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ACANTO

A CyberphysicAl social NeTwOrk
using robot friends

Deliverable 4.3.1

User communities creations based on user's profile matching (static profile): social network creation and evolution in older adults communities

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Executive Summary

The combination of longer life expectancy, evolving socio-economical norms and conditions, and new technologies are dramatically changing life after retirement, and not always for the better. In more and more countries, older adults find themselves with many years in front of them, some of them likely characterized by reduced physical and cognitive abilities. For older adults, this span of time out of the workforce was traditionally devoted to the role (and source of great joy) of caring for grandchildren. However, this role is fading out because of increased mobility of children, who may live far away for work, love, or other reasons.

The ACANTO project aims – among other objectives - at rethinking long life and understanding the socio-economical context that can make this period of life more exiting and attractive.

The specific angle we take is that of enabling older adults of all ages - and specifically including adults with limited mobility or that have reduced cognitive abilities - to connect, move and interact among themselves and their social circles (family member, care-givers) and health circles (doctors, nurses) leveraging on existing and yet to be developed information and communication technologies, tools and devices.

The purpose of this first deliverable is to study the current context and state of the art of social network creation and evolution in older adult' communities. Specifically, we want to analyze from a non-technical perspective the social, regulatory, institutional and market context as well as the opportunities, challenges, barriers and risks as a base for the creation and use of such social networks in the ACANTO project.

This document presents and discusses:

☐ The social context of the social networks, the benefits of social contacts, motivations and possible improvements.

☐ The regulatory context that designates the relevant categories related to data protection and privacy and other specific aspects to take into account related with safety and security. It is essential to understand the regulatory context in general with older adults and more specifically within Social Networks, which applies to the ACANTO platform, since this may be one of the most important barriers for the final commercialization and wide spread use of such platform(s).

☐ The institutional context analysis including the type of institutions and services related to long term care and house nursing as well as the educational and volunteer institutions for older adults that support their active participation in society.

☐ The market context correlated with the current products and services available in the so-called "silver market" and relevant worldwide social communities for older adults.

☐ Finally, we describe the opportunities, challenges, barriers and risks associated with social network creation and use by older adults in the context of ACANTO project.

This information will be used in subsequent years of the project as the baseline for the design, development and testing of ACANTO's tools and social network based services.

Introduction

The purpose of this document is to study social network creation and evolution in existing older adults' communities as a starting point for our work on social networks for older adults' within the ACANTO project. We thus analyse, from a non-technical perspective, the social, regulatory, institutional and market context as well as the opportunities, challenges, barriers and risks.

We start by examining the social context of the social networks creation and evolution in older adults, the main benefits of social contacts, motivations and improvements.

Then, the regulatory perspective designates the important categories related to data protection, privacy, disclosure, third-party endorsement, governance and oversight, information archiving that relate to safety and security.

Subsequently, we present the institutional context analysis where we describe the type of institutions and services related to long term care and house nursing as well as the educational, volunteer institutions and existing social communities for older adults that support their active participation in society.

The market section explores the potential of Information and Communication Technologies (ICT) products and services from a commercial point of view. The focus is on ICTs that can be used to enhance user social and active life. The analysis has considered the heterogeneity of the customer segment called older adults, as well as the current barriers in terms of ICT penetration in aged 55 and older. It also describes in general the classification criteria of the social network sites, social network descriptions, a comparison of social networks bound and not bound with proprietary devices and a comparison between criteria and functionalities of the most popular social networks.

Finally, we describe the opportunities, challenges, barriers and risks associated with social network creation and use by older adults.

Social Network creation and evolution in older adult' communities

Social networks for older adults are becoming more and more relevant in today's society. In the European health policy framework [1] from the World Health Organization (WHO), in the section referred to the evidence-based strategies to be applied and the key stakeholders, several solutions suitable for healthy older people are listed. Among them an important category of solutions focuses on health, social services and support for informal care and social networks. The aim is to reduce health inequities and promote the empowerment of older adults through health literacy and disease self-management. This international initiative is aligned with the objectives of ACANTO's Project.

In this document, we define social network sites (SNS) as web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site [2].

1.1. Social Context

In this section we analyze the social context for social networks for older adults, the benefits of social contacts, motivations and possible improvements.

By definition: "The social context states to the immediate physical and social location where individuals live or where something occurs or develops". [3] It is "the environment developed by humans in contrast to the natural environment; society as a whole, especially in its relation to the individual". [4]

Older adult communities can have many shapes and the social environment is composed of the combination of networks, neighborhoods and institutions (independent and interdependent). Through their actions, they define the activity space that they cross and collectively constitute communities with interaction routines.

The social context of older adults

Nowadays, the social context of older adults is mostly categorized by living isolated and alone due to the geographical distance of their relatives, physical impairment limitations and lack of opportunities to stablish social contact with others [37].

According to a US study, the volume of contacts with network members decreases with age until members reach mid-sixties and then - at mid-seventies - it starts increasing again. This is

probably caused by the changes in relations with social institutions (such as work) and the increased need for care in the late life [6].

A Dutch study confirms that as adults' age, their network is progressively composed of family members. This change in composition maybe related to cognitive and physical decline or it may be that their friends have died and they have not replaced them with new friends [6].

