Chapter 22
Towards an Impact Assessment Framework for ICT-Based Systems Supporting Older People: Making Evaluation Comprehensive Through Appropriate Concepts and Metrics

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Abstract Although it is internationally acknowledged that ICT-based systems have the potential to provide cost-effective services, their deployment is still limited. Through the User Centred Design, it is possible to draw up information on key concepts, such as attitude towards technology, acceptance and usability of any new products. The collected information will serve for the technological development on one side, and for the Impact Assessment Analysis on the other one, that will describe the future path of the devices. The paper describes in details the most important metrics—attitude towards technology, usability and accessibility—for conducting a prompt evaluation of a new device for the older people, suggesting common guidelines and critical issues to solve.

1 Introduction

Although more and more evidence suggests that ICT-based systems have the potential to provide efficient support services for the elderly at home—fostering their independence, quality of life and social participation—their deployment is still limited and far from being mainstreamed in most countries.

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S. Longhi et al. (eds.), *Ambient Assisted Living*, DOI: 10.1007/978-3-319-01119-6_22,

Many barriers contribute to this situation, such as, for example, the low digital skills of older people, the ethical concerns over privacy, intrusion and lifestyle monitoring, as well as a general resistance to change [1, 2].

Many studies have underlined that, when faced with new technologies, older people can find themselves in a relatively weak position, having prejudices about their usefulness and ease of use [3]. Often, such devices are too complex that older people prefer not to use them. Moreover, common limitations make new technologies difficult to use, and, even more often, the technological devices and services do not reflect the real needs of the end users.

Although some evidence concerning the effects of ICT-based systems for older people exists, much more effort would be necessary for improving the state-of-the-art knowledge in the field. In fact, despite the number of ongoing projects and interventions is rising, the quality of evaluations carried out and the comprehensiveness of results still seem to be limited, at least in the European context.

In this respect, it is obvious that impact assessment is an essential phase of the development and implementation of these initiatives and social innovations in general, especially concerning the characteristics of human-computer interaction (HCI) enabled by ICT systems, which require serious attention. For these reasons, our aim is to design and provide a basic framework for impact assessment that may be applied in every case ICTs are used for addressing needs of older people.

Through using the User Centred Design (UCD) as the main pillar of such a framework, it is possible to define a set of key criteria that should be assessed in a proper context of use, i.e. attitude towards technology, acceptance, usability and cost-benefit analysis. The collected information will serve, on one hand, for the technological development, and, on the other hand, for an adequate evaluation (ex ante, in itinere or ex post) of main direct effects of the user-system interaction.

2 The Elderly Profile

Even though solutions and services are conceived for offering help to the users, the application of the technological innovation has been limited until now, among the older people [4]. Some explanations can be found in:

1. *The general reluctance to use technology*. The main barriers in applying technologies to older people and caregivers originate from psychological factors, especially the perception of quality of life, prejudices, habits and education. Many elderly people strongly reject anything that could ask them to change their life or habits. Often, these people are not aware of the opportunity they could have to improve their quality of life.
2. *The unclear evidence of the real benefits of technologies*. The low level of technological literacy, especially in the Southern European countries as well as the Eastern ones, represents the most important issue to overcome, by spreading the knowledge on how to use the technology for achieving and supporting the well-being.

3. *The difficulty in using the technologies in an appropriate way.* In addition to the difficulty in learning the functioning of any new devices, also the ageing limitations can make a new technology too difficult to use for the elderly. The most common age-related impairments can be, for example, vision decline, hearing loss, motor skill diminishment, and the cognitive processes' deterioration in remembering names or maintaining the flow of the conversation, and the increased tendency to misplace things.
4. *The partial broadband coverage in many European geographical areas*. Broadband is a fundamental issue for the development of AAL technology, that allows the remote monitoring of the environments and elderly or non-autonomous people, as well as the connection of the users with the services. Unfortunately, broadband is not available throughout all the European areas: many rural areas and some Southeastern European countries are not covered by a broadband network. Older people who live in these specific areas often do not make a good use of all the public services, and, in particular, elderly people remain isolated from such applications.

3 The Impact Analysis Assessment

The final goal of every policy, intervention or project should be to produce positive effects on the target population. Since the range of ICTs for older people is tremendously wide, in this work we distinguish only a set of criteria that are applicable in every system delivering any kind of support service through technologies. The criteria described below can be of course integrated by practitioners and researchers with additional ones in relation to the real objective(s) and function(s) of the ICT-based system: dimensions of impact may include also users' quality of life, social participation, knowledge increase, empowerment in daily activities, cost-benefit analysis etc., strictly depending on the type of technology and services provided.

3.1 Attitude

With the term "attitude" is usually intended the individual predisposition directed toward some object, person or event, that can influence the behavior, for example, of technology usage [5]. Attitude towards technology depends on believes and values [6, 7], as well as the user's awareness of the technology and its purpose, the extent to which the features of the technology are consistent with the user's needs, the user's experience with the technology and the availability of support such as documentation and training [8]. Kai-ming and Enderwick [9] hypothesised that attitude is influenced by other internal believes such as the degree to which the perceived application of foreign technology is free of efforts (perceived difficulty), the history of adoption of new technology, the supplier's commitment and the perceived benefit.

According to the increasing literacy about ICT use by older adults, it is important to understand the nature of the attitude because it influences the willingness to accept and use technology, as well as it is modifiable during the life span, providing information and experience with ICT [10].

