	**Prematurely Ended**
Primary End User	Elder resident in the building			
Secondary End User	Relatives			
Additional Comments	During the Grand opening of test site 2, a television channel was filming. At tv we could see the woman expressing interest in using the Giraff to keep in touch with her daughter with family who lives in Johannesburg, South Africa. The woman has fiber in her apartment and wanted to be able to use the Giraff also within her home. Due to the fact that the test site was at distance, a pre-configured router to which the Giraff should be able to automatically connect was sent to the woman. The woman already had another router that was used to provide the woman with internet and television services. The router would be connected to this router through an rj45 cable. A decision was taken to end also this test site in June 2012.			

TestSite_Sweden_3			
Type	**Start Date**	**Location**	**Status**
Rehabilitation center	December 2011	city, Örebro Sweden	**Ongoing**
Primary End User	People in need of rehabilitation after e.g. strokes visit the rehabilitation center regularly (1-2 times per week). Description individually follows below.		
Secondary End User	Occupational therapist connects to the Giraff and interacts with the elderly.		

Additional Comments	This testsite is in the same locality as testsite 1b, but with new user group. Interaction takes place during coffee breaks as well as during actual training. Each newcomer to the group coming to the rehabilitation center on Wednesday have been asked to participate in the ExCITE long term study and fill out questionnaires in the longterm plan of ExCITE regularly. The rehabilitation center moved temporarily between locations from February – June 2012 due to reconstruction work. Person a: The woman started in the Wednesday group on Feb 29th 2012 and was introduced to the Giraff and ExCITE. She was then asked to participate with long-term feedback in the project by filling in questionnaires regularly. Person b: The man started in the Wednesday group on Feb 29th 2012 and was introduced to the Giraff and ExCITE. He was then asked to participate with long-term feedback in the project by filling in questionnaires regularly. After two weeks the man says he has been discussing having a Giraff at home with his wife and requests a meeting about this. Preparation for a test site 5 begins. Person c: The man started on April 18. Person d: The woman started on May 9. More persons have started in the group but we estimate that they cannot answer the questionnaires. We inform all persons starting in the group about the Giraff and the ExCITE project. If we believed that the person could answer questionnaires we asked the person to do that. The people connecting to the robot write a comment for every time they connect to the robot and put it in a log.

TestSite_Sweden_4			
Type	**Start Date**	**Location**	**Status**
Private residence	January 2012	city, Örebro Sweden	**Ongoing**
Primary End User	Elder woman who lives in her own residence who wishes to compare Skype and Giraff (with the extra mobility) with her family.		
Secondary End User	Two of the woman's sons with families, one of which lives in the Republic of Fiji (Pilot A) and one (Pilot B) who lives outside Örebro. The woman's brother (Pilot C) who lives about 150 km from her is also a secondary end user.		
Additional Comments	The main previous means of interaction between the primary and two of the end users (Fiji and brother) is Skype. The son outside Orebro sees the woman every week but they are interested in testing the Giraff for communication as well. All users fill out questionnaires regularly following the long term plan of ExCITE (see Section 5.1).		

TestSite_Sweden_5				
Type	**Start Date**	**End Date**	**Location**	**Status**
Private residence	Initial contacts March 2012, Deployment April 2012		city, Örebro Sweden	**Ongoing**
Primary End User	A man who has had a stroke that lives with his wife.			
Secondary End User	Son and grandchild in Portugal. Alarm operators from Tunstall (See Test site 1).			

	Other possible users are occupational therapists, formal caregivers, wife.
Additional Comments	The person is the same as Testsite 3 (Person b). The man uses a stroller and is lame on the right half of the body after the stroke. The wife is worried about that he sometimes loses the balance and falls over the stroller. The wife feels that this could assure her that her husband is safe if she goes away on shorter trips or to their summer holiday house. They wish that they could also use the Giraff in their summer house or at least that the wife could connect to it when she is there, however as they only have mobile internet available there, the ExCITE team cannot promise this. Contacts were immediately taken to prepare Tunstall and the issue of falling was brought up with them. Late April 2012, 38 alarm operators took a training course in driving the Giraff after which they were asked to fill an adopted S0 questionnaire.

5.3.2 Test Sites in Spain

In Spain we have currently 4 test sites *ongoing*. In the following we report a table for each test site explaining the main features. Section 5.4.2 reports the initial feedback gathered from each test site.

TestSite_ Spain_1			
Type	**Start Date**	**Location**	**Status**
Private residence	May, 2011	Málaga, Spain	**Ongoing**
Primary End User	A widow woman around 65 years old living with one of her sons, but spending a lot of time alone. She tries to be occupied but she is lacking of personal relations: she only meets the relatives from time to time. All of the communication with them are made through phone calls given she is not a technological user, and thus, does not use computers, nor is familiarized with videoconference, although ADSL connection is present in the site. The main need of this person is to be connected to some of their relatives in a more personal manner than a mere phone call.		
Secondary End User	Relatives, one daughter living in a town more than an hour from Malaga, a son in the same city (Malaga), and a nephew living in France. A first impression test about the performance and mobility aspects of the Giraff platform were conducted at UMA considering ten people with a high technological profile. The average age is 28 years (from 24 to 35 years) of both sexes.		
Additional Comments			

TestSite_ Spain_2			
Type	**Start Date**	**Location**	**Status**
Private residence	November, 2011	Estepona (Málaga), Spain	**Ongoing**
Primary End User	A widow man of 80 years old who lives alone at home. He is self-sufficient but needs on-site attention, by means of interviews, in order to check the evolution of their mental abilities, as well as routine medical attention, like revising the medication, monitoring the blood pressure, temperature, blood sugar level, etc.		
Secondary End User	Relatives, health center in Estepona (Málaga)		
Additional Comments	The second Spanish test site is managed by a professional team of a health center in Estepona (Málaga), within the public Health Andalucian Service ("Distrito Sanitario Costa del Sol - Servicio Andaluz de Salud". Since this Health Center is at a very touristic area in the Costa del Sol, other potential users of Giraff at this test site may include foreign residents in Spain with relatives living in other European countries. Thus, apart from the local assistance carried out by nurses or caregivers, an additional benefit to evaluate is how Giraff can improve or facilitate social and family relationships.		

TestSite_ Spain_3			
Type	**Start Date**	**Location**	**Status**
Private residence	January, 2012	Coín (Málaga), Spain	**Ongoing**
Primary End User	A widow woman of 77 years old living alone at her house. Since she is in a wheelchair, she is not self-sufficient and needs a caregiver at home, who does the daily chores and assists her. She is glad to participate in the ExCITE project and hopes to be in a closer contact with her relatives through the Giraff, especially with her grandchildren, who live in other cities of Andalucía. An internet connection with a wifi signal provided by a router was available, though the elderly woman has not notions about computers and new technologies.		
Secondary End User	Relatives and friends		
Additional Comments			

TestSite_ Spain_4			
Type	**Start Date**	**Location**	**Status**
Private residence	March 2012	Estepona (Málaga), Spain	**Ongoing**
Primary End User	An English couple who lives in the Costa del Sol. He is a former pilot, now retired, of about 75 years old. Although both of them are self-sufficient they have some heath issues that require periodic monitoring and checking. They are also willing to have the Giraff to establish more frequent and friendly connections to some friends and relative in UK.		
Secondary End User	Relatives, professionals from the health center in Estepona (Málaga)		
Additional Comments	This test site is also managed by a professional team of a health center in Estepona (Málaga), within the public Health Andalucian Service (“Distrito Sanitario Costa del Sol - Servicio Andaluz de Salud” given the health problems of the primary user. Serious health problems of this primary user together with limitations of the internet connection in the health center have significantly reduced the number of connections in this test site. For this reason, it is being considered the replacement of this test site.		

5.3.3 Test Sites in Italy

In Italy we currently have a total of 7 test sites attempts of which, 3 *prematurely ended* and replaced, 4 still *on going* following the evaluation plan. In the following we report a table for each test site explaining the main features. Section 5.4.3 reports the initial feedback gathered from each test site.

TestSite_ Italy _1(a)				
Type	**Start Date**	**End Date**	**Location**	**Status**
Private Residence	Initial contacts in October 2010	December 2010	Rome	**Prematurely Ended** (replaced by TestSite_Italy_1(b))
Primary End User	The first attempt of a test site in Italy was that of a private home of a woman with a reduced mobility capability, who lives with a caregiver and spends much of her time at home receiving weekly visits from her daughter who lives in the same city. The woman has two other sons who live far away and Giraff could have offered the possibility of increasing the frequency of contact with them. In this first case, we experienced many problems with Internet connection at the old woman apartment that prevented a robust use of the robot. These initial problems discouraged the old woman and contributed to reduce her interest toward the experimentation. Additionally she had health problems and she decided to end her participation in the experimentation			
Secondary End User	Relatives, especially her daughter			
Additional Comments	The test site ended due to participant's mild ischemia, which occurred in December 2010.			

TestSite_ Italy _1(b)				
Type	**Start Date**	**End Date**	**Location**	**Status**
Private Residence	Initial contacts in July 2011	September 2011	Rome	**Prematurely Ended** (replaced by TestSite_Italy_1(c))
Primary End User	This woman lives alone in an apartment and is in contact with her relatives and friends as well as an operator from a Charity organization Comunità di Sant'Egidio and her daughter and nephew.			
Secondary End User	An operator form the charity organization and his son			
Additional Comments	There is a cultural aspect connected to the Italian case that seems to discourage the use of such a technology. Privacy issues have been raised, connected to the internet connection use. Privacy issue; psychological fears were the main reasons for ending the test sites			

TestSite_ Italy _1(c)				
Type	**Start Date**	**End Date**	**Location**	**Status**
Private Residence	Initial contacts in October 2011	November 2011	Rome	**Prematurely Ended** (replaced by TestSite_Italy_1(d))

Primary End User	This woman lives alone in an apartment and is in contact with her relatives and friends as well as an operator from a Charity organization Comunità di Sant'Egidio and her daughter and nephew.
Secondary End User	an operator form the charity organization and her daughter and nephew
Additional Comments	Participant's illness and hospitalization were the reason for ending the test site

TestSite_ Italy _1(d)			
Type	**Start Date**	**Location**	**Status**
Private Residence	January 2012	Grottaferrata (20Km from Rome)	**Ongoing**
Primary End User	A couple of old people living in the countryside near Rome. The man has reduced mobility, while the woman has problems with her sight. They are quite independent although their health condition is slowly deteriorating. Their son lives in Rome and visits them on a regular basis (usually once a week).		
Secondary End User	The son living in Rome city centre (very busy person who uses computer for work) and their nephew (skilled videogamer)		
Additional Comments			

TestSite_ Italy _2			
Type	**Start Date**	**Location**	**Status**
Health care organization	Initial contacts in January 2011	Rome	**Ongoing**
Primary End User	The aim of this test site is to investigate the use of Giraff as a tool for rehabilitation of Mild Cognitive Impaired patients. The robot is under test at the center since the beginning of 2011. In collaboration with the center a protocol has been set up to first assess the emotional response of a sample of elderly people with mild cognitive impairment in terms of stress and anxiety to the Giraff physical presence. End users are 17 older adults.		
Secondary End User	A therapist at Istituto Don Gnocchi.		
Additional Comments	It is worth highlighting how the use of Giraff in a context different from a private residence and also involving fragile people has entailed the need to introduce a preliminary evaluation phase to understand the emotional reaction of this people to the interaction with a therapist trough Giraff. This also entailed a specific effort to obtain the Ethical Approval of the study.		