Benefits of social contacts

The preservation of social contacts is considered an essential aspect for aging well especially for older adults living isolated and alone. It is crucial the creation of ways to enable older adults to establish connection with their communities, supporting their participation in social activities and foster the social support and mutual help among them.

The social networks and social communities, when used correctly, can provide the necessary technological support to fight against isolation and loneliness. Being part of an extensive social network has a protective effect on health [5]. For instance, social networks can be used to connect with children or grandchildren who live far away helping older adults to not feel distant from family events. There are a great number of research projects that are presently using Information and Communication technologies to simplify the participation of older adults in online social networking and online communities [35].

A social network for older adults is an opportunity to maintain regular communication with friends and family. It provides the opportunity to join groups and discussions about particular topics and hobbies, sharing their daily life issues from the comfort and privacy of their home. The studies also established that self-disclosure is considered easier via Information and Communication Technologies (ICT) than face to face interactions [36].

It also provides a general sense of connectedness and augmented control and this perception is also felt by formal and informal caregivers. A study made in an online forum of caregivers' shows that the amount of messages posted in a week reduced negative emotional state (such as anxiety or stress) and developed the sensation of security. From the formal caregiver's perspective, it can be used to improve health-related knowledge like information for prevention, diagnosis, and treatment of specific conditions and disabilities. [5] The online communities are able to provide and receive social support in cases of difficult life situation, independent of geographical location or time. Finally, the results have identified several benefits related to social network use such as reduction of the sensation of loneliness, stress, and the improvement of the sense of control and self-efficacy.

Other studies have shown that positive social interactions between older adults prevent the early development of difficulties associated with physical and mental functions. A UK study about older adults' social engagement and health, and their use of community care and medication, concluded that those older adults who were more socially involved were less likely to consult the family doctor or district nurse compared with the month prior to the study manipulation [6].

A European study concluded that social relations among the over 65s help to preserve the activities of daily living and/or restore them after an injury or trauma [7]. Social programs that provide personalized support to socially isolated older adults increase the sensation of self-worth, confidence and the ability to interact with the community. [8] Furthermore, they can provide the opportunity for older adults to maintain and increase social contacts by joining online social networks and online discussion forums and this potential is even greater if we take into account the number of possibilities to apply at clinical practice field.

Motivations

The motivations that encourage older adults to use the social networks are mainly related to geographical distance from their relatives, physical impairments, essential obligations like caregiving and the low number of opportunities to engage in social contacts [5].

The participation in social networks can alternate from passive behavior similar to reading posts and online discussions (also known as lurking) to an active participation by posting, blogging or uploading multimedia content. Posts and messages can be addressed to a wide audience of community members, and they can also be addressed to single persons or subgroups. The privacy of the messages differs depending of the network, the application under use (e.g. personal message, restricted discussion board, open forum), and the user alias (nickname or real name). The quantity of the personal information shared ranges from superficial information similar to chitchatting and recommending ('liking') web content up to revealing conditions, disorders and other personal experiences. Online communities that specifically address the needs of older users are growing steadily. [9]

Improvements

Social Networks are an important way for older adults to enjoy the benefits of the digital empowerment but in isolation, do not necessarily meet the important need for social contact. They are considered as a valid and progressively used instrument to complement other techniques for social interaction but it is necessary to make them more accessible and usable for older adults. In first stage family members, caregivers, community architects and trainers should provide assistance to older adults to facilitate their regular use. At the same time new concepts of design and user friendliness for older adults should be addressed by developers. [10]

In another study conducted in older adults to answer the questions "What are older adults' perceptions of social media?" and "What educational strategies can facilitate their learning of social media?" concluded that privacy concerns are the prime barrier to adoption of social media and this aspect should also be considered to improve [38].

1.2. Regulatory Context

It is essential to understand the regulatory context in which Social Networks for older adults must operate. This applies to ACANTO platform, since this may be one of the most important barriers to the final commercialisation and wide spread use of such platform(s). Across general laws and regulations, there are five categories to which the consortium should pay special attention:

1. **Data protection and privacy:** Laws and regulations that ensure customers' rights to privacy are covered (and appropriately stated in several regulations, such as the EU General Data Protection Regulation, including the "right to be forgotten") when organizations collect, store, and use social media data. It is essential to win the older adult's trust. Encryption and authentication mechanisms are also demanded.

2. **Disclosure and third-party endorsement:** Proper protocols for product marketing, endorsements, and disclosure of information, ensuring these activities take place in a "clear and transparent" manner on social media, and that social features, such as Facebook "likes" and Twitter "re-tweets," are appropriate and transparent for the end-user.

3. **Governance and oversight:** Rules that require establishing proper processes, controls, and monitoring for people managing the social network. It would be beneficial to draw-up a code of conduct or guidelines covering issues such as privacy, security and data protection. This will be reviewed by the ethics advisory panel.

4. **Information archiving and retention:** Parameters that specify how and in what circumstances the consortium should capture and retain social media conversations for legal purposes and investigations to improve the services, should be well-explained and communicated: transparent to end-users. This will be reviewed by the ethics advisory panel.

