



Health, demographic change and wellbeing

Personalising health and care: Advancing active and healthy ageing

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ACANTO

A Cyberphysical social NeTwork
using robot friends 

Deliverable 1.3 (1.2.2)

Motivation and persuasion report

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Executive Summary

The purpose of deliverable D1.2.2 is to understand the factors that can encourage older adults into sustained and varied physical and social activity. To this aim, a semi-structured interview, based on the Integrated Behavioural Model framework (IBM), was used to elicit and explore the activities that older adults like to take part in, the factors that influence their intention to take part in the activity and any barriers versus taking part. These interviews were carried out in both Italy and the UK. In contrast to the stereotypes reported in the literature, portraying older adults as people in need and technology as the solution to their problems, our results provide a portrait of older adults as independent active people involved in different kinds of activities in both social and private contexts. Several design implications, in line with the literature, emerge which may be used to improve the design of the cyberphysical social network increasing the involvement of older adults in a healthy lifestyle.

Introduction

ACANTO's main focus is to foster physical activity which, very often, older adults do not engage in at a satisfactory level [1, 2]. Although physical activity cannot stop the biological ageing process, evidence in the literature shows that regular exercise can minimize the physiological effect of ageing, thus increasing life expectancy and limiting the development and progression of chronic diseases [3, 4]. Reduced physical activity in older age is just in part connected with physical decline, but it may be related to psychological variables as well [5]. For instance, low self-efficacy, that is the belief of not being able to successfully perform a specific activity, is generally associated with low physical exercise in older adults, independently of their actual physical abilities (e.g. [6]). The lack of social support, another psychological variable, has been shown to also have a negative effect, especially in long-term maintenance of exercise behaviour among older adults (e.g. [7]). Finally, reduced physical exercise may be the result of a lack of interest in this type of activity. This is especially true for those who were forced during their childhood to exercise [8] and have been exposed to loss-framed rather than gain-framed persuasive message [9].

Taking advantage of the role of physical abilities and psychological factors in physical activity of older adults, ACANTO aims to foster active ageing by designing technological devices that provide physical and motivational support to older users.

Most technology-based interventions to address active ageing have designed their deliverables around a dominant stereotype [10], which describes older adults as people in need and technology as the solution to their problems [11, 12]. However, there is strong evidence that this stereotype often leads to inappropriate design of artefacts, which older people may refuse to use, or, in the worst case scenario, may be hampered by [13]. To counteract stereotypical design, this deliverable proposes a cost-effective methodology to direct persuasive technology design and elaborates on its application to inform the ACANTO vision. The deliverable considers some of the relevant literature for our innovative approach to persuasive technology for older users. This knowledge is used for elicitation of the requirements for persuasive technology, which is applied to scope the design space of ACANTO. Specifically, our approach builds on the Integrated Behavioral Model, IBM [14-16]. This model will be further explained in a subsequent paragraph. For the moment, we anticipate that IBM is not a prescriptive model (i.e. what should be done), but rather a descriptive model that - based on extensive empirical research - identifies the psychological factors that are high likely to contribute to behaviour intention, implementation and change. These factors guided the questions of our semi-structured interviews (N = 18) that were run in Italy and the UK. In these interviews we explored the activities that older adults like to take part in, the factors that influence their intention to take part in the activity, and any barriers to taking part. The information that emerged from the interviews was elaborated in a design perspective aimed at identifying concepts and frameworks and unveiling new trajectories for design.

Theoretical framework

Persuasive technology and behavioural change models

Persuasive technology is designed to change behaviours of users through persuasion and social influence, but not through coercion [17]. Such technologies are widely used (e.g. in sales, politics, military training, public health, and management) and may potentially be useful in any other area of human-human or human-computer interaction. Specifically, persuasive technology can be used to support healthy ageing, although to be effective in prevention, it should start to be used earlier in life [18]. Moreover, in addition to offering initial motivation for change, persuasive technologies have to provide long-term support for healthy behaviours [19].

An influential model proposed to design persuasive technology is the Fogg Behavioural Model FBM [20]. According to it, a given behaviour is performed when three key factors occur at the same time: the person must be motivated, possess the ability and be triggered to perform the behaviour. These factors may vary in relation to the agent's characteristics and the situation. The FBM has the advantage of being simple and being presented along with a list of guidelines for designers. However, as it is presented now, the FBM appears best suited to the identification of why and what is not working correctly when a persuasive technology fails to encourage a behaviour that designers intended rather than to facilitate ideas and generation of requirements to design novel technology. Its simplicity (behaviours depend upon 3 factors) can be very useful in guiding the search for what is missing (is it about motivation? ability? triggers?). At the same time, it risks creating an oversimplification in the design phase especially for persuasive technology, such as ACANTO, that addresses a very complex set of behaviours pertaining to active aging. In this deliverable we elaborate and validate a more sophisticated psychological framework to ground the design of ACANTO on the Integrated Behaviour Model.

Our approach: The Integrated Behaviour Model.

The intention to perform a specific behaviour has been considered by several theoretical models as a good indicator of the likelihood to engaging in that behaviour. The Integrated Behaviour Model (IBM, [16]) is one of these models and can be considered a further development of the Theory of Reasoned Action (TRA, [21]) and the Theory of Planned Behaviour (TPB, [22]). As TRA and TPB, the IBM (see Figure 1) posits that the intention to engage in a given behaviour is a function of the *attitude*, the *perceived norm* and *personal agency* related to that behaviour. The attitude can be defined as a person's overall favourableness (or unfavourableness) towards the behaviour. It is determined by the experiential, emotional responses (affective) and the beliefs about the outcomes (instrumental) associated with a given behaviour. What other people think one should do (injunctive norm) and the perception about what others are doing (descriptive norm) reflect the social pressure one feels to perform (or not perform) a particular behaviour. Finally, personal agency consists of two constructs: perceived control and self-efficacy. Perceived control is determined by the perception of the degree to which various environmental factors may facilitate (or prevent) carrying out the behaviour. Self-efficacy is the perceived confidence in the ability to perform the behaviour. Differently from the TRA and TPB, the IBM suggests that also other factors (knowledge on

behaviour, no environmental constraints, behaviour salience and having performed the behaviour previously) influence the likelihood of engaging in a behaviour in addition to intention.

