






Connect Elderly to Other Generations Through iTV: Evaluating Notifications' Potential

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Abstract. Television is among the preferred technological devices of the elderly due to their familiarity with its simple interface and because it acts as a sort of companion, being this especially relevant for those living alone. This phenomenon was particularly observed during the social isolation resulting from the Covid-19 pandemic. In the most critical period of the health crisis, the consumption of television content among older people and the adoption of other digital solutions aimed at entertainment or social interaction increased significantly. At the same time, technological advances in the television ecosystem have made it possible to include resources capable of making the gadget increasingly interactive and friendly. An example is the use of notifications, a mechanism that consists in displaying messages on the device's screen, engaging users to a specific topic. TV notifications can act as an information-focused tool with the potential to promote the connection of seniors with their family or friends. In the aforementioned context, the objective of this paper is to identify how TV notifications can contribute to reduce the rates of social isolation among the elderly, offering new forms of interaction with society. For, initially, a literature review was carried out to allow contextualizing the problem. Studies conducted in this field were evaluated to identify whether the television ecosystem would be able to enhance human relationship. These studies supported the construction of a questionnaire focused on identifying the habits of the elderly in relation to the adoption of technological devices, the consumption of television content and the acceptance of notifications in this context. Therefore, this study provides evidence that notifications can connect generations, being an important mechanism to reduce the rates of loneliness among older individuals.

Keywords: Elderly · Seniors · notifications · Social isolation · TV · iTV

1 Introduction

Television is a device often used by the elderly, especially when they feel alone [1]. Social isolation is recurrent among these individuals being the main reasons that keep them from social life are physical disabilities and low education [2]. This situation intensified during the Covid-19 disease pandemic, which significantly increased the consumption of television content among older people, as well as the adoption of other technological resources aimed at entertainment and social interaction [3]. Since family members were further away due to the health crisis, videoconferences and social networks helped to

reduce social isolation [3]. However, while they help, digital resources can represent a barrier, mainly because skepticism about using new technological resources tends to be higher among the elderly [4].

In contrast, advances in Artificial Intelligence (AI) and Big Data have allowed devices to anticipate users' needs, rather than just reacting to them [5, 6]. One example is notifications, a mechanism that directly impacts the public and contributes to stimulate the use of digital resources [30, 31].

Based on this perspective, the objective is to identify if such messages (used in the television ecosystem) can increase the elderly contact with other people, thus reducing social isolation rates. For that, this article was divided into four parts. The first brings data on the rates of isolation among the elderly. Next, it is based on the detailing of the methodology used in the selection of articles and for the characterization of the identified sample. Such studies served as a basis for structuring a questionnaire about preferences in relation to TV and the use of technologies that help to keep in touch with other people. This process is detailed in Sect. 3, which also contains the characterization of the sample of 20 senior citizens who were interviewed for the present study.

Section 4 presents the main results, organized into two parts: literature review and interviews. Finally, there are the final considerations, which pointed the benefits of the study to the television ecosystem and the senior audience. Still in this section there is also a brief explanation of future work in this area.

2 Technology to Promote Interactions

During the COVID-19 pandemic, which started in March 2020, the need for social isolation forced people to stay in their homes and use digital platforms to minimize the effects of confinement [7]. In the case of the elderly, this imposition was even more significant because of the higher risks involved— the deaths of individuals over 65 years of age correspond to 80% in the United States and 95% in Europe [8]. This scenario enhanced the levels of loneliness of the senior public, who historically suffered from problems related to lack of contact [2].

In Portugal, it is estimated that 42,434 elderly people are isolated, in a situation of vulnerability due to their physical and psychological conditions [9]. The pandemic, in turn, contributed to amplify the problem, evidencing the need to provide means for this public to maintain healthy relationships and actively participate in communities.

One way to minimize social isolation rates is using mobile devices and resources such as videoconferencing and gaming, for example [10]. However, incorporating them into everyday life can still represent a barrier for older people due to several factors – and one of the main factors is its difficulty of use [2]. Not always the senior possesses sufficient skills or familiarity with technological resources [3]. And this is the result of several factors, such as skepticism about innovative technologies and rapid renouncement when facing difficulties related to usage [4]. Since there is a barrier, mechanisms that require less cognitive effort, such as notifications, are a way to facilitate the usage of technological resources [11]. By being proactively sent to seniors, these messages enable access to information and to other people, stimulating the connection between individuals [12]. In addition, notifications facilitate access to newly available information, making the user's attention turn to the content in question [13]. It is an element

considered important in the communication ecosystem because it directly impacts the public without intermediaries, inducing the user to view specific information and be received from different devices, such as the TV set [14]. Such messages can have different formats (visual, auditory or vibration/touch alerts), increasing accessibility [15]. In addition, especially in the case of the elderly, notifications usually send reminders of important activities, for instance medication schedules or appointments on the agenda (Fig. 1). Health-monitoring applications can also send frequent bulletins to the family or caregivers [24], reaffirming the multiplicity of functions and possibilities of this type of mechanism.



