

Getting Older People Involved in the Process of Ambient Assisted Living Research and Development

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Abstract—This paper proposes an investigation protocol for research and development of Ambient Assisted Living technologies for elderly people, based on effective strategies for motivating users and establishing a long-term relationship that enables them to “enter in the User Centered Design loop”. For a project that aims at the experimentation in the users’ homes, we advocate the building and nourishing of a solid network of users and stakeholders for project support. It is crucial to involve local authorities, associations of elderly people, and social operators as *de facto* partners of the project, sharing with them the ambitious research and development objectives, and identifying ways of integrating research activities with their existing daily practices. This guarantees continual users’ involvement, which favors interest in the scientific objectives, reduces risks of abandonment, and produces improved information.

I. INTRODUCTION

TECHNOLOGY can play a crucial role in increasing in elder people (and in their families and associated caring personnel) the feeling of confidence required for aging-in-place. The Ambient Assisted Living (AAL) approach envisages the equipment of the elders’ houses with advanced sensor networks and interaction interfaces for the provision of services aimed at supporting the daily living, possibly based on the monitoring of environmental conditions and of inhabitants’ behaviour. AAL may offer some basic support to everyday activities (like reminders and guidance instructions), detect health critical situations, and may facilitate and strengthen the communication with loved ones. However, the success of AAL solutions greatly depends on an effective design. Even more than with ‘ordinary’ technologies, in fact, *acceptance* by users (i.e., the demonstrable willingness to employ information technology for the tasks it is designed for) determine the actual adoption of the technology: no matter how functional a technology is, the elderly will not use it, if they perceive it as intrusive, complex, embarrassing, revealing their limitations, or disrupting their home environment [9]. From a user perspective, it is important to realize that technology can be seen as an intruder in the safe home environment, and that residents can be afraid to lose control over their home. In addition to that, the design challenge is to develop concepts that are not only useful to the inhabitant, technically possible and reliable, but also supported and accepted by the large group of

stakeholders (families, care givers, service suppliers, product suppliers, local governments and financing agencies, insurance companies, architects, housing corporations, building companies, ...).

Recent studies have started to shed some light on the issues related to the effective involvement of older people in the design-development-validation cycle ([2],[4]). In many respects, however, we are still at the initial stages, with the difficulties due to the poor understanding of elders as users of AAL services exacerbated by the experimental nature of many of the underlying technology (e.g., ambient intelligence) and functionalities (e.g., behaviour monitoring), and by the ensuing ethical and privacy issues. In the end, involving elders into the process of designing AAL solutions means making them part of a complex research process that requires the building and nourishing of a long-lasting network of users and stakeholders for project support; this goes well beyond the current practices of sporadically resorting to care givers associations and/or end users to deal with specific project requirements (e.g., requirement elicitation, evaluation) [2].

Traditional User Centered Design methods can be appropriately adjusted and balanced to work also with elderly people [2]— with proper precautions, even the more innovative Participatory Design techniques [13] can be fruitfully applied, at least in the early stages of project development. However, some specific additional strategies need to be developed to circumvent the critical issues that emerge when engaging old aged users in a long-term enterprise dealing with their daily life and home environment.

In this paper we present and discuss a protocol for the design of advanced AAL services that distills insights gained in the course of the NETCARITY (FP6) project by a multidisciplinary team (interaction designers, social scientists and care givers). The paper focuses on a concrete strategy for: motivating the participation of elders in the design team and establishing long-term relationship with the other elders and the ‘experts’; reducing the risk of drop-outs; securing the quality of the information obtained. The attainment of those objectives requires: nurturing the sense of belonging to a pioneering group; emphasizing the value of individual and group contributions; increasing trust and confidence; develop a sense of ownership of the project’s results. Moves and actions that are instrumental to those goals are: a) the endorsement and direct involvement in the project of local authorities and elders associations, with the role of mediators and guarantors; b) the constant integration of design activities with existing daily practices—e.g., in aggregation centers, by embedding

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the activities of the design team in regular activities, and at home, by finding suitable time and space slots where testing activities can be carried on; c) the continuous clarification to elders of how any specific activity (e.g. interviews, focus groups, etc.) contributes to the following steps of the project and to the project as a whole, and how it is linked to previous activities (e.g., through the appropriate selection of the material used—questions, stimuli, props, etc.— and periodic events where findings are presented and discussed with users).