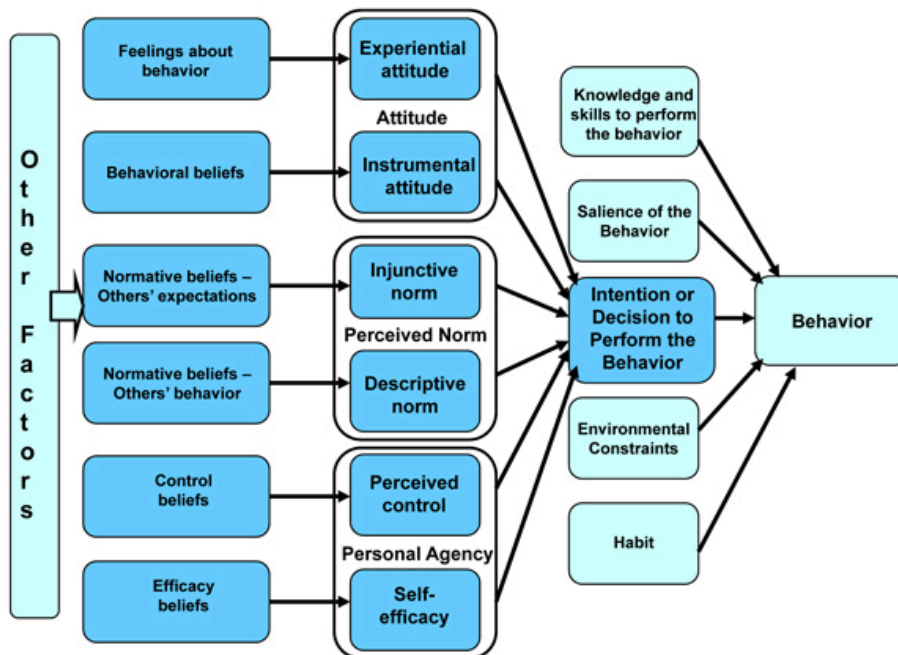


Figure 1. IBM model representation [16]

The IBM has been extensively validated in empirical research, although to our knowledge it has been never used in the context of persuasive technology design. We believe that this theoretical approach has great potential in this context, as it presents some advantages compared to the FBM. Here we will describe similarities and differences between these two models and spell out which are, in our opinion, the advantages of the IBM compared to FBM.

Motivation, ability and triggers are the three necessary elements to engage in a behaviour and that, according to FBM, a persuasive technology should address. The relevance of these elements is also stressed by the IBM, although they are differently named (“motivation” in the FBM corresponds to the intention, the attitude and the social norm component in the IBM, “ability” in the FBM matches the personal agency, environmental constrains and knowledge and skills to perform the behaviour in the IBM, triggers in the FBM parallels behaviour salience in the FBM). What differentiates the two models is the relation among these components and their role in predicting behaviour. For the FBM motivation, ability and triggers are all necessary, but none is a sufficient condition for engaging in a behaviour (suggesting thus a multiplicative relation among these three components). For the IBM, the only necessary and sufficient condition is the behavioural intention, the rest of the variables are only indirectly related to the behaviour. Attitudes, social norms and personal agency, each can contribute to foster or inhibit behavioural

intention (suggesting thus an additive/subtractive relation). The weight of each of these constructs hardly depends on the type of behaviour under scrutiny and, of course, the type of person.

Compared to the FBM, the IBM presents several advantages especially in the phase of eliciting user requirements. One is its complexity. The IBM covers a broader range of constructs compared to FBM. In addition the IBM refers to theoretically founded and empirically validated psychological constructs (attitude, self-efficacy, etc.); this facilitates the generation of questions to probe motivators and barriers in interviews, but also the creation of questionnaires to empirically test the role of each predictor (e.g. attitude) in behaviour engagement. Differently, some of the elements involved in the FBM motivation, ability and triggers refer to psychological state or process (e.g. brain cycles) that are not theoretically and empirically established yet in the scientific literature. Finally, the IBM stems from a long empirical research tradition; whereas, being more recent the FBM does not.

Method

Starting from the IBM, we conducted semi-structured interviews with members of the study population to elicit the preferred activities older people engage in, the salient behavioural outcomes, affective responses, sources of normative influence, and perception of agency. This information was used to identify barriers and facilitators associated with the target behaviour allowing us to frame the design space and to elaborate design trajectories, which will be explored in the project.

The study received ethical approval from the Ethics Committee for the experimentation with human beings at the University of Trento (Ref: 2015-010 H2020 n. 643644) and at the University of Northumbria in Newcastle (SUB080_McNeill_150615). See *Annex 1* for more details.

Participants

We interviewed a total of 18 participants. Ten of them were interviewed in Italy (6 females, 4 males; age ranging from 65 to 102 years old, mean 75; 5 from rural areas, 5 from urban areas), and 8 in the UK (4 females, 4 males; age ranging from 60 to 87, mean 70, 8 from urban areas).

Procedure

In order to define and validate the procedure, a pilot study was conducted with 3 participants (2 Italians and 1 British). Transcripts were analysed and discussed in a face-to-face meeting among all the authors of this deliverable, leading to question wording refinement and an initial coding scheme. Participants were then recruited through older adults associations in Italy and in the UK (in UK, through the NorthEast Age Database held at Northumbria University). The interviews were conducted either at the participants' home or at the offices of the associations involved, in the native language of the participant. The first three interviews with the Italian sample were conducted in tandem by two female researchers, leading to further improvement in the procedure. One of them individually completed the remaining interviews. A male researcher ran all the interviews in the UK.

At the beginning of the meeting, participants were presented with an overview of the ACANTO project, specific information on the present study, and signed a consent form. The interview started with a generative question to stimulate narratives about daily activities, while the following ones probed selected activities on the IBM categories. These questions elicited experiential and instrumental attitudes, injunctive and descriptive normative influences, perceived control and self-efficacy. Furthermore, we used direct questions to enquire about motivators and barriers. Activities to be investigated with the IBM framework were selected based on (1) participants' preferences, and (2) inability of the participants to carry on the activity at present times (see *Annex 2*). We deliberately did not directly ask about exercise behaviour, but about activities that our interviewees like to do. In fact, exercise behaviour may have a negative connotation for some older adults due to personal experiences. In addition, there was the potential risk that asking about taking exercise – an activity culturally associated with being young and healthy – would have primed a negative and stigmatized identity (not young anymore) and a prevention focus (i.e. non losses) in

our interviewees. Finally, the ultimate aim of ACANTO is that of improving active aging and not only exercise behaviour. Having this goal in mind, activities that our interviewees like to do are highly informative on the type of older adults' occupations and interests that include some physical activity or that could be used to motivate to a more physically active life style.