Fig. 1. Example of how notifications can be displayed on TV to send health alerts.

3 Methodology

3.1 Literature Review Protocol and Sample Characterization

A survey was carried out to identify the potential of notifications to reduce the rates of social isolation among seniors. Therefore, the methodology of a systematic review of the PRISMA model was chosen [16] to carry out the work. A review protocol was defined based on a research protocol with three groups of keywords on the SCOPUS and Web of Science platforms. The first survey was conducted at SCOPUS, between July 12 and 15, 2021, with “elderly AND notification AND social AND isolation AND television OR TV”. 18 results were found, and after reading all abstracts, it was identified that only 3 were pertinent. Studies that do not address the use of notifications directly on the television screen were excluded. Then, a second search with the following terms “notification AND television OR tv OR iTV AND elderly” had 76 results. All abstracts were re-evaluated and only three were considered relevant.

Both searches were also performed on the Web of Science platform, and the results considered relevant were repeated. To verify that the keywords chosen were the most appropriate, we chose to search the Web of Science more widely with the words “elderly

AND TV OR television”. A total of 111 results were found, which had their abstracts evaluated. Only 9 of them were related to the use of notifications on TV. In total, therefore, 15 studies were evaluated. All the texts in the sample are in English and present the notifications displayed on television as possible mechanisms to make relevant information more easily reach users.

In the SCOPUS sample, 67% (4) studies are about social contacts, 17% (1) about health and 17% (1) refer to the format of display on the screen. In the Web of Science sample, 22% (2) refer to the format/design, 44% (4) contribute to promoting health, 22% (2) integrate Smart Home circuits and 11% (1) are about education.

3.2 Interviews Protocol and Sample Characterization

As mentioned, the scientific mapping performed in the initial phase of this study served as the basis for the creation of a questionnaire that was later applied to a group of 20 elderly. The interviews had three specific objectives: i) to characterize the public; ii) identify the relationship of the elderly with technological resources and the consumption of television content; and iii) understand the perception of this public concerning the usage of notifications in the television ecosystem.

In total, there were 30 fixed questions, divided into three sections, created according to the above-mentioned objectives. Additional questions were made during the conversations, as participants said something related to their experiences using electronic devices.

Each interview lasted, on average, 40 min and were conducted from December 2021 to March 2022. In total, 20 elderly people ages between 60 and 95 years participated, 14 Portuguese and six Brazilians (the last six interviews were made by telephone, since the interviewees live in Brazil). Some examples of the questions that were asked with the participants:

- Do you think television is a companion?
- How many hours a day do you watch TV?
- What would you think if messages sent by your family members were displayed on the television screen?
- Do you believe that this kind of message would hinder or add value to your experience of consuming television content?

The average age of the participants was 76.9 years. Regarding gender, 70% (14) are women and 30% (6) men. Of the total number of interviewees, 45% (9) live alone and 55% (11) live with their partner or with their children. When asked about possible physical limitations, 10% (2) said they have hearing loss, although they still listen, and another 10% (2) pointed out that they have difficulty seeing very small letters on television or other electronic devices.

Regarding the use of technological devices to communicate, only 15% (3) stated that they do not have a cell phone and that they communicate with their relatives or caregivers essentially by landline phone. These participants are in the group of respondents over 85 years of age (two people are 87 and one 88 years old). The others stated that they use

their cell phones daily. The main activities carried out by senior citizens are described in Fig. 2.