5. **Safety and Security**: aspects related to the safety and security aspects must be re-defined based on the cognitive age-related decline and high prevalence of mental disorders in older adults. On the other hand, social networks, in conjunction with other technologies such as GPS, could be useful to track and monitor, in a non-invasive way, older adults with specific disorders, such as bipolar, dementia, and Alzheimer. In these cases, formal or informal caregivers may control the gathered information. This fact should comply with the suitable regulatory issues. These aspects should be analysed based on the final features of the platform.

In the next paragraphs we focus on the description of the 2 main EU policies to take into account during the technical development of a social network. Both policies cover the categories stated previously.

Data Protection: Privacy and protection of personal data are fundamental rights under Article 7 and 8 of the EU Charter of fundamental rights [11]. The Data Protection Directive 95/46/EC and the ePrivacy directive [12] [13] define some restrictions for the processing of personal information at European level. Because the rapid advances in technology and changes to the ways in which individuals and organisations communicate and share information, the EU legislative bodies are preparing an updated and more harmonized data protection law to replace the current regulatory framework: the proposed General Data Protection Regulation "GDPR" [14]. The GDPR remains under negotiation in a draft form, although it has been anticipated that the text of the regulation will be finalized in the first half of 2016.

Opinion 02/2013 on Apps on Smart Devices [15]**:** This Working Party was set up under Article 29 of Directive 95/46/EC. It is an independent European advisory body on data protection and privacy. Its tasks are described in Article 30 of Directive 95/46/EC and Article 15 of Directive 2002/58/EC. This working party clarifies the legal framework applicable to the processing of personal data in the development, distribution and usage of apps on smart devices. It analyses the key data protection risks, provides a description of different parties involved and highlights their legal responsibilities. The opinion notes that whilst app developers wish to provide new and innovative services, the apps may have significant risks to the private life and reputation of users of smart devices if they do not comply with EU data protection law. In addition, apps must provide sufficient information about what data they are processing before it takes place in order to obtain meaningful consent and the opinion further notes that poor security is another risk which could lead to unauthorised processing of personal data which increases the possibility of a data breach. Opinion 02/2013 provides some recommendations for parties involved in the development, distribution and technical capabilities of apps:

- **Recommendations for App Developers:**
  - ➢ App developers must be aware of and comply with their obligations as data controllers when they process data from and about users.
  - ➢ App developers must ask for consent before the app starts to retrieve or place information on the device i.e. before installation of the app.
  - ➢ App developers must allow users to revoke their consent and uninstall the app and delete data where appropriate.
  - ➢ It is recommended that app developers inform users about their proportionality considerations for the types of data collected or accessed on the device, the retention periods of the data and the applied security measures.

- **Third Parties must**
  - ➢ Be aware of and comply with their obligations as data controllers when they process personal data about users.
  - ➢ Comply with the consent requirement under Article 5(3) of the ePrivacy Directive and not circumvent any mechanism to avoid tracking.
  - ➢ Develop and implement simple but secure online access tools for users without collecting additional excessive personal data and only collect and process data that are consistent with the context where the user provides the data

1.3. Institutional Context

The institutional context refers to typical institutions providing long term care or house nursing and also to educational and volunteer institutions for older adults that support their active participation in society. By 2025 more than 20% of European inhabitants will be over 65, with a particularly fast increase in numbers up to 80 years-old. Older adults have different healthcare needs and health systems need to adapt to provide adequate care and remain financially sustainable [16]. These demographic and health transitions will require the core institutions to change and to develop innovative approaches for work, family life, caregiving, and education across the life course. [17]

The formal and informal institutional contexts can be critical for the social integration of older adults and may have downstream effects for health. The sociological studies demonstrate the importance of the existence of local gathering places [18]. The density and quality of the institutional environment have important consequences for older adult's health and determines the impact of age related results of a residence in a disadvantaged neighborhood context. The institutional involvement and access should be reflected by formal organizations as well as quality and availability of the local business and informal interaction like the involvement of older adults in voluntary institutions and/or religious organizations. This extensive diversity is considered important for the quality of daily life for older adults and to provide access to current support such as community-based older adult centers, participation in voluntary organizations and regular informal gatherings in local restaurants, clubs or recreation facilities.

Studies demonstrate the importance of institutional and organizational involvement in the wellbeing of older adults and the need for a better definition of the processes with the aim of improving it but unfortunately the access to their physical locations varies depending of the geographic location or country [18].

Long-term care

Long-term care (LTC) is an example of a service provided for older adults in institutions and varies in nature across Europe. The percentage of adults over 65 = receiving services in institutions varies from less than 1% in Poland up to 9% in Iceland. When compared with home-

based public funded services it differs from a very small percentage at countries in Eastern Europe up to 25% in Denmark. It is also important to note that in almost all of Europe the majority of adults receiving LTC are over 80 years old.

Most older adults prefer to live at home but public policy is slow to support a change from institutions and hospitals to home and community based services. Informal care has the largest number of care hours in all European countries, even in the countries with the highest support to public care. However, the greater percentage of public funds destined to LTC still goes to public institutional care: above 70% in Belgium, Iceland and Switzerland which is equal to a percentage range from 0.3 up to 3.9 of GDP.

