Remote home physical training for seniors: guidelines from the AAL-supported MOTION project

Remote Home Physical Training for Seniors: Guidelines from the AAL-supported MOTION project

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Abstract

European population will face an unprecedented ageing era in the next years. Albeit ageing in itself is a success goal, it may bringwith it a general decline and functional limitations. In order to decelerate such decline, one of the most efficient strategies is physical activity. The present paper reports the insight emerging from three focus-group interviews organized at the beginning of the *MOTION - Remote Home Physical Training for Seniors* project, whose main aim regarded the implementation of an ICT system capable to offer home-based gym sessions to healthy seniors. The sixteen interview participants (11 females and 5 males, averaged age 72.3) provided several indications, which were grouped into the following themes: 1) ICT technical characteristics; 2) Platform accessibility; 3) Physical program features; 4) Psychological factors. At the end of the thematic analysis, results suggest that theoretical frameworks mainly focusing on ICT issues might be insufficient to endorse the successful development and maintenance of ICT systems such as *MOTION*, which challenges seniors to accept ICT while staying committed to the physical exercise program.

Keywords. *Older people, Remote physical training, Coaching, Socialization, ICT*

**"The opposite of loneliness,
it's not togetherness.
It is intimacy"**
Richard Bach

Introduction

Ageing related issues. Europe is ageing: the age profile of the EU will change dramatically in the coming decades. Unfortunately, such increase will affect any health care system (European-Social-Network, 2008) because, apart from the physical issues, ageing highly correlates with debilitating mental conditions (Galeotti et al., 2013). Due to the nature of cognitive impairment and dementia, in particular, it has been calculated that the age-related public expenditures would increase by 4.1 percentage points of Gross Domestic Product by 2060 (European Commission, 2015; Rechel et al., 2013; Zsarnoczky, 2016). However, no drug has yet been identified as capable to modulate the curve of cognitive decline. The only actions to deploy in order to contrast such conditions are psychosocial interventions. In fact, much recent evidence suggests that the earlier psychosocial interventions are implemented, the higher are the chances to stabilize as much as possible both cognitive functions and quality of life (e.g., Barnett, Lewis, Blackwell, & Taylor, 2014; Vernooij-Dassen, Vasse, Zuidema, Cohen-Mansfield, & Moyle, 2010). Recently, the evidence suggesting the positive effect of cognitive, affective and social treatments has been enriched by further, independent, reports which addressed physical exercises as capable to exert positive cognitive and psychological effects, on the top of physiological ones (Alkhatib, 2016; Snigdha & Prieto, 2017; Sofi et al., 2011).

However, access to gyms or the possibility to practice physical activities may be difficult if one lives in rural and semi-rural areas (Abbaspour, Farmanbar, Najafi, Mohamadkhani Ghiasvand, & Dehghankar, 2017; Coburn et al., 2007; Perkins & Moran, 2010), or if one is subjected to limited availability of income (L. P. Smith, Ng, & Popkin, 2014), or refrained by cultural barriers (Clark, 1995; I. H. Smith, 2017). Seniors can be reluctant to enter the changing rooms, as they would like not to share intimacy with people they know too little, especially when they suffer from embarrassing, even when not invalidating, physical problems. Moreover , the frequent occurrence of fears, negative beliefs or overprotection from people who take care of them can lead seniors to refrain even more than what the former would expect(Dergance et al., 2003). Further aggravating such scenario, it is a fact that people aged 65 are usually more numerous than the working age population (Eurostat European-Comission, 2013) who, ultimately, often cannot support seniors in reaching the gyms (Bertolini, Pisano, Sivini, & Scaramuzzi, 2008).

ICT-based supports for successful ageing. In all these cases Information and Communication Technologies (ICT) might represent a suitable solution (Y. Chen & Schulz, 2016). Indeed, as Blažun, Saranto, Kokol, and Vošner (2012) showed, the development of basic ICT skills - like browsing the Internet, using e-mails, word processors, chat rooms and forums - directly increases socialization and self-confidence, but also increases the amount of physical activities people perform. On the other hand, ICT might also offer people unable to access gym facilities a set of opportunities to live comparable experiences. ICT projects using web-based apps (Cotten, Anderson, & McCullough, 2013), telephone debriefing interventions (Cattan, Kime, & Bagnall, 2011) or mobile visual pet companion (Machesney,

Wexler, Chen, & Coppola, 2014) can increase contacts, social interactions and quality of life among the senior population. In their review Y. Chen and Schulz (2016) analysed the case of Nintendo Wii, a technology used to have elderly plaing. Nevertheless, the results Kahlbaugh, Sperandio, Carlson, and Hauselt (2011) reported regard improvements in mood levels, less experienced loneliness, but no modulation either in life satisfaction or in physical activity. Further, independent evidence tends to suggest that once ICT solutions are used to invite people, each staying at their own houses, to play ball game together (Mueller & Agamanolis, 2005) or to follow a instruction of a virtual gaming agent (Vaziri et al., 2016)), the effects on the amount of performed activity increase, as well as on what concerned their quality of life (see also Gordt, Gerhardy, Najafi, & Schwenk, 2018). Moreover, ICT solutions increase the quality of life of frail seniors by supporting people to stay at their own homes as much as possible (Keränen et al., 2017; Meiland et al., 2007; Nugent, 2007).