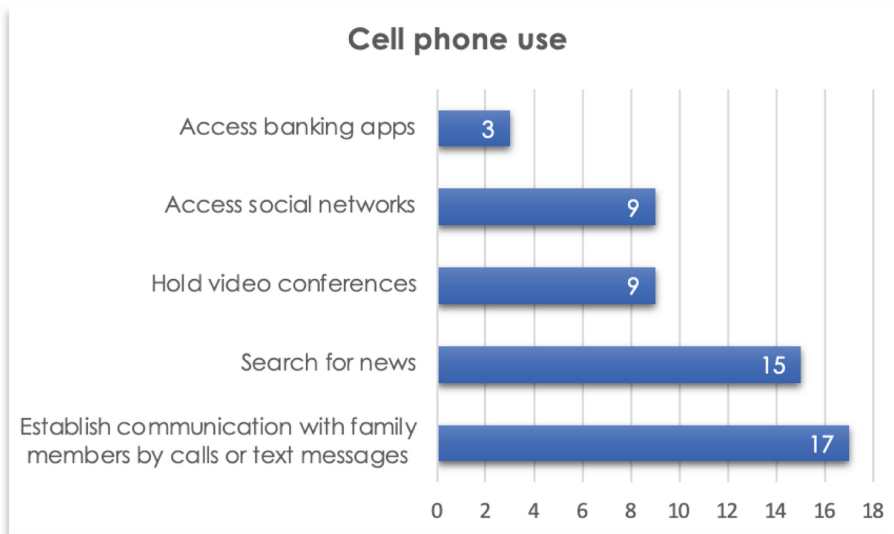


Fig. 2. Reasons why the elderly use the mobile phone (separated by volume of mentions).

Among the participants who have a mobile phone, only 10% (2) stated that the device is not a smartphone. That is, it is a device that only makes calls and sends text messages. “Although I don’t have this more advanced phone, I really like making video calls to my grandchildren who live in another country. My daughter comes here every weekend to make the calls. Seeing them is something else, it helps kill the longing and brings us closer. I would adopt knowing how to use this type of resource, but I have difficulties”, commented one of the participants, 87 years old.

When asked about the use of notifications on the mobile phone, only two of the 17 individuals who own the device stated that they did not know the meaning of the word “notification”. After a brief explanation, they understood its definition and stated that they receive this type of warning daily.

Among the other participants who said they had a mobile phone, all pointed out that they receive daily notifications, especially from banking apps, social media and messaging applications. None of the participants were bothered by this type of functionality. Overall, they said it’s “a positive thing and helps inform them about news and updates to the device.”

In addition to the mobile phone, 45% (9) of respondents said they have other electronic devices, such as tablets and notebooks, but use them less frequently compared to the phone. According to the interviewees, the main activities performed on these electronic devices are “watching series”, “play electronic games” and “accessing websites belonging to local governments”. “I prefer to watch movies and series on the tablet because the screen is bigger,” said a 77-year-old participant.

Only one participant (90 years old) stated that she has a virtual assistant (Alexa, Amazon) and uses it daily, especially to schedule reminders related to everyday tasks. Finally, two participants (both 64 years old) said they have smartwatches to control health-related aspects and can access messages received on their mobile phones more easily.

All participants were also asked if they have difficulties in the use of technological devices. Only 10% (2) stated that they do not have any type of problem or impediment – these participants are 60 and 77 years old. The other 90% (18) said they have difficulties to use them on a day-to-day life, and 88.8% (16) turn to close relatives to ask questions and 11.2% seek information in tutorials available on the Internet. “My generation has a hard time dealing with technology. I try to learn to the fullest, but there are aspects where I need explanations from the younger ones. Unfortunately, I think there is a barrier to teaching older people, because young people do not always have patience or didactics,” commented a 63-year-old participant.

4 Results and Discussion

4.1 Literature Review

The studies [17, 18] and [19] focused on reducing social isolation and have identified that notifications are important mechanisms to attract the attention of the elderly to messages sent by their families or friends. The feature was used to disclose reminders of family commitments [17], send alerts for calls on mobile phones [18] and encourage participation in gamification dynamics [19]. In this last study, the interactions took place by voice, and the intelligent assistant was considered by the elderly a sensitive, sociable and friendly company, able to contribute by itself to reduce the rates of loneliness. Also in this context, [1] focused on creating a prototype of Facebook adapted for television. Seniors positively evaluated the feature in terms of usability and the potential to increase online and offline interactions.

Regarding studies focused on health promotion, the notifications were used in [20–22] to remind seniors about medication schedules, medical care or information related to their well-being. In these cases, in addition to facilitating access to important data, the messages connected the elderly to external issues, which also contributes to the reduction of social isolation. This conclusion was also present in [23], the only article related to education. By analyzing the behavior of older people in the face of messages coming from e-learning applications, television is detected as an important device to promote access to learning. In [24], the authors chose the opposite way: notify the families via television and other devices if the elderly suffered a fall. The multitude of devices helped reduce the waiting time for help.

Of the total articles, three were about the design and messages format. In [25], the use of icons related to messages content facilitated understanding. In [26], it was detected that the use of a virtual assistant, which combines textual and audio messages, can facilitate interactions.