Analysis

All interviews were audio recorded (mean length: 00:48:04) and transcribed applying specific criteria to identify linguistic, paralinguistic and extra linguistic aspects. Each participant was identified by a string of letters (initials and nationality) and numbers (birth year) in order to protect anonymity. The transcripts were analysed using thematic analysis [23] extrapolating all the statements relevant to IBM's constructs that describe behavioural intention. The software Atlas.ti [24] supported the coding process. Two researchers worked independently for the Italian sample. Double coding was conducted on 20% of the Italian data, leading to an inter-rater reliability value of 80%. Disagreements were discussed and resolved by the coders to facilitate the establishment of a common scheme, which was then applied in the UK. Codes were constructed according to the IBM and gathered into 4 code-families: one was associated with activities, the others were labelled as the original categories of the theoretical model (Activity, Attitude, Perceived norm, and Personal Agency). Each code family was further enriched with specific codes as reported in Table 1.

Code Family	Codes	Quotation(s)
Activity	1. Activity s/he avoids 2. Activity s/he dislikes 3. Activity s/he wishes s/he could do 4. General activities s/he does 5. Past job	136
Attitude	1. Experiential attitude 2. Instrumental attitude	37
Perceived Norm	1. Injunctive norm 2. Descriptive norm	47
Personal Agency	1. Perceived control 2. Self-efficacy	110

Table 1. Results of coding on the Italian sample

Results

Participants talked about activities (see *Annex 3*) they currently engage in, and they also elaborated on activities enjoyed in the past (e.g. world activism, photo shooting, house cleaning). However, often, the *barriers* precluding them from performing preferred activities were only marginally related to ageing (e.g. need to take care of relatives, economical cost, availability of a group to share the activity with). According to their main focus, activities were clustered in two main categories: *hedonic* and *altruistic*. Hedonic activities were performed for leisure in order to satisfy a personal need leading to pleasure and self-gratification. Most of these activities were *physical* (e.g. walking, going to the gym, dancing, gardening). Other activities were *intellectual* (e.g. reading, playing instruments or chess). Overall, they represented a large set of leisure activities, which we believe appeal to a variety of life periods, and did not easily discriminate older from younger adults.

Altruistic activities were performed in order to satisfy communal needs. In return, these activities produced a feeling of self-worth and respect. Several participants, (only women in the Italian sample), spoke about their contribution to volunteering. Altruistic activities encompass volunteering as *civic* behaviour, and *political* commitment meant as activism and participation in demonstrations. Practically, it concerned organizational activities (e.g. trips, social events, and courses for the University of the Third Age), charity work (e.g. distribution of food, search of accommodation for migrants), and community services (e.g. taking care of community property). In the UK sample it was often connoted by a religious dimension. Figure 2 illustrates the frequency of hedonic (physical and intellectual) and altruistic (civic and political) activities, as elaborated by the participants of the two samples.

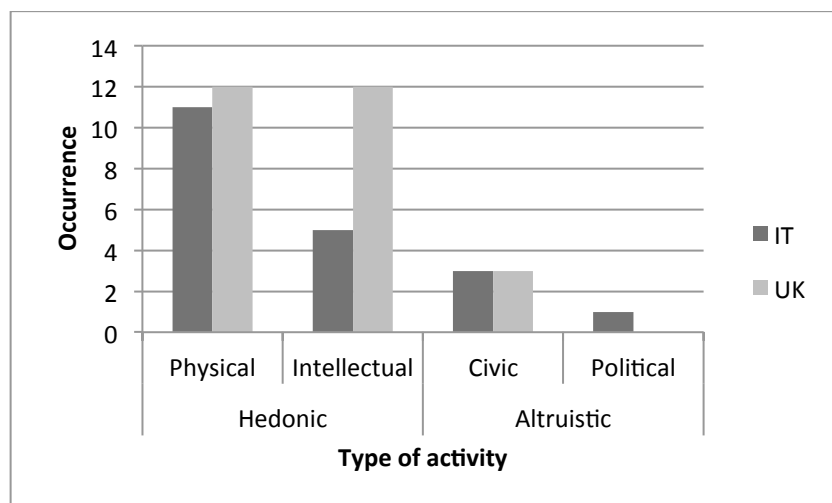


Figure 2 Types and frequency of activities in the Italian and UK samples

In addition, people mentioned a number of different activities that we considered as markers of active ageing. Explanations about these activities was fragmented so that we could not apply the IBM to interpret them consistently. There were however important narratives about the contribution older adults are still giving to their family (children, grandchildren or relatives) and accounts of productive activities they continued to do after retirement. Men, in particular, reported a strong commitment to their past job. It was described as a duty, but they proudly continued to do it whenever possible. Women paid less importance to their previous job, which they referred to mainly as a way to justify their current activities. For example, one woman referred to her professional managerial work as what legitimized her to cover a leading role in a charity.

There were some differences between the UK and Italian data, based on the activities reported. While the numbers are small and not easily generalizable, some of them reflect geographical differences. For example, two UK participants mentioned attending football matches – something likely due to the presence of a large football club in Newcastle upon Tyne. Attendance at large sporting events was not something mentioned by Italian participants, probably also due to contextual factors. UK participants also mentioned a number of predominantly English activities such as croquet and cricket. Interestingly, the UK participants also mentioned several activities either associated with or part of religious life.