Rationale

The present paper presents some of the results that were yielded during the running of the *ALL*-supported[1] project called *MOTION - Remote Home Physical Training for Seniors*[2]. The project was a result-oriented research, that is, a project whose results are supposed to reach the market in 2-3 years. Such a line of research was featured by a double funding-based system, i.e., research was funded by the National Funding Agency of each partner who takes part in the consortium, and, jointly was complemented by the European Commission. Specifically, the *MOTION* project aimed at providing the services that can be found in a professional gym , i.e., to do physical exercise while supervised by professional trainers, within the walls of the users' own homes instead. At the end, the results that would emerge from the study are expected to exert a twofold effect: On one side they will increase the practical knowledge about the aspects related to implement future ICT platforms delivering gym sessions for seniors; On the other side, they should help to identify the most adapt theoretical background to describe seniors' acceptance of ICT platforms delivering physical programs coached remotely.

Practical side. The present paper reports the insights that emerged during three focus-group interviews organized in Italy at the beginning of the project. The interviews were aimed at identifying features, facilitators and negative factors that could affect the usability of the *MOTION* platform (Dal Bello-Haas, O'Connell, Morgan, & Crossley, 2014). After the data collection, the results of the interviews were shared with the *MOTION* technological partners for the platform design and further development. In any ICT project devoted to support end-users in some life aspects (Hartswood et al., 2002), their co-involvement is fundamental as they foster the project development by bringing into discussion naïve insights, realistic problems and real-life experiences (Lindsay, Jackson, Schofield, & Olivier, 2012)

Theoretical side. According to one of the most influential model accounting for technology acceptance, i.e., Technology Acceptance Model (TAM) (Davis, 1989; Holden & Karsh, 2010; Venkatesh, Morris, Davis, & Davis, 2003), people acceptance of any ICT systems is mostly modulated by perceived usefulness and perceived ease at use of the system.

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[1]http://www.aal-europe.eu/
[2]http://www.motion-project.eu/en/

However, in this project, ICT is a mean to support seniors to keep doing physical exercises. Consequently, by incorporating two challenges at the same time, i.e., that seniors accept an ICT platform (1) and that they stay committed to the program of exercises delivered and guided by trainers who are not close at hand (2), other, more general, theoretical frameworks, as the *Theory of Planned Behaviour* (Ajzen, 1985), might explain better the interviews' results.

Ethical clearance

The interviews were carried out in accordance with the Declaration of Helsinki. Participants were all informed about the aims of the project and provided with all the time they needed to raise any doubts. Afterwards, they signed the consent form. The personal details that were gathered were treated following the indication of Italian Law for Data Protection (D.Lgs 196/03).

Methods

The focus-group interviews that were organized aimed at stimulating the most diversified possible type of users of the *MOTION* system to share their opinions and thoughts about how a remote home physical training for seniors might be, in order to effectively work. Indeed, as many authors pointed out (Hartswood et al., 2002; Kristoffersson et al., 2016; Lindsay et al., 2012; Llorens, Molina, Compañ, & Satorre, 2014), end-user support must surely be considered at the beginning of any project, but also later, when the project is running (Barsocchi et al., 2016). During the focus groups, the interview moderators explored all the instances that emerged along the interviews, until data saturation was reached (Glaser & Strauss, 2009), that is, until *"no new or relevant data seem to emerge regarding a category."* (Strauss & Corbin, 1990, page 188). In particular, each interview started with the moderators contextualizing the topics of the discussion by presenting a summary of the main goal the project *MOTION* was designed to achieve (i.e., Physical activity for seniors delivered distantly). Then, they drove the participants' attention towards the fundamental impact that end-users involvement has on the project development. Participants were then requested to talk freely about any attitude or experience they had with technological devices and means they were used to use; later, participants were urged to talk about their attitude or experience with physical exercises and gyms, and then about the combination of the two aspects. Every time a group went silent, the interview moderators asked participants if nothing could be added to the discussion concerning the just-debated point; if not, they were prompted to think and talk about a further aspect to consider.

Participants

The focus groups were advertised publicly through wall posters displayed on the external facilities of the project partners and inviting the interested public. Age limits-indicatively to be around 65 years old- were indicated just for seniors, while no limits were set for the professionals. No other limits were expressed but the following inclusion criteria. Once people expressed the intention to participate they were sorted in two groups. One focus-group was composed of participants selected because they admitted having no familiarity with the Internet. Another group was composed of people that were familiar

with the Internet. The last group was composed of either Internet, healthcare or gym-related professionals. The majority of participants were over 65, retired from work and female. Among them was a Director working for the Local Health Authority, an Internet service developer, a yoga teacher and two psychologists who were experts in the care of older people (for more details, see Table 1). Due to the fact that no senior with cognitive impairment showed up, cognitive screening resulted unnecessary.

Table 1

Focus-group interviews participants' characteristics. Age is expressed as a function of mean and standard deviation.

