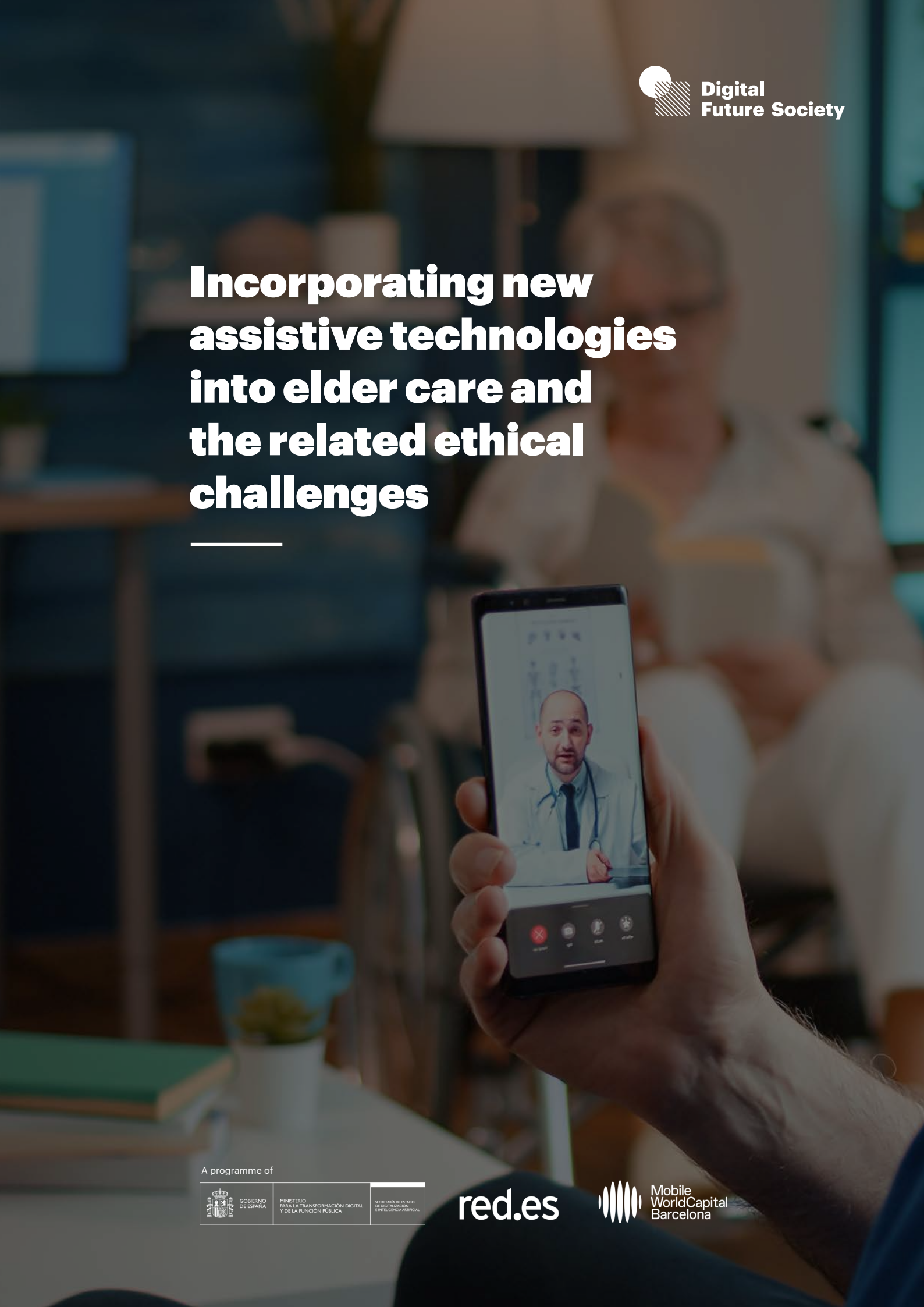
Digital Future Society

Incorporating new assistive technologies into elder care and the related ethical challenges



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Introduction

The intensive use of technology in elder care is becoming an increasingly viable option to address ageing populations in post-industrial societies. Ageing populations are a universal phenomenon in the West, with regional peculiarities existing within it. This paper **explores the progress and implementation of technological solutions in elder care in Spain.**

To this end, **Digital Future Society (DFS) conducted a systematic literature review of coverage in the press and the scientific literature in Spain between 2010 and 2023**. Based on the knowledge gathered the paper identifies opportunities and knowledge gaps, provides an ethical reflection on the transformation of care work, examines public opinion, and offers an overview of the state of international developments on the issue. The paper also offers recommendations and suggestions for potential future lines of research.