Attitudes. Analysing the *attitudes* towards the activities people still engage in, the ageing variable could almost go unnoticed. Older participants elaborated on physical and mental well-being, gratification, and reward. Such attitudes were strongly embodied often relating to the aesthetic and sensory dimension of *being* and *doing*. For instance, physical activities, such as walking or hiking, were described as sources of serenity (mental well-being) and a way to stay fit (physical well-doing). Participants' descriptions were rich with sensorial references. All senses were involved: vision, while describing animals or plants; hearing, while reporting natural sounds; touch, while describing the pleasure of water on the skin; smell and taste while talking about plants and cooking. Furthermore, people elaborated on cognitive capabilities, spatial abilities, attention and concentration (e.g. while describing a path or the ability to recognise a plant), as well as social skills (e.g. when they walk with others, friends or acquaintances). These varied positive attitudes, related to senses and cognition, counteracted the risk of physical, social and psychological decline.

As regards the activities that were favoured in the past but participants cannot perform anymore, attitudes were still very positive. However, participants elaborated on physical barriers (e.g. low vision for embroidering), economical costs (e.g. photo shooting), and safety concerns (e.g. fears of falling).

Norms. Reflecting on the *norms* which regulate their activities, participants presented a view of themselves and their actions as strongly *situated* in the social and material world. In these reflections, we noticed an interesting dichotomy. If on the one hand, family members seemed to have a main influence in the selection of an activity (*injunctive norm*), same-age peers became influential in defining the norms regulating the activities in practice (*descriptive norms*). Relationships with peers were perceived as being influential in practice because they were framed into a mutual exchange among people with similar life experiences. On the contrary, relationships with family members reflected an asymmetrical role, with somebody being in charge of helping the other. The majority of interviewees reported to still play this role

(i.e. with children and grandchildren) while others declared to need help from family members or caregivers because of physical impairments. In the latter case their relationships with family members were at times described as frustrating, due to a loss of autonomy, and dependency. The need for help induced an image of themselves as people in need.

Agency. The effect of ageing came out strongly when considering the perception of personal agency. All participants were well aware of a general decline of their physical abilities, but they appeared to be determined and resilient (*self-efficacy*). The majority of the participants reported a high internal locus of control which helped them to face the difficulties related to ageing (*perceived control*). The narratives about agency reflected a view of ageing as a natural process. Even when talking about health impairments as a barrier to specific activities, ageing was not perceived as negative. On the contrary, resilience, persistency and proactivity were main topics. Participants took pride in emphasizing what they actually did and stressed their persistent will to be active. It is noteworthy that five persons identified physical barriers (i.e. pain, chronic disease, impairment), while reporting proactivity in doing such activities anyway. Numerous participants reported that their activities either had been or were currently restricted by caring responsibilities. Two participants mentioned that they had previously engaged in caregiving while one was regularly engaged in caring for his wife. Another talked about caring for a friend during a terminal illness and how the death affected the structure of her life and left open opportunities for more activities. When considering the agency of older adults, it is important to consider their social relationships.

Discussion

By applying thematic analysis to the IBM, we coded data gathered through semi-structured interviews. Analytical categories were labelled according to this theoretical framework as “Activities”, “Attitudes”, “Norms”, and “Agency”. Results about activities were clustered in two main categories (hedonic and altruistic) regarding, respectively, physical and intellectual, and civic and political activities. Attitudes were strongly positive and embodied. Well-being and well-doing were the main motivators to be active. Reflections on norms highlighted a differential role for family and same-age peers. Finally, considerations about agency depicted a profile of older adults as well aware of ageing as a natural process which can be dealt proactively and resiliently.

The overall framework emerging from the two samples was in sharp contrast to the main stereotype reported in the literature to be driving technology development, which depicts older people as frail and passive creatures. On the contrary, the groups we interviewed demonstrated competence, resources, and resilience. They appeared to be well capable of dealing creatively with the variety of challenges encountered through the process of aging. In this task, they could employ objects as resources, adapting them and reinventing their functionality to suit varied needs. The Italian lady who declared preferring an umbrella to a walking stick provides an illustrating example. The two objects can functionally perform the same task, but the umbrella avoids stigmatization and can be transformed into a fashion accessory. These results confirmed the idea that: “it is a mistake to think of the older user as a wheelchair user or as severely disabled, hard of hearing or partially sighted. Older users are that vast number of people who, in advancing age have some discernible impairment, but also have a strong drive to remain independent and to contribute to the community, but are hampered by inappropriate design. Better design can play a crucial role in enabling older people to remain physically and mentally active” ([25], p.32).

Furthermore, the analysis confirmed the pertinence of defining ageing as a “wicked problem” [26], meaning a social phenomenon that is difficult to manage through traditional processes [27-29]. Generally, wicked problems are socially complex and require both *contextual knowledge* and a *multidisciplinary approach* because there is not just one solution and it is critical to capture the full range of possibilities and interpretations. This is a crucial aspect to consider throughout the ACANTO project, which we aim to fulfil by following a process of Participatory Design (PD, [11]).

Design implications

Our data resonates with Manzini’s [28] reflections that designing for older people requires a paradigmatic change in considering the *elderly* not as a problem but *as agents of solutions*. This statement has interesting implications for design, because it emphasises the need for supporting older people’s capabilities and their will to be involved in decisions and action and optimising their use of social networks. Considering older people, not only for what they need, but also for what they are able and willing to do, can lead researchers

to unpredicted directions for design. We will elaborate on these directions after presenting the basic design themes, which we define as the keystone of ACANTO.

Themes

Table 2 summarises the data and links them to important design themes. Reading the activities collected in our studies through the theme of engagement, we associated the psychological concept of attitudes to attachment, perceived norm to framing, and personal agency to resources.

Engagement. Engagement is a concept rooted in the PD tradition [30]. From this perspective, engaged users actively participate as co-designers of outputs targeted for them. The core principle of PD research and practice is that people have a basic right to make decisions about what concerns their life. Engagement also refers to a meaningful relationship between participants and technology. Thus, design in ACANTO will engage older people preserving and stimulating their active role instead of causing their passive adaptation to persuasive devices.

Attachments. Engagement can be facilitated by the creation of attachments, a concept that can help to elaborate on participation when designing technology [31]. Creating attachments means connecting motivation to action in order to generate new motivation which can in turn lead to new action. The discourse about attachment is strongly related to the need for an aesthetics framework for designing technologies for older people. Aesthetics is one of a number of factors that influence the acceptability of products and systems [32, 33]. Generally, while functionality and usability are relatively familiar to designers of technology for older users, aesthetics has received less attention [34]. Attachments to devices in ACANTO will be stimulated through well-being and well-doing, thus replicating the attachments to leisure activities.