At this end, experimental researches have shown a rather positive attitude towards technological modification in the domestic environment of the elderly, suggesting a strong association between the elderly inclination to use a device and the problem they have to cope with [11, 12].

3.2 Usability

The definition of usability from ISO 9241-11 [13]—the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use—is considered as the main reference of usability.

Effectiveness, efficiency and satisfaction are the first dimensions that have constituted the meaning of usability, followed by concepts like flexibility, learnability, safety, memorability and quality in use [14–17]. As it is shown, usability is not given an absolute definition, but is relative to the users, goals and contexts of use that are appropriate to the particular set of circumstances [18].

Designing any products or environments involves the consideration of many factors, but often such products and environments are designed for the average user, without taking into account the abilities and needs of specific target groups, like the older people. So, the conceptualization of usability, as it is currently formulated, needs to be extended to the concept of accessibility, essential prerequisite for the development of any assistive technologies.

The concept of accessibility is defined as "the usability of a product, service, environment or facility by people with the widest range of capabilities" [19]. For matching the accessibility of a given device, it is necessary to adopt the Inclusive Design approach, defined as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" [20].

Currently, there are many tools and techniques deeply described in literature, that can be applied for the analysis of the usability of any technologies, but they seem not fully appropriate in the case of older people, because they don't take into consideration the accessibility issue, on one side, and the particular characteristics of the elderly, on the other side. An example of this, can be offered by the application of the Nielsen's heuristics, for the evaluation of the human computer interaction [21, 22].

Typically, in fact, the heuristics evaluation involves evaluators examining the interface and judging its compliance with recognized usability principles, the heuristics. In this way, the risk of adopting an "expert perspective" seems to be higher than the adoption of the end-user perspective and, in addition, the accessibility remains unexplored.

Some researchers have made attempts in order to promote the development of guidelines on heuristics for the older people, that take into consideration key factors for evaluating their performance with a device.

In this case, the choice of the evaluation strategies represent a key issue to gain all the necessary information on the usability and accessibility of a technological artifact but also to keep the evaluators user-centered, whereas typical heuristic evaluations often become system focused or rule-focused [23].

Some researchers have shown that the method called "persona" can represent a good solution to understand if the artefact may be considered usable or it may not with the older users. More than a simple scenario, in fact, persona describes the user's goals and way of interaction, with the purpose of understanding the most important tasks in the User Interfaces and the user's motivations, allowing the observations of the artifact "through" the users-personas [24, 25]. In the case of persona, important characteristics of older users are addressed, such as: age (including chronological age and life experiences), ability (cognitive and physical) aptitude (expertise with the technology) and attitude (confidence levels and emotional state of mind) [23], even if issue of the great heterogeneity of the elderly population still remain to be solved.

3.3 Acceptance

The individual acceptance of ICT has been researched from multiple theoretical perspectives in order to better understand this complex construct. No theory is dominant, but there are some common themes across paradigms: acceptance behaviour is influenced by individual differences, social and situational influences, believes and attitudes [26].

On the research side, a step forward is necessary, in order to investigate which are the elements that can be considered as determinants of the technology use by the older people, not only in relation to impairments and/or unsatisfied needs.

In their model, Thinker and McCreadie suggested a linkage between the acceptance of technology and the felt need for assistance, based on individual characteristics and disability and attributes given to Assistive Technology (AT) [27]. For the authors, the AT offers the opportunity of narrowing the gap between individual capacity and the environment, depending on older people's willingness to use the artefact, which is strictly connected with its acceptability [27].

In this view, the acceptance of technology represents a more complex phenomenon respect to the analysis of older people needs per se and it could be defined as "the demonstrable willingness within a user group to employ technology for the task it is designed to support" [28].

To understand the kernel of the older people rejection of new technological artefacts means to understand deeply the personal believes that characterized the elderly and that can determine their closure to the innovation.

The positive or negative acceptance of a device is linked to intrinsic or extrinsic factors related to the technology. The overestimation or the underestimation of the devices' potentialities can lead to an overall erroneous vision of the technology, that can be modified and/or re-established through specific training, aimed at creating a technological literacy. As it was defined by ITEA, "technological literacy is the ability to use, manage, assess, and understand technology. It involves knowledge, abilities, and the application of both knowledge and abilities to real-world situations. Citizens of all ages benefit from technological literacy, whether it is obtained through formal or informal educational environments" [29].

Starting from the older person representation of the artefact, an adequate technological literacy training should provide skills and expertise to know how to use properly the artefact on one side, and to understand how technology can improve his/her daily life, on the other one [29].

4 Conclusion

The promotion of the technological literacy in the older people and the adoption of the Inclusive Design approach are the overall issues to follow for the development of new technologies for the elderly, as well as the progress in the usability content definition, through the use of effective evaluation strategies and the cooperation of a multisciplinary team, in order to provide guidelines for the specific target.

Even if the evaluation of the metrics described represents the kernel of impact assessment, some attempts should be made in order to find appropriate means for integrating evaluation with other dimensions of impact which depend on the peculiarities of the ICT-based system.

In this respect, the most useful and applicable dimension is quality of life of users. However, this construct is currently measured by instruments typically derived from social or health sciences. In many cases, they are not adapted for the evaluation of the improvement of the quality of life through the use of a new device, mainly due to their conceptualization derived from clinical contexts. For this reason, it is necessary to move further in the state of the art and develop adequate tools addressing the complexity of the range of technology-based systems developed in the field of gerontechnology.

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