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Introduction

Over last 10-20 years digital technologies have become an integral part of the home ecosystem, affording the members of each respective environment the opportunity to engage and play with videogame consoles, access to Emails, conduct online activities such as shopping, banking, communication via Skype, or Facetime, and/or share information (e.g. photographs) via social media platforms.

Contemporary scholarly research [1] [2] [3] [4] [5] and evidence [6-7] exemplifies the impact, barriers and enablers citizens are experiencing through their engagement with digital technologies. However, the Covid-19 pandemic has highlighted the importance of digital technology in the lives of citizens, both old and young. This evidence will include the following areas:

1. Use of digital technologies in the community context
2. Citizens who are ageing-without-children
3. Use of videogames in the context of PTSD
4. Using and deploying digital technologies in the context of intergenerational, social isolation and loneliness
5. Introduction to the COVID-19: Technology, Social Connections, Loneliness and Leisure Activities Project
6. 'Smart Age-friendly Ecosystem' for the future

At the beginning of the pandemic, Marston, Musselwhite & Hadley [8] highlighted a myriad of societal issues and concerns surrounding the unfolding global pandemic in the UK context. For instance, the community spirit, in the way communities came together to support one another via digital technologies and social media presence. One such example can be taken from a community support group [8], accessible to all residents who had access to the Internet and a Facebook profile coupled with additional contact details (What's App numbers) for specific points of contact (POC) in the town.

Additional discussions included the potential impact of COVID-19 on citizens in society who are ageing-without-children (AWOC) and who are having to self-isolate, as advised by the UK Government. This area of gerontology has received little attention from funders, current and past Governments and UK agencies as an area that requires greater investigation from the standpoint of research, but also a key concern for local, regional and national agencies, starting with greater discussions of a subject that is very rarely discussed. Moreover, Hadley [9] [10] [11] [12] is developing this scholarly research detailing the issues, and concerns surrounding childlessness from the standpoint of men. The Office for National

Statistics (ONS) [13] report there is a high number of baby boomers who are AWOC and in conjunction with greater life expectancy means there will be fewer older people in the future with adult children. The latter (adult children) are usually the providers of informal care to their ageing older parent(s) [13]. Furthermore, the ONS estimate that there are 23,000 women living in England and Wales aged 80 years who do not have children [13] and this number is projected to increase to 66,000 older women by 2045 [13]. However, missing from this ONS [13] publication is the number of men who are ageing-without-children (AWOC). Greater research is needed surrounding this area, focusing on the existing implications of citizens who are ageing-without-children, and their care needs, for current and future ageing populations (e.g. Generation X).

Digital technologies have the capability to be deployed and used across various sectors of society, including the Police Force and first line responders. Marston and Kowert [14] exemplifies, how videogames can be used in the context of serious games/games for health, assisting health practitioners and emergency responders to alleviate post-traumatic stress disorder (PTSD) [15]. Marston and Kowert [14] discuss how videogames can play an integral role in reducing trauma exposed not only to emergency responders but from the perspective of COVID-19. This also includes health and social care workers, who chose to move into their working environments to shield their vulnerable residents at the height of the pandemic. Furthermore, Marston and Kowert [14] discuss the potential benefits of videogames as a means of bridging social connections and reducing the feeling of loneliness for those citizens who are AWOC. Furthermore, videogames have the potential to facilitate social engagement between young and older adults. Marston and Morgan [16] discuss how specific social media profiles can assist citizens' escape from the realities of life during the pandemic, connecting with fellow users and feeling connected to animals.

To date there has been very little research focusing on intergenerational gaming with the exception of [17]. However, intergenerational gaming offers citizens the opportunity to share experiences and learn from each other. In circumstances such as the pandemic, this type of gaming can afford citizens young and old the opportunity to socially engage together who are living in the same living space or via massively multiplayer online role-playing games (MMORPG) (e.g. living in different places, countries). Nevertheless, either method of playing videogames can offer citizens the opportunity to reduce their feelings of loneliness, and social isolation [14]. Thus, given the uncertainty of the future regarding local, regional and national lockdowns, it is possible that many citizens are fearful of experiencing the same level or greater sense of social isolation and loneliness in the future.

During the pandemic and possible future lockdowns, citizens old and young maybe concerned about maintaining communication with loved ones and friends. The an international, multi-centre [Technology In Later Life \(TILL\) study](#), provided insights into the various digital technologies accessed by citizens aged 70+ years living in rural and urban ecosystems for day-to-day activities [18] and leisure activities [19]. The study indicates the benefits of using digital technologies to facilitate intergenerational communication. For example, Skype

calls between grandparents, their adult children and their grandchildren. Consequently, the likelihood of loneliness and social isolation were reduced [20].