TestSite_ Italy _3			
Type	**Start Date**	**Location**	**Status**
Private Residence	May 2012	Rome	**Ongoing**

Primary End User	A very active 74 years old woman living alone in Rome is the end user of this test site. The woman suffers from depression and feels often alone. She likes the idea to use Giraff as a way of increasing her social communication with the external world.
Secondary End User	Her grandchild and daughter are the main current secondary users. Additionally we have also recently involved day care center that provides weekly connection to the woman. The center usually provide daily social support to elderly and people in need.
Additional Comments	Initial problems with the internet connection delayed a bit the achievement of the steady state of this test site. The problem are now solved apart some sporadic events due mainly to the internet service robustness in Italy.

5.4 Long-term evaluation initial results

In this section we provide a summary of the main results gathered from each test site in the three countries. Specifically we report the feedback obtained from both the successfully on-going or ended test sites and form the prematurely ended ones. These last cases also contributed to the data gathering and can be specifically considered as an important source of information for risk of failures and lack of acceptance of this kind of technology.

5.4.1 Results from Test Sites In Sweden

5.4.1.1 TestSite_Sweden_1(a)

TestSite_Sweden_1(a)				
Type	**Start Date**	**End Date**	**Location**	**Status**
Private Residence	November 2010	March 2011	Rural area, Örebro Sweden	**Prematurely Ended** (replaced by TestSite_Sweden_1(b))
Feedback and Results				

Some important feedback from the alarm operators at Tunstall who piloted the Giraff was given.

(1) Alarm operators who had never visited the homes of the primary Giraff users, gave the feedback that they needed a map to find their way around and to find the docking station when done using the Giraff. The map included the position of the docking station
(2) Due to the fact there were many alarm operators and possibly stressed situations, Tunstall expressed there was a need for visible signs on what is straight forward on the Giraff
(3) alarm operators had problems docking the Giraff, this was both due to spatial constraints and an insecurity in driving straight forward.

When deploying the Giraff, Tunstall visited the house and sketched a blueprint of all rooms, on this map the docking station was marked. At the operating station at Tunstall a map and a description of where the docking station was positioned was placed at an available space. A vertical line in a colour differentiated from the Giraff cover was put on the cover to mark out the straight forward direction.

During the run of the test site we had continuous problems of the Giraff being discharged. Although education was given to the elderly, their caregivers as well as the alarm operators, it wasn't enough.

(1) Not all caregivers understood the need for the docking station to be continuously positioned against the wall and how exactly the Giraff needed to be put in the docking station.
(2) The design of the docking station was not satisfactory on a leaning floor and an uneven baseboard and required that a book was placed behind it. This book was occasionally removed during cleaning situations.

It was also discovered that the system that the home care service in Örebro municipality used to log their visits temporarily disconnected the couple's phone and ADSL line (and thereby also the Giraff) for a few minutes after each of their real visits in the couple's home during which data was transmitted to the system. Further, it was discovered that the security alarm that the couple used to connect to Tunstall in case of alarms, similarly to the logging system disconnected the ADSL modem from internet for a short while. The security alarm session had to be disconnected for a short while before Giraff came online again to allow Tunstall to connect through the Giraff instead of through the regular alarm service. However, due to the fact that the couple primarily wanted Tunstall to connect through Giraff only if there had first been a quiet alarm that had been followed up by Tunstall attempting to call the couple via the regular phone which is the regular way of handling quiet alarms at Tunstall, this was not considered an issue.

Overall the couple was happy with having the Giraff. The Giraff had a prototype version of the remote control (a mouse with a *yes* and a *no* button), the functionality was understood by the couple. They appreciated the answer/reject function. The couple also understood they could turn the Giraff off as well as reboot it by pushing/pulling the button on the Giraff cover. The couple appreciated they were able to decide if they wanted to answer or not as well as the possibility to allow some people emergency access (this was given to the alarm service and the health care workers). However, due to the weak health they were unable to push the Giraff into the docking station properly if needed.

5.4.1.2 TestSite_Sweden_1(b)

TestSite_Sweden_1(b)				
Type	**Start Date**	**Type**	**Start Date**	**Type**
Rehabilitation center	March 2011	November 2011	city, Örebro Sweden	**Successfully Ended**
Feedback and Results				

A common problem with the Giraff was that it was "Unavailable" which required frequent restarts. The pilot also experienced a latency in the sound compared to the image resulting. Also the elderly commented on the low synchronization. A possible reason pointed out is that the pilot's computer is connected to the private municipality network while the Giraff is on the public municipality network. However at about the same time as the Testsite was renamed to be a longterm test site, a new software arrived and was installed at the Giraff.

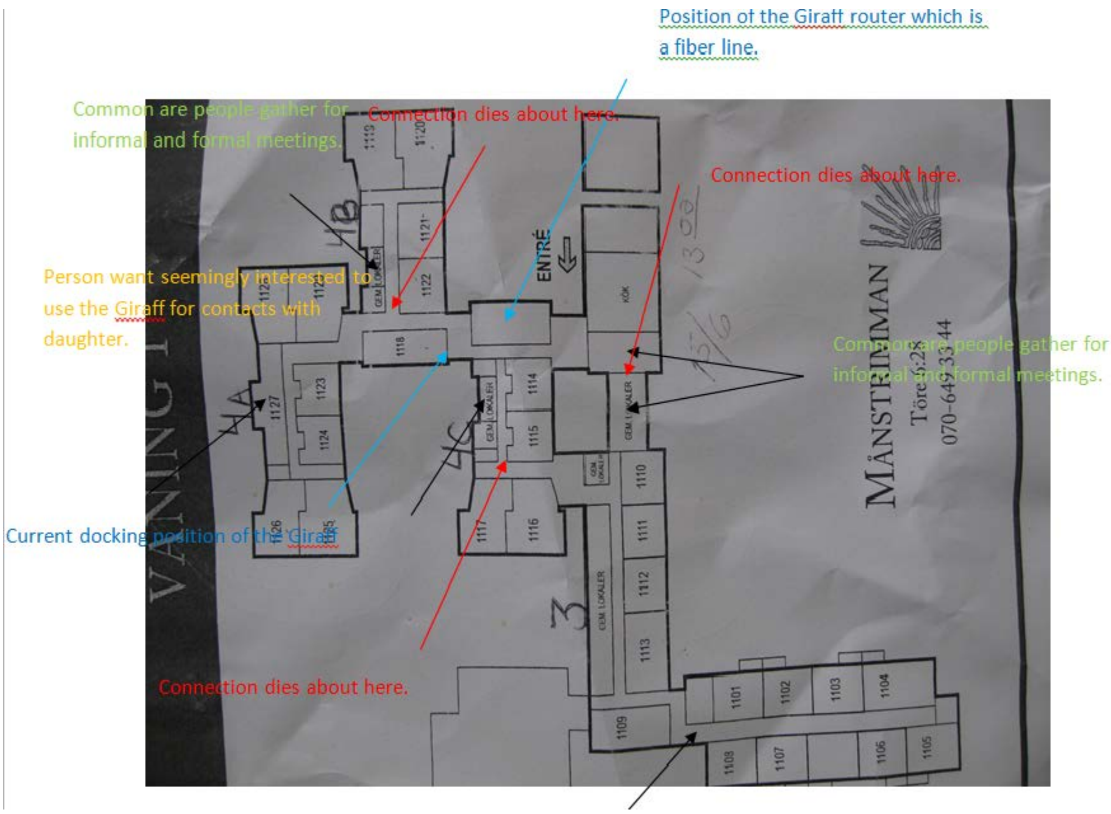
At the end an Almere questionnaire was handed out but the response is really varying between respondents. Clearly one of the respondents did not like the Giraff and responded all questions with 1 and wrote that the Giraff was totally unnecessary while others were more "open" and responded to each question separately. Several people had difficulties filling in the questionnaire and were thinking it was too long.

It should be noted that these people did not have the Giraff at home and who they talked to via the Giraff was the head of the unit whom they also met frequently which could have increased the feeling of it being an unnecessary tool.

5.4.1.3 TestSite_Sweden_2

TestSite_Sweden_2				
Type	**Start Date**	**Type**	**Start Date**	**Type**
Elderly residential home	March 2011	March 2012	Töre (rural area North of Sweden)	**Successfully Ended** (continued by TestSite_Sweden_2PersonA
Feedback and Results				

The size of the living complex presented a key challenge in setting up of this test site which provide userful feedback to a technical bottleneck in the Giraff system but also a potential issue with other telepresence solutions. As the robot was used throughout the corridors a key technical issue arose which related to the need of the Giraff to switch routers during a calls to maintain a strong connection. Alternative communications such as 3G are not sufficient to maintain a good connection speed with the unit, however, more crucial, cannot ensure enough reliability when steering the Giraff and presents a sasfety hazard. A thorough analysis of the network strength was made and a system of repeaters was used to extend the network range.



The result of the extension with the repeaters was in part successful however network speed was reduced packet sent is in fact “repeated” across the entire network, causing much redundant packats. As contacts were made in the building, a strategic decision was taken to install the Giraff near the apartment of a resident. The resident selected was PersonA and a new testsite was created – TestSite_Sweden_2PersonA. The conclusion was made that the Giraff unit without a more robust netwok connectivity offered perhaps with a 4G network, is not yet technically adapted for large residential living. An elaboration of the tests performed and the internal memo which resulted in provided in Appendix B.

5.4.1.4 TestSite_Sweden_2PersonA

TestSite_Sweden_2PersonA				
Type	**Start Date**	**End Date**	**Location**	**Status**
Elder living at the residential home (test site 2)	March 2012	June 2012.	Töre (rural area North of Sweden)	**Prematurely Ended** (replaced by TestSite_Sweden_2PersonA
Feedback and Results				

While installation of the Giraff was to occur within an apartment in the Töre living facility technical problems arose again caused by the fact that the router interfered with the current cable provider of television and telephone. As Töre, small hamlet in the north most regions of Sweden, has little alternative options for infrastructure, after deliberation it was decided to end this testsite prematurely. The experience in Töre was undoubtedly useful as it showed that the unit still required to adapt to a number of current technical challenges . It also justifies the need to focus explicitly on the communication aspects in the project. While communication infrastructure required for video conferencing can work with a stable wired connection. There are several aspects which non-trivialise the communication intended not only for a mobile device but also for a mobile device whose movement should not jeopardize the safety of the occupants. This feedback was delivered to Giraff AB.