Gender	Female	Male
Number	11	5
Age	62.6 ± 17.4	82.0 ± 13.0
Participants marital status		
Married/in a relationship	9	3
Divorced	-	-
Widowed	1	2
Unmarried	1	-
Group composition		
Participants familiar with the Internet	6	1
Participants non-familiar with the Internet	1	3
Expert participants	4	1

Data collection

Each focus-group interview was governed by experienced moderators. In particular, the focus-group interviews that assessed expert and naïve Internet users were conducted by the same moderator. All the interviews were recorded and transcribed verbatim.

Data Analysis

Each focus-group interview was coded by using *conventional content analysis*, its main feature regarding the way coding categories are derived (e.g., Hsieh & Shannon, 2005; Mariani, Vernooij-Dassen, Koopmans, Engels, & Chattat, 2016). Differently from other forms of content analysis, the codes emerge directly from the text data. In the present context the direct approach was assumed not to be the one of choice, as the initial assumption was that investigating the usability of an ICT system, capable to connect seniors and coaches in order to exercise together, could involve supplementary theoretical modules in addition to the ones used to describe mere technological acceptance (Venkatesh & Davis, 1996).

Pragmatically, the first step into the process of analysis regards the interview transcripts that were read carefully. The meaning units seeming to capture relevant factors were identified and labelled with appropriate codes. GO and ER identified independently the units, thus they discussed the codes until they reached a consensus: when no consensus

was reached, RC, AT and TG were involved in the discussion. No further inter-rater checks were used. On the base of the relations among codes, GO and EM sorted the identified codes into categories, the latter were then organized and grouped into the main themes reported in Table 2.

In the following paragraphs the *MOTION* remote home physical training for senior is indicated with the term *the platform*, while the exercise program is indicated with the term *the program*.

Results

Table 2

The table reports the main themes, categories and codes emerged from the analysis of the three focus-group interviews.

Themes	Categories	Codes
ICT Technical characteristics	ICT components	Types of platform Platform features Communication devices (interactions)
	Health-related components	Physical parameters devices GP involvements
	Setting components	Set-up exercise room Sessions' timing and scheduling
Platform accessibility	User attitudes	ICT attitudes Physical activities attitudes Service charges
	ICT-related assistance	Initial set-up External support concerning technology Simple instructions Intergroup support
Physical program features	Trainers features	Trainers professional expertise Psychological and communicative characters of the trainers Trainers physical aspect
	Training program characteristics	Goals of the exercises Technical equipments (mat, balls, dumbbells) Users' groups
Psychological factors	Intrinsic motivational aspects	Loneliness Commitment Motivation
	Extrinsic social aspects	Socialization Secondary ICT uses Self-esteem

Theme: ICT technical characteristics

The theme labelled *ICT Technical characteristics* is a theme that comprehends all the requests addressed by the focus-groups participants concerning the platform technology.

The theme can be sorted into three distinctive categories: *ICT components*, *Heath-related components*, *Setting components*.

ICT components. The first issue that arose among the participants in the interview was related to the screen. They immediately expressed the need for the screen to be wide enough to include the image of people doing exercises. The ideal dimensions for the participants' screens were identified to be the ones of a family TV ($\sim$ 21-24"): within the screen, the image of the participant her/himself and the images of the trainers must be included.

While the dimension problem was easy to spot, the nature of the screens was a bit controversial. Seniors described people of their age as more confident with a television-like device than thinking about an extension of a computer. They were aware of the difference between TVs and computers, as well as of the fact that computers are going be very popular in everyone's house; but since the system was to be be built for seniors, they suggested that seniors may preferably use devices resembling pieces of technology they have already used.

> *Participant non-familiar with the Internet* said: We all have a TV, so why not to plug a computer- or something smaller than that- into the TV screen: problem solved! [. . .] The TV is a passive device; the computer enters our homes even if you do not know how to use it. In a few years it will become something to get familiar with. Computers can serve other purposes that we could never have imagined when they arrived at our home.

Coherently with the old-fashioned suggestion, they also suggested that, in order to be capable to interact with the platform, a sort of remote control may be provided. The remote control devices, but also the entire platform, were asked to be provided with few, bright and colourful buttons to press. Such *easily-detectable* choices were envisioned to decrease any discomfort that might be generated by the platform use, since seniors tend to be aware that their perceptual system is deteriorating with time.

As for the trainers' screen, instead, participants immediately agreed that those screens must be the widest ($\sim$ 40"). Indeed, trainers must be capable to watch and keep control of many participants moving at the same time, together with a picture of themselves moving too. In fact, it was suggested that trainers must see each person entirely while s/he is moving; however, it might be very useful if they were provided with the possibility to zoom in and focus on some parts of the figure so they can detect if some movements have been performed wrongly, and prevent accidents.

> *Participant familiar with the Internet* said: First of all, the trainers should be put in the condition to see the entire person doing the exercises; later, in case they need to do so, they might have the chance to zoom in on the image and see more in detail how the movements are executed.

