# **Television Is Powerful: An iTV Solution as a Motivator of Social Interactions Among Older Adults**

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Keywords: Active Ageing, Gamification, Older Adults, Social Interactions, Television, Well-Being.

Abstract: This study explores the development of and evaluation of ProSeniorTV, an interactive television system designed to enhance social participation and cognitive engagement among older adults. Leveraging a familiar medium for older individuals – the television – the system incorporates proactive notifications to inform users about local social events and cognitive stimulation minigames to foster regular interactions. A 30-day field study conducted with 20 participants demonstrated promising results. Participants attended an average of 1.4 events, reflecting a 35% engagement rate with suggested activities. Notably, 95% of users recognised the system's effectiveness in providing accessible information about local events, reducing reliance on other sources. Additionally, ProSeniorTV contributed to significant decreases in reported loneliness levels, with moderate loneliness dropping from 60% to 30%, and all participants reporting enhanced social connection by the study's conclusion. The inclusion of gamification elements, such as a leaderboard and participation rewards, proved effective in motivating sustained interaction. While mobility challenges and transportation reliance were identified as barriers, the system's overall usability and impact align with active ageing principles, supporting its potential for broader implementation. ProSeniorTV underscores the value of innovative technologies in addressing social isolation and promoting healthier ageing.

# 1 INTRODUCTION

Population ageing is a global trend resulting from increased life expectancy and declining birth rates, particularly evident in developed countries. This phenomenon has significant social implications.

In Portugal, the proportion of older adults has been steadily increasing. In 2023, the ageing index reached 188.1 older adults for every 100 young people, compared to 184.4 recorded in the previous year (INE, 2024).

This ageing is reflected not only in demographic structure but also in the growing need for approaches that promote the physical, psychological, and social well-being of older adults (Fulop et al., 2019; Woodhead & Yochim, 2022).

The literature suggests that the ageing process should not be analysed solely from a chronological perspective but also considering biological, psychological, and sociocultural factors (Fonseca,

#### 398

Faria, G., Silva, T. and Abreu, J. Television Is Powerful: An ITV Solution as a Motivator of Social Interactions Among Older Adults. DOI: 10.5220/0013493500003938 Paper published under CC license (CC BY-NC-ND 4.0) In Proceedings of the 11th International Conference on Information and Communication Technologies for Ageing Well and e-Health (ICT4AWE 2025), pages 398-405 ISBN: 978-989-758-743-6; ISSN: 2184-4984 Proceedings Copyright © 2025 by SCITEPRESS – Science and Technology Publications, Lda.

2006; Santos et al., 2022; Schneider & Irigaray, 2008).

Among the associated challenges are social exclusion and limitations linked to physical and cognitive decline, which underscore the urgency of strategies aimed at fostering an active and healthy lifestyle in old age. In this context, social activities play a crucial role in the well-being of the senior population.

Social engagement is an essential component of the active ageing concept promoted by the World Health Organization (2002). Robust social networks and frequent social interactions are associated with benefits such as improved cognitive health, emotional stability, and physical condition (Kelly et al., 2017; Wang et al., 2021). However, ageing often exacerbates the risk of loneliness and disconnection, reinforcing the importance of initiatives that promote inclusion and participation in community activities (Kitzmüller et al., 2018; Tani et al., 2022).

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Beyond social interactions, television plays a central role for many older adults, serving as a primary source of information and entertainment.

In Portugal, 68% of the population aged 65 and older rely on television as their main medium for accessing news content (Cardoso et al., 2024). In addition to providing leisure, television contributes to strengthening social interactions, acting as a basis for conversations and social gatherings (Abreu, 2007).

The high level of television consumption among seniors, who account for about 30% of audiences in Portugal (OberCom, 2021), demonstrates its potential as a tool for social inclusion and enhancing quality of life.

Based on these premises, this article presents the ProSeniorTV system, developed to foster social interaction and participation in social events organised within the residential community of older adults.

The system was designed to incorporate functionalities that facilitate access to information about such events and encourage users to participate in social activities using a well-known medium widely accessible to older adults - the television.

This study contributes to the field of active ageing and social inclusion by introducing ProSeniorTV, an interactive television system specifically designed to encourage older adults to engage in cognitive and social activities. Unlike existing solutions that often require digital literacy and the use of unfamiliar devices, ProSeniorTV leverages a familiar mediumthe television-to seamlessly integrate social and cognitive engagement into the daily routines of seniors. The system's proactive notification mechanism represents an innovative approach by automatically informing users about local social events and encouraging participation through gamification strategies. Furthermore, this study provides empirical evidence from a real-world, 30field trial, demonstrating measurable day improvements in social participation, access to event information, and reductions in loneliness and isolation levels. By combining cognitive stimulation with social engagement in an accessible and intuitive way, ProSeniorTV offers a scalable, low-barrier technological solution to promote active ageing.