5.4.1.5 TestSite_Sweden_3

TestSite_Sweden_3			
Type	**Start Date**	**Location**	**Status**
Rehabilitation center	December 2011	city, Örebro Sweden	**Ongoing**
Feedback and Results			
The test site is ongoing. So far four new people have started in the Wednesday group. One of them was immediately positive enough to become Test site 5 which has been deployed in April 2012. The other person has so far only filled the Baseline S0 questionnaire and it is too early to do any analysis. More people are expected to start in the Wednesday group and participate in the study during the spring.			

5.4.1.6 TestSite_Sweden_4

TestSite_Sweden_4			
Type	**Start Date**	**Location**	**Status**
Private residence	January 2012	city, Örebro Sweden	**Ongoing**
Feedback and Results			
Initially only positive feedback from the users. The primary user has filled the S0 questionnaire and the S1 questionnaire. The pilot A has filled the S0 and S1 questionnaire. Pilot B and C have filled the S0 questionnaire due to becoming pilots of the Giraff at a later stage in time than Pilot A. Diaries are being filled by the pilots. Regarding the connection between Pilot A and the primary user there is some delay in image and sound but they do not experience it as a larger problem than what they already have experienced when Skyping between Fiji Islands and Sweden. Early April the Giraff stopped working and was replaced with a new robot. After some initial deployment problems of that robot, the Giraff seem to function well.			

5.4.1.7 TestSite_Sweden_5

TestSite_Sweden_5			
Type	**Start Date**	**Location**	**Status**
Private residence	Initial contacts March 2012,	city, Örebro	**Ongoing**

	Deployment April 2012	Sweden	
Feedback and Results			
The primary user and his wife are eager to get the Giraff installed. Internet has been ordered and the plan for the start-up is being discussed with Tunstall. The wife wants to evaluate the system from her perspective, it is investigated how to do this. All important feedback. Need to include also Tunstall feedback			

5.4.2 **Results Test Sites in Spain**

5.4.2.1 TestSite_Spain_1

TestSite_Spain_1			
Type	**Start Date**	**Location**	**Status**
Private residence	May, 2011	Málaga, Spain	**Ongoing**
Feedback and Results			

Regarding the primary user side, there are different and diverse issues reported:

(1) The primary user switches the Giraff on when she is expecting a call. The rest of the time the Giraff is disconnected.
(2) Sometimes the internet connection went down and the primary user did not notice that event. The possibility of a special warning for this issue would be convenient.
(3) Another important point is that this user complains about noise during calls. She added that this noise disappears when the secondary user uses headphones
(4) Finally, this Giraff experienced problems related to the charging process of the batteries. Some times when the Giraff is docked at the charging station the robot is slightly displaced without any intervention and remains disconnected from the charging contacts.

From the secondary users perspective:

(1) The video quality is not adequate. This secondary user experienced problems to visually distinguish, for example, the meal on the plate of the primary user.
(2) Interruptions of internet connection and time lags for the communication. Sometimes this kind of problems was solved when the router was reset.
(3) Regarding to the robot teleoperation, users from this test site reported problems to maneuver the Giraff or to carry out the docking at the charging station, particularly in cases of delays in communication.

5.4.2.2 TestSite_Spain_2

TestSite_Spain_2			
Type	**Start Date**	**Location**	**Status**
Private residence	November, 2011	Estepona (Málaga), Spain	**Ongoing**
Feedback and Results			

This test site is progressing correctly. This primary user is comfortable with technology and is very receptive to cooperate with the project.

From the primary user side, the most relevant inputs are related to the inclusion of new features:

(1) This primary user wants to be able to make a call when he feels alone or in the case of an emergency or an urgent care.
(2) As a second contribution, this user pointed out the benefits of making the primary user able to teleoperate the Giraff. Thanks to this new feature, this primary added that he would feel great helping inexperienced secondary users to teleoperate the Giraff in difficult manoeuvres. On the other hand, he considered this feature useful in the case that he needs to move the Giraff for any reason.

There is no relevant feedback from the secondary user side in this test site.

5.4.2.3 TestSite_Spain_3

TestSite_Spain_3			
Type	**Start Date**	**Location**	**Status**
Private residence	January, 2012	Coín (Málaga), Spain	**Ongoing**

Feedback and Results

Some important and structured feedback from the users involved in this test site was given.
From the primary user perspective:

(1) There were some problems with the availability of the Giraff because this primary user forgot to switch it on. The reasons for switching the Giraff off were the noise produced by the internal computer at night and electricity consumption. So, when the primary user knows that is very unlikely to receive a call (e.g. at night, early in the morning...) she disconnects it.
(2) An issue during this period was the identification of a malfunction of the router placed at the primary user house. The Giraff and router were switched on, everything seemed to be working properly for this primary user but the Giraff wasn´t available because the router did not have access to internet service.
(3) The main request of this primary user is to be able to make calls in case of necessity or emergency.

Secondary users contributions:

(1) Secondary users reported as uncomfortable event, the fact that everything was dark when the primary user accepts the call. This happens because the Giraff is docked in a room that usually has the lights off and the primary user accepts the call from another room.
(2) Complaints about the quality of the video image. The secondary user argues that it is difficult to perceive states of mind or emotional states of the primary user.
(3) Related to the previous point, secondary users required the possibility to zoom in or out in order to highlight a region of interest.

Finally, regarding the issue of a secure teleoperation, the secondary users pointed out the importance and convenience of having some obstacle detection and/or avoidance in the robot.

5.4.2.4 TestSite_Spain_4

TestSite_Spain 4			
Type	**Start Date**	**Location**	**Status**
Private residence	March 2012	Estepona (Málaga), Spain	**Ongoing**

Feedback and Results

This test site is the worst in terms of feedback and conclusive results.
This older man had high expectations in the benefits of his participation in the project, but the results are not as expected, for several reasons:

(1) The number of secondary users is very limited. He is living in Spain, but he was born in England and always worked outside Spain. The involvement of his relatives and friends abroad as secondary users was expected to be more frequent.
(2) Internet connection problems in the Health Centre where this man is receiving long term care, limited the involvement of health professionals as secondary users.
(3) Finally, this primary user experienced health problems three months after he joined the ExCITE Project. These problems confined him to bed for a long time, his wife doesn´t express interest in technologies and usually the Giraff is not available.

In conclusion, the replacement of this test site is being strongly considered.

5.4.3 Results Test Sites in Italy

5.4.3.1 TestSite_Italy_1 (a)

TestSite_Italy_1 (a)

Type	**Start Date**	**End Date**	**Location**	**Status**
Private Residence	Initial contacts in October 2010	Ended in December 2010	Rome	**Prematurely Ended** (replaced by TestSite_Italy_1(b))

Feedback and Results

This first site soon highlighted specific problems for Italy.
The main problem is related to the internet connectivity and bandwidth. There are several areas even in a big city like Rome where the internet connectivity is not particularly reliable. This entails communication problems that create some discouragement to participants.
The internet problems were however related to both the pilot and to the end users side. Indeed even though we could manage to have a rather acceptable connectivity in Rome, the secondary user wanted to use the Giraff pilot from a house she has in a small country in the rural side of a different region in Italy.
This was really challenging. In addition the Italian houses are usually very small and some help in the navigation systems to avoid smoothly the furniture has revealed to be necessary.
For this specific primary user, the Giraff size was really a concern. This suggested for instance the possibility to make the height of the robot adjustable according to users' preferences.
Another problem highlighted by this test case was the fact that usually in Italy elderly does not have the internet connection, neither they are willing to activate it. Even for experimental purposes this was really difficult due also to the general slowness of the internet provider companies have to activate the service. In this respect a solution could be for instance to rely on the mobile broadband connection so as to give to users a "closed solution" ready to be used.
Another problem highlighted by this test site was the fact that the software of the pilot side is only running under windows machines. At least two other clients for this test site could have been possible (the son of the old woman and their grandchildren). However these persons had a Macintosh machine and for this reason they could not use the pilot from their machines. This suggests an improvement to the Giraff Pilot software so as to make it platform independent.

5.4.3.2 TestSite_Italy_1 (b)

TestSite_Italy_1 (b)

Type	**Start Date**	**End Date**	**Location**	**Status**
Private Residence	Initial contacts in July 2011	September 2011	Rome	**Prematurely Ended** (replaced by TestSite_Italy_1(c))

Feedback and Results

This test site highlighted a potential general mistrust and fear among people to do some modification of the home environment or in general to change the normal status of things in order to test the technology. Specifically, in this case the need to activate the internet connection has been an important issue to discourage the person. Some concern connected also to the privacy issue emerged. Specific attention should be given to ensure privacy to the elderly and also the minimization of home modification to integrate the technology smoothly.

5.4.3.3 TestSite_Italy_1 (c)

TestSite_Italy_1 (c)				
Type	**Start Date**	**End Date**	**Location**	**Status**
Private Residence	Initial contacts in October 2011	November 2011	Rome	**Prematurely Ended** (replaced by TestSite_Italy_1(d))
Feedback and Results				
This test site prematurely ended due to an illness of the elderly person that entailed an hospitalization.				

5.4.3.4 TestSite_Italy_1 (d)

TestSite_Italy_1 (d)			
Type	**Start Date**	**Location**	**Status**
Private Residence	January 2012	Grottaferrata (20Km from Rome)	**Ongoing**

Feedback and Results

Also in this case we experienced some problems with the specific topography of the Italian houses that has created some initial problems due to reduced space (particularly in going through doors and some narrow passage in the house) in the path toward the connection to the recharging station and to smoothly move in the house.
This highlighted the need to improve the mobility capability of the robot (for example some better tool for smoothening path when passing close to a wall or crossing a door) and the need to provide a functionality of automated docking for recharging.

Some comments regarding the movement of the robot inside the house show that the safety of the movement is closely linked to those who drive it: "the movement is safe if the driver is knowledgeable and goes slowly", "You have to go slowly because there are doors and furniture around", etc.

In general, the couple stressed the desire to have additional functionalities on the robot. Even though the robot keeps them company and does not invade their privacy, they still make a passive use of it, "my son calls us and we talk to him", "I would also call but it is not always possible", "I can not use it that much, I can just answer". These comments are quite recurrent.

Some additional suggested features relate to the environmental safety. The robot could be a way to feel more secure at home and be connected for example with the police for example if "someone who is not known enter the house or try to do it". So besides the fact that the robot keeps company it clearly emerged the need to have some additional functionality. The old man asked how far the research is from being able to add more useful features.