Informal care can be a determinant in the sustainability of LTC systems in the near future. To achieve it, is essential to have a better balance between informal care and public support and a greater harmonization between health services, social services and technical aids. [1]

LTC consists of numerous services providing assistance for long periods of time to people (older or not) that have experienced function loss triggered by chronic disease or by physical/mental disabilities. It contains direct care and general supervisory assistance and varies in terms of regularity and intensity depending on the needs of older adults. LTC can be divided into two types of activities support:

- **Activities of daily living (ADL):** including basic functions such as eating, bathing, dressing, getting into and out of bed or a chair, and using the toilet.

- **Instrumental activities of daily living (IADL):** additional tasks essential to maintain independence, for example, meals preparation, medication management, shopping for groceries, and transportation use.

For LTC, the family members are directly involved and are considered the primary source of support for older adults with functional limitations. LTC service is divided into two main service groups:

- Home and Community-based Services (HCBS)

- Nursing homes (NH)

HCBS refers to services with different frequency and intensity provided within a wide group of non-institutionalized scenarios at the older adult's home with different living requirements. The care provided can be supplied by different entities and independent providers with or without overall synchronization and management and varies in terms, nature and scope of the services. For instance, the services provided under Assisted Living (AL), a particular category of HCBS, merges the limits between institutional and non-institutionalized care. Normally, AL is provided in independent apartments that offer significant privacy and control for the residents, but there are also cases with more restricted environments, especially for older adults that experience severe cognitive impairments. In some cases, the models of congregate group housing seem closer to institutional settings.

Example list of HCBS Services:

- Care coordination or case management
- In-home services
    - Personal care assistant service
    - Personal attendant service
    - Homemaker agency and personal care agency services
    - Home hospice services
    - Home delivered meals
    - Home reconfiguration or renovation
    - Medical services
    - Transportation
    - Cash payments or allowances managed by the consumer or a consumer representative to pay for above services
- Services provided in congregate living settings that are expected to be in the older adult's home, such as assisted living, adult foster homes, small group homes, and residential care facilities:
    - Cooking, housekeeping and mobility assistance are services provided by personal care assistants and personal attendants or home health supporters under HCBS
    - Personal care (can include medication administration, medication) management
    - Activity programs
    - General oversight and safety supervision
    - Wellness assistance and health monitoring
    - Palliative care
- Services provided outside the home (regardless of whether it is a private home or a group residential setting)
    - Adult day care
    - Day health care
    - Older adult centre programming

NHs are institutional facilities licensed by the government that offer a 24-hour room and board, supervision and nursing care. However, they serve distinct populations related with specific funding and consist of multiple functions. They assist long and short stay residents that require rehabilitation or post-hospital recovery. The quality and access differs extensively in Europe and these services are often expensive. Example list of NH services:

- Personal care, ADL services

- Medication management and administration
- Nursing management, restorative nursing
- Palliative care
- Meals
- Rehabilitation
- Activities
- Transportation
- General care coordination, care planning, oversight [19]

Other institution types for older adults

Health institutions

The Order of Malta is an institution which manages numerous specialized centers for older adults in England, Germany, Spain, Austria, United States of America, Chile and Mexico providing a diversity of services that includes meals on wheels, transport services, visiting services, shopping help and procedures of emergency call systems in order to make their life at home easier as well as running a number of nursing homes [20].

In the UK, local councils often give support to adults over 60 years-old with a program called "sheltered housing" where they can live independently. This program is composed by different types of sheltered housing schemes and by a scheme manager (known as warden) that can live onsite or offsite, and provides a 24-hour emergency help with the assistance of an alarm system.

Educational Institutions

Nowadays, it is also possible to find a list of educational institutions and social communities that offer to older adults the opportunity to share their knowledge and learn new subjects related with their personal interests. With the use of social media channels they can participate in research or learn about new topics. These activities can create new hobbies, new business ideas and find out more about managing their health conditions. They can also learn about new products, work on their ancestry projects or simply learn something new during this process.

The Elderhostel is an example of a worldwide network that provides the possibility of access to lifelong educational opportunities for older adults. The program offers low cost short-term academic and cultural programs held by educational institutions around the world [21].

In the United States, there are also colleges and universities that offer courses for older adults at almost no cost. According with the America Council on Education, 60 % of the certified educational institutions offer tuition to older adults. The College for All Texans Senior Citizen is

an initiative in Texas that encourages older adults to continue with their education and stay involved with local colleges and universities giving at least six credit hours of educational courses. [22]

In the UK, there is also a very popular educational institution called the University of the Third Age (U3A) where older adults can meet and learn together and members are invited to share their life experiences and skills. Usually it is difficult to distinguish between teachers and students. It is funded by the national organization Third Age Trust. [23]

Volunteer institutions

Volunteer institutions can be a bridge for older adults to create social contacts and stay active. Studies demonstrate that the number of older volunteers is rising around Europe in countries such as Finland, Spain, Belgium, France, Austria, Romania, Slovenia, and Sweden. Other EU countries, such as the Netherlands, already have a high rate of older volunteers: 41% of 65-74-year-olds currently volunteer, and 24% of over 75 years-old. In the case of Finland, 40% of 65-79-year-olds currently volunteer. In Germany, the rate of volunteering by 60-69-year-olds is 37%, and over 70 years-old, is 25% [24]

Popular Volunteer Programs for older adults

VolunteerMatch is a comprehensive tool to help locate volunteer programs for retired adults by simply entering the zip code and defining an appropriate distance. The activities can vary from helping with animal rescue to working at a nonprofit's fundraising event.