Framing. Design is a matter of problem solving and problem framing, two autonomous but interacting dimensions [28]. On the one side, designers are concerned with problems to solve, on the other side they focus on meanings, framing them on the contexts and relationships which contribute to making sense of them. Problem-solving and problem-framing are both relevant. However, according to the artefact in question and the design framework, one or other of these two approaches tends to take precedence. Results highlighted the importance of framing design by looking at the participants' relationships, all the more with age peers. Thus, the design of ACANTO technologies should consider not only the relevance of an aesthetic framework to create attachments, but also its social implications.

Resources. Literature about design methods confirms that in order to create value for people and organizations, whoever and whatever they are, it is important to look for opportunities and resources [35]. Results suggest a profile of active and resilient older adults with a high internal locus of control and self-efficacy. Participants were resourceful people both for family and society. Researchers should consider older adults' agency as a basic resource to support, value and integrate into the ACANTO project.

IBM	Activities	Attitudes	Perceived Norm	Personal Agency
Results	<i>Self:</i> Physical/Intellectual <i>Others:</i> Civic/Political	Well-being Well-doing	Reciprocity of situated relationships	Awareness Resilience
Design concepts	Engagement	Attachments	Framing	Resources

Table 2. *Results informing design*

Directions

While reflecting on the data we identified two directions leading towards design for *resourceful ageing* and *design for pleasure*, which will be developed in ACANTO.

Design for resourceful ageing

The theme of resourceful ageing was discussed at an American Conference in 1991 elaborating on four main areas which could benefit from a major involvement of older adults: life-long learning, family/care giving, work /second employment, volunteering [36]. Yet, according to Angus, over 20 years later these objectives were left unfulfilled mainly due to the persistence of a negative age stereotype [37]. The design framework for resourceful ageing embeds three main assumptions, which may help counteract ageism. Firstly, it emphasizes the role of older people as resources for society, pushing designers to reflect on how this role can be embedded and made visible in the tools they design. Secondly, it regards objects and tools as resources, which can flexibly be adapted to changing environments according to the user's will. This assumption links closely with the meta-design framework [38]. Thirdly, by emphasizing agency and power, it encourages a life-course perspective and challenges the tendency to look at issues for older people in isolation from the rest of society. This assumption represents the core of inclusive design [11]. By grounding design on resourceful ageing, the focus shifts from the creation of tools in support of older people, to the construction of devices which improve self-efficacy. So, on the one hand, it is of interest for designers to investigate possibilities for exposing the positive image of the elderly as active and resilient, making visible their skills, knowledge, abilities while respecting their will. On the other hand, designers have the opportunity to work on the creation of a sustainable ecosystem of human and material resources, while amplifying their social value with technological tools. Such an ecosystem can be self-sustainable, because it encourages older people to become agents for problem-solving and problem framing associated to ageing. The framework of resourceful ageing suggests interesting design trajectories related to volunteering and family care-giving, which will be developed in ACANTO's Task 1.4 as design scenarios. Engagement of older adults in volunteering has been discussed in literature. Several researchers have documented that volunteers reported higher levels of well-being and life satisfaction compared to non-volunteers, suggesting that volunteering can play an important role in maintaining good health in later life.

In an eight-year long study of over than 1,200 adults above the age of 65, Musick and colleagues [39] documented that volunteers have a lower risk of dying than non-volunteers, even after considering the effects of physical health, socioeconomic status, and social connectedness. Moen et al. [40] studied a sample of 300 women over a 30-year period and found that volunteering at an earlier time was related to functional ability at a later time. The willingness to volunteer demonstrates that older people are not only resourceful for themselves (meaning that they struggle to make up with existing objects for their weaker physical and cognitive abilities), but that they are resourceful for society. Older people have the time, the skills and the drive to benefit others.

Design for pleasure

Over a decade ago, Newell [41] claimed that despite assistive technology not being considered as a fashion accessory, the demographic changes were likely to produce the need for incorporating aesthetic design within products. His reasoning stressed the difference between “need” and “want”. The things we “want” usually are beautiful – in the eyes of the beholder at least. The products which somebody else decided we “need” may not satisfy the requirement of being beautiful, as functionality was considered to be of utmost importance. However there is no reason why assistive technology devices should be ugly and, at worst, stigmatising. These devices do not motivate users to adopt them and, rather than “helping them”, may generate social isolation instead of networking [42].

Also as suggested by our results, pleasure and enjoyment play a crucial role in motivating older people. Concepts such as aesthetics, sensuality and feelings define a promising and most innovative space for designing “scaffolds for experiencing”. Such scaffolds can be technological devices that help users to realize their dreams, while expressing their creativity [43]. By elaborating on this trajectory we will go beyond the dominant medical model according to which older people need to be monitored, helped and assisted.

Digital games and exergames (i.e. games to promote physical exercise) are an interesting direction for design. Design opportunities already identified by literature (e.g. [18, 44]) refer to the use of digital games for relaxation and entertainment for older users and as a means of socializing with others within and outside networks. Games can be beneficial for stimulating the older adults’ memory and attentional abilities [45]. Moreover, the sense of accomplishment and perceived self-efficacy after mastering a certain game can provide a significant boost to one’s self-esteem. Digital games afford ways of interacting that are both more natural and engage the whole body. In particular, balance and strength training seems to be suitable and enjoyable physical exercise for the elderly [46]. The literature shows that many older users are interested in playing exergames if this could benefit their health [47, 48]. A comparative study shows that playing with exergames has a positive impact on social well-being of older users compared with traditional board games [49]. Physical activity by means of exergames seems to have a positive impact also for subsyndromal depression, a condition often seen in the elderly [50]. Brox and colleagues provide an interesting narrative review of how exergames can help to motivate elderly to exercise more, focusing on persuasive technologies and social interactions in online exergaming [51]. Romero and colleagues [52] show that including various stakeholders (e.g. peers, family, and care givers) in users’ networks may improve the efficacy of persuasive solutions to maintain/increase their social and physical activities.

Finally, the design effort in ACANTO has to also consider the advantage of using a virtual coach to support the user while performing physical activities [53, 54].