Considering all these aspects, the next section describes the ProSeniorTV system and its usage scenarios. Subsequently, the results of a field test conducted in a real-world context are presented, analysing the system's effectiveness in promoting social participation and combating isolation among older adults. The article concludes with a discussion of the results obtained, highlighting the system's contributions to active ageing and future implications for the development of inclusive technologies.

### 2 RELATED WORK

The role of digital games in cognitive stimulation and social engagement for older adults has been widely explored in academic and commercial research. Various studies emphasize the potential of serious games in mitigating cognitive decline and improving quality of life (Barnes et al., 2007; Glass et al., 2013). Research suggests that video games can enhance skills such as memory, attention, spatial cognition, and language comprehension (Oei & Patterson, 2013; Vasconcelos et al., 2012). Additionally, interactive digital experiences have been found to promote social interaction (Tekinbas & Zimmerman, 2004) and cognitive benefits that extend into daily activities (Video Game Training Improves Brain Function in Older Adults, 2013).

Despite these advantages, most cognitive training games are designed for computers, tablets, or smartphones (De Paula et al., 2020), devices that many older adults find difficult to use. This challenge has led to efforts to integrate cognitive training with more familiar technologies, such as television. For instance, Matos et al. (2020) developed a cognitive game called *MemoGinga* within the Brazilian digital TV system specifically for older users, demonstrating the feasibility of TV-based cognitive interventions. Similarly, De Paula et al. (2020) adapted the classic *Stroop Game* for digital TV, using remote control buttons for interaction, ensuring accessibility for senior players.

Several other studies have explored cognitive games tailored for older adults. The *A-go!* Project (Lau & Agius, 2021) featured 3D environments to train cognitive functions through gesture-based interaction. The *CogniPlay* platform (Vasconcelos et al., 2012) focused on memory training via tablet-based games. *VIRTRA-EL* (Rodríguez-Fórtiz et al., 2016) used immersive 3D environments for cognitive exercises but was limited to computer and tablet interfaces. Other solutions, such as *BrainHQ*<sup>4</sup> and *CogniFit5*, provide a range of cognitive exercises but lack

<sup>&</sup>lt;sup>4</sup> https://play.google.com/store/apps/

details?id=com.positscience.brainhq.app&hl Accessed: 18-02-2025

<sup>&</sup>lt;sup>5</sup> https://play.google.com/store/apps/

details?id=com.cognifit.app&hl Accessed: 18-02-2025

television integration, which remains a key barrier to accessibility for seniors (De Paula et al., 2020).

The ProSeniorTV system differentiates itself by integrating gamified cognitive exercises into a proactive iTV-based solution that simultaneously encourages real-world social participation. Unlike previous studies, ProSeniorTV not only offers cognitive training games but also employs a notification system to inform users about local social events, addressing both cognitive decline and social isolation in a unified platform. Leveraging television - a widely adopted technology among older adults ensures accessibility and ease of use, potentially increasing engagement and impact.

#### **3** THE ProSeniorTV SYSTEM

ProSeniorTV was conceived as an innovative solution to promote senior engagement in cognitive and social activities. The system utilizes television notifications and an accessible interface, operated via a remote control, to provide an intuitive experience tailored to the needs of this audience.

This chapter outlines the main usage scenarios, functional requirements, and information architecture underpinning the system.

#### 3.1 Usage Scenarios

ProSeniorTV envisions two primary usage scenarios designed to stimulate cognition and strengthen social ties among users.

Firstly, the system offers **suggestions for cognitive stimulation mini-games**. While watching TV programs, as shown in Figure 1, users receive notifications inviting them to test their mental abilities. By selecting this option, they gain access to an interface where they can play mini-games, earning points for a global leaderboard. After engaging with the mini-games, users can explore other activities, view the leaderboard, or return to their television programming.

Additionally, the system **informs users about social events in their area**, encouraging participation and the maintenance of interpersonal relationships. For each attended event, participants receive a code that can be entered into the interface to accumulate participation points. The system also provides **reminders to enter these codes** in the system's interface, ensuring users do not miss the opportunity to register their participation. The interface allows for code input, point verification, and the exploration of other features.



Figure 1: ProSeniorTV notification examples (Faria et al., 2024).