Some of the technologies currently in use, such as telehealth devices, already have a long history. Other solutions, such as social robotics, represent more recent developments and promising areas of research. All aim to address the challenges ageing populations present and meet the aspirations and care needs of older people. Objectives include facilitating greater independence, improving the quality of life and extending the time spent living in comfortable, family environments.

The **analysis** of the **revised literature** offers an initial diagnosis of the situation in Spain, however, the number of papers and articles on care technologies in the Spanish context is small. Currently, **the prevailing interest is in the newest area, social robotics**. References to telehealth and home automation also exist but to a lesser extent.

There are also a limited number of **pilot experiences in Spain**, though these have not always given rise to scientific literature.

01 State of the art: assistive technologies in elder care in Europe, Japan and Spain

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The relationship between older people and care technologies has been extensively addressed internationally in both academic publications and the mass media. However, in Spain there is less coverage. Therefore, before addressing the state of the issue from a national perspective, this section will briefly address the situation in Europe and Japan due to their unique characteristics. These experiences will then serve as a backdrop to the findings for Spain.

1.1 The situation in Europe

According to statistics from the latest Eurobarometer dedicated to technology, **European citizens are largely unsupportive of the use of certain technologies for care**. Only 30% would approve of a robot attendant being responsible for their care when they reach old age or in the case of illness. Moreover, 72% believe that those robots would be 'stealing' jobs from people (European Commission 2017).

In Europe, the ageing population presents significant challenges for elder care. Digital technologies are undoubtedly a promising option and substantial resources have been allocated alongside considerable hope.

The Active and Assisted Living Joint Research and Development Programme (AAL) is one of the main exponents of this effort. It is framed under the objectives of the Horizon 2020 research and innovation programme, in the area called "Societal Challenges: Health, demographic change and well-being". Since 2013 it has enabled the **investment of more than 440 million EUR** in 13 countries to support the development of care technologies such as **robotics, home automation and telehealth** (AAL Programme 2023).

Under this programme, **care robots are one of the most innovative areas**. In countries such as Spain, Germany, the United Kingdom and Sweden, pilot projects and research programmes in care homes are being conducted to assess the impact of these robots on the quality of life and well-being of users. Even so, **their integration remains problematic**. The robots used, such as Paro and Pepper, require a lot of technical assistance and sometimes do not offer sufficient added value to justify their use (Cortellessa et al. 2021).

Introducing robotics into homes requires rethinking the workflow of caregivers to **appropriately integrate human-robot interaction**. This will prevent inefficiencies that could lead to poor care or a deficient return on investment, which could discourage implementation.

In other words, **incorporating robots into elder care has a different impact to that of digitalisation** which can involve remote monitoring with sensors or cameras. It introduces a transformation into the field of care and, as such, requires change management for adoption and acceptance. This would help governments be able to perceive the investment as profitable (Wright 2023) and would improve the responsiveness of caregivers and public opinion regarding the integration of robots into care.

Concerning digitalisation, **remote monitoring technologies have exploded** in Europe over the last decade, with a **great cost-benefit ratio** compared to robots. These systems, which many insurers offer, consist of **placing smart sensors, cameras, clothing or wearable (portable) accessories and mobile applications into homes**. These devices allow healthcare professionals and family members to monitor the health and well-being of older people remotely, with procedures that are unintrusive and comfortable for care practices (EU Health Programme 2019).

1.2 The situation in Japan

For decades, Japan has been noted for its **dense population and high level of technological advancement**, with industry globally recognised for quality and innovation. But its current circumstances are far from ideal. The low birth rate, low immigration, the post-World War II baby boom and long life expectancy have led to a demographically challenging scenario.

The drastic reversal of the population pyramid has resulted in **few young people being available for care tasks** and an **increasingly large population of dependent elderly people**. Almost 30% of the population is 65 years old or over and people are leaving the country at an alarming rate (Oliver 2015).