To understand the impact of Covid-19 and the lockdown experiences on citizens, the project '*COVID-19: Technology, Social Connections, Loneliness and Leisure Activities*' project was created. In the following section we present and describe this project.

[COVID-19: Technology, Social Connections, Loneliness and Leisure Activities Project](#)

Within a week of the UK Government declaring a national lockdown, the first survey version (English) of the COVID-19: Technology, Social Connections, Loneliness and Leisure Activities project was deployed across various social media channels, snowballing and media.

The purpose of this rapid response COVID-19 project was to capture the impact, use, barriers and challenges of digital technologies on leisure activities, social connections, loneliness and social isolation as the virus was rapidly spreading.

[The COVID-19: Technology, Social Connections, Loneliness and Leisure Activities project](#) is an international Consortium featuring scholars from 12 Countries (UK, Malta, France, Germany, Austria, Romania, India, Singapore, Brazil, Portugal, Spain and Turkey; and nine languages (English, German, French, Hindi, Mandarin, Portuguese, Brazilian Portuguese, Romanian, Turkish). Each version of the survey is held open for three-months from the point of deployment and all ethical documentation from the Consortium partners was shared with the project lead who in turn updated the ethics committee at The Open University. A full study protocol and description is currently under review.

Preliminary results from the UK (English version) of the survey found in the context of the pandemic, 40.4% of respondents 'strongly agreed' and 54.1% of respondents 'agreed' to conducting 'new experiences'. For example, being able to cook for their family during the pandemic. While 52.7% of respondents 'strongly agreed' and 41.0% 'agreed' to being more isolated. However, 60.0% of respondents 'somewhat disagree' and 'neither agree nor disagree' to feeling more isolated during this period of the pandemic. The survey asked whether citizens had volunteered in their community. Preliminary results found that 48.3% responded positively to 'helping in their community', while 53.5% said they had not helped their community, while 41.9% answered 'no, but they would like to'.

Since 2000 digital technologies have afforded citizens a myriad of ways of communicating with friends and family, be-it through various models of mobile/smartphones, mobile apps (e.g. Snap Chat), social media platforms (e.g. Facebook) or communication tools such as WhatsApp. Preliminary survey findings show 56.2% of respondents from the UK reported to have changed their way of communication. While 52.2% and 44.4% reported 'a little' and 'not' respectively to changing their ways of using digital devices to communicate with

others. There were gender differences relating to digital technology use and behaviour was changed, showing 76.2% of women responding positively, while 75.2% and 72.7% reported 'a little' and 'no' to having their behaviour change during the pandemic. However, 25.3% of men reported to not having changed their ways of communicating, while 22.8% reported they had. Similarly, from the perspective of age, the highest response was reported by adults aged between 40-44 years, 45-49 years and 35-39 years. The least behaviour change relating to using digital technologies for communication was adults aged between 80-84 years (1.0%), 75-79 years (1.0%) and 18-24 years (2.0%).

Lending support to the notions and discussion presented by Marston, Musselwhite and Hadley [8], the preliminary findings from the survey evidence an early trend in respondents in the UK volunteering to help residents in their local communities. Findings showed the majority of adults aged 60-64 years (14.5%) joined digital support groups in their community, followed by 14.5% of adults aged 35-39 years, and 13.3% aged between 45-49 years. While the least number of adults aged between 90-94 years (1.0%), 80-84 years (1.0%), 75-79 years (1.2%), and finally adults aged 70-74 years (2.0%). This aligns with the directive of the UK Government for those older adults aged 70 years or older should self-isolate.

Data analysis is just commencing across all survey versions, and given its international reach and scope, this project will play an integral role in understanding the social and behavioural factors surrounding digital technology use, access and impact during the pandemic.

Previous evidence [6-7] indicates how technology can assist citizens to continue and enhance their lives, with Marston and Musselwhite [7] stating how:

“there is a lack of information surrounding the needs, issues and concerns of younger adults, and how they perceive the impacts, barriers and enablers to technology as they age.”