#### **3.2 Functional Requirements**

The functional requirements of ProSeniorTV were designed to ensure a smooth and engaging experience.

The system includes an **authentication mechanism** to create profile accounts linked to each household, allowing for the management of up to three user profiles per account. Each profile is customizable, with easy switching between users.

ProSeniorTV integrates **automatic notifications**, displayed in the upper left corner of the screen, informing users about social events and inviting them to access cognitive stimulation mini-games.

The interface features a **leaderboard** combining scores from games and points earned through participation in social activities, emphasizing the value of in-person events.

A dedicated **code entry area** is an essential feature, enabling the registration and calculation of points earned through mini-games and participation in suggested social events.

The **mini-games**, designed to stimulate users' cognitive abilities, include three options: *i*) a sequence game to train memory; *ii*) a colour game inspired by the Stroop Game to enhance attention skills; and *iii*) a 3D block-moving game aimed at improving visuospatial skills. Each mini-game is accompanied by an **explanatory tutorial**.

To ensure navigability, the interface includes an **exit function** that allows users to return to regular programming at any time.

# 3.3 Information Architecture and Graphic Interface

The graphic interface of ProSeniorTV was designed to be accessible and intuitive, with a focus on strong contrasts and large text, facilitating interaction for senior users. The interface is divided into several main areas. On the **profile selection screen**, users choose from up to three distinct profiles, identified by name and avatar. This screen serves as the entry point for a personalized experience.

**Tutorials**, presented during the system's initial use and before each mini-game, consist of navigable slides that explain the functionalities and rules.

The **main screen**, presented in Figure 2, centralizes all available options, including access to mini-games, the leaderboard, and code entry. At the top of this screen, there are buttons for switching profiles or exiting the interface.

The **leaderboard** organizes scores into groups of five, highlighting each user's name, avatar, and score.

On the **code entry screen**, a modal presents a numeric keypad for easy code entry, accompanied by buttons to cancel, delete, or validate the operation.

Finally, the **mini-game screens** follow a uniform structure, displaying scores, levels, and interaction instructions in the upper sections of the screen.

This design prioritizes clarity and simplicity, employing visual and interactive elements that make the system accessible and motivating for seniors. This way, ProSeniorTV aims to encourage older individuals to get out of their homes and get involved in suggested social events, offering them meaningful moments of interaction with others and promoting a more active and socially healthy ageing process.



Figure 2: ProSeniorTV interface main screen (Faria et al., 2024).

# 4 FIELD TRIAL

The field trial of the ProSeniorTV system was conducted to evaluate its effectiveness in promoting senior participation in social and cognitive activities. This chapter describes the context in which the test took place, the period of the study, and the participants involved.

#### 4.1 Context and Period

The field test was conducted in a real context - the participants' homes. The objective was to replicate everyday conditions, ensuring that the system was used as part of the users' normal routines.

Before the tests began, the ProSeniorTV system was installed in each residence, and participants were guided to explore its main functionalities, including notifications, mini-games, and the entry of participation codes for events.

Each test lasted 30 days, which was considered sufficient time to observe the system's impact on the participants' daily habits.

#### 4.2 Participants

The study included 20 senior participants, aged between 57 and 87 years, with an average and median age of 71 years. Although the youngest participants were 57 years old, they can still be considered seniors in the Portuguese context. According to the RUTIS (Rede de Universidades Seniores)<sup>6</sup>, individuals aged 50 and above are eligible to attend senior universities in Portugal, reinforcing the classification of participants in this study as part of the senior population.

Most participants (70%) were female. Regarding education levels, 40% had completed only primary education, 30% had basic education, 20% had secondary education, and 10% held a university degree.

Geographically, participants were distributed across three Portuguese districts: Aveiro, Coimbra, and Lisbon.

#### 4.2.1 Television Consumption Habits

All participants used television daily, with 90% dedicating at least two hours per day to this medium.

The most popular content included news, soap operas, debate programs, and documentaries.

Additionally, 75% of participants watched TV during or after dinner, highlighting the centrality of this medium in their routines.

<sup>&</sup>lt;sup>6</sup> https://rutis.pt/universidades-seniores/ Accessed: 18-02-2025

IS4WB\_SC 2025 - Special Session on Innovative Strategies to Enhance Older Adults' Well-being and Social Connections

#### 4.2.2 Social Interaction Habits

In terms of household structure, 70% lived in households with two to three people, 20% lived alone, and 10% belonged to larger families (four to five members).

Most participants (75%) were retired, while 25% were still employed.