This is one of the reasons why Japan's government and large technology companies are **investing large sums into R and D to develop the care industry and improve the quality of life of this sizeable segment of the population**. Between 2013 and 2017, still in an emerging market, the Japanese government invested **the equivalent of more than 300 million EUR** in programmes to develop robots and other technologies for older people (Wright 2023).

According to 2022 data, **the domestic market in Japan reached 17 million EUR in 2021**, with an expected year-on-year growth rate of 12%. At this rate, private turnover will reach 23 million EUR by 2025, when it is estimated that there will be 320,000 caregivers to cover demand (Yano Research Institute 2022).

From a cultural perspective, **Japanese society is highly receptive to the use of robots**. In Japan, inanimate objects are considered beings with their own soul and are more highly valued than in many other cultures, including most European societies (Nomura et al. 2015). Humanoid robots are found in places like restaurants and hotels and are very well-received by the general public.

Furthermore, socially displaying physical weakness is usually avoided and the presence of non-family members for caregiving tasks is viewed as intrusive (Anshin 2009). Assistive robots could, therefore, provide more personalised and intimate help, aligning better with the values of this society. Even so, like in other parts of the world, tests with robots such as Paro and Pepper have had mixed results, given that while they are more accepted, their current functions and capabilities do not justify their high cost (Kolstad et al. 2020).

Studies bear this out, suggesting that in Japan the implementation of care robots is a technical rather than a social problem. **Their potential and acceptance are high, but their cost and care benefits must be improved** to justify their use (Hsu et al. 2020).

1.3 The case of Spain

1.3.1 The presence of robots in the media

In general, the media in Spain seem to agree that **robotics must soon play an essential role in caring for the elderly**. There is a consensus regarding the problems arising from the **rapid ageing of the population** in Spain, including a potential **shortage of caregivers**. In this context, the use of robots is seen as a potential solution to address the issue.

According to articles in the press, **robots can be effective allies in the fight against unwanted loneliness**, which is seen as a pressing issue and largely responsible for the deterioration of the living conditions of older people. In addition, if robots were able to mitigate this unwanted loneliness, they would also contribute to enabling **a general wish of the elderly: to age in their own home to the greatest extent possible** (Aceros 2018).

In fact, according to 2011 data, **87.3% of Spanish seniors wish to continue living in their own homes, even if they live alone** (Imserso 2011). According to a 2020 survey, 72% of older people prefer to stay at home for as long as possible (Fundación Pascual Maragall 2021), even those who face difficulties from Alzheimer's.

Robotics sometimes appear to be the natural evolution of telehealth, which has traditionally been the main resource supporting ageing at home. The advantage of robotics lies in mobility, and not being confined to a fixed location in the home. However, the role robots may play in accompanying the elderly remains unclear **as what they can offer at present could only be described as modest** — a far cry from the images science fiction gives us.

Robots in residential care homes can provide services such as announcing the menu, remembering scheduled events, offering personalised information or helping to make video calls. As for **older people living alone at home**, the possibilities include helping to exercise the mind with games on the robot touchscreen, providing exercise routines for those who have long been inactive, detecting falls, remembering appointments and taking medications.

Additionally, **robots currently struggle to have 'real' conversations** with older people, akin to person-to-person interactions. However, this could change soon due to recent advances in natural language processing (NLP), a branch of artificial intelligence (AI) that enables more sophisticated understanding, interpretation, and generation of human language (Tellex et al. 2020).

In any event, the level of satisfaction with the few pilot experiences discussed in the press appears to be rather positive.

Nevertheless, while **references to the ethical issues** in the press are unusual, some considerations can be found. **The main concern is substituting people with robots** to perform tasks that require human skills, such as empathy and emotional expression. There is widespread consensus that **robots should exist as a complement to human caregivers, rather than replacing them**. Human interactions are deemed essential for well-being, so care based solely on robots is considered inadequate.

Other ethical issues that have emerged on a less recurrent basis have to do with **information processing and the privacy of those under care and liability in the event of an accident**. The review found only one reference to the human rights of people in care, but it is important to mention this, as it provides a human rights framework for assessing the suitability of the technologies used in care.

Regarding **other technologies used in care tasks**, the review found only a few **references to smart walkers and the use of sensors in private homes**. Smart walkers are mentioned in pilot experiences still in their early stages. The use of sensors in homes is more advanced, monitoring the movements and routines of users and **registering and alerting irregularities such as strokes or falls.**

Lastly, in the media analysis, the review found only one reference to **the concept of co-design**, which involves incorporating the users and recipients of the service into the design process.