II. ELDERLY PEOPLE VOLUNTEERING FOR R&D

The design and implementation of useful, usable and acceptable services for the well-being of elderly people starts with the study of the actual needs and preferences of the target population, and has to proceed hand-in-hand with users' evaluation and feedback. User Centered Design (UCD) advocates that users' opinions are crucial in (i) the elicitation of initial requirements, (ii) the identification of credible and acceptable technological scenarios, (iii) the iterative design and the assessment of the related services and interaction interfaces, both in the lab and in real homes. However, involving old aged people greatly challenges the applicability and validity of traditional investigation User Centered Design tools (e.g., questionnaires, focus groups, interviews, practical workshops, shadowing, cultural probes, mock-ups etc.), due to the peculiar physiologic, psychological, and ethical issues that enter into play [4]. For example, distress of traveling, unfamiliar environments, or meeting unfamiliar people may be a problem when organizing focus groups or interviews: the psychological discomfort might, in fact, hamper the willingness to participate and the frank contribution to the discussion [7]. And even though in-home observations allow the researcher to note things that are not explicitly mentioned by elders, it is difficult to get the consent [3]. To keep into account all these factors, and to balance the various pros and cons of the different investigation tools, many alternative methods of investigation need to be properly integrated, adapting them to the various stages of the investigation. But, above all, one of the major difficulties in convincing older people to participate to technological R&D is their low confidence in discussing technological issues, and a general underestimation of their own abilities in using new technology.

For a long-term project on the development of AAL technology, users' contribution is essential all along the project duration. Therefore, the problem of recruiting a large, representative, and motivated sample of older people should not be underestimated [2]. In our experience, contacting users just for spot interviews or focus groups undermines the efficacy of recruitment efforts. Continuity in users' involvement, instead, favors interest in the scientific objectives, reduces risks of abandonment, and produces higher quality information, due to a deeper understanding of the potential benefits, the personal interpretation and appropriation of the project meanings and views, and a franker contribution of opinions. Though,

the absence of an immediate and tangible benefit from participating in a long-lasting, not completely definite initiative may increase resistance. So, first and foremost, researchers need to work out a successful strategy for: motivating users, setting off the value of their contribution, increasing trust and relaxation, and establishing a long-term relationship that enables them to "enter in the UCD loop". As confirmed by our experience, this is a long and quite complex process that cannot be reduced to the simple compilation of a database of available users, but requires the building and nourishing of a network of users and stakeholders for project support. Despite the fatigue required to bootstrap this process, the initial efforts are well paid back.

A. Stakeholders Involvement

The resort to care givers associations, local charities, or advertisement in local media for users' contact is undoubtedly valuable [2]. However, for a long-term AAL project that aims at experimentation in the users homes, it is crucial to involve local authorities, associations of elderly people, voluntary networks and cultural services as de facto partners of the project, sharing with them the ambitious research and development objectives of the project, identifying ways of integrating research activities with their existing daily practices, possibly pursuing concrete benefits for the local community. For example, in our project, after a preliminary stage aimed to clarify the characteristics of the target users (autonomous elders, aged >65, living alone,...), we contacted and involved the personnel managing the local University for the Third Age and two aggregation centers for elderly people of a medium-size town in northern Italy. Initial presentations, brainstorming and planning meetings have been carried out to establish a mutual understanding of the project's goals and expectations. These stakeholders have not only embraced enthusiastically the project objectives, but also contributed to clarify and better tune them.

1) Early advice

Care givers, social workers and educators working at improving the life quality of elderly people have a privileged vision over the social norms, rules, psychological and ethical issues that characterize the aging process. They can provide invaluable help in providing some early user requirements and in tuning the research tools correctly to the old aged audience, avoiding some gross mistakes. For example, they can check that the stimulus material used for focus groups (e.g., terminology, images) does not suggest stigmatization and does not address sensitive topics in an abrupt way.