Later the zooming facility was envisioned as useful also for the users, as they might need to see in detail how trainers are executing a movement and better copy them. While

thinking about watching the movement straight after its execution, participants envisioned a sort of repository where to store the images. By accessing such storage, participants and trainers might retrieve videos of past sessions. The request was advanced by participants to see themselves after the session in order to improve the execution of the actions. In this light, they also suggested that the possibility to see others' actions might improve the performance, since each participants might understand better what to avoid/ how to execute a correct movement. Coherently with these video features, they advanced the option of implementing a slow motion facility to see each movement in detail.

> *Participant familiar with the Internet* said: Another aspect that could be useful is to have a facility that allows trainers to say "hang on a second, I need to see again which movements were wrong".

Aside from the features about the visual information conveyed by the platform, participants highlighted that a proper headset, composed of headphones and microphone, was to be preferred by speakers.

> *Participant familiar with the Internet* said: What about a headset? It would serve to improve communication between users and trainers and among users, they can say something like: "I can not see the exercise; how should I do it? and so on".

Heath-related components. Independently of the nature of the screen, participants suggested to leave some spare space at the bottom of the screen to display physiological feedback indexes (e.g., heart rate or blood pressure) that ad-hoc studied bracelets should record during the exercises. In this light, the use of bracelets or portable devices capable to measure the changing of seniors' physical state were considered controversial. The device was assumed to be important as a measure of improvements in physical shape, and as a safety measure: once the level of heart rate, for example, would exceed the safety limits indicated by users' general practitioners (GPs), trainers should make an emergency call. On the other hand, bracelets were said to refrain people from getting interested, as they may impede movements. Connected to the discourses about the physical states and measurements, the importance to create a connection between trainers and GPs was felt as fundamental. Again, frailty of elderly people was reported as a main issue and the possibility to be in control of what is happening, alerting the doctor or paramedics if something is not going well, was reported as crucial since trainers are not in the same room as the users.

> *Participant non-familiar with the Internet* said: By taking into account what the GP has indicated, the trainer makes you do certain- specific- exercises.

Setting components. One of the aspects that captured the attention of the participants in the interview was the set-up of the exercise room. The space around the spot where people would exercise must be large enough to permit their movements. However, in order to do so, another important issue has to be solved: where to put the platform. Moreover, this aspect was envisioned as closely related to the type of platform that would be used. The majority of our participants suggested that the device must be small and easy to move, as seniors are used to living in small places; other participants suggested that the platform might be hanged on the wall or behind a door. Again, whatever the platform, in any case it must be composed of easy parts: concerns for difficulties to carry or move the platform around the house were expressed for people their age.

> *Participant non familiar with the Internet* said: The platform must be movable: it must be moved around the house, to find the best place to exercise.

Music too emerged as an issue that interested participants: they highlighted the need to use only instrumental music. Moreover, the music must be respectful of the exercise effort so that high bpm (beat-per-minute) music accompanies high exercise rhythm and low bpm music is used for relaxing and cooling-down moments.

Another setting issue involved the idea to receive a signal that warns users that the session is about to start. It was suggested that, preferably, the signal should be a telephone call made by trainers, but also a text message sent to the users' mobile was suggested to be good enough. Interviews' participants reported that such a call serves to develop the psychological relationship, especially at the very beginning of the program.

> *Expert participant* said: From my working experience, seniors are usually very happy to receive a call from a person trained to speak with them, to remind (in my case) to take their pills.

The warning call opens the discussion about the program scheduling. Seniors are very busy people. They have many duties to accomplish: to take care of grandchildren, to go to the cinema, to go shopping and prepare lunch and dinner. However, they quite easily converged upon the indication that the best time to exercise is in the morning.

> *Participant familiar with the Internet* said: Once awake, it takes time for an old person to wake up completely and to get ready to exercise. Thus, the training must be done between 9.00 am and 11.00 am or between 10.00 am and 11.00 am. This way, people can go shopping, prepare for the session, but prepare lunch too [. . .]. The morning is a very good moment: usually, in the afternoon, our body sends some backdown signals.

Theme: Platform accessibility

The theme *Platform accessibility* includes the issues that could emerge after the development of the platform, once that it reaches the user's premises doorstep. The theme consists of two categories, namely *User attitude* and *ICT-related assistance*.

User attitudes. Participants described Italian seniors as people used to being involved in many social activities. However, according to them, just very few are the ones that are interested in learning new technological competences and attending specific courses, for example.

> *Participant non-familiar with the Internet*: The truth is that
> Italy is full of older people that meet other people to play cards,
> going to the theatre, or other similar activities; they do not want
> to spend time in learning new [ICT] activities.

At the same time, participants admitted that, in the very last years, seniors were obliged to become used to technology: one way or another, they learned how to use some devices, primarily the mobile phones. In fact, seniors were described as used to using them only to accomplish simple tasks, such as sending Short Text Messages and receiving calls. Regardless of such admissions, they assumed that seniors may be worried to face new- and maybe more complicated- instruments.

> *Participant non-familiar with the Internet*: I am not prepared
> for technology: I have a mobile, where I can receive calls, text
> messages, everything. I can also call. I am an older person,
> what do I have to do with the remote training platform? I can
> use the TV, if there is some disc or tape, I can use those.