1.3.2 The presence of robots in the scientific literature

In the Spanish context, research on assistive technology encompasses a diversity of devices and services, categorised into two main areas based on the state of empirical exploration: telehealth and home automation, and robotics.

Overall, the literature takes a primarily engineering perspective and does not adequately cover social aspects. This technological focus is not unique to the Spanish context but reflects an international trend in this type of research.

Consequently, there is a knowledge gap regarding how social relationship networks and personal identities are transformed when technology is introduced into elderly care settings (Cifuentes et al. 2020). In addition, information is lacking on the role that the social sciences — such as sociology, social psychology and anthropology — could play in technological development (Mlynář et al. 2018), as well as the perceptions of health professionals and care home residents toward these advances (Koh et al. 2021).

In the case of telehealth and home automation, the Spanish context has a long history of exploration and pilot testing (Luperto et al. 2023; Asl et al. 2022). Specifically, there was a remarkable surge in publications between 2005 and 2015. More recently, this trend has significantly shifted, with a drastic decline in scientific literature on the subject rendering it residual. However, commercial applications such as telemedicine have seen a significant increase, especially since the COVID-19 crisis.

In Spain, the integration of telehealth into the daily lives of older people dates to the adoption of telehealth services introduced by the Red Cross in the early 1990s (Leal et al. 2012). Since then, this incorporation has facilitated a large number of social studies focused on analysing its effects and regulations.

Knowledge has been developed regarding how the design and operation of remote care systems contribute to defining good care practices. This understanding has enabled a deeper examination of various age-related issues, including the social implications of ageing. For instance, the resistance of some users to wearing a necklace or bracelet that allows them to contact the alarm centre suggests older people are not comfortable with the prevailing societal view of old age as being a stage of fragility requiring constant surveillance (Aceros et al. 2013).

Robotics remains an emerging research field, tending to focus on developing care relationships through socio-emotional connections with technical devices (Aceros 2018). In Spain today, robots for older people consist of companions that can interact with their users, respond to their affections and entertain them, while also contributing to strengthening autonomy and independence (Ibid.).

In recent years there has been significant growth in national and especially European funding for research, development, and innovation (RDI) in robotics technologies (Fernández Bernat et al. 2017). In addition, important research groups have been consolidated, such as the Robotics Lab at the Carlos III University of Madrid, the CARTIF Technological Center in Valladolid, the Institute of Robotics for Dependency at the Ave María Foundation located in Sitges (Barcelona), and the Social Living Lab, which is part of the Ave María Foundation robotics and home automation dependency laboratory inaugurated last year, led by the University of Malaga and the Ministry of Social Inclusion of the Junta de Andalusia.

Since around 2017, various projects have been initiated focusing on the development and testing of social robots designed for the elderly, including those living in residential care centres (Hoyo et al. 2016; Salichs et al. 2017). These robots perform specific functions, including facilitating non-pharmacological therapies, reminding users of medication schedules, providing meal assistance, offering companionship and information, delivering cognitive training, and detecting physical frailty. Prominent robots in Spain include Pepper, Temi and ARI, Felipe and Walkit, and Misty II.

However, empirical experiences carried out in Spain remain limited and the continuity of the use of robotics is a key challenge in pilot tests, especially when aimed at helping fragile people (Cortellessa et al. 2021). Spain is still at an early stage, with a very low level of commercialisation compared to countries with higher levels of economic development and robust social security systems (Rozo-Reyes 2010). In short, today in Spain for those over 65 years of age, robots are more of a promise than a reality (Aceros 2018).

02 Ethical and social implications

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New digital technologies have been brought into the care sector gradually over the last decade. During this time, various questions and concerns have arisen regarding the ethical dilemmas this generates and uncertainties surrounding the legislation that should regulate its use.

These considerations encompass a wide range of topics, including the conceptualisation of old age, the transformation of care practices and the gender perspective.

2.1 Ethical issues

The introduction of technologies, particularly robotics, into elder care has sparked new controversies and ethical debates. **Four sensitive aspects are especially relevant**: deception, the substitution of humans with robots, privacy, and liability (Vallès-Peris and Domènech 2020a).