2) Multidisciplinary objectives

Stakeholders should not be considered as simple "servants" of the technology developers, even in the case they are paid for their involvement in the project. Care givers, social workers and educators have professional goals – that of improving the psycho-social well-being of elderly people – that naturally integrate with the final goals of technology developers. In our project, for example, the research activities functional to UCD provided to the

educators of the aggregation centres the expedient for promoting among the elderly the sharing of emotions and experiences about the aging process and the difficulties of their daily living. It is also a good practice that of envisaging with stakeholders possible technological services that empower their current entertainment activities to reach users also when they are at home: this additional benefit for stakeholders increases their enthusiasm in the technological project.

3) *Recruiting*

The stakeholders involved in NETCARITY have intelligently managed to smoothly insert focus groups and research experiments within the activities programmed at the aggregation centers for elderly people they work in, as an additional opportunity for socialization and making the most of elders' knowledge and life experience. They have solicited users' participation in the project with the same friendly and human approach they use for recruiting volunteers for charity and social events, and have motivated users to "do something that will help them and other elderly people live better" [9][12]. The same rooms used for Third Age University lessons, for painting courses and cards tournaments have been used as a familiar environment for interviews and focus groups: known caregivers and educators have personally contacted people and made appointments, introduced researchers, and provided reassurance when needed, for example when interviews had to be conducted in the elders' homes. They have managed to appropriately balance the different personalities of the elders participating in the working groups, and have associated project events with refreshments and leisure activities (as suggested in [3]).

B. *Users Motivation and Continual Involvement*

Continuity and coherence in users' involvement is crucial for enhancing motivation and long lasting participation: it is important that they perceive and understand the contribution that any activity (e.g. an interview on personal lifestyle) brings to the following steps of the project (e.g. a focus group on different ways of aging). Questions and stimulus material used by researchers have to include references to results emerged from previous activities, strengthening the feeling that elders are active research partners and that their contribution counts. Periodic events should be organized to present to and discuss with the users the emerging findings. At the beginning of the UCD process, the elders may hesitate to express certain opinions (e.g., intrusiveness, uselessness or complexity of the technology) to researchers associated with technology [3], or they may be reluctant to reveal information and opinions that might induce stigmatization (e.g., feelings of loneliness or isolation [13]). However, this behavior reduces as the project progresses, due to the increased involvement and familiarity with the project team.

1) *Strategies for controlling expectations and rewarding users*

Projects for R&D in innovative fields such as AAL necessarily involve a long-term plan of activities, with

intermediate results that are often simply experimental and not robust, and that can be tested just in the lab due to the complexity of the hardware and software infrastructure they require. Furthermore, researchers need time for tuning the correct Human-Computer Interaction paradigms, for implementing mock-ups and prototypes, for organizing evaluation experiments and for analysing research results. Therefore, during the project development there are periods in which researchers need to work in autonomy, without resorting to users' help. These "gaps" may be difficult to be understood by elderly people, who gradually get so involved in the project that constantly expect feedback on previous experiments or new activities to be performed. Stakeholders can preciously leverage users' expectations and keep the motivation of the group high by organizing side activities put under the project umbrella, like periodic recreational meetings or focus groups on general topics related to the aging in place. These collateral activities have the additional benefit of increasing socialization and of helping elders elaborate in a group of peers the psychological issues related to aging, daily living, and loneliness. The more they feel good at participating at project activities, the more they are motivated to continue also with more demanding tasks.

2) *Help users be objective*

To circumvent the side-effects of a possible "Stockholm syndrome" with respect to the design (i.e. the development of a feeling of empathy wrt the researchers and an attachment to the design solutions discussed in a participated way that prevent the frank expression of negative opinions [7]), it is important that many discussions and evaluation experiments be conducted in aggregations centres. In such a familiar environment, in fact, users feel more comfortable and have the additional opportunity, when researchers have left, to comment more freely their experience with care givers. In this sense, it is important, at the users' eyes, to keep the distinction neat between the role of care givers and social workers (i.e., project facilitators) from that of technology developers.

III. ADAPTATION OF INVESTIGATION TOOLS TO AGE-RELATED FACTORS

Recent studies have started to explore the adjustments required to traditional HCI methodologies for involving old age users in requirements elicitation and experimental design [3][4][2]. In our experience, we have found that group work (e.g., focus groups, testing mock-ups in pairs) is particularly welcome by elders because of the socialization "side-effect", even though researchers are faced with the increased difficulty of keeping them focused on the topic of the discussion.