Seniors negative attitudes might not only involve ICT aspects. Seniors might tend to be somewhat lazy to do physical exercises. And this is particularly real when physical exercises are something that seniors have never done in their life. Participants recommended the education of seniors as a very important factor. According to them, seniors need to change their point of view and realize how physical exercise is fruitful to improve their quality of life.

> *Participant non familiar with the Internet* said: You need to
> inform and educate older people. By education, I mean that
> you have to convince them that exercises are necessary. We are
> a bit lazy, especially people who are sedentary or who could not
> do what healthy [senior] people can usually do.

The last issue that participants rose was related to the program payment. The point was stressed while talking about the commitment one must dedicate to the program. Gym lessons are usually paid in advance; here the platform should work in the same manner, however, the fee might also be provided by the National Health System, or by hospitals for prevention or rehabilitation, or by insurance companies.

ICT-related assistance. The worry about a new device was not reported as insurmountable. Participants suggested that through an adequate assistance, any senior could face such novelty. They reported, for example, that when their adult children give them some new technological gifts, they require them to provide assistance; when children would not, they tend to loose interest in the device.

> *Participant non-familiar with the Internet* said: At the very beginning of the training program, users' children or external professionals might be involved to support seniors to familiarize with the platform.

Moreover, the technology-related worry was suggested to be reducible even more, if easy instructions are provided.

> *Participant non-familiar with the Internet* said: If you use the computer, you have to turn it on, you have to ask your children to tell you how to do so. You need to have three or four key-actions to learn, not much more.

In fact, once the program begins, users might support one another. The group will surely work to self-support all of its members.

Theme: Physical program features

The theme *Physical program features* aggregates all the components featured in the entire programs, not just the ICT part. The theme includes two categories: *Trainers features*, *Training program characteristics*.

Trainers' features. According to interviews participants' trainers should already have experience working with older people. Trainers should be used to listening and paying attention to older people's requests. They should know which is the most proper modality of communicating, the warmest one.

> *Participant familiar with the Internet* said: The most important aspect is the relationship that would be created between users and trainers. I know that today I am going to have a session with my trainer, s/he is all for me: I have to prepare myself, comb my hair, wear a clean gym suit, put some make-up on, and so on. Even if I'd rather not, I will make the effort [. . .] Trainers must speak Italian while understanding us using dialectal jargon.

One way to boost the creation of good and profitable relationships between users and trainers would be the scheduling of trainers' visits to users' premises. The fact that the gym sessions occur via remote connection rose the issue of how important is physical

contact for seniors. Participants were indeed afraid that the lack of it may affect negatively the entire program: to avoid negative consequences , as drop-offs for example, participants suggested that a strong relationship should be sought from the beginning of the program. If a qualitatively good start is implemented, any difficulty emerging afterwards would be faced more easily.

> *Participant familiar with the Internet* said: Before the beginning of the course, the trainer should visit all participants at their premises. This way, they can establish a dialogue, a discourse, they can get to know each other.

Trainers experience must also be reflected through asking people to do the right exercises. Indeed, particular attention must be paid to what users would say about their physical status and about the information conveyed by the measuring devices (e.g. bracelets): on the basis of such information trainers must be experienced enough to modulate the exercise program.

> *Participant non-familiar with the Internet* said: Trainers should know how to motivate older people, to adapt the exercise to the people's needs: our body is fragile, we cannot crack open our legs.

Even the physical aspect was identified as crucial: trainers should not be too fit, in order to permit participants to identify with them.

> *Expert participant* said: The trainer we have is very appreciated by the users, he is very handsome, fit but not too much, and, most importantly, he speaks very gently and warmly even when he has to correct the execution of some exercise: seniors love him.

Training program characteristics. Any signal users should provide about their heath status must be used to adapt the training program.

> *Participant non-familiar with the Internet* said: It is not easy when one wakes up with pains: not all days are the same.

Reciprocally, trainers must constantly talk to seniors about the reached levels of fitness, about what they are going to do next, and the reason why.

> *Participant familiar with the Internet* said: It is necessary that trainers constantly tell users what they are going to do next, why, and what are the expected outcomes.

Trainers must be prepared that exercises are not performed in a gym. If, on the one hand, they might bring tools as mats, balls and dumbbells to users' home during one of the visits, on the other hand they might implement bodyweight exercises, that is, without specific tools, or they might be prepared to ask people to use pieces of furniture to help seniors doing the exercise. They could ask seniors, for example, to grab the chair and stand on one foot; otherwise, they may ask people to seat on the chair and extend one leg per time.

> *Participant familiar with the Internet* said: I cannot think about any equipment to use for this exercise. I can do low level exercises as raising my arms, crossing them, sitting, standing, and so on. People with difficulties in orientation can hardly perform such simple actions.

Moreover, another aspect arose during the interviews. It concerned the number of people that might compose each gym group and the possibility to swap from a group to another to meet other people or to exercise more. The issues was controversial, as not everyone agreed. Some participants envisioned the chance to enlarge the number of friends; some others claimed that the relation among users might benefit from small and stable groups.