The son instead, after a period of initial discomfort related to the fact of not feeling competent in the use of the client or "clumsy" in the use of this specific technology, stated that the client is now rather easy to use.
This discomfort has been initially increased by the used computer platform (he initially used the client on a Windows machine while he is a native Mac user). Indeed, once he started to use the Giraff client on his Mac, thanks to a new version of windows emulator (Parallel), the use became more frequent, and its motivation to use the tool with more "regularity" increased.

The old lady is used to stay very close to the robot for checking the incoming calls. This results in an increased risk

of accidentally hurting the elderly while undocking the robot. The docking which is still very complicated and time consuming represent the main big problem. The main part of the call is dedicated to docking and these sometime discourage the call. In general the worry to leave the robot in the middle of the room causes him a regular concern, hence he calls only when he is sure to have enough time for completing the call. Indeed in this case the automated docking would be really of big help. The son also notes that his mother take care of the robot ("treats him like a son", "takes away the dust", "hooded it when it did not work"). The grand child on the contrary does not use the Giraff robot often and for this reason we do not have specific feedback from him. Some additional study on the differences due to age could be introduced in this study.

5.4.3.5 *TestSite_Italy_2*

TestSite_Italy_2			
Type	**Start Date**	**Location**	**Status**
Health care organization	Initial contacts in January 2011	Rome	**Ongoing**
Feedback and Results			
The study of the robot as a system of rehabilitation at a distance of healthy elderly persons or patients with mild cognitive decline represents an attempt to structure a research protocol aimed at validating the use of telemedicine as a robot for a specific class of users older. The research is based on the use of objective and subjective feedback to study the influence of the presence of the robot. The combination of objective and subjective measures proved to be an extremely valuable approach for better and more complete understanding of user response to a possible use of telepresence robots in the field of cognitive rehabilitation. The results of this study show a general trend of the sample recruited to well tolerate the presence of the robot during the cognitive stimulation task . In terms of cardiovascular response, no significant difference emerged in the response of the heartbeat between the control group and the one with mild cognitive decline during the interaction with both the human experimenter and with the robot. However, a thorough analysis of Heart Rate Variability detects a significant difference in the degree of variability of the heart rate, the lower for the group with mild cognitive decline in the interaction with the robot. This result may indicate a lower tendency of the participants to adapt to the presence of the robot during the performance of cognitive stimulation. Referring to the data obtained by the subjective self-report measures, the interaction with the robot does not generate any state of anxiety in both groups of participants. Similarly, there is a prevalence of positive affects for both groups during the interaction with the human experimenter and subsequently with the robot. In terms of social presence, the data obtained from the final interview reveal that 94% of the sample recruited felt physically involved during the interaction mediated by the robot. Among the benefits identified, 72% of the subjects stated that the robot would help them to feel more secure at home if circumstances arise of disease and disability. Finally, the majority of participants (88%) thought the robot is nice to see. For a detailed discussion of the procedure and the results of this study please see (Tiberio et al., 2012).			

5.4.3.6 *TestSite_Italy_3*

TestSite_Italy_3				
Type	**Start Date**	**End Date**	**Location**	**Status**

Private Residence	May 2012		Rome	**Ongoing**
Feedback and Results				

Both the lady and her grandchild are enthusiastic of the robot. They would also like that the robot do additional things. The lady, as most of the elderly people interviewed, is concerned about possible costs associated to the robots (e.g., the electricity consumption). Overall she really appreciates the possibility to stay in contact with her relatives, also relying on the video capability of the robot. She also appreciate the service provided by the day care center that allow her to have a more frequent contact with operators from the TANGRAM center.
Initially, the contact person for this woman was her grandchild who however is not often connected to a PC being most of the day at the university. For this reason she did not feel satisfied about the possibility to call only him. She rather used the robot in a passive way, mainly receiving calls and not being able to do call by herself.
After a while we decided to change the contact person and a reference person at the Tangram center was chosen. From that moment on the lady felt better about the possibility to call them so as to use the service in a more active way.

However, the use of the robot from her point of view is rather passive: she has never adjusted the volume and never closed a video call, then simply using the green and red button as well as the on and off button.
The robot is judged stimulating but at the same time the lady expressed the desire to have a list of contact persons that she could call in case of need or simply to chat to friends.

Also in this test site, the old woman usually checks the incoming calls trying to look at the robot display heading to the wall. Then, the risk of accidents is increased while undocking the robot.

6 Summary of the succesfull and currenlty active test sites

The previous section has shown the effort done to arrive to a stable situation with the long-term test sites. After the initial difficulties we have currently a number of active test sites, which are following the evaluation plan illustrated in Section 5.2.1. Figure 12 shows the current situation in a summarized way. Specifically, for each test site of the three countries, the figure shows its status with respect to the ExCITE evaluation plan.

Test sites vs. evaluation phases	S0	S1	S2	S3	S4
TestSite_Sweden_3	✓				
TestSite_Sweden_4	✓	✓	✓		
TestSite_Sweden_5	✓				
TestSite_Spain_1	✓	✓	✓		
TestSite_Spain_2	✓	✓	✓		
TestSite_Spain_3	✓	✓	✓		
TestSite_Spain_4	✓	✓			
TestSite_Italy_1 (d)	✓	✓	✓		
TestSite_Italy_3	✓	✓			

Figure 12 Summary of the currently successfully active test sites vs. the evaluation phases

The picture gives a quick view of the steps that are missing till the end of the project to complete the whole evaluation cycle in all the tests sites.

It is worth underscoring that the TestSite_Italy_2 is not reported in this table since it is following a completely different evaluation plan, as already mentioned above. Also TestSite_Sweden_1b followed a more qualitative approach and is not reported in this table.

To complete the work some additional test sites are about to start. At the end of the whole evaluation cycle the gathered data will be analysed and reported in a final evaluation report.

7 Improvements to the Giraff platform based on user feedback

An important part of the project is the improvement of the Giraff platform in order to make it easier to use, more reliable and robust. Technical improvements of the Giraff platform and the Pilot software, Sentry software and various support systems, processes and documents have been implemented following recommendations of the users derived both form the short term and from the long term evaluation sessions. Many changes have been implemented in these two years of project to overcome the technical difficulties encountered in long term tests and to respond to explicit comments from the users.
The major task of the UMA partner in the EXCITE project is the improvement of the Giraff platform in order to make it easier to drive, in a reliable and robust way. The technical improvements achieved in this direction during this year have been focused both on the milestones planned in the project's proposal for this period and on the users' comments and suggestions. It is worth underscoring how the feedback gathered during the evaluation sessions, and most of all from the running test sites have been particularly useful to prioritize the planned technical improvements and in fact to guide their implementation.

Concretely, deliverables D4.1 and D4.2 have been satisfactorily accomplished by integrating into the Giraff platform an additional sensor in order to gain in perception capabilities. After a meticulous study of the alternatives, a laser range scanner has been considered for both detecting obstacles and for robot localization, key points for the aforementioned deliverables that can be summarized into the following points.

- **Obstacle detection** has been added to the platform by warning the user through different alert sounds according to the distance to the closest obstacle. If a near obstacle is detected, and the user commands a movement in that direction, the robot will cancel it in order to avoid the collision.

- **Giraff Self-Localization** within a map of the house. Giraff drivers have also identified the utility of knowing the position of the robot within the environment. This is especially useful when the visitor is not familiar with the house, for example a caregiver who visits a number of patients every day. The proposed solution consists of adding to the interface a schematic map of the house where the current position and orientation (i.e. localization) of the robot is continuously displayed (see figure 10).

- A **semi-autonomous navigation** has been accomplished. This new functionality enables a secondary user to select in the schematic map of the house a destination point near to the current position of the robot and it moves automatically to that position while avoiding obstacles perceived by the laser scanner.

Figure 13 - Graphical interface used for testing the Giraff robot.
Note the schematic map of the environment where a small, green circle indicates the position and the orientation of the robot. Around it, some red points appear indicating the proximity of obstacles (one of them, a trash bin that can be hardly seen in the image on the left).

Apart from the above new functionalities that were specified in the project proposal, users' trials have raised interesting suggestions that have been reckoned and implemented in the current version of the platform. Namely, automatic docking and robot recovery from wifi disconnection have been implemented in this period.

- Autodocking One of the trickiest operations reported by users while teleoperating the Giraff platform is parking the robot at the docking station. The autonomy system of the robot has been improved to relieve users from this task. For this aim, we rely on the camera onboard the robot to automatically detect a piece of white paper with a printed pattern formed by three black circles. This pattern, when located on the docking station, guides the robot by means of computer vision algorithms. Once the pattern is detected, the appropriate movements' commands are ordered to the robot wheels controller for autonomously approaching the docking station. The operation finishes when the motor controllers detects it is already plugged.

- Wifi recovery In the initial version of the Giraff's software the user was not informed about the wifi signal intensity. Thus s/he could drive the Giraff to a non-return point where the robot is disconnected from internet due to a low wifi signal (this specific problem emerged clearly from the work at fielding the Giraff in several test sites). In this period we have been working to overcome this limitation. In one hand a visual indicator of the wifi signal strength have been included in the interface to inform the user about the quality of the wifi signal during the robot teleoperation. On the other hand, in case of an unexpected wifi disconnection the autonomy system of the robot includes now the ability to go back to a previously visited place where the signal strength was appropriate.

It is important to remark that all these new features have been developed in a separated application called NAAS (NAvigationASsistant) which is currently being tested in one testsite in Malaga, Spain, but has not been integrated in all the testsites. The reasons for that are the following:

1. Major changes have to be made in the software architecture of both the Giraff robot and the Giraff Pilot interface. New software incorporating such changes needs to be extensively tested and highly reliable before to proceed to its deployment in all the testsites.
2. The current price of a laser scanner (around 800 €) would increases considerably the cost of a Giraff robot

However, the integration of the NAAS software into the Giraff software is expected to be done in the near future.

Another example of an improvement due to explicit user requests is the ability to initiate a call from a person resident with the Giraff to a caregiver. A new remote control was implemented that allows the elderly to call a pre-selected client user (call out user) and also to respond or deny a call. The new remote is now under evaluation at the test sites and will be further improved according to the feedback of the users. This improvement corresponds to the milestones on available call initiation procedures to user requirements. The physical appearance of the Giraff has also changed over time following user input.
To achieve call security, a database management system for users called Sentry has been introduced. Sentry allows care organizations to manage Giraffs and users within their own domain and enables the creation of Giraff identities, permissions between users and Giraffs, and assigning of a callout user for each Giraff. Giraff identity configuration includes selecting the name displayed on the Giraff, the language in which messages on the Giraff are displayed, and adjusting parameters such as the angle of tilt on the Giraff display. Sentry now supports the configuration of 7 EU languages on the Giraff and Pilot software. These not only facilitate the running of the test site during the course of ExCITE, but are long term improvements that are part of the Giraff commercial solution. The Sentry was further a response to raised concern among elderly and caregivers, namely the need to be able to decide who is to have access to the Giraff and under what premises. This improvement corresponds to the milestone on available call security procedures.
Table 4 summarizes the most relevant changes to the robot in response to the users feedback.