A. *Scenario-based design*

Appealing stimulus material, like dramatized stories of technology use, turns out to be particularly effective in initiating the discussion on unfamiliar computer-based solutions. Videos or theatre performances with actors playing according to storyboards appropriately prepared by researchers may also be particularly engaging [1][11], though the production costs and time of preparation might

make the testing of several alternative scenarios and the iterative updating of the stimulus material according to early stakeholders' or users' feedback difficult. In our NETCARITY project, during the user requirements elicitation phase, we conducted a series of successful focus groups based on a cheaper and more flexible approach exploiting *personas* and narrative scenarios presented through comics. *Personas* are invented characters with personal features, life stories, goals and tasks [5]. They are introduced to users to favour empathy and identification, encouraging the production of personal interpretations. All the stimulus material is validated in advance with stakeholders to maximize efficacy. A comic strip is then used to show the persona involved in a daily situation (e.g., Nina accidentally tripping over a carpet, as in Fig. 1(a)). Participants are stimulated to discuss about the verisimilitude of *personas*, and the plausibility of the presented situation, and are encouraged to freely envisage possible solutions (technological and non technological) to the presented problematic situation, expressing their fears, needs and preferences (Fig. 1 (b)). Typically, at this stage of the discussion, many personal stories emerge, and the focus group facilitator has the challenging role of containing the emotional involvement of participants. Later on, a technological scenario is presented, suggesting a possible role of technology in solving the problem (in Fig. 1(c), a ubiquitous videoconference device is used to get in touch with an emergency operator). Participants are then encouraged to express their opinions (with respect to acceptability, perceived usefulness, envisaged changes, and so on) on the introduced services and functionalities. In order to keep older people focused and to facilitate turn-giving, participants are assigned a concrete, manipulative task: they are given green and violet tokens, and pictures with scenes from the scenario are put at the centre of the table to draw people's attention on the most relevant features to comment on. Users are then asked to exploit tokens to either express appreciation (green tokens), or raise doubts (the violet ones), as shown in Fig. 1(d).

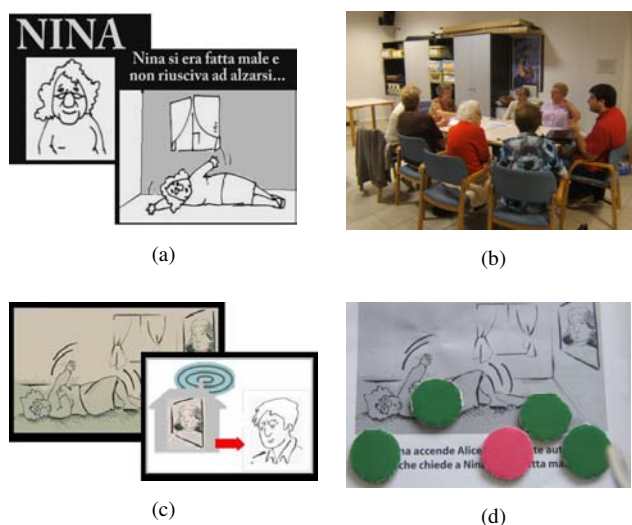


Fig. 1. Scenario evaluation with users. (a) Persona and use scenario presentation. (b) Scenario discussion. (c) Technological scenario presentation. (d) User evaluation.

B. Cultural probes

Also more innovative investigation tools can be adapted to work effectively with an old population, provided that they are framed in a meaningful way. In NETCARITY we are currently experimenting with the collection of cultural probes revolving around the theme of daily living for people who are aging in place. By using different expressive objects (pen and paper, postcards, cameras, maps, etc.), people are asked to answer stimuli provided by researchers. In this way people produce by themselves information and data through their subjective narrations, through objects they collect and through pictures they create. To motivate users to participate, the activity has been proposed in a different way to two separate user groups. (i) For the old-aged students of the local Third Age University, who are more familiar with the concepts of “study” and “homework”, cultural probes have been presented as a sort of “cultural investigation” for which they can provide valuable input. (ii) For the elders attending a local aggregation centre, instead, the playful and creative aspects of collecting cultural probes has been emphasized, with the eventual aim of producing a final booklet/exposition, as was done with previous initiatives at the centre.