> *Expert user* said: Groups tend to generate habits: you can change the groups, it might stimulate the components, but you must take into account how to coordinate the swaps. The idea might be useful to improve socialization even further, but habit is synonymous of stability.

Theme: Psychological factors

The theme *Psychological factors* comprehends all the psychological issues that might influence how each user decided to adopt the platform. Two categories emerged, namely, *Intrinsic motivational aspects* and *Extrinsic social aspects*.

Intrinsic motivational aspects.   Participants revealed that seniors are very used to live alone. The platform- and the entire program firstly- was envisioned as a very good tool to contrast such negative psychological condition. Seniors would be supported doubly: first they would be supported and guided to acquire (or refine) technical skills; later, they would be supported and taken care of by the trainers all the way through the program.

> *Participant used to the Internet* said: My isolation must not become chronic and insurmountable: if I could get involved with other people in projects like this, I would feel more prone to do the suggested activity. Loneliness is the most important problem for older people, especially when the person is affected by an invalidating disease.[. . .] Recently, I met my new fiancée in a group chat.

Regarding the issue of support, users' families were described to support seniors in dealing with ICT devices just during the approaching phase. The support a son or a daughter can provide was indicated as important only during the first approach to the new activity, while keeping the seniors' family informed about the progress of the system was not mentioned.

> *Participant non-familiar with the Internet* said: At the very beginning of the training program, users' children or external professionals might be involved to support seniors in familiarizing with the system.

Physical exercises require a strong commitment to reach valuable results. Such issue was highlighted by participants as an important one to face. It was related to seniors' attitude, but also to the fact that seniors, indisputably, tend to avoid unnecessary pain.

> *Participant non-familiar with the Internet* said: Persons must be appropriately supported: the person knows that it [the program] requires commitment, because from a psychological point of view, life is at its end; children are distant, we get bored and depressed easily if we have nothing to do- even walking the dog. However, being committed to something, for instance, each Monday, Tuesday, or let's say Thursday, means to organize ourselves, prepare ourselves for the meeting- comb our hair, taking a shower, putting some make-up on.

In line with the commitment issues, motivation proved to be fundamental to avoid seniors getting bored or losing interest in the exercise program.

> *Participant familiar with the Internet* said: It is necessary that trainers constantly tell users what they are going to do next, why, and what are the expected outcomes.

Another aspect that emerged as important arose from the assumption that seniors are frail people. In this light, participants suggested they might need many attentions and much support.

> *Participant non-familiar with the Internet* said: More than a training program, seniors need kindness and caresses- both physical and psychological.

Extrinsic social aspects.   Socialization was seen as a powerful incentive to carry on exercises, given the initial technological support and personal involvement. In order to foster the fulfilment of such need, the possibility to leave participants free to communicate with each other at the beginning and at the end of the gym sessions, or even when the session is terminated, was very important. By using a web-cam and headsets, users can socialize and build friendly relationships that might be further explored outside the virtual environment provided by the platform.

> *Expert participant* said: With time, by exercising together, gym users usually make friends. Once the number of persons using the platform rises, more chances to know new people will be available.

Technology is also seen as providing the chance to bring secondary benefits. One of them is the possibility to use the communication system of the project to communicate with parents and relatives, grandchildren in particular.

> *Participant familiar with the Internet* said: Once I get better, I will use this [computer] to communicate with my grandchildren.

While developing the remote physical training system, it would be necessary to take into account that the system should be used to support the person in avoiding personal fall-down, getting grumpy, and loosing interest in personal activities, as personal hygiene.

> *Participant non-familiar with the Internet* said: I believe that a person suffering from problems that prevent her/him to go outside, would use a cyclette (i.e., exercise bike) for a very short period: if personal trainers are provided to support and drive the person in exercising, using appropriate rewards, that would drive the person to perform the exercise.

Discussion

The present study increases the body of research aimed at understanding how to support seniors to do physical exercise. In particular, by focusing on ICT remotely delivered exercise program, the study represents the preliminary example of guidelines for further development.