Social interactions were a significant part of participants' lives, with 90% reporting daily interactions with friends or family. However, only 25% regularly attended social events. Despite considering these events important for maintaining their social relationships (90%), many participants reported difficulties in obtaining information about available activities, relying primarily on friends and family for this purpose.

Standardized instruments were employed both before and after the field trial to assess the impact of ProSeniorTV on loneliness and social interaction. The UCLA Loneliness Scale (version 3) (Russell, 1996), in its Portuguese-validated version (Kuznier, 2016) was used to evaluate participants' subjective feelings of loneliness and social isolation. Additionally, the Lubben Social Network Scale (LSNS-6) (Lubben et al., 2006), in its Portuguesevalidated version (Ribeiro et al., 2012), was applied to measure the extent of participants' social networks and the risk of social isolation. These assessments allowed for a comparative analysis of the participants' social connectivity and emotional wellbeing before and after interacting with the ProSeniorTV system, providing quantitative insights into the system's effectiveness in fostering social inclusion.

## 5 RESULTS

During the field trial period, each participant received four notifications suggesting social events held near their homes.

On average, participants attended 1.4 events, representing 35% of the total suggested events.

The distribution of participation in the events, presented in graphic 1, was as follows:

- 4 participants (20% P9; P11; P15; P17) did not attend any events.
- 8 participants (40% P4; P7; P8; P10; P13; P18; P19; P20) attended 1 event.
- 5 participants (25% P2; P3; P12; P14; P16) attended 2 events.
- 2 participants (10% P1; P6) attended 3 events.

# • **1** participant (5% - P5) attended all 4 suggested events.



Graphic 1: Number of participants by the total of events attended during the field trial period.

#### 5.1 Reasons that Hindered Greater Attendance at Events

Participants with lower attendance rates were asked about the reasons that prevented them from participating in more events.

Among the 12 participants who attended no more than one event, the following factors were identified as limiting their engagement with the suggested events during the field test:

- Mobility difficulties: 50% of those participants (n = 6) reported physical issues that made it difficult for them to travel to the event locations.
- Busy schedules: 50% (n = 6) indicated they had prior commitments or regular activities that conflicted with the dates and times of the suggested events.
- **Dependence on others for transportation:** 42% (n = 5) mentioned needing assistance to travel, which limited their ability to participate independently.
- **Professional obligations:** 25% (n = 3) stated that their work schedules interfered with their availability to attend the events.

# 6 DISCUSSION AND ANALYSIS OF RESULTS

Field trial results show that the ProSeniorTV system may effectively promote seniors' participation in social events, facilitate access to information about local activities, reduce isolation and loneliness, and, more broadly, motivate greater social integration among older adults.

### 6.1 Evolution of Social Events Participation Levels

Before the field test, only 25% of participants attended social events regularly, despite 90% considering such events important for maintaining their social relationships.

During the field trial, 80% of participants attended at least one of the suggested events, with an average of 1.4 events per participant, representing 35% of the total suggested. This difference reflects the system's positive impact on promoting social participation.

Although the average number of participations increased compared to pre-test habits, the data reveal that, as previously noted, significant barriers still prevent seniors from accessing social events that could enhance their social well-being. Mobility difficulties, reliance on others for transportation, and scheduling conflicts limited this type of engagement. These factors are corroborated by the literature, which highlights the lack of accessibility and logistical support as common obstacles to social participation among seniors (Abdi et al., 2018).

# 6.2 Ease of Access to Information Related to Local Social Events

One of the most relevant aspects of the results was the significant change in participants' perceptions regarding access to information related to local social events.

Before the field trial, only 40% of participants reported having ease of access to information related to local events, with friends and family being the primary sources of such data.

During the test, the ProSeniorTV system proved to be an effective solution, with 95% of participants recognizing that the notifications displayed via TV facilitated access to this information.

This result validates the system's value proposition, which uses proactive notifications to inform users about local events organised close to their homes, reducing reliance on friends and family for accessing such information.

Additionally, the strategic repetition of notifications at different times and days ensured that users were reminded of these events with sufficient notice to increase the likelihood of participation.

# 6.3 Changes in Levels of Loneliness and Isolation

The reduction in levels of loneliness and social isolation was another notable impact of the system.

Before the test, 60% of participants exhibited moderate levels of loneliness, while 40% reported low or no loneliness.

After the test, the proportion of participants with moderate levels of loneliness decreased to 30%, demonstrating a significant improvement in emotional well-being among the field test participants.