IV. INVESTIGATION PROTOCOL FOR AAL PROJECTS

In summary, the lessons learnt from the intensive initial stages of our long-term research and development project on AAL for elderly people suggest an overall investigation roadmap based on a strong partnership with stakeholders and on strategies for users' continual involvement:

1. Contact local authorities, associations of elderly people, voluntary networks, social operators and cultural services and select the most appropriate stakeholders to be involved in the project. Identify ways of integrating research activities with their existing daily practices, possibly negotiating their official participation as project partners.

2. Organize interviews and focus groups with stakeholders to understand the type of currently available services in support of independent living, to discuss their work practices and problems, and to sketch preliminary user profiles and requirements.

3. After a clear identification of the project technological objectives and constraints, and an accurate sociological analysis of the local communities, identify the relevant features of the users to be involved and plan with stakeholders a viable strategy for users' contact, motivation and continual involvement.

4. Prepare general project presentations for elderly people to be performed in the selected aggregation centers to provide means for understanding, raise interest and curiosity, and bootstrap the person-to-person contact process carried out by stakeholders. Care must be taken to avoid unrealistic or inaccurate expectations, e.g. about immediate benefit from project outcomes, or about the time of delivery of new solutions.

5. Conduct interviews and focus groups with elderly people (possibly in combination with in-home

observations) to elicit current life styles, interests, preferences and needs and translate them into preliminary general user requirements. Cultural probes may also be useful to engage users in an unusual, creative activity that may help them disclose information about their daily routines.

6. Organize periodic events for returning results to users (possibly interpreting with their help contradictory data sometimes emerging from separate activities) and rewarding their contribution. This process should be orchestrated by stakeholders for several reasons: (i) to lighten the researchers' efforts; (ii) to enrich the R&D objectives with more immediate objectives of improving the psycho-social well-being of the project user group (to improve the users' perceived benefit and increase the stakeholders' motivation); (iii) to let stakeholders collect franker opinions from users.

7. Invent preliminary design concepts for the user-home interaction paradigm to inspire the overall scenario-based design.

8. Elaborate "personas", i.e. profiles of fictitious elderly inhabitants of technology augmented homes intended: (i) to provide concreteness to the exploration of user goals, attitudes and stories, and (ii) to facilitate end-users understanding and identification.

9. Elaborate narrative scenarios describing life scenes supported by technology inspired by the user requirements gathered in steps 2 and 5.

10. Test the verisimilitude and acceptability of personas and narrative scenarios in focus groups with stakeholders, to ensure that stimulus material does not suggest stigmatization.

11. Use (revised) narrative scenarios during focus groups to help elders envisaging potential benefit of AAL in their lives and generate refined user requirements grounded within the project objectives. Adopt strategies for keeping the discussion focused and favor the contribution of all participants.

12. Revise the use scenarios to address the targeted services, and functionalities, and proceed with the actual design of interaction interfaces and services, by means of iterative mockups and prototypes testing (Fig. 2).

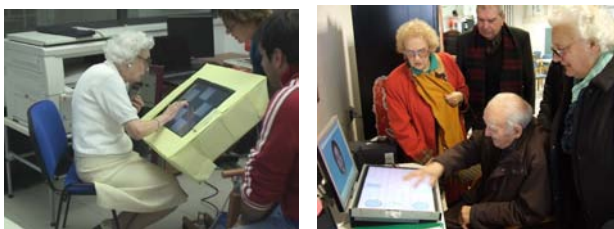


Fig. 2. Users testing project prototypes.

V. CONCLUSION

This paper reported the lessons learnt by a multi-disciplinary group in collecting user requirements for a large project aimed at developing AAL technologies for elderly people. Although a standard UCD approach has been undertaken, the peculiarities of the scenario forced us to reflect on the process of users' involvement. Our

experience is summarized in a protocol for user involvement that suggests a stronger role of mediation by the institutional stakeholders and arguments for the establishment of a longer term relationship between the research team and the user group.

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