Evaluation/Development Cycle leading to improvement of the Giraff concept	
User input	**Improvement made**
Eldery want more control over the robot	• Introduction of a remote control to accept/refuse call

	• Added the possibility to call out from the Giraff to pre-specified users
Elderly wants to be sure nobody can look at them without them knowing	• The Giraff camera faces the wall when docked • The screen is tilted downwards when not in a call • When somebody connects to the Giraff, there is a sound
Elderly want to be sure that just authorized persons can connect to the Giraff	• Implementation of Sentry database where is specified for each Giraff who can access it (normal or emergency call)
Suggestions on appearence of the Giraff	• 3 versions of the Giraff have been constructed and evaluated
pilot users find it difficult to navigate in unknown environment	• Automatic creation of a map of the area that can be shown in the client interface • User see where the robot is in the map
pilot users are worried to bump on things	• Obstacle detection function that alert when too close
Pilot users perceive docking as difficult	• Autonomous docking when the robot is close to the docking station. Tested, to be implemented in the Giraff software in 2012.
Pilot users would like a visual guide for understanding the orientation of the robot	• Possibility to mark forward position of Giraff under implementation
Pilot users experience that they cannot reach the Giraff anymore	This problem is due to wifi shadows or to the fact that Giraff has gone to far from the wifi router. We addressed the problem as follows: • Giraff can navigate through areas with low wifi using the map and come back to better covered areas • If Giraff goes over the border of wifi coverage it come back to the previous point where wifi was available.

Table 4 Technical improvements to the Giraff platform in response to users feedback

Some system improvements are in response to specific user requirements as listed above, but many are general improvements in response to multiple requirements, and most importantly to improve the overall reliability and robustness of the entire Giraff system. A summary of these improvements follows:

<u>Giraff</u>

- Hardware improvements, focused on reliability and robustness of the platform, and to support software enhancements such as those developed by UMA:
    - New motherboard with faster processor and USB bus
    - Upgrade to Windows 7
    - Replaced flash drive with solid-state hard drive
    - Improved electronics on motor board
    - Switched motor supplier for more reliable performance

- Mechanical improvements, also focused on reliability and to reduce repairs caused by damage in use or shipping
    - New homing stop switch
    - New display section plastic design
    - New welded suspension arm
    - New suspension design and motor torque selection to provide more stable driving, ability to cross door thresholds, etc.

- Configuration changes now save without unprotect process, to make configuring a Giraff for a specific home environment easier, and to add other applications
    - Add new wireless networks
    - Add 3rd-party applications
    - Change Windows configuration (set audio parameters, etc)

- Software improvements
    - Numerous reliability improvements, bug fixes
    - Emergency call ability, and new emergency call audible
    - User (elderly resident) callout ability
    - New low battery warning audible
    - Improved audio performance
        - Lower background noise
        - Faster echo cancellation convergence time
    - Simplified P2P (now called "local") operation
        - Application is now a desktop icon
        - IP address is displayed

- Accessories
    - Replaced keyboard with U.S. layout
    - New docking station, cast aluminium, replaces plastic station to make it more reliable

- Complete redesign of packaging to reduce shipment damage
    - Reinforced box material
    - Additional foam packing inside
    - Addition of wooden pallet

Pilot

- UI improvements

  - Reversed U-turn arrow
  - Display tilt method changed from mouse position to scroll wheel
  - Low battery warning UI changed
    - Visible and audible warnings come sooner
  - Camera selection option
  - Local camera image review before call
  - Ability to manage audio settings from within Pilot

- Simplified P2P (now called "local") operation
  - IP address is entered directly into application as displayed on Giraff
  - No change to host file required

- Improved audio performance
  - Lower background noise
  - Faster echo cancellation convergence time

- Language support
  - English
  - Swedish
  - German
  - Italian
  - Spanish
  - Danish
  - Finnish

- Added "expert" mode for additional features
  - Network performance
  - Error logging
  - Camera and sound testing
  - Language selection

- Improved video resolution from 320x240 to 640x480 (planned for software release 2.0)

- Auto-docking (planned for software release 2.0)

- "Plug-in" architecture (for easier integration of third-party applications, planned for software release 2.0)

Sentry

Some of these enhancements are already implemented, and some are currently in the prototype stage and will be released to the users in January 2013.

- Alert email sent to admins when Sentry is down

- Can enter target software release for each Giraff

- Alert email to appropriate admin when a Giraff marked for service goes down

- Better viewing of Giraff identity being edited

- Limit users shown to appropriate domain (instead of all users)

- Limit identities shown to appropriate domain (instead of all identities)

- Identity creation forces admin to enter a callout user

Support

- Introduction of Unfuddle development priorities system to manage and balance user input against design team requirements for reliability, etc.

- Introduction of Mojo user support system, allowing users direct access to the support team with the ability to see the status of problems, etc.
  - Customer trouble ticket system
  - Support phone number
  - Support email address

- Document improvements
  - Pilot user guide now includes a video
  - Basic operations guide
  - Advanced operations guide
  - Technical support documents including network and firewall troubleshooting

- Improved trouble shooting procedures documented in operational guide

During the next year additional improvement will be made so as to respond to as many requests of users as possible. A deliverable on the technical recommendations derived from this document will list the set of technical requirements together with a priority level.

8 Conclusions

In this report we have gathered the main relevant results of various evaluation activities carried out during the first two years of the ExCITE project.
In particular, the evaluation followed a twofold approach that aimed to collect user feedback as a result of both short-term and long-term interactions between end users and the Giraff platform. The various evaluation sessions highlighted a number of requests for improvement of the robotic platform, which in part have been already implemented and in part will be analysed and discussed in order to produce technical recommendations to be implemented in the coming year. The evaluation sessions will continue throughout the next year. In particular, the final evaluation report will contain a detailed and critical description of the results of the long term test sites in Sweden, Spain and Italy, which are currently following the evaluation plan specially designed and described in this document.

9 Appendix A: Test sites Protocol

This document summarizes the general protocol used for documenting the procedure of implementing the test sites in ExCITE. This document contains a number of fields which are intended to be filled by one of the members of the consortium. It reflects the observations of the researchers when implementing the test sites.

Potential Test site Physical Description and Short description of Elderly Users
Prior to establishing a test site, it is important to collect basic information about the test site and to consider a number of aspects that could significantly impact the test site's successful running. *The researcher proposing a test site should fill the following form that is then evaluated by the consortium members to assess the suitability of the test site.* Each potential test site should have a unique identifier.

For each test site, a physical description of the location should be given. This includes, address of the test site, type of housing, people living in the test site environment, special configuration of the test site environment (e.g. units). The physical description aims to give a general indication of the environment in which the Giraff is intended to be operated. Information about motivation to use Giraff and potential pilot users is essential for assessing if the test site is suitable for the project.

The form below is used to decide if a test site should be started and it is used as basic information for the test site

TestsiteID: COUNTRY-No-TYPE
Location of test site (City, Country):
Partner responsible for test site:
Person filling report:

Select one of the following::

- ☐ Private Home
- ☐ Nursing Home
- ☐ Medical Facility
- ☐ Care Facility
- ☐ Other: ____________________________-

Give a general description of the environment in which the Giraff is situated and expected to operate (e.g rooms, floors, size of environment):

How many people are expected to interact with the Giraff:
What ages (range):

How many people are expected to connect to the Giraff:

What ages:
What relations to the elder (list):

For what types of interactions are the Giraff expected to be used:

Do the elderly users have any hearing or visual impairments that may make it difficult to use the Giraff:

- Yes
- No

Do the pilot users have any hearing or visual impairments that may make it difficult to use the Giraff:

- Yes
- No

Is there any feature in the environment that will restrict the Giraff mobility?

- **Yes**
- **No**

(if yes then specify e.g floors, crowded environment, placement)
____
____

How easy is it for a technical team to reach and support the test site

- Same city as researcher
- City suburbs
- Elsewhere

(if elsewhere, then how far from test site in km _______

Is internet existing prior to installation?

Describe (briefly) the elder user motivation for using a Giraff.

Describe (briefly) the pilot users motivation for using a Giraff

Describe any special characteristics of the test site environment and persons involved.

How to provide training and Introduction to all Users. After that a test site is selected, the project, the Giraff robot and the pilot interface need to be properly introduced to all potential users and in some cases training needs to take place.

For an elder

- Arrange a meeting
- Show the videos concept and installation
- Show the Giraff if possible

- Discuss with the elder how the Giraff will be used
- Explain the follow up procedure used during and after the test site period.
- Come to an agreement about the practical aspects.
- Fill the consent form.

For potential pilot users

- Arrange a physical meeting if possible
- Show the videos concept and installation
- Discuss the advantage of Giraff
- Do a trial run
- Always offer a training session with Giraff.
- Fill the consent form.
- Discuss when and how the system is going to be used, this needs to be agreed with the elder.

How to prepare a test site for installation

- If internet does not exist prior to installation at test site, order internet and get a date for when it will be installed.
- Agree with elder about date for installation.
- Inform the pilot users about agreed installation date and reach an agreement on first call date.

TestsiteID: COUNTRY-No-TYPE
Location of testsite (City, Country):
Partner responsible for test site:
Person filling report:

Training and Introduction of elder

Number of meetings/encounters between first introduction of Giraff and prior to receiving a Giraff:

Please indicate which videos have been viewed:

Please indicate if the consent form has been signed:

- ☐ Yes
- ☐ No

Training and Introduction of caregiver

Number of meetings/encounters between first introduction of Giraff and prior to receiving a Giraff:

Please indicate which videos have been viewed:

Please indicate if the consent form has been signed:

- ☐ Yes
- ☐ No

Briefly explain the training:

Preparation of a test site for installation

If internet is not existing, is it ordered?

- ☐ Yes
- ☐ No

Agreed Date of test site installation with elder:

Are the pilots informed about installation date?

- ☐ Yes
- ☐ No

Deployment and Installation of the Giraff

Basic information about the deployment of the Giraff needs to be collected for each test site. The filling of the form below insure that all required steps have been made and keep track of possible problems encountered.

TestsiteID: COUNTRY-No-TYPE
Location of testsite (City, Country):
Partner responsible for test site:
Person filling report:

From deciding to start the test site how long did it take to receive a Giraff:

Describe the internet connection:

Was internet acquired when starting the test site or was it present already:

Where is the docking station located?

Detail the quality of the wireless connection – are there any blind spots in the home (this needs to be checked during the visit, by moving the Giraff in the home):
____
____
____
____

Is a map of the home needed (users not familiar with the home)?:
- ☐ Yes
- ☐ No

Tried test call during installation with Giraff with ExCITE staff:
- ☐ Yes
- ☐ No

Tried test call during installation with Giraff from a pilot user:
- ☐ Yes
- ☐ No

Information about documentation has been given to the users:
- ☐ Yes
- ☐ No

Phone number for troubleshooting has been given:
- ☐ Yes
- ☐ No

Researcher has made a follow up call the following day?
- ☐ Yes

- ☐ No

Researcher has made a follow up call one week after installation?