National Senior Service Corps it is an online social community that also links concerned older adults with volunteer programs by connecting their particular skills to charity projects that will benefit local communities. It is found in most communities as an affiliate to a larger nonprofit entity.

Civic Ventures provides an opening for older adults looking for volunteer opportunities as well as employment in the non-profit sectors.

Environmental Alliance for Senior Involvement is a combined effort between AARP and the U.S. Environmental Protection Agency to promote older adult involvement in preserving the environment. They are invited to participate in activities such as community garden development, classroom environmental education, and local, state, and national park service.

Global Volunteers is a volunteer program that is part vacation, part activism. Participants pay a fee to become involved in a variety of local and international efforts, and then spend up to three weeks in service. This is an especially good volunteer program for older adults looking for a group activity.

The Service Corps of Retired Executives is a valuable asset to many small business owners and budding entrepreneurs. This organization is ideal for people wanting to stay involved in the business sector.

There are a lot of volunteers around the world and most organizations are excited to welcome the contributions of their volunteers, from the young to the young at heart. [21]

EU Projects for Older adults

Finally, we found a number of EU funded projects supporting programs to assist older adults. Specifically, we found two strongly related projects that present very interesting focus for address social problems related to older adults. These programmes are:

Active and Assisted Living Programme (AAL)

The Active and Assistive Living (AAL) programme funds projects in public-private partnership in the field of information and communication technology (ICT) for active and healthy ageing. The overall objective of AAL is to enhance the quality of life of older adults while strengthening the industrial base in Europe using ICT. The AAL projects aim at introducing their solution to the market within 2 to 3 years after the end of the project. For this reason, as part of their funded work, the projects perform pilot tests in realistic settings and develop their business model together with the most relevant players of the value network. An example of a related project is Express2Connect.

 Express2Connect: It is a consortium for addressing the social problem of loneliness and isolation amongst older adults. To approach this social problem, they developed, tested and deployed digital story-telling games. This consortium was developed from 2010 to 2013. This project has 7 work products, the 1st to the 4th works on making a real product

Lifelong Learning Programme (LLP)

The Lifelong Learning Programme (LLP) was designed to enable people, at any stage of their life, to take part in stimulating learning experiences, as well as developing education and training across Europe. The activities of LLP continue under the new Erasmus+ programme from 2014-2020. An example of a related project is CareNet.

 CareNet: This project is aimed at developing a critical set of ICT competences in two identified 'at risk' target groups: care-workers and older persons. The project is designed to work in a synergistic way to tackle identified problems in the low skilled and under professionalised care-worker sector while at the same time promoting social inclusion and enhancing the quality of life of older people.

1.4. Market Context

Currently, social networks do not have a penetration among older adults comparable to other segments, although it has nearly tripled over the last 10 years, and currently 35% of older adults (over 65) use social networking sites [25]. This percentage is slightly higher in urban areas. That means that there is a potential target market for social media focused on the older adult population of **170M customer** in the EU-28.

However, older adults are a complex customer segment with a high degree of heterogeneity from an economic, literacy and healthy perspective. In addition, we should consider the penetration of portable devices (tablets, smartphones) among older adults. Currently, smartphone penetration among older users (65+) is around 34% in developed countries [26]. From them, as an average, less than 30% own a tablet too in EU-28 (although it is estimated that this percentage will ramp up very quickly in the next years). Again, around 25% of these users have never downloaded an app. That means that, roughly speaking, we have currently a **market of 4.5M customer ready to use a social network such as the proposed by ACANTO consortium**. These are our **Early Adopters**, and the design of the social network, as well as the business model, should address these Early Adopters' needs and desires.

Considering products and services available in the Silver Market – the market for older adults – most ICTs focus only on monitoring or clinical needs, and **few on the improvement of everyday life and inclusion of active older people** (see Table 1). The most used language on these Social Networks/Websites is English, although there are some examples in other languages. In any case, few of them are older adult-oriented Social Networks adapted to smart portable devices. Thereby, an **older adult-friendly Social Network** app for portable devices (tables, smartphones) may become a disruptive technology.

Table 1: ICTs for middle and old age

Social Network	Target Group	Description
Buzz50 (buzz50.com)	50+	Community site with chat, forums and friendship for over fifties. It has social networking with the ability to add your own profile, photos, blog and more (Free, English).
SeniorMaze (seniormaze.com)	40+	social networking website that is dedicated to people around the world aged 40 and over (Free, English).
Stitch (stitch.net)	50+	Social network designed to help members find friends, romantic companionship, or just new activities to try (Freemium, English).
SeniorSite (seniorsite.com)	55+ (and families)	community designed for older adults and their families to better connect with each other and find useful personalized information and services.
thirdAGE (thirdage.com)	45+, female	Health and wellness **portal** targeted to women 45 and older, with healthy living information