The last 12 months between September 2019 and August 2020 society has been challenged, and the future looks uncertain. Various projects such as the [Technology 4 Young Adults \(T4YA\) study](#) which aims to understand the impact and use of digital technologies by Millennials, the [Technology In Later Life \(TILL\) study](#) which focused on adults aged 70 years and over living in rural and urban locations, will feed into understanding how citizens at different stages in their lives

The importance of understanding the barriers and enablers to digital technology use and behaviour by citizens does not solely stop with older adults and baby boomers but also citizens who are categorised as Generation X [21] [22]. Over the last five years or so, there is a growing body of research [21] [22] [23] has started to be conducted by games scholars Brown and Marston which has to date been overlooked by several actors including Gerontologists, Gerontechnologists, policy makers and Industry.

As we move towards a different societal ecosystem, taking an agile approach at various levels, and simultaneously interacting with different actors, we as a

society are working at micro and macro levels have witnessed the importance of digital technologies in the various ecosystems (e.g. individual, community, education, business etc.).

Marston and van Hoof [24] coined the term 'Smart Age-friendly Ecosystem' while proposing their extended framework (Figure 1) which extends the WHO [25] framework to accurately represent 21st century life. This framework is reflective of the role and impact digital technologies have within our societal ecosystems, and includes three specific domains, 1. The age-friendly living environment, 2. The age-friendly physical space and 3. Technology & associated ICTs.

The Smart Age-friendly Ecosystem proposed here offers a holistic and powerful unifying systemic conceptualisation which can be utilised and deployed by interdisciplinary actors – when discussions could become fragmented/compartimentalised.

This COVID-19: Technology, Social Connections, Loneliness and Leisure Activities project is an interdisciplinary consortium and the findings will make a substantial contribution to the fields of gerontechnology, the social sciences, human computer interaction, gerontology and media communications. Given the importance of this data and the work carried out by the Consortium, we believe to date, this is the first project of its kind, and is of significance to the science community, policy makers, stakeholders and the charity sector.

It is the intention of this evidence to offer an interdisciplinary outlook, building on existing research, projects, and evidence with a viewpoint to penetrating the multiple layers of society.

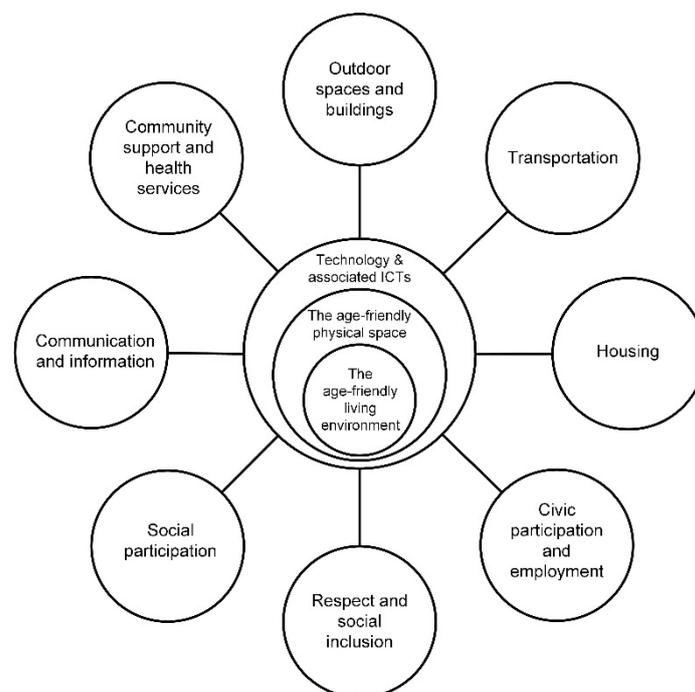


Figure 1 – Smart Age-friendly Ecosystem [24]

Previous evidence [7] proposed a high-level route map for future work in the realm of digital technology use by citizens residing in different geographic locations. In the context of the pandemic, and post-pandemic society, the evidence presented here indicates how certain technologies (e.g. videogames) can be used in the context of PTSD and trauma. Such research has the potential to positively impact and benefit respective personnel (e.g. police, health and social care workers) and their families alike. During the pandemic, there was little narrative and acknowledgement surrounding the impact of social isolation and loneliness of citizens who are ageing-without-children (across all age cohorts, for example Generation X). This is a critical area for interdisciplinary research that requires urgent attention which to date has not received attention from stakeholders.

Future research should consider using the proposed 'Smart Age-friendly Ecosystem' [24] which now acknowledges and includes the use of digital technologies within the (Smart) Age-friendly sphere. This proposed framework is adaptable and a blueprint for alternative ecosystems now and in the future – in a post-pandemic society.

Citizens in society are unsure of the future in a post-pandemic ecosystem but all citizens should have the opportunity to express their experiences, fears, hopes and expectations for the future in the hope that knowledge can be shared and lessons can be learned.

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