Practical implications. The main aspect that emerges from the data analysis is that seniors did not seem to be reluctant to test themselves on new activities. They were aware of the technology boom, and of the fact that sooner or later, technological devices will be part and parcel of everybody's life. At the same time, however, they figured that the effort to use technology must be counterbalanced by some support work. Older people's attitude towards technology is sometimes negative (Timmermann, 1998). Even if such attitude is mainly related to the poor performance seniors realize to achieve at their first attempts (Hawthorn, 2007; Sayago, Sloan, & Blat, 2011; Turner, Turner, & Van de Walle, 2007)), the seniors we interviewed described people of their age as not very prone to learn new skills. In fact, in order to bypass such worry, they suggested to implement a system resembling or embedding some features seniors already know. One of the solution they envisioned relates to plugging a computer into the old TV systems; another involves the use of a remote control to manage the system's features. When taking into account what was requested by the focus-group interviews participants, it is necessary to consider that none of them was a digital-native. Their age, indeed, suggests to classify them as digital-immigrants (Bennett, Maton, & Kervin, 2008; Prensky, 2001). As predictable to occur to such a type of immigrant people, our participants envision clearly the need of a real (read: physical) support at the beginning of such a new ICT experience. Congruently, moreover, they requested to have someone to whom they can physically rely on. However, even within such immigrant label there are differences: today seniors define a quite heterogeneous group (Amaro & Gil, 2011). Indeed, in some cases seniors got used to technological devices during their life, but such devices were just electronic, meaning that they were just programmed to very specific actions. These seniors may have been either housewives used to knead bread, oven cooking, dishwashers or washing machines, or blue collars who were used to utilize, to start, or to control automatic machines. On the contrary, there is a minority of seniors who worked in administrative offices and that, along the years, were obliged to develop office-related abilities according to the evolution of the office automation. Even if all these categories may have a certain predisposition to technology, it is quite likely that the latter more than the former would present themselves as very prone to face ICT computer-based devices. Atop of that, as soon as one thinks that the indications we gathered during the focus-groups interviews will be used to develop future ICT systems, one must evaluate that seniors of tomorrow will not be the same as those of today. In the last twenty years, the relationship with technology has changed drastically (Bennett et al., 2008; Helsper & Eynon, 2010; Prensky, 2009): it has changed because, nowadays, the devices are providing users with a level of freedom that would have never been reached by electronic devices. However, as Arthur and Polak (2004) addressed, any piece of technology is not build from scratch: it is the combination of older pieces, assembled to respond to up-to-then not fulfilled human needs. In this way, the capability of end users to be in control of any new piece of technology that enters the market may put pressure on the users, especially if they belong to the "seniors" group. However, programs like *MOTION*, i.e., programs that aimed to have seniors exercise with a remote supervision, are not merely composed of technological components. One of the most important aspects regards the execution of gym exercises. In this light, it may be considered that, atop of the worries seniors reported to exist about having to deal with ICT systems, exercise-related worries must also be taken into account in developing such systems. As Grove and Spier (1999) pointed out, in pursuing

the commitment to follow exercise programs, seniors may be afflicted by many personal and motivational conflicts. The way our interviewed participants described the support needed by senior users, target such points directly. Warm listening, calm replies, consideration of the individual state, feedbacks about the training level reached are all responses that trainers must learn to provide to seniors, using them to avoid drop-offs. It must also be pointed out that such responses gained even further importance as they must also counterbalance the ICT-related worries. In fact, in programs like *MOTION* drop-offs are particularly problematic: every time one *MOTION* user would leave the program, the cost to install the system in another user's site would increase the total costs. The cost/person of systems as *MOTION* is approximately 10% of the total cost for each installed user. However, aside from what interviews participants reported, there was another issue that only retrospectively, i.e., just once the *MOTION* project terminated, we realized they skipped. None of our participants mentioned that the internet band width may be problematic. Speculatively, we can assume, that by being invited to discuss about a system that was presented as using an Internet connection to put in contact users and trainers, participants may have underestimated Internet bandwidth problems. The project was developed by assuming that users would have a dedicated ADSL broadband connection with a download capability of at least 4 mbps/s and an upload capability of at least 600 kbps/s. In reality, however, many *MOTION* users were not provided with the necessary signal to allow good communication. In Emilia-Romagna, i.e., the Italian region where the *MOTION* project was run, during the second semester of the project period, the averaged upload band calculated over 27101 samples was $552\pm.3$ kbps/s ($95\% = 558$ - 5% 542 kbps/s). The average download band was instead 7354 ± 18.1 kbps/s ($95\% = 7632$ - 5% 6733 kbps/s)[3]. In particular, the values that were recorded with the premises of *MOTION* users' who reported connection problems, concerned a download bandwidth of 6554 ± 9023 kbps/s (with the former indicating the mean value and the latter the standard deviation value) and an upload bandwidth of 845 ± 968 kbps/s. The solution the *MOTION* technicians operated was the downgrade of the bandwidth necessary to transmit the video/audio information to 256 Kbps. Both trainers and users reported that the quality of images was good enough. Moreover, they reported to be happy that such action decreased the number of interrupted sessions. At the end, the ICT platform MOTION technicians developed involved screens that were, at least, larger than 23". In fact, two different platforms were developed. One solution involved a PC embedded into a touch screen, i.e., a Lenovo C50-30 58,4 cm (23 Zoll FHD LED) All-in-One Desktop-PC and an Intel-NUC 5I3RYH with wired or wireless keyboard and mouse, which needed to be connected to users' TVs. The two solutions were developed in order to offer users the chance to pick the most appropriate solution according to their preferences and needs. For what concerned the physiological feedback used to monitor the progression of the exercises, *Hearth Rate Mio Link* bracelets were connected to the *MOTION* platforms via blue-tooth connection. Instead, for what concerned the warning call, the solution adopted and implemented was the following: when users agreed to have an exercise session, as soon as they would turn the platform on, warning messages were promptly displayed. However, if there were platform features that matched with the indications, there were few aspects that were not implemented. Within the allowed budget, the zooming was a feature that was

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[3]`https://www.misurainternet.it/stats_values.php?regione=emilia_romagna&periodo=1_2016`

considered not to be crucial, for example. In the same manner, the change to have a devoted button on the screen to begin a emergency call was solved by explicitly requesting trainers to make the emergency call with their mobiles as soon as they noticed that something was going wrong. For what concerns the gym program, trainers were selected on the base of their experience to work with seniors. Exercises were indicated to be selected by fitting the exercises goals with the requests of the seniors. A workshop was organized to train the trainers to communicate with seniors by paying attention to seniors' needs, and supporting them in those negative moments when they might be not willing to participate.