		for women 45+ and their family. thirdAGE provides thoughtfully curated health and lifestyle content, offering a full-range of interactive up-to-the-moment information — including video, slideshows, health condition centers, articles about cutting-edge research and more—all medically reviewed and approved by a team of thirdAGE physicians (Free, English).
SeniorNet (seniornet.org)	50+	SeniorNet's mission is to provide older adults education for and access to computer technologies to enhance their lives and enable them to share their knowledge and wisdom (Payment, English).
Senior.com (senior.com)	50+	Senior.com is a resource for information, products, and services focused on meeting the needs of older adults and those caring for older adults in our communities (Free, English).
SeniorDatingAgency (seniordatingagency-uk.co.uk)	50+	Social network for older adults to meet people. It allows contact with other people, searching them by location to find other singles in your area. As a member you can also use more advanced search options to find other singles by interest, age, postcode, or whether they have children or smoke. (Freemium, English-UK).
SeniorDatingAgency-Spain (seniordatingagency-spain.com)	40+	SeniorDatingAgency-Spain.com is an over-40s dating website primarily for English speaking people in Spain but with many Spanish members as well. The site is run by an expat living in Spain who saw the need for an English dating site in the Country for older people (Freemium, English/Spanish-Spain).
Widows or Widowers (widowsorwidowers.com)	Widows/Widowers of any age	Dating site for widows and widowers who are looking for friendship or romance (Freemium, English-USA).
60 y más (60ymas.eu)	60+	Social network for Spanish speakers, to get in contact, recommend places/activities, etc. (Free, Spanish)
Bloom (bloomcloser.com)	50+	A product (software/hardware) with a private social network. It includes gadgets for older adults: activity band and tablet. Family and friends could register to be in contact with grandparents. There is a cellphone app for relatives and friends connection (Payment, English).
SenTab (sentab.com)	For any age, but very suitable for	Sentab is a private social network focused on use it via a TV. The product includes the

	older adults.	Sentab Hub, TV controller, video camera and mic, remote control and all cables. There is a cellphone app for relatives and friends connection (Payment, English).
GrandPad (grandpad.net)	50+	GrandPad is a product with a private social network focus on the use of a proprietary tablet. There is a cellphone app for relatives and friends connection (Payment, English).

Another aspect to take into account is that current trends in the Silver Market to persue tools enhance the involvement of older adults in social life (see Table 1 for some examples). Thus, social networks should be complementary with older adult's social lives, avoiding isolation and dependence on the solution: i.e. improving the ways to connect with relatives, friends, people from their social circles (e.g. gym, day-care centres, community organizations, and neighbourhood). Otherwise, both end-users and relatives could reject this kind of technology.

Finally, to facilitate the market penetration, there are several local initiations that promote the uptake of new technologies for older people that can boost social network adoption within older people. Each local region is very different (from a demographic, social and economic point of view), and this fact should be taken into account when the commercial strategy is launch.

1.4.1. Comparisons between some popular existing Social Network Sites

As described in the previous section, a number of Social Network Sites (SNS) are currently targeting the older adults, with different interests. We have performed a preliminary analysis on the current status and services' offers in SNS for older adults. In our work, we have found it useful to establish some classification criteria describing the scope of SNS's features.

Classification Criteria

General criteria

Two global high level classifications are identified in the following: use of proprietary devices and the cost model.

According to the use of auxiliary proprietary devices:

- **Bound with proprietary devices**: social networks which use a proprietary device from the same company that provides the social network.

- **Not bound with proprietary device:** Web based Social Networks with no need to have a proprietary device from the company that supports the social network.

According to cost it could be categorized as:

- **Paid**: social networks you must pay to use.

- **Free:** social networks free to use.

- **Mixed**: social networks that have a free version and a paid version.

Feature related criteria

In our study we have selected specific criteria to classify the social networks, which are related to their features, 6 main criteria and 7 secondary criteria. These feature-related criteria are evaluated as binary in our analysis (i.e. yes or no) according to the presence (or not) of the feature in the evaluated SNS. The main selected criteria are:

- **Message**: send and receive message from other members of the social network.

- **Voice Call**: make and receive voice calls (need microphone and speakers).

- **Video Call**: make and receive video calls (need microphone, camera and speakers).

- **Photos Share**: send and receive photos.

- **Forum**: generate or participate in group discussion about specific topics.

- **Support**: the company provides a way of helping users with the use and configuration of everything related to the social network.

The secondary selected criteria are:

- **News**: news available.

- **Games**: cognitive games available.

- **Calendar**: calendar with events administration.

- **Fitness:** available functionality for tracking fitness activities.

- **Weather**: information about actual and nearby whether forecast.

- **Dictionary**: dictionary available.

- **Music**: available functionality for searching for and listening to music (need speakers).

Social Network Descriptions

A first list of (1) SNS bound with proprietary devices and (2) not bound to proprietary devices is presented with their main characteristics.

1) Social Network bound with proprietary devices.

Blom is a product with a private social network. It includes gadgets for older adults: activity band and tablet. Family and friends can register to be in contact with grandparents. There is a cellphone app for relatives' and friends' connection.

Sentab is a private social network that uses the TV. The product includes the Sentab Hub, TV controller, video camera and mic, remote control and all cables. There is a cellphone app for relatives' and friends' connection.

GrandPad is a product with a private social network focus on the use of a proprietary tablet. There is a cellphone app for relatives' and friends' connection.

Ownfone is cellphone for older adults. It is a custom and simple phone for making calls to a limited amount of people.