Firstly, **deception** refers to the **risk that people will be unable to understand how technologies work and what their capabilities are**. In the case of robotics, a lack of understanding of the artificial nature of the robot could lead someone to maintain a close relationship with a robot as if it were a real person. The emotional and psychological effects of deception are even more problematic when it comes to vulnerable groups, such as dependent elderly people.

The second ethical issue to consider is the substitution of humans with robots (Domènech 2023). The concern is whether integrating digital technologies into care could reduce human contact and negatively affect the personal relationships and emotional well-being of older people. From this perspective, it is important to consider those technologies designed to address unwanted loneliness.

Incorporating technologies into elder care also gives rise to **concerns for users' privacy and data security**. One challenge in the development of these technologies is discerning between confidential information and information that can be disclosed. Another is ensuring the data, including information collected and recordings, are stored securely.

Finally, care technologies also raise **liability issues** such as: who is responsible if a robot makes a mistake? To avoid these types of ethical and legal problems, **liability in case of injury or harm to a person** must be clearly defined. This involves establishing responsibilities beforehand among the various actors involved: manufacturers, developers, suppliers and end-users.

2.2 Design and legislation issues

The 2023 report by the European Union Agency for Fundamental Rights (FRA) Fundamental Rights of older persons: ensuring access to public services in digital societies shows that **legislation in European Union (EU) countries does not always recognise the risk of digital exclusion or address the barriers** older people may face (FRA 2023). This is in contrast with data from the EU itself, which shows that only 1 in 4 people aged 65 to 74 has basic digital skills, meaning **this group faces the most difficulties when accessing new digital technologies** and requires the most help to use them correctly (Casamayou and Morales González 2017).

For this reason, the EU has opted to follow the recommendations of the FRA and legally guarantee, both with European regulations and the General Data Protection Regulation (GDPR) as well as through articles such as Article 50 of the Spanish Constitution, **that technology be designed and used in a way that respects the dignity and rights** of this group. This includes considerations regarding the privacy of individuals and their data, their autonomy and equity of access.

It is important to acknowledge that autonomous decision-making among older people regarding the use of care technologies is often challenging or simply impossible, due to their lack of technical knowledge (due to a lack of digital literacy) or their physical or cognitive condition. This has made clear the need to impose an ethical responsibility on the part of the developers and suppliers of these technologies through regulation.

In addition, it is important to emphasise that **the design of assistive technologies for the elderly** must focus on the needs and capacities of older people, empathising with their abilities, without becoming paternalistic, which can lead to rejection. **These technologies should be inclusive, accessible and easy to use, taking into account the physical and cognitive limitations** that some more vulnerable groups may experience. Studies indicate that design practices can often be contaminated by a distorted and prejudiced conceptualisation of ageing, in part due to the absence of integration processes or user involvement in product development (Fisk et al. 2009).

In line with the recommendations of the FRA, political agreement has recently been reached **for the EU regulation on AI**, aiming to ensure that AI systems commercialised on the European market and used in the EU are safe and respect the fundamental rights of all citizens and EU values (European Council 2023). In addition, UNESCO has recently developed a series of **guidelines on the ethics of AI**, which **can serve as a guide for legislation in the field of care and the treatment of robotics with people** (UNESCO 2023).

2.3 Conceptualisation of old age

The design and development of care technologies do not occur in a vacuum. It is articulated within the context of socially current and specific notions of ageing and the discourse that surrounds it. This leads to the projection of certain identities, the definition of appropriate activities for old age and the promotion of desirable environments for ageing (Aceros et al. 2014).

It is essential, therefore, to consider the notion of old age that the designs convey, especially considering that a significant proportion of the literature on technology and the elderly includes a set of stereotypes regarding this group (Frennert and Östlund 2014). In the Spanish context and beyond, we find that **old age is portrayed as a homogeneous group characterised by loneliness, weakness and the need for help**.

Furthermore, even well-known social robots like Paro and Aibo do not fully address all the needs of the elderly or their caregivers (Broekens et al. 2009). These **robots are designed without direct input from older adults,** leading to a focus on generalised needs derived from medical care demands and demographic changes rather than addressing the specific concerns identified by older individuals themselves (Frennert and Östlund 2014).

In contrast, evidence indicates that older people are far from passive consumers of technological devices. **Whenever their conditions allow, they adapt to them and use them creatively to meet their needs** (Joyce and Loe 2010).