The scientific effort for improving computer-mediated health-care systems is to find a convergence between affective computing and persuasive technologies with biomedical engineering. A framework for future research in this emerging area has been proposed by García and colleagues [55], highlighting the potential contribution for the modification of patients' attitudes and behaviours, such as engagement and compliance.

Conclusions

This deliverable has demonstrated a method for gathering requirements and has provided rich information on motivations and barriers of older people towards their preferred activities. The method proved to be efficient, reliable, and easy to link to design thinking. Although the results cannot be generalized due to the limitation of our sample, most of the results were unexpected providing a portrait of the elderly in contrast with the stereotype as people in need but as independent active persons involved in different kinds of activities in both social and private contexts.

Our future work will concentrate on expanding the design directions identified in this report increasing the involvement of the elderly in healthy life styles.

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Annexes

Annex 1:

Ethical approval from the Ethics Committee for the experimentation with human beings at the University of Trento



COMITATO ETICO PER LA SPERIMENTAZIONE CON L'ESSERE UMANO

Report of Committee Decision

Project Title: **"ACANTO, A CyberphysicAl social NeTwOrk using robot friends (Phase 1: Requirements Analysis)"**.

Prot. 2015-010
[H2020 n. 643644]

Principal Investigator: **Luigi Palopoli**
Department of Information Engineering and Computer Science
Università degli Studi di Trento

Ethical issues reviewed:

Involvement of adult volunteers; risk assessment; participant's rights; information supplied to participants and informed consent to participation; data management and personal data protection; informed consent to data handling.

Ethical Committee decision taken:

APPROVED

The President



The Secretary



June 22nd, 2015

Ethical approval from the Ethics committee at the University of Northumbria (SUB080_McNeill_150615):

Ethical approval

Subject: RE: ethics submission

From: Nick Neave (nick.neave@northumbria.ac.uk)

To: Andrew McNeill (andrew.mcneill@northumbria.ac.uk)

Date Received: 26 June 2015 11:02

Dear Andrew

Submission code: SUB080_McNeill_150615 and the amendment to this project dated 26.06.15

Following independent peer review of the above proposal, I am pleased to inform you that Faculty approval has been granted on the basis of this proposal and subject to compliance with the University policies on ethics and consent and any other policies applicable to your individual research. You should also have recent Disclosure & Barring Service (DBS) if your research involves working with children and/or vulnerable adults.

The University's Policies and Procedures are available on the ELP; Organisation name: HLS0002: Research Ethics and Governance

All researchers must also notify this office of the following:

- Any significant changes to the study design, by submitting an 'Ethics Amendment Form'
- Any incidents which have an adverse effect on participants, researchers or study outcomes, by submitting an 'Ethical incident Form'
- Any suspension or abandonment of the study;

Yours sincerely

Dr Nick Neave BA (Hons), Cert Ed, Ph.D.

*Reader in Psychology, Department of Psychology, Faculty of Health & Life Sciences
Faculty Director of Ethics*

Annex 2:

Interview schedule

IBM model applied to the generation of the questions for the semi-structured interview

First Phase:

[Generative question]

1. Can you tell me about your everyday life?
 - a. Who do you live with?
 - b. What is your normal mode of transport? (probe: if they say by car ask if they still drive)
 - c. Do you live in a rural area? Urban area?
 - d. What sort of groups do you belong to/attend (e.g. church, bowling club, walking group)?
 - e. What activities do you like to take part in? How frequently do you do each one?
[If necessary, ask whether there is at least one activity related to physical activity]
 - f. Who do you do these activities with?
 - g. How do the seasons affect your activities (i.e. summer and winter)?
 - h. Are there any activities you would like to be able to do but don't currently?

For each activity ask the following questions (or most frequent)

[Criteria to focus on activities that interviewee has mentioned before: "present activity that s/he likes to do" – "past activity that s/he liked to do in the past, but s/he doesn't do in the present"]

[IBM - Experiential Attitude]

2. How does this activity make you feel?
 - a. What do you like about the activity?
 - b. What (if anything) do you dislike about the activity?

[IBM - Instrumental Attitude]

3. What do you expect to gain from taking part in this activity? (Probe: for instance does it keep you fit)

[*Motivator*]

4. What does make this activity attractive to you?

[IBM – *Injunctive Normative Influence*]

5. How important is it what other people think? Whose opinion matters most?
6. What do significant others (e.g friends, family, doctor) think about you doing this activity (probe: positive and negative)?

[IBM – *Descriptive Normative Influence*]

7. What sort of other people take part in this activity? (Probe: Do your friends?)

[IBM – *Perceived Control*]

8. How much control do you have about taking part in this activity? What sort of things or people make it easy for you to take part in this activity when you want to? What sort of things or people prevent you doing this activity when you want to?

[IBM – *Self Efficacy*]

9. Do you feel able to keep doing this activity? How well can you perform this activity?

[*Barrier*]

10. Are there any specific constraints which prevent you from doing this activity?

Annex 3:

Raw data from the interview (N=10) in Italy and the UK (N=8).

ID Interviewee (initial+birth year+nationality, sex, area)	Activity	Experience Feelings	Attitude Benefits	Influential Others	People like you	Perceived Control	Self Efficacy	Motivator	Barrier
FB50IT, woman, urban area	hiking (<i>she does it</i>)	feel good	serenity	[daughter – friends]	friends, groups of persons who share the same interest both younger and older adults	health, availability of medical devices as ventilator	she believes in the power of mind	relationships with nature	asthma
	swimming (<i>she does it</i>)	to be "immersed as in placenta"	serenity, to be supple	[daughter - grandchildren-family members]	alone	ageing	[personal will]	relationships with wather	//
	activism around the world (<i>she wishes she could do it as in the past</i>)	//	//	daughter	friends, groups of persons who share the same interest both younger and older adults	health	self-determination, character	[political ideal]	asthma, the present condition of her brother, costs
						availability of			