GrandCare is a system for older adults. It has different products: Medical Based, Community Based, Non-Medical (homecare, health agency, etc.), and Family Based. Basically, it provides a web application for monitoring or connecting with elders. It includes a touch screen tablet for the elders to communicate with careers, family and professionals.

#	Name	Webpage	Cost	Start Year
A1	Blom	https://bloomcloser.com/	Paid	2014
A2	Sentab	https://www.sentab.com/	Mixed	2015
A3	GrandPad	https://www.grandpad.net/	Paid	2014
A4	Ownfone	http://www.ownfone.com/elderly	Paid	2012
A5	Grandcare	http://www.us.grandcare.com/	Paid	2005

Table 2: Social networks bound with proprietary devices

Social Network not bound to proprietary devices.

Stitch is a private social network with free and pay options. Its focus is on meeting other adults in order to take part in activities together.

Older Is Wiser is a free social network focused on groups, news and forums about older adult's particular interests.

Eldr is a free social network focused on groups, news and forums about older adult's particular interests.

Breezie is a tablet app for android systems. It has a more usable interface for older adults' interaction with applications. It includes support and configuration of the devices.

ConnectedLiving's online community is only part of the company's approach to helping older adults. The gated social network was designed to integrate with other tools, such as calendars, menus, and private communications with family members. It is web-based, secure and private. It is equally useful to the staff.

MAX 50plusnet is a free social network for older adults in the Netherlands. It aims to join people with common activities interests together. Its main objective is to confront the loneliness and social isolation of older adults.

#	Name	Webpage	Cost	Start Year
B1	Stitch	http://www.stitch.net/	Mixed	2013
B2	Older Is Wiser	http://olderiswiser.com/	Free	2011
B3	Eldr	http://www.eldr.com/	Free	2007
B4	Breezie	http://www.breezie.com/	Paid	2010
B5	Connected Living	http://www.connectedliving.com/	Paid	2007
B6	MAX 50plusnet	https://www.50plusnet.nl/	Free	2006

Table 3: Social networks not bound with proprietary devices

Comparison

The SNS listed above allows people to interact in different ways. In Table 4 and 5 we described the selected social network in terms of the features classification criteria.

#	Name	Message	Voice Call	Video Call	Photos Share	Forum	Support
A1	Blom	yes	yes	yes	yes	no	yes
A2	Sentab	yes	yes	yes	yes	no	yes
A3	GrandPad	yes	yes	yes	yes	no	yes
A4	Ownfone	no	yes	no	no	no	yes
A5	Grandcare	yes	yes	yes	yes	no	yes

Table 4: Main feature classification criteria defined for social networks bound with proprietary devices

#	Name	Message	Voice Call	Video Call	Photos Share	Forum	Support
B1	Stitch	yes	yes	no	no	yes	yes
B2	OlderIsWiser	yes	no	no	yes	yes	yes
B3	Eldr	yes	no	no	no	yes	yes
B4	Breezie	yes	yes	yes	yes	yes	yes
B5	Connected Living	yes	yes	yes	yes	yes	yes
B6	MAX 50plusnet	yes	no	no	no	yes	yes

Table 5: Main feature classification criteria defined for social Networks not bound with proprietary devices

Moreover, we also analyzed the selected SNS's secondary features criteria shown in Table 6.

#	Name	News	Games	Calendar	Fitness	Weather	Dictionary	Music
A1	Blom	no	no	no	yes	no	no	no
A2	Sentab	yes	yes	yes	no	no	no	no
A3	GrandPad	no	yes	no	no	yes	no	yes
A4	Ownfone	no	no	no	no	no	no	no
A5	Grandcare	no	no	no	no	no	no	no

Table 6: Secondary features criteria defined for social networks bound with proprietary devices

#	Name	News	Games	Calendar	Fitness	Weather	Dictionary	Music
B1	Stitch	yes	no	no	no	no	no	no
B2	OlderIsWiser	yes	no	no	no	no	no	no
B3	Eldr	yes	no	no	no	no	no	no
B4	Breezie	yes	yes	yes	yes	yes	yes	yes
B5	Connected Living	yes	yes	yes	yes	yes	yes	yes
B6	MAX 50plusnet	no	no	no	no	no	no	no

Table 7: Secondary features criteria defined for social networks not bound with proprietary devices

As reported previously, another important aspect for SNS is the privacy issue, which is mentioned in the published policies for every SNS. In a way it is related to support functionality, because education and appropriate configurations are usually needed to manage privacy. We do not analyze it here (i.e. in feature related issues) since it is more of a non-functional feature.

Comparison Popular Social Network Sites

As a way of comparison, it is interesting to set side by side the selected SNS for older adults with most popular social network: we have chosen Facebook and Google+ as popular general social networks in Europe and US.

Facebook is a free social network that focuses on connecting friends. It is web based and it is not bound with a proprietary device. It is possible to register from 14 years old.

Google+ is a free social network that focuses on personal interest. It is also a web based and it is not bound with a proprietary device. It is possible to register from 14 years old.