In fact, in a recent study on robotics requirements, **older people and caregivers established an extensive list of their requirements** (García-Soler et al. 2018). These included specific support functions for daily activities, cognitive and social supports, and requirements related to oversight, privacy and security. The list also covered tasks related to cleaning, lifting heavy objects and recognition and communication of emergencies (Ibid.).

Therefore, **the literature does not offer conclusive findings regarding older people's reception of technological innovations** in the field of care. Obstacles such as digital illiteracy and physical and cognitive impairments hinder the integration of technologies into their lives. On the other hand, there is increasing evidence suggesting growing interest and active involvement by older people in the development and use of new technologies.

One explanation for this apparent paradox is the fact that this population is perceived to be predominantly homogeneous. Yet, like any population group, **older people are highly heterogeneous**, and the variability of cases and individual aptitudes with technology can be wide-ranging.

In Catalonia, for instance, approximately 1.5 million people are over the age of 65. This accounts for 20% of the population according to IDESCAT data (IDESCAT 2023). One challenge for the designers and developers of technologies for elder care is addressing a highly heterogeneous group with diverse habits, behaviours, and a wide range of physical and psychological conditions.

2.4 Transformation of care practices

Far from being neutral intermediaries, technologies designed for aged care embody specific notions in their designs of what care means, as well as its organisation and management (Vallès-Peris and Domènech 2020b). When **these conceptualisations intersect with the historical and social conditions of care**, they lead to a transformation of care practices.

In Spain, caring for the elderly and dependent people **has historically fallen to families, especially women** (Digital Future Society 2021). It is undervalued and unpaid work that has been taken for granted until relatively recently. The feminisation of care entails multiple social problems, such as the restriction of employment opportunities for women, the imbalance between paid and unpaid work and the perpetuation of gender inequality.

How is the concept of care understood in terms of technological development? In the case of robotics, during the design process care is understood as a set of activities, organisations and relationships. With this rationale, **care can be fragmented into specific and separate tasks, some of which can be delegated to technology**.

Another aspect of care is **institutionalised care**, which **also falls heavily on women**. This work, while essential to the well-being of society, is often low-paid. When the logic of fragmented care enters into dialogue with the political and social context without a global rethink of roles and relational processes, **the incorporation of technology can be interpreted as a threat to caregivers**. This threat manifests as the standardisation of roles and tasks, increased division of labour, the emergence of a managerial superstructure, and the disqualification and devaluation of labour (Vallès-Peris and Domènech 2020a).

Nevertheless, **various studies indicate that technology is a promising option that improves the working conditions of caregivers**. It brings potential improvements in time management, reduced physical burden and an interdisciplinary perspective on care, among other things.

In this regard, **technology in itself is neither good nor bad, but nor is it neutral**. Home automation, telehealth and social robotics have ethical, political and social implications in the practices of elder care. For this reason, this paper re-emphasises the **need to carry out a thorough examination of the social effects of their implementation**, but also to **open the design processes of these technologies to include older people and care professionals**.

03 Lines of research to pursue

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While the scientific literature often adopts a predominantly technical approach, technological projects have refined their methodologies to better understand the needs and expectations of their audiences and incorporate the end user perspective. In this context, **integrating research methodologies from the social sciences into the development of new care technologies** — analysing the impact of their introduction in the lives of older people — **would bring significant added value**.

In addition, it is essential to approach the study from a multidisciplinary perspective of care, **not only to build technologically sound, but also socially accepted solutions** (Cortellessa et al. 2021). One of the challenges future research should address is the implementation of co-design methodologies that incorporate the perspective of users and caregivers along with those of designers and engineers.

3.1 Technical issues

The lack of advanced systems of interaction and conversation that closely reflect natural language, combined with the high cost of robotic components has driven **the development of touchscreen communication interfaces in complex care robots**. However, these interfaces **are often cold, uncomfortable or ineffective** for older people and even for caregivers who often prefer more natural, warm and agile interactions.

This is where **simple robots, like robotic pets, find their niche**. These robots offer a more intuitive and emotional interaction with technology at more affordable prices, providing more autonomy and lower maintenance as well as minimal assistive functions.

The challenge is to **design more balanced robots that can adapt to the individual needs of users**. They should offer a personalised and meaningful experience, and more sophisticated interaction capacities — beyond simple pre-programmed responses — while maintaining low maintenance requirements and reasonable access costs.