Theoretical implications. The TAM is a very influential model capable to explain people usage of technology. The model is very modular and recently it evolved and included the factors modulating technology acceptance in seniors (K. Chen & Chan, 2014). However, as *MOTION* is a project aimed at providing the services that can be found in a professional gym- i.e., to be supervised by professional trainers- within the walls of the seniors' own homes, it requires seniors to face two types of adaptive challenges: On the one hand they have to deal with the ICT platform; on the other hand, they have to stay committed to the gym program. Although, TAM might provide a good theoretical background for our data, on the base of the results we yielded at the end of the thematic analysis, TAM seems provide a less valid theoretical framework than TPB (Ajzen, 1985). The TPB appears to work better as it is more general and can account both the components featuring the *MOTION* project: ICT (e.g., Holden & Karsh, 2010) and physical exercises (e.g., Norman, Conner, & Bell, 2000). Indeed, as our data suggest, ease of use may be a crucial factor, but only at the beginning of the adoption of the ICT platform, as it fades away with time (Venkatesh et al., 2003); its mention was just related to the development of the ICT platform. Such time-related decrease suggests to consider this one as a factor lighter than others in accounting for the adoption of systems as the *MOTION* one. Attitudes towards ICT and physical exercise are both frequently reported in our data. However, as the data suggest, the initial support of ICT experts and the continuous one provided by the trainers can both impact favourably on users' attitude towards the MOTION program. In our data, this factor seems to be composed by what we called intrinsic motivational and extrinsic social aspects featuring our data. Moreover, the TPB indicates that being able to obtain tangible results from the behaviour is important to describe and predict the behaviour. Our participants required the system to share results with their GPs and the adoption of bracelets as conditions that can promote the adherence to the ICT gym program. In the same direction goes the fact that our participants suggested that the system should remind them that a new sessions is starting soon. In this way such a form of continuous communication generates a sense of engagements that very likely is reinforced even more by the communicative skills trainers are required to possess. However, as we admitted at the beginning of the last comment, the data we gained allow us just to speculate about the models that might better describe our data, although, we are confident that our assumptions can support researches to suggest the need to verify potentially important relationships not specified earlier. Using the same speculative logic, we might also formulate few hypotheses on the amount of effort that would be requested to the next users, when *MOTION* would be launched to the market. The participants who tested the prototype declared to be very happy to participate to the project and they remained so until the program reached its natural end. However, as age increases, the behaviour one plans requires functional adaptations. As the SOC

model predicts (Freund & Baltes, 2002), the physiological decrease of the senses might be problematic when one needs to start an ICT supported plan of physical exercises, for example. The increasing weakness could have an effect too, balanced, however, by the past exercising rate (Dishman, Sallis, & Orenstein, 1985; Norman et al., 2000; Oman & King, 1998). In this light, the compensatory actions that seniors' caring systems must be focused on regard the development of a plan to provide seniors with firm support and warm communicative abilities, confident patience.

Conclusion

The present paper attempted to identify the features that designers should take into account during the process of building a system aimed to do physical exercises with seniors within their houses walls. Overall, this study indicates that the technical aspects emerged as important in developing a system like *MOTION*. Aside from the technical issues, however, psychological ones were strongly highlighted. Their nature was twofold: on the one hand, they dealt with the support seniors need when they have to face new pieces of technology; on the other hand, they dealt with the support that must be provided during the exercise program. If one wants to speculate about the underpinning psychological issues, he might suggest that people must feel to be part of the program, to be active. In our case, people loved to know which gym level they reached, what they were going to do, but even more generally, people loved to exert control of the activity they were doing (Edvardsson, Tronvoll, & Gruber, 2011; Sanders & Stappers, 2008). The effect of *MOTION* did not stop once the program terminated: independently of social meetings we organized, users crated autonomously a sort of community: they met to have some tea together, to go to the theatre, they keep calling each other. However, despite the positive process of development and implementation of the *MOTION* platform, there is a main limit that can be used to foster further research: all our participants were seniors who did not suffer of cognitive impairments. People in those conditions have different needs and resources than healthy seniors (Long, 2010), but that factor should be taken into account as soon as one wants to address his research and commercial attention towards the various level of frailty characterizing the end-of-life period (Laurin, Verreault, Lindsay, MacPherson, & Rockwood, 2001; Lautenschlager et al., 2008). Finally, the most important message we derived from the *MOTION* experience is that any program involving users must be planned and organized keeping in mind their co-involvement.

Acknowledgements

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