Regarding social isolation, only 10% of participants were initially at risk. However, by the end of the field trial, all participants (100%) reported a greater sense of social connection.

The system's use as a starting point for social interactions and its encouragement of event participation were critical factors in these improvements. As such, the proposed system aligns with the World Health Organization's (2002) guidelines on active ageing and social inclusion.

#### 6.4 Utility and Effectiveness of ProSeniorTV

The ProSeniorTV system demonstrated a significant positive impact on motivating seniors to engage in social and cognitive activities.

The inclusion of gamified features, such as score rankings and rewards for event participation, was particularly effective in promoting regular interactions with the system.

The results suggest that the system not only improves access to information but also fosters behavioural changes among seniors, promoting a more active and healthier lifestyle. However, the identified limiting factors, such as mobility difficulties and reliance on transportation, indicate that additional improvements, such as partnerships with transportation services or community initiatives, could further enhance the system's impact.

#### 6.5 Comparison with Existing Work

The results obtained from the ProSeniorTV field trial align with and, in some aspects, surpass those of previous studies on digital interventions for older adults. Existing research has demonstrated the benefits of cognitive training games in enhancing memory, attention, and problem-solving skills among seniors (Barnes et al., 2007; Oei & Patterson, 2013). Studies such as *A-go!* (Lau & Agius, 2021) and *CogniPlay* (Vasconcelos et al., 2012) have shown that engaging seniors in interactive digital games can improve cognitive function. The ProSeniorTV system also achieved this, with participants actively engaging in mini-games and reporting increased cognitive stimulation.

However, unlike many previous studies, which primarily focused on cognitive benefits, ProSeniorTV was designed to simultaneously address social isolation. More commercial solutions such as *BrainHQ* and *CogniFit* have provided cognitive training without integrating social engagement components. In contrast, ProSeniorTV's notification system actively encouraged participation in realworld social events, with 80% of participants attending at least one suggested event. This is a notable improvement compared to the pre-test habits, where only 25% of participants regularly attended social activities.

Moreover, while solutions like the *Stroop Game* for Digital TV (De Paula et al., 2020) and *MemoGinga* (Matos et al., 2020) successfully adapted cognitive training to television interfaces, they lacked mechanisms to proactively notify and engage users in social activities. ProSeniorTV's gamification approach further contributed to motivation, with a ranking system that rewarded both in-game participation and real-world engagement—something not commonly found in other TV-based cognitive training systems.

Regarding social impact, the reduction in reported loneliness among ProSeniorTV users (from 60% to 30%) supports previous findings that digital engagement can foster social connections (Tekinbas & Zimmerman, 2004). The *VIRTRA-EL* system (Rodríguez-Fórtiz et al., 2016) demonstrated improvements in cognitive functions but lacked realworld social integration. The results from ProSeniorTV suggest that combining cognitive training with proactive social engagement strategies could be more effective in reducing loneliness and fostering social inclusion among seniors.

In summary, while previous research has demonstrated the benefits of cognitive training or social interaction separately, ProSeniorTV presents an integrated approach that not only provides cognitive stimulation but also promotes active participation in real-world social events, setting it apart from existing solutions.

# 7 CONCLUSIONS

This study highlights the potential of ProSeniorTV as an effective tool for promoting active ageing by facilitating social participation and cognitive engagement among older adults. By integrating proactive notifications and gamification strategies into a familiar medium—television—the system addresses key barriers that often hinder social interaction and access to relevant information.

One of the most significant contributions of ProSeniorTV is its capacity to provide direct access to local events information. This not only fosters greater autonomy among older adults but also encourages participation in community activities that might otherwise go unnoticed. Moreover, the system's integration of cognitive stimulation minigames offers additional engagement opportunities, reinforcing its role as a multidimensional support tool for active ageing.

Despite these positive outcomes, the study also underscores the persistent challenges that limit participation in social events, particularly mobility constraints and transportation dependence. Addressing these factors in future iterations of the system could further enhance its effectiveness and accessibility. Additionally, expanding the system's implementation to diverse senior populations could provide deeper insights into its broader applicability and long-term benefits.

In conclusion, ProSeniorTV demonstrates how digital solutions can be harnessed to support ageing populations, offering a scalable and practical approach to fostering social inclusion and cognitive well-being. Future research must focus on optimizing the system's usability, exploring partnerships to overcome mobility barriers, and assessing its impact over extended periods and larger user groups.

## **ACKNOWLEDGEMENTS**

This study is funded by the Fundação para a Ciência e a Tecnologia through a PhD research grant. It is also being conducted in partnership with ALTICE LABS.

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