- ☐ Yes
- ☐ No

Which Questionnaires for the elder were filled (at S0)? Tick the ones filled. * are mandatory.

S0 Expected communication Questionnaire ID /	Elder at home – Family-members/friends	Elder at home – Health care professional
Q1 (now or earlier)	☐ *	☐ *
Q2	☐ *	☐ *
Q3	☐	☐
Q4	☐	☐
Q5	☐	☐
Q6	☐	☐
Q8.2	☐ *	☐ *
Q7	☐	☐ *

Which Questionnaires for the pilots were filled (at S0)? Tick the ones filled. * are mandatory

S0 Expected communication Questionnaire ID /	Elder at home – Family-member/friends Caregiver	Elder at home – Family-member/friends NOT Caregiver	Elder at home – Health care professional
Q1_C (now or earlier)	☐ *	☐ *	☐ *
Q2_C	☐ *	☐ *	☐ *
Q3_C_SupportExpectation	☐ *	☐ *	☐ *

Running of the test site

To ensure continued use and troubleshoot early in a test site, a monthly report for each test site should be filled with the following information.

TestsiteID: COUNTRY-No-TYPE
Location of test site (City, Country):
Partner responsible for test site:
Person filling report:

Summarize number of connections made to test site from Sentry:

Summarize total talking time, from Sentry:

Does the Diary Q4 correspond to the number of connections made to the test site?

- ☐ Yes
- ☐ No

(if not, push for it to be continuously filled by the pilot users)

At least one check up call should be made per month to the testsite from an ExCITE researcher. Report briefly about user feedback given during the call(s):

Conclusion of a test site

A specific procedure should be followed at the end of a test site both if the test site has reached its natural end or if it has been interrupted.

TestsiteID: COUNTRY-No-TYPE
Location of testsite (City, Country):
Partner responsible for test site:
Person filling report:

When has the giraff been removed:

Describe the uninstallation procedure:

Has internet been disconnected (if provided for under the project):

- ☐ Yes
- ☐ No

Has all pilot users been informed?

- ☐ Yes
- ☐ No

After two months has the follow up questionnaire been filled from both elder and pilot users?

- ☐ Yes
- ☐ No

Has the test site ended naturally or been interrupted? In case of interruption, please give explanation of interruption!

Periodically, user sides are asked to fill in questionnaires. The frequency depends on the total length a test site is expected to be run. There are in total five sets of questionnaires to be filled (S0, S1, S2, S3 and S4) where S0 is filled when the Giraff is installed, S3 when the Giraff is being removed and S4 two months after the removal.

Fill what dates the set of questionnaires were filled and tick which were filled.

Set of questionnaire	Date filled (Elder)	Date filled (Pilot)
S0	☐	☐
S1	☐	☐
S2	☐	☐
S3	☐	☐
S4	☐	☐

For each of the sets (S1-S4): Which Questionnaires for the **elder** were filled? Tick the ones filled. * are mandatory.

S1 Questionnaire ID / Expected communication	Elder at home – Family-members/friends	Elder at home – Health care professional
Q3	☐	☐
Q5	☐	☐
Q6	☐	☐
Q8	☐ *	☐ *
Q7	☐	☐ *

S2 Questionnaire ID / Expected communication	Elder at home – Family-members/friends	Elder at home – Health care professional
Q8.1	☐ *	☐ *
Q8.2	☐ *	☐ *

S3 Questionnaire ID / Expected communication	Elder at home – Family-members/friends	Elder at home – Health care professional
Q8.2	☐ *	☐ *
Q3	☐	☐
Q4	☐	☐
Q5	☐	☐
Q6	☐	☐
Q7	-	☐
Q9 PIADS	☐ *	☐ *
Q10 PANAS	☐ *	☐ *
Q11 INTERVIEW	☐ *	☐ *

S4 Questionnaire ID / Expected communication	Elder at home – Family-members/friends	Elder at home – Health care professional
Q3	☐	☐
Q4	☐	☐
Q5	☐	☐
Q6	☐	☐
Q7	-	☐

For each of the sets (S1-S4): Which Questionnaires for the **pilots** were filled? Tick the ones filled. * are mandatory.

NB! Be sure to use the questionnaires that are tailored for each type of expected communication!

S1 Questionnaire ID / Expected communication	Elder at home – Family-member/friends Caregiver	Elder at home – Family-member/friends NOT Caregiver	Elder at home – Health care professional
Q4	☐ *	☐ *	☐ *
Q7	☐ *	☐ *	☐ *
Q6_C_Baseline	☐ *	☐ *	☐ *

S2 Questionnaire ID / Expected communication	Elder at home – Family-member/friends Caregiver	Elder at home – Family-member/friends NOT Caregiver	Elder at home – Health care professional
Q3_C_SupportAssessment	☐ *	☐ *	☐ *
Q5_C_TPI_NM	☐ *	☐ *	☐ *
Q6_C_Midterm	☐ *	☐ *	☐ *

S3 Questionnaire ID / Expected communication	Elder at home – Family-member/friends Caregiver	Elder at home – Family-member/friends NOT Caregiver	Elder at home – Health care professional
Q8_PIADS	☐ *	☐ *	☐ *
Q9_PANAS	☐ *	☐ *	☐ *
Q10_INTERVIEW	☐ *	☐ *	☐ *

S4 Questionnaire ID / Expected communication	Elder at home – Family-member/friends Caregiver	Elder at home – Family-member/friends NOT Caregiver	Elder at home – Health care professional
Q3_C_SupportFollowup	☐ *	☐ *	☐ *

Appendix B: Internal Project Memo regarding Gateway Switching

Our attempts to get Swedish test site 2 up and running we are having requests from the owner of the building that we need to extend the range of the Giraff coming in on March 8th during us visiting the building with the Giraff.

Below will follow a figure which we'll reference in the explanation of the problem.

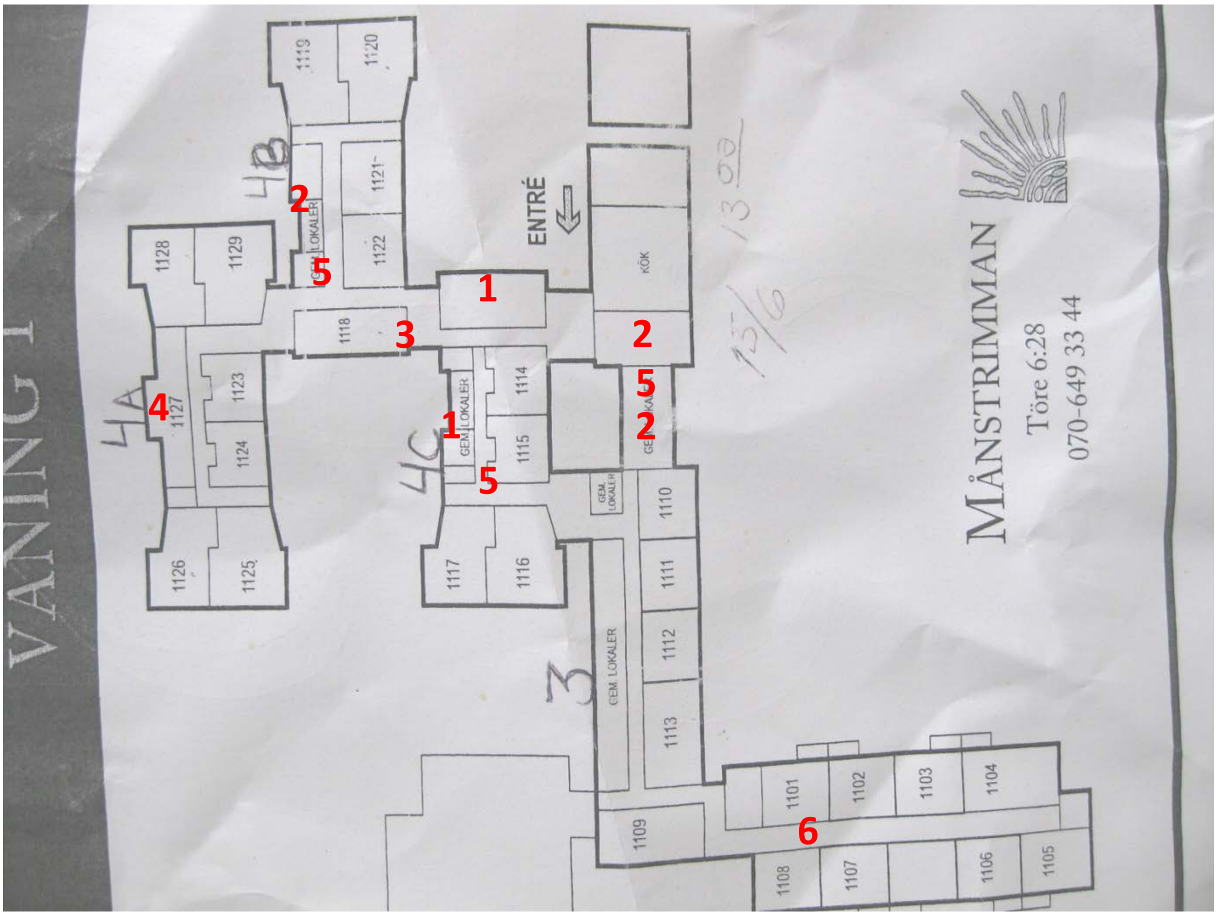


Figure 14 - 1. Position of the Giraff router which is a fiberline. 2. Common areas where people gather for informal and formal meetings. 3.. Current docking station position. 4. Location of apartment in which the person seems willing to use the Giraff for contacts with daughter. 5. Approximate positions where connection dies. 6. Several floors in this part of the building.

While talking to the owner of the building he wants to show us where he wants to use the Giraff. In particular he has called for a meeting in the "bottom area" in the rightmost common area (green). This is a restaurant so it can fit a lot of people. He wants to use the Giraff to have more frequent meetings with the residents of the building. We attempt driving to the location from two directions but the connection dies at the red arrows.
USER REQUEST 1: Use the Giraff in the rightmost common area.

There are also many other common areas in the building. The following picture is showing the typical layout of them and is the topmost common area in the picture. We think these could be good spots to use the Giraff and to make it available. Here, in this particular common area, the owners of the building wanted to use the Giraff when we were up to inform municipalities and such about the ExCITE project. However the Giraff does not reach all.

USER REQUEST 2:
Usage of the Giraff in common areas.

During the grand opening of the building (in Feb) tv was there and a woman expressed great interest in using the Giraff to talk with her daughter who lives in Johannesburg. This woman lives in apartment number 1027 (orange).