	doing steps, gym as rehab (<i>she does it</i>)	physical wellbeing	rehab	son, daughter, son-in-law, "badante"	//	impairments due to repeated ictus and falls, need of a walker	determination	[health]	//
	home cleaning and cooking (<i>she wishes she could do it as in the past</i>)	dissatisfaction due to loss of autonomy	[cleanliness]	"badante" as her caregiver	//	impairments due to repeated ictus and falls	awareness of physical limits	love for home	fear of falling
MD48IT, woman, rural area	charity work (<i>she does it</i>)	to be trusted	//	//	pensioners and older adults	needs of the Association	good health, balanced effort according to the awareness of ageing	appointed by the Association	take care of her mum was a barrier in the past
	gym (<i>she does it</i>)	//	wellbeing	//	older adults	characteristics of the village which is in the mountain	good health, balanced effort according to the awareness of ageing	[healthy behaviour]	//
	managing home-vegetable garden (<i>she does it</i>)	satisfaction	order and cleaning	//	//	possible unexpected changes related to health	awareness of ageing	wellbeing	//
MGF46IT, woman, urban area	walking (<i>she does it</i>)	pleasure	wellbeing, meet others	friends, contacts	groups of persons who share the same interest, friends, alone	availability of medical devices as a walking stick, just in case		to be in tune with the nature	limits related to private ownership of territories she would cross
	charity work (<i>she does it</i>)	other people's gratitude	//	friends, contacts	volunteers, friends	//	[she is able to]	[altruism]	//

MT39IT, man, urban area	dance (<i>he does it</i>)	to be well-liked, physical pain	social relationships	family members, contacts	contacts	precarious health	awareness of physical limits, proactivity	socialization	pain in the feet
	walking (<i>he wishes he could do it as in the past</i>)	//	improve the flow of the blood	//	//	health	awareness of physical limits	[health]	fear of falling, hot weather
RV44IT, woman, rural area	charity work (<i>she does it</i>)	satisfaction	//	family members especially husband and children	pensioners and older adults	territorial fragmentation	[she is able to]	character	many activities to do, fear related to responsibility for participants to activities she organizes, bureaucracy, scarce participation
	embroider (<i>she wishes she could do it as in the past</i>)	happiness	//	//	//	functional impairments	awareness of physical limits	//	decline of vision
GS13IT, woman, urban area	gym (<i>she does it</i>)	pleasure	motility- independent movement	children	older adults of the Centre she attends to	muscle strength and flow of blood	determination, awareness of physical limits	character	weather
UP44IT, man, urban area	gym (<i>he does it</i>)	pleasure	wellbeing	physician- general practitioner	//	health worker	awareness of physical limits	reaction to boredom caused by TV	weather, physical impairments
BP39IT, man, rural area	photo (<i>he wishes he could do it as in the past</i>)	aesthetical gratification	//	family members	//	technological change- digitalization	technological knowledge	keep memories	costs
AL40IT, man, rural area	restoration (<i>he does it</i>)	//	//	wife	alone	//	//	//	//

	play instrument (he wishes he could do as in the past)	//	//	//	brother, family members	functional impairments due to accidents and injuries	awareness of physical limits	//	health
TY35UK, man, urban area	Visiting family (does it regularly)	pleasure	Feelings of connection, enjoy spending time with them	Family encourage visits	Other church friends visit family	No caring responsibilities, feeling of freedom, better eyesight, availability of car	Able to keep doing it because it is not strenuous	//	//
	Arranging day-trips with church group (does it once or twice per year)	Enjoy giving pleasure to others, disappointed that some cannot attend	Pleasure, [social relationships]	Group look forward to it	Other groups do similar activities	Not difficult to organize, help from others is good, but low numbers may stop activity	Able to do it. Will keep going until unable.	//	//
	Shopping (does it regularly)	Doesn't like shopping in the big stores [but he does]	It gets him out of the house, keeps his mind active, physical activity, finding products for family	He is left to do what he wants	//	Shop is nearby. Doesn't go when he doesn't need anything or when trying to avoid unhealthy snacks.	He hopes to be able to keep doing it	//	//
CL45UK, woman, urban area	Going to church (does regularly)	She knows the people involved, enjoys meeting them. Likes the feel of going to church. Dislike: vicar did not contact her when husband was sick.	Being involved. Enjoys taking on additional responsibilities.	Her daughter-in-law is a vicar.	Friends attend.	Husband's illness made her housebound for a few months. Distance is a potential problem.	When she can no longer drive, she won't be able to go.	Spiritual and social benefits. She got married in that church.	Husband's illness.
	Attending University of the Third Age (U3A) (monthly)	Enjoys meeting friend. Enjoys listening to interesting speakers.	Social and knowledge benefits	Friend introduced her to it but she would go even if friend didn't.	Lots of people go but their does not influence her	Easily accessible by bus	//	Social and knowledge benefits	Husband's illness.

	activity)				decision to go.				
	Bowling (tried for a short time and stopped)	Did not enjoy it	To get her husband into an activity (both social and exercise benefits)	Some people from club still meet her and ask why she does not come back.	Other elderly people attended	Easily accessible. Her husband is an anxious person.	//	To provide an activity for her husband	The other players were much better than her husband. He did not enjoy it.
JT55UK, man, urban area	Going for meals/drinks with friends (regular activity)	Relaxed social environment	Just enjoyment. Socialising.	A friend would phone up and organise a meeting	//	Transport (he does not drive)	Able to keep doing it	If it is someone he has not seen for a while	The effort required to go out
	Attending sports match (cricket and football) (not very regularly)	Disillusioned with football. Enjoys atmosphere of the clubs. Enjoys exploring history of the clubs.	Enjoyment	Friends try to persuade to attend football but he declines.	Friends attend	Transport	Able to keep doing it	Enjoyment	Transport availability
JM47UK, woman, urban area	Visiting her friend to play Uno (does regularly)	She likes her friend's character	Enjoys being with her friend. Her friend is sociable and talkative. She has a nice dog.	Mutual influence on each other	//	Distance and levels of traffic (she drives)	Able to keep doing it	Friendship	Time
	Dance class (does weekly)	She likes the class leader. Wishes it would start on time.	It makes her move her feet quicker. Socialising. She gets to meet people she would not meet elsewhere.	Loyalty to class leader. The caretaker at the centre keeps and gives her crosswords.	Old people attend	The comfort of training shoes. Being able to drive.	Able to keep doing it	Loyalty to class leader	Nothing. She has enough money to attend.