This requires investment in research and development that prioritises artificial intelligence and human-machine interaction. **Understanding and responding more naturally to human language and emotions is a major challenge to overcome**.

Finally, another significant challenge is ensuring that all this technical capacity at the software level **is matched by improvements in the manufacture of mechanical components and sensors.** This would reduce production costs and **improve public accessibility to assistive robotics**, as has occurred in the sectors of telehealth and home automation.

3.2 Psychosocial issues

Firstly, it is crucial not to ignore the fears and uncertainties surrounding this technological transformation in social care. **Resistance to technological innovation is normal** given that emerging technologies are more than mere tools that expand our capabilities, they create new ways of life.

In addition, these feelings reflect the vital importance of care in our lives and the need to approach any change in this area wisely. **Citizens must be involved in decision-making processes, ensuring that they understand and accept the proposed innovations**.

On one hand, **citizen participation must extend beyond mere evaluation of technologies** to encompass active involvement in their development and design (Palmer et al. 2018). Innovating for people rather than with them is a fundamental mistake that can lead to the rejection of technologies. Engaging the population in a co-design process will ensure solutions are genuinely useful and accepted.

But again, technology is not neutral; each innovation incorporates values and perspectives that can have consequences for certain groups. **When integrating assistive robots into social care, it is important to consider their effects on human relationships, individual identities and social meaning**. This requires conducting case-by-case assessments based on real and plausible experiences rather than on speculative futuristic scenarios.

It is also essential to offer cross-disciplinary training in digital and communication technologies to all levels of society. **Digital literacy is necessary for the correct, measured and responsible use of new assistive devices** (Gros Salvat and Contreras 2006). Only in this way can users be empowered, and technological advancements not discriminate against groups less familiar with new devices.

Finally, there is also a need to reflect on the definition of old age. The literature often presents a homogeneous description, yet the **needs of a 60-year-old person cannot be equated to those of a 90-year-old, nor can those of people with different degrees of health**.

Research is needed that incorporates a heterogeneous assessment of this population segment (Compagna and Kohlbacher 2015). The need becomes more pressing when considering that technological developments are often underpinned by stereotypical perceptions of old age that focus on its less positive aspects like loneliness and weakness or the need for help.

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Conclusions and recommendations

The first conclusion from the analysis is that the various technologies identified are at markedly different stages of development. Currently, **the predominant technological proposition of researchers and governments appears to be social robotics, though their social acceptance is not yet an established fact**.

The second conclusion is that **a number of aspects still require empirical research to determine how technology can improve older people's lives**. While there is a determined commitment to social robotics, evidence supporting its suitability is lacking.

The third conclusion addresses the need to **establish mechanisms for analysing the applicability of technologies from a multidisciplinary perspective**. When examining the technological options that promote extended independence, it is insufficient to weigh the pros and cons of specific aspects. The discourse around these technologies should encompass broader considerations regarding **the societal model we aspire to, the state of elder care and the definition of quality care**.

In this context, the recommendations are structured around two primary axes. Firstly, they stress the **need for an interdisciplinary approach to research in elder care technology**. In addition to the engineering perspective, it is crucial to consider as many other viewpoints as possible to fully grasp the potential of technological devices in elder care. Secondly, they advocate **for the involvement of the target users of these technologies — both the elderly and their caregivers — in the design and manufacturing processes**.

Rather than rely on assumptions regarding what might be beneficial to elder care, **a co-creation-based methodology would facilitate an interdisciplinary approach**, both for needs assessment and for the design or implementation of pilot tests. This co-creation may involve forming focus groups, conducting interviews, using surveys, engaging in participant observation, or organising participatory design activities.

When collaborating with older people, we recommend:

Identifying, informing and involving the target population, as well as other key actors.

- Informing potential participants regarding the topic and what is expected of their involvement.
- Establishing a relationship of trust with the participants, mitigating the risk of reproducing bias and power relations.

- Evaluating the participants' technological literacy levels before collecting data.
- Allocating time and resources to provide support and training to enable them to access the digital environment.
- Conducting a review of good practices for the research (Darley and Carroll 2022).

Implementing co-design for these technologies will not only increase the satisfaction of users, but it will also result in products that better adapt to their genuine needs.

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