I spoke to the woman over the telephone yesterday and it is very fortunate that her daughter will actually come home on a quick visit. We will then connect to them via the Giraff so they can see a bit how it works and discuss how they may want to use it.

We find it likely that the woman will want to use the Giraff in her apartment. She has internet so an alternative could be that she moves the Giraff manually to her room when she wants to connect to it and that we put a properly configured router in there. But the real solution should include an extended network.

USER REQUEST 2: Usage of Giraff in apartment 1027.

Here it should be noted that we completely neglect the “bottom part” of the building where there are more common areas situated on different floors.

Report from testing with repeaters

We have bought two repeaters (Netgear WN3000RP) which have been configured to inherit the same settings as a BIKT1 router of Trendnet brand. These have been tested at Karlslund which is the temporary location of the Swedish testsite 3. At Karlslund, the layout is a bit similar to the one at test site 2 (with long corridors).

We initially tested the repeaters at Ängen but did not have much success. The Giraff could reach anyhow between the appartments to which we have access and when trying to carry it up the stairs the elevator killed the signal of the repeater. We then decided to test the Giraff at Karlslund, blueprint follows.

The test site 3 is basically located on top of the red line in the picture. Some other locations are pointed out on the blueprint.

I began testing the Giraff with repeaters on March 27th. But because of bad luck (maybe a software bug) the Giraff stopped responding to calls or docking, this is likely a bug in the software and is investigated by Giraff now). After an upgrade to the latest software (bug fix from the first 1.3 version) the Giraff has been turned on since March 28th without restart when I begin my trials on April 3rd.

I plugged in the repeaters on the spots in the blueprint. I connected to the Giraff and drove and drove to **Spot a**. Here the connection died and I lifted the Giraff back in to range. I connected again to the Giraff and drove out of range (about to **Spot a**). I then lifted back the Giraff into range and everything looked normal (on both user ends, the Giraff said it was within network range and on the client side the Giraff became available!). However, this was not the case, although I called the Giraff, the Giraff itself did not ring. After a restart of the Giraff, everything worked as normal again from the same spot!

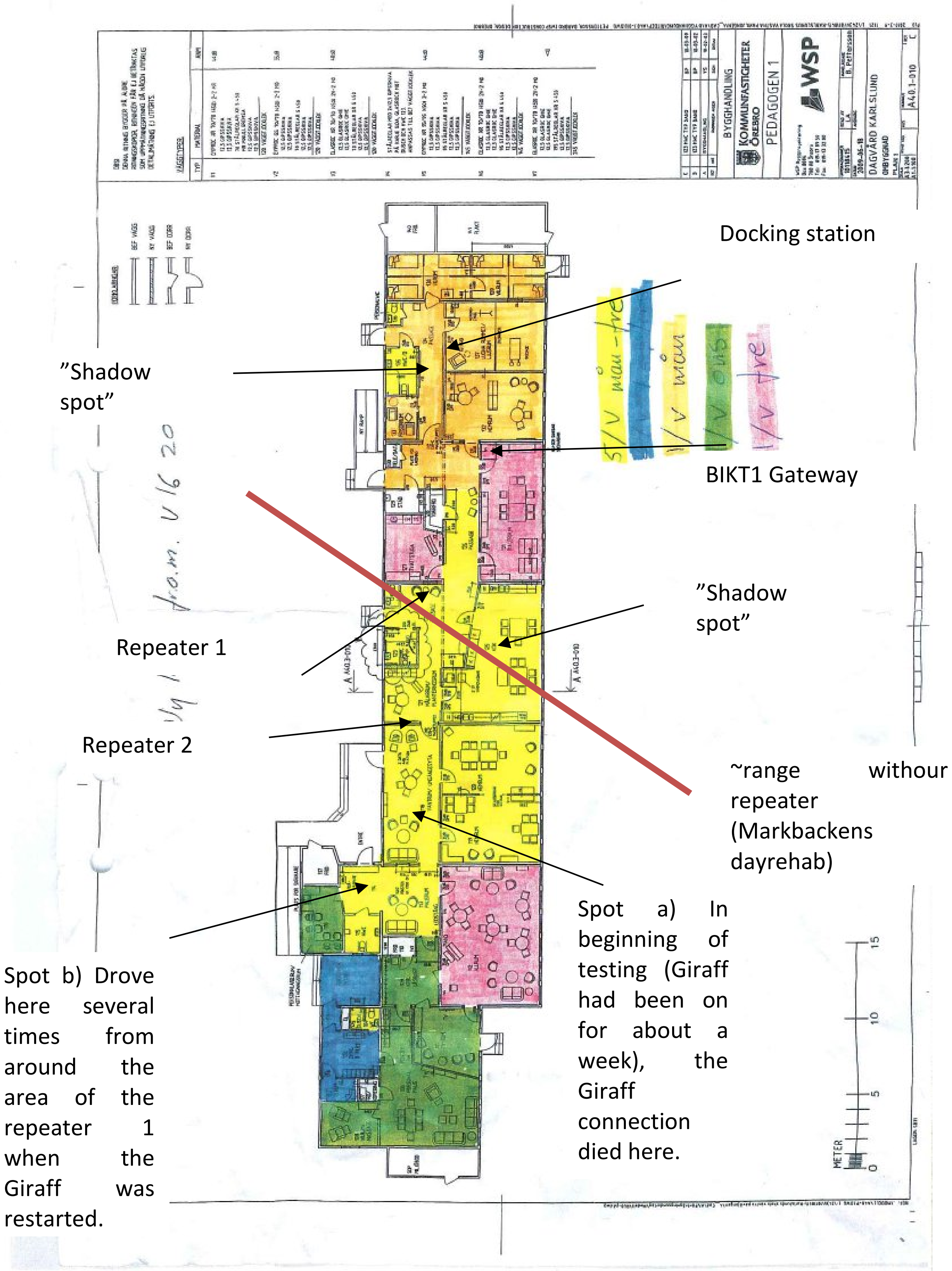
I now decided to test the range again and assumed it would be possible todrive to Spot a. Suprisingly I could now drive to **Spot b!** I drove there and back to outside the room of the gateway 2-3 times and the connection lasted. *However I experience a loss in visible connection with the Giraff occasionally which I believe is when the Giraff jumps between the different repeaters (and Gateway), what is a bit bad here is that the Giraff itself kept moving forward for like a meter*

several times without me seeing this move on the screen before I had already moved. The losses usually happened between the repeaters and the Spot a.
After some driving back and forth I drove back in to the middle of repeater 1 and the gateway and kept the line busy. I now went to fetch my repeaters from the wall sockets. The Giraff client lost the connection but when looking in the client the Giraff kept saying it was busy for like one minute of time. So, obviously it had been connected to one of the repeaters when I disconnected it and now found the gateway itself again.
I now connected again to the Giraff and drove away towards **Spot a**. I now could not reach the point, I now moved the Giraff manually in to where I knew I was in range of the gateway and tried connecting to it several times but the Giraff never called. After a restart it was available again. I connected via emergency call and drove it back to its docking station.
So some thoughts here…

The repeaters are indeed extending the range but it needs more testing! This, we in Orebro hope can be done by UMA or Giraff (or Ratio Consulta). It also needs to be tested with even more repeaters before we would dare sending them to our testsite number 2.
The Giraff and the client doesn't give the right message sometimes, it should not look as if everything is as it should if it is not.
The Giraff's range seem to lower with amount of usage from restart somehow.

Please refer to the Figure on the next page.

At the keyboard,
Annica Kristoffersson
Örebro University.



Docking station
"Shadow spot"
BIKT1 Gateway
"Shadow spot"
Repeater 1
Repeater 2
~range withour repeater (Markbackens dayrehab)
Spot a) In beginning of testing (Giraff had been on for about a week), the Giraff connection died here.
Spot b) Drove here several times from around the area of the repeater 1 when the Giraff was restarted.

Connecting to Giraff from a 4g connection

Last Friday (30 march) I decided to try connecting to Ängen with a wifi connection between my working laptop and my home 4g router which I knew had a very good connection speed (measured 29mbit down 10mbit up at the time) and drove around at Ängen for many minutes without trouble. I think the option to connect over 3g/4g should be investigated further; both directly with a dongle and with the Giraff being connected to a 4g router connection. We have to order internet for all test sites right now but most of them already have mobile internet!

10 References

Adalgeirsson S.O. and Breazeal, C. “Mebot: a robotic platform for socially embodied presence,” In Proceedings of ACM/IEEE Int Conf on Human-robot interaction, pp. 15-22, 2010.

Baker, D.B., Zhou, R. and Song, D. “Design and prototyping of an economical teleoperations test-bed for human factors research: Cost, resource requirements and capability assessment,” In Proceedings of Int Conf on Computers and Industrial Engineering, pp. 526-529, 2005.
Beer, J. and Takayama, L. “Mobile remote presence systems for older adults: acceptance, benefits, and concerns,” In Proceedings of ACM/IEEE Int Conf on Human-robot interaction, pp. 19-26, 2011.

Biocca, F. and Harms, C. (2002). Networked Minds Social Presence Inventory (scales only version 1.2). Tech. rep., M.I.N.D. Labs, Michigan State University, Michigan, USA. http://cogprints.org/6742/.

Bickmore, T. W. and Picard, R. W. (2005). Establishing and Maintaining Long-Term Human-Computer Relationships. ACM Transactions on Computer Human Interaction, 12:293–327.

Boissy, P., Brière, S., Corriveau, H., Grant, A., Lauria M., and Michaud, F. “Usability testing of a mobile robotic system for in-home telerehabilitation,” In Proceedings of IEEE EMBS, pp. 1839-1842, 2011.

Bruemmer, D. J., Douglas, A.F., Walton, M.C., Boring, R.L., Marble, J.L., Nielsenand, C.W., Garmer, J. "Turn off the television!: Real-world robotic exploration experiments with a virtual 3-d display", In Proceedings of Hawaii Conference on System Sciences, 2005.

Cabibihan, J.-J., So, W.-C., Saj, S., and Zhang, Z. “Telerobotic Pointing Gestures Shape Human Spatial Cognition,” Int Journal of Social Robotics, vol. 4, no. 3, pp. 263-272, 2012.

Deegan, P., Grupen, R., Hanson, A., Horrel, E., Ou, S., Riseman, E., Thibodeau, S., Williams A., and Xie, D., “ Mobile manipulators for assisted living in residental settings,” Autonomous robots, vol. 24, no. 2, pp. 179-192, 2008.

Desai, M., Tsui, K.M., Yanco, H.A. and Uhlik, C. “Essential features of telepresence robots, “ In Proceedings of Technologies for Practical Robot Applications (TePRA), pp. 15-20, 2011.

Drury, J.L. , Scholtz J. and Yanco, H. “Awareness in human robot interactions,” In Proceedings of IEEE Int Conf on Systems, Man and Cybernetics, pp. 568-573, 2003.