#	Name	Message	Voice Call	Video Call	Photos Share	Forum	Support
C1	Facebook	yes	yes	yes	yes	yes	yes
C2	Google+	yes	yes	yes	yes	yes	yes

Table 8: Main features criteria defined for popular social Networks

#	Name	News	Games	Calendar	Fitness	Weather	Dictionary	Music
C1	Facebook	yes	yes	yes	no	no	no	no
C2	Google+	yes	yes	yes	no	no	no	no

Table 9: Secondary features criteria defined for social Networks

Comparing the features criteria between popular general social networks and older adult's social networks we found little differences in the coverage of the criteria. The main differences lay on the ways they display the information to the users and the procedures put in place to use the defined criteria.In the above analysis, we have seen that current SNS functionalities are very similar to each other. However, older-adult oriented SNS are more focused on: (1) easy configuration, (2) a good support system and, (3) easy to use functionality (few and easy steps). In general, SNS for older adults is focused on facilitating configuration options and usability, e.g, connectivity could be already set up, or someone from the support service could do it.

Another notable difference is the filter of general information, with focus on related information for older adults, making it less overwhelming and giving a sense of belonging.

1.5. Opportunities, Challenges, Barriers and Risks

Social network sites for older adults are bringing opportunities and challenges to active ageing. We list here some opportunities we have identified in our analysis.

 Active Ageing is an issue addressed currently by governments and organizations. A number of European and national projects (like the one presented above) are clear example of this intention. We believe that all projects will benefit and leverage their potential results by including the possibility to connect older adults to specialized social networks to share experiences and enhance relationships.

 Social Networking is found to have a profound affect for older adults because it helps them to maintain a healthy life related to indices of psychological well-being. Therefore, using modern ways to connect and the related ICT technologies is a potential and under exploited opportunity for this user group

- The number of older adults using social networks sites increased from 2% in 2005 to 35% in 2015 [27] indicating a strong interest in such tools and technologies.

- In our study we could not find SNSs that provide recommendation systems of various types (activities, similar friends, health advices et al). In ACANTO we will focus on developing this specific opportunity.

However, a number of challenges need to be met during the development of appropriate and effective social networks for older adults. These include:

- Older adults articulate many concerns with online social media, including the time required for legitimate participation, the loss of deeper communication, content irrelevance, and privacy [28]. The general apprehension of older adults to the use of social networks is the possibility of misappropriation and distribution of personal data and the adoption of potentially dangerous information. [29]Studies concluded the presence of resistance to the use these technologies and that older adults in Europe are not spending much time at it. In the UK only 33% of adults over 75 years old have ever used internet and Ofcom (the independent regulator and competition authority for the UK communications industries) estimates that only 25% of online adults over 65 have created a profile at a social network. This lack of engagement is frequently related to the perception that older adults have of the networks and the general feeling that they are too old for it or that it is very complex. There are a considered number of factors that explain the small number of adults over 65 using social networks. Many of them make the conscious decision to not have access to a computer or internet motivated by privacy concerns, issues finding important features in the website and/or concern about receiving abusive messages from other users.

  Unfortunately, most of the social networks do not take into account these concerns and the result is that potential older users automatically exclude themselves from the benefits that can be offered. When compared with the younger population, that which spent most of their life dealing with technology, older adults mostly think that the risks are greater than the benefits.

AGE RANGE (YEARS)	INTERNET USE	SOCIAL MEDIA USE	E-MAIL USE
18-29	97%	86%	91%
30-49	91%	72%	93%
50-64	77%	50%	90%
65+	53%	34%	86%

(Madden, M. 2010. Older Adults and Social Media: Social Networking Use Among Those Ages 50 and Older Doubled Over the Past Year)

- The purpose/benefits of SNS are not obvious to older participants [30]. Educators developing ICT programs for older adults need to take into consideration this population's characteristics, attitudes, and beliefs about ICT as well as, It is necessary to address

concerns and lack of confidence with technology and present ICT as personally relevant and user friendly, whilst building knowledge and skills that equip them to successfully navigate ICT and its on-going developments [31].

The success of social networks is clear in a younger population, but for older adults it seems to be not that attractive because of existing barriers, namely:

☐ There is a gap between young people and older adults regarding the SNS and the aim for which they use it. This could generate more distance between young people and older adults, not allowing intergenerational sharing and communication.

☐ Technical difficulties and the fact that current Web design does not take the needs of older users into account [32].

☐ Mobility is a specific problem for older adult [33], so special care should be taken in the way events and activities are proposed to this user group.

☐ Decreasing cognitive abilities is a reality for older adults. Also here special care needs to be taken in the development of proper and adaptable user interfaces.

Conclusion

From a social perspective, the preservation of social contacts is considered by the majority of related studies as an essential aspect for aging well and it is fundamental to the creation of ways to allow older adults to maintain connection with their communities, and to support their participation in social activities. The social networks can be one interesting and potentially successful technological bridge to support older adults to continue to be socially engaged.

Innovative specific social networks for older adults designed for portable devices and able to address their specific needs and desires – including local inclusion - may find a novel market niche, and play an important role in transforming older lives and the older adult care paradigm.

The number of older adults using social networking sites is ramping up quickly and the potential to use such IT-based tools to face some of the problems encountered by this specific user group is an important opportunity for all projects related to older adults' well-being.

The privacy concerns and User-centred design methodologies are recognized as the most appropriate software engineering approaches to reflect the needs of older adults more accurately, resulting in products and services more usable and marketable.

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