	Attending the theatre (does regularly – around once per month)	Enjoys being entertained. The unpredictability of live theatre. Dislikes modern plays.	Seeing something you have not seen before, it “takes you out of yourself”. Seeing costume design.	Sometimes goes alone and sometimes with friend. Mutual influence of friend.	//	Quick walk to theatre. Comfortable financial situation.	Able to keep doing it while hearing and eyesight last. Availability of return bus.	Aesthetic experience	Nothing
	Attending football matches (regularly but thinking about stopping)	Frustrated. There are no heroes to follow now. She has no control over it.	“A rush of adrenaline”	Some friends discourage her because of the team.	Some friends attend.	Close to home	Able to keep going	Misguided loyalty	Loss of interest
PM52UK, man, urban area	Croquet (does regularly)	Dislikes having to dress in white.	Good way of getting out, social aspect, provides structure to life. Skill improvement	Wife attends. Someone always turns up.	A range of older people and some younger attend	Transport, owning a mallet.	Able to keep going as long as knee does not get worse	He can play it well. You get a “buzz” from winning.	None.
	Walking group (does fortnightly)	Social contact. Likes getting out in fresh air, exercise. Enjoys seeing nature. Aesthetic pleasure.	Fitness, keeps brain active	Does not feel pressured to go unless scheduled to lead walk	Most others in group similar – retired	Seasons of year, weather, knee problems	Able to keep going	//	None.
	Exercise group (recently started)	In previous group he felt talked down to. Sense of accomplishment.	Health benefits, increase heart activity	Suggested by cardiac rehab centre but personal decision. Encouragement from wife.	Other attendees are older people with health conditions. Others are heavier than him.	Easy to access, not expensive. Difficult to increase motivation.	Hopeful that he can continue. Social aspect of group increases commitment.	Heart attack prompted activity. Exercise group is more active than walking.	Knee problems with certain exercises

	Mahjong group (started about two years ago – does weekly)	Enjoys mental aspect, competitive element, social aspect. Good fun.	Social and mental aspects.	Wife thought it would be interesting and encourages him	Other retired people attend	Clashed with croquet playing so he moved group. New group is closer. If pub is busy they need to stop.	Able to keep going	//	Clash with other activities (timetabling)
JV28UK, man, urban area	Taking wife out of nursing home for afternoon (does regularly)	“I don’t have emotions”	Sense of duty, reciprocation of care	People congratulate him for caring for wife. Nursing home staff encourage him.	Some people visit family in nursing home but some do not get visitors	Wheelchair accessibility, adapted car is useful.	He won’t be able to keep doing it. He tries not to think about it. He will have to enter nursing home eventually.	Sense of duty	Gardens are not always wheelchair accessible
	Research participant at Newcastle universities (does regularly – started four years ago)	Enjoys meeting “pretty PhDs”, enjoys learning about research, feeling useful.	Meeting other people	Friends don’t attend	//	Nothing makes it hard. Directions to location need to be clear.	Able to keep doing it until something unexpected happens or until he cannot drive	//	No specific constraints
	Sunday lunches with friends at their homes (does weekly)	//	Conversation about similar interests, similar attitudes to life	Mutual expectation of friends	//	Easy to order takeaway to take round.	Able to keep doing as long as nothing unexpected happens	//	None
	Chess club (used to play long ago)	Made him feel intellectual, enjoyed mental stimulation, now he would think it was a waste of time	He enjoyed beating people	Relatives taught him	//	It was easy to spend time at it but it should have been difficult to waste time	//	Would start again if someone suggested it	Geographical move disrupted attachment to group. He now feels that he would be bad at it.

JM53UK, woman, urban area	Croquet club (does twice weekly)	Enjoys being outdoors in fresh air, feeling of involvement. Disliked previous club because of domineering leaders and bad attitudes towards mental health.	Keeps you fit, mentally alert, social aspects, inspiring to see older people playing	Husband plays too but will go without husband	Range of ages. Previous club excluded younger people. Enjoys having a range of ages.	Long distance to travel, knee problems, there is always someone at the club, previous club was in city park (unsafe at night)	Able to keep going	Being out in fresh air	If the car broke, bus travel would be awkward wearing whites.
	Knitting group	Feel that you are doing something useful, enjoys social aspect, enjoys knitting. Dislikes trying to be included in other church activities.	Social network, use skills for a good cause	Friend invited her to attend. Friend would encourage her but would go alone.	Other people from the community	Happy making smaller items, arthritis makes it difficult for larger items	Able to keep doing it as long as car is available. But could use bus.	Charitable work, needs purpose for knitting, does not require much commitment	None
	Yoga group (recently joined)	Relaxing, enjoys teacher, feels better for doing it	More supple, relaxing, physical benefits	Enjoys the teacher. Personal decision to attend.	Range of ages but mostly older. Does not want a group of only old people. People are friendly.	Accessible by walking. Enjoys being able to attend some weeks but not others.	Able to do more than she thought she could despite knee problems	Previous experience of yoga. Death of friend provided more opportunities. Needed more structure in life.	Clash in timing activities
AS44UK, woman, urban area	Pilates group (does regularly)	You feel stretched, feel like you have done your body good	Exercise	Personal decision	Women, mostly over 60 attend. Some younger people with health problems	Easy to walk to group, friend drives her home	Able to keep doing it	Happy, non- judgemental class, helps arthritis	None

					attend.				
	Cycling at gym as part of research (does regularly)	Enjoys getting stronger	Improves muscle tone, enjoys meeting people in sauna afterwards	Husband is very fit, he encourages her.	Range of people	Needs TV or rock music to assist pace. Timetabling difficulties. Easy to access by walking. Activity is free but would pay. Does not like having to carrying changing bag.	Able to keep going	Exercise	None
	French country dancing group (stopped attending)	Boring, can't do waltzing. Music was excellent. Embarrassed by sitting at side when not dancing.	Exercise and social aspects	Husband won't do dancing. Knows the organisers.	Attendees were too posh	Couldn't do all the dances	//	Encouraged to attend by organisers (friends)	Attendees too posh, felt embarrassed sitting at the side
	Buddhist temple (stopped attending)	Couldn't understand Thai chanting	Appreciates buddhism	//	//	Difficult to access via bus. Difficult to sit for two hours and listen.	Intends to attend closer group	You can pick and choose what to believe. Shared values	Understanding, access, patience in listening for two hours