González-Jiménez, J., Galindo C., and Ruiz-Sarmiento, J.R. “Technical Improvements of the Giraff Telepresence Robot based on Users’ Evaluation,” Submitted to Ro-Man 2012.

Guizzo, E. “When my avatar went to work,” IEEE Spectrum, vol. 47, no. 9, pp. 26-50, 2010.

Hart, S. G. (2006). Nasa-Task Load Index (NASA-TLX); 20 Years Later. Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 50(9), 904-908. Human Factors and Ergonomics Society.

Heerink, M., Kröse, B. J. A., Evers, V. and Wielinga, B. J. “Assessing Acceptance of Assistive Social Agent Technology by Older Adults: the Almere Model,” I. J. Social Robotics, vol. 2, no. 4, pp. 361–375, 2010.

Hutchins, E. (1995). Cognition in the Wild. MIT Press.

ISPR 2000 - International Society for Presence Research, "The concept of presence: Explication statement", Retrieved 120821 from http://ispr.info/, 2000.

ISCED (2011). International Standard Classification of Education 2011, UNESCO.

Ito, T. “Hand gesture-based manipulation of a personalized avatar robot in remote communication,” In Proceedings of HCII, the 2011 international conference on Human interface and the management of information - Volume Part I, pp. 425-434, 2011.
ITU-T Recommendations, "P.805 (04/2007) - Subjective evaluation of conversational quality," http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=9066, 22 April 2007.

ITU-T Recommendations, "P.910 (04/2008) - Subjective video quality assessment methods for multimedia applications," http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=9317, 6 April 2008b.

ITU-T Recommendations, "J.247 (08/2008) - Objective perceptual multimedia video quality measurement in the presence of a full reference," http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=9497&lang=en, 13 August 2008b.

Jouppi, N.P. “First steps towards mutually-immersive mobile telepresence,” In Proceedings of Computer Supported Cooperative Work (CSCW), pp. 354-363, 2002.

Jouppi, N.P., Iyer, S., Mack, W., Thomas S., and Slayden, A. “A first generation mutually-immersive mobile telepresence surrogate with automatic backtracking,” In Proceedings of ICRA, pp. 1670-1675, 2004.

Jutai, H. D. J. “Psychosocial Impact of Assistive Devices Scale (PIADS)". Technology and Disability, vol. 14, no. 3, pp. 107 – 111, 2002.

Keyes, B., Casey, R., Yanco, H.A., Maxwell, B.A. and Georgiev, Y. “Camera placement and multi-camera fusion for remote robot operation,” In Proceedings of IEEE Int Workshop on Safety, Security and Rescue Robotics, 2006.

Kiselev, A. and Loutfi, A. “Using a Mental Workload Index as a Measure of Usability of a User Interface for Social Robotic Telepresence,” Submitted to Ro-Man 2012 Workshop on Social Robotic Telepresence, 2012.

Kendon, A. (1990). Conducting Interaction: Patterns of Behavior in Focused Encounters. Cambridge University Press.

Kristoffersson, A., Coradeschi, S., Loutfi, A., and Severinson-Eklundh, K. “An Exploratory Study of Health Professionals' Attitudes about Robotic Telepresence Technology,“ Journal of Technology in Human Services, vol. 29, no. 4, 2011.

Kuzuoka, H., Furusawa, Y., Kobayashi, N., and Yamazaki, K. “Effect of displaying a remote operator's face on a media robot,” In Proceedings of Int Conf on Control, Automation and Systems (ICCAS), pp. 758-761, 2007.

Labonté, D., Boissy, P., Michaud, F., Corriveau, H., Cloutier, R. and Roux, M.-A., “A pilot study on teleoperated mobile robots in home environments,” In Proceedings of IROS, pp. 4466-4471, 2006.

Labonté, D., Boissy, P. and Michaud, F. “Comparative analysis of 3d robot teleoperation interfaces with novice users,” IEEE Transactions on Systems, Man, and Cybernetics Part B: Cybernetics, vol. 40, no. 5, pp. 1331-1342, 2010.

Lombard, M., Ditton, T., & Weinstein, L. (2009). Measuring telepresence: The Temple Presence Inventory. Presented at the Twelfth International Workshop on Presence, Los Angeles, California, USA.

Lund, A. M., “Measuring Usability with the USE Questionnaire,” STC Usability SIG Newsletter , vol. 8, no. 2, 2001.

Michaud, F., Boissy, P., Labonté, D., Corriveau, H., Grant, A., Lauria, M., Cloutier, R., Roux, M.-A., Iannuzzi, D. and Royer, M.-P. “Remote assistance in caregiving using telerobot,” In Proceedings of Int Conf on Technology and Ageing, 2007.

Michaud, F., Boissy, P., Labonté, D., Brière, S., Perreault, K., Corriveau, H., Grant, A., Lauria, M., Cloutier, R., Roux, M.-A., Iannuzzi, D., Royer, M.-P., Ferland, F., Pomerleau, F. and L’Etorneau, D. “ Exploratory design and evaluation of a home-care teleassistive mobile robotic system,” Mechatronics, vol. 20, no. 7, pp. 751-766, 2010.

Nakanishi, H., Murakami, Y., Nogami, D. and Ishiguro, H. “Minimum movement matters: Impact of robot-mounted cameras on social presence,” In Proceedings of Computer Supported Cooperative Work (CSCW), pp. 303-313, 2008.

Nakanishi, H., Kato, K. and Ishiguro, H. “Zoom cameras and movable displays enhance social telepresence,” In Proceedings of ACM SIGCHI Conf on Human Factors in Computing Systems, pp. 63-72, 2011.

NMSPI. Networked minds social presence inventory (scales only version 1.2). [Online]. Available: http://cogprints.org/6742/

Nielsen, J. Usability engineering. San Diego, CA: Academic Press, 1993.

Nomura, T., Suzuki, T., Kanda, T. and Kato, K. ”Measurement of negative attitudes towards robots,” Interaction Studies, vol. 7, no. 3, pp. 437-454, 2006.

van Oosterhout, T. and Visser, A. ”A visual method for proxemics measurements,” In Proceedings of Workshop on Metrics for Human-Robot Interaction, pp. 61-68, 2008.

Rae, I., Takayama L., and Mutlu, B. “One of the Gang: Supporting In-Group Behavior for Embodied Mediated Communication,” In Proceedings of ACM SIGCHI Conf on Human Factors in Computing Systems, pp. 3091-3100, 2012.

Riano, L., Burbridge, C. and McGinnity, T. M. “A study of enhanced robot autonomy in telepresence,” Proceedings of Artificial Intelligence and Cognitive Systems, 2011.

Ricks, B., Nielsen, C. and Goodrich, M., “Ecological displays for robot interaction: A new perspective,” In Proceedings of IROS, pp. 2855-2860, 2004.

Rogove, H. J., McArthur, D., Demaerschalk, B. M. and Vespa, P. M. “Barriers to telemedicine: Survey of current users in acute care units,” Telemedicine and e-health, vol. 18, no. 1, pp. 43-53, 2012.

Rubio, S., Diaz, E., Martin, J., & Puente, J. M. (2004). Evaluation of Subjective Mental Workload: A Comparison of SWAT, NASA-TLX, and Workload Profile Methods. Applied Psychology, 53(1), 61-86. Wiley Online Library.

Russell, D., Peplau, L. A. and Cutrona, C. E. "The Revised UCLA Loneliness Scale: Concurrent and Discriminant Validity Evidence," Journal of Personality and Social Psychology, vol. 39, pp. 472–480, 1980.

Sabanovic, S., Michalowski, M., and Simmons, R. (2006). Robots in the wild: Observing human-robot social interaction outside the lab. In Proceedings of the International Workshop on Advanced Motion Control, Istanbul, Turkey. ACM.

Sauro J., and Lewis, J. Quantifying the User Experience: Practical Statistics for User Research. Software Usability Scale (SUS). Chap. 8, pages 198-208. Morgan Kaufmann, 2012.

Sirkin, D. and Ju, W. "Communicating meaning and team role through gesturing robots," In Proceedings of RSS 2011 Workshop on human-robot interaction: perspectives and contributions to robotics from the human sciences, 2011.

Sirkin, D., Venolia, G., Tang, J., Robertson, G., Kim, T., Inkpen, K., Sedlins, M., Lee, B. and Sinclair, M. "Motion and attention in a kinetic videoconferencing proxy," Human-Computer Interaction – INTERACT 2011, pp. 162-180, 2011.

Takayama, L., Marder-Eppstein, E., Harris, H. and Beer, J. "Assisted driving of a mobile remote presence system; System design and controlled user evaluation," In Proceedings of ICRA, pp. 1883-1889, 2011.

Terracciano, A., McCrae, R. R., and Costa, P. T. "Factorial and Construct Validity of the Italian Positive and Negative Affect Schedule (PANAS)," European journal of psychological assessment official organ of the European Association of Psychological Assessment, vol. 19, no. 2, pp. 131–141, 2003.

Tiberio, L. , Cesta, A., Cortellessa, G., Padua, L., Pellegrino, A. R. (2012). Assessing affective response of older users to a telepresence robot using a combination of psychophysiological measures. (To appear) IEEE RO-MAN: The 21st IEEE International Symposium on Robot and Human Interactive Communication. September 9-13, 2012. Paris, France.

Tsui K. M., and Yanco, H. A. "Assistive, rehabilitation, and surgical robots from the perspective of medical and healthcare professionals". In Proceedings of AAAI Workshop on Human Implications of Human-Robot Interaction, pp. 34-39, 2007.

Tsui, K. M., Desai, M., Yanco, H.A., Cramer, H. and Kemper, N., "Measuring attitudes towards telepresence robots," Int., Journal of Intelligent Control and Systems Special Issue: Quantifying the Performance of Intelligent Systems, vol. 16, no. 2, pp. 113-123, 2011.

Tsui, K. M., Desai, M. and Yanco, H.A. "Towards Measuring the Quality of Interaction: Communication through Telepresence Robots," In Proceedings of Performance Metrics for Intelligent Systems, 2012.

Ware, J. E. J., Kosinski, M. and Keller, S. D. "A 12-Item Short- Form Health Survey: Construction of Scales and Preliminary Tests of Reliability and Validity," Medical Care, vol. 34, no. 3, 1996.

Witmer, B., and Singer, M. "Measuring presence in virtual environments: A presence questionnaire", Presence, vol. 7, no. 3, pp. 225-240, 1998.

Yesavage, J. A., Brink, T. L., Rose, T. L., Lum, O., Huang, V., Adey, M. and Leirer, V. O. "Development and Validation of a Geriatric Depression Screening Scale: a Preliminary Report," Journal of Psychiatric Research, vol. 17, no. 1, pp. 37–49, 1983.

Zimet, G. D., Dahlem, N. W., Zimet, S. G. and Farley, G. K. "The Multidimensional Scale of Perceived Social Support," Journal of Personality Assessment, vol. 52, no. 1, pp. 30–41, 1988.