Finally, although not focused on the senior audience, the study [27] presented guidelines for the design of messages based on focus group, interviews, and tests. The analysis

results showed that users are receptive only to crucial messages, presented subtly, especially in the intervals of the schedules. Finally, in [28] and [29] television integrates Smart Home projects, which favor the access of the elderly to content and health-related care and assist in homework. Table 1 presents the sample of 15 articles mapped from databases, summing up the relevance that the notifications had within the studies found.

Table 1. Use of notifications to reduce the elderly's social isolation.

Ref	Goal	Strategy	Relevance
17	Connect people	Family reminders	High potential to stimulate interactions
18	Connect people	Phone calls alerts	High potential to connect generations
19	Connect people	Chatbot/gamification	High potential to connect people
1	Connect people	Facebook app adapted for television	High potential to promote online and offline interactions
20	Promoting health	Medical reminders	High potential to provide relevant information
21	Promoting health	Medical reminders	High potential to provide relevant information and improve health
22	Promoting health	Well-being reminders	Relevant to provide relevant information
24	Promoting health	Notifications to the family, reporting falls	TV was an important means of notifying families with agility
23	Promote learning	T-learning apps	High potential to promote learning
25	Evaluate the format/design	Study of relevant icons	Icons related to themes make it easy to understand messages
26	Evaluate the format/design	Testing a virtual assistant	Textual and verbal messages facilitated the understanding of the information
27	Evaluate the format/design	Study of the formats with better acceptance	Notifications are well accepted if they do not abruptly interrupt the contents
28	Smart Home system	Evaluation of TV in this context	Relevant to disclose the important reminders and assist in household chores

(continued)

Table 1. (continued)

Ref	Goal	Strategy	Relevance
29	Smart Home system	Evaluation of TV in this context	Relevant to disclose the important reminders and assist in household chores

4.2 Interviews with the Elderly

Consumption Habits of Television Content

Regarding the consumption of television content, all participants stated that they watch television every day. The daily TV watching average time is 6 h, reaching peaks of 17 h a day in some cases. “Turning on the tv is a habit. No matter what type of content, it’s always on at home, whether it’s to watch interesting programs or simply to make noise, disguising loneliness,” said a 64-year-old participant.

About consumption habits and preferences, Fig. 3 shows the types of content that are most frequently consumed by respondents.

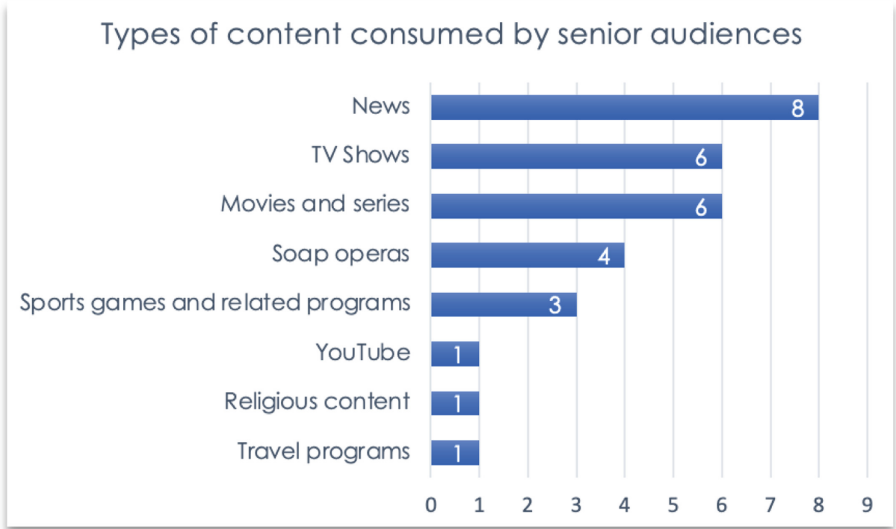


Fig. 3. Diversity of content consumed by the elderly.

Among all respondents, only 10% (2) stated that they have a Smart TV at home. However, one of the individuals said that he doesn’t know how to use the resources. “I tend to use only the most traditional channels,” said the 68-year-old. The other participant who claimed to own the device highlighted that he uses it daily to watch content available

on YouTube. “I really like music videos and old songs. So, I decided to buy the device to watch what I’m interested in,” commented the 69-year-old.

When asked if they consider television a kind of companion, especially in moments of solitude, only 20% (4) said they do not see the device in this way. The average age of these respondents is lower than the whole group average: 68.5. The other interviewees stated that they believe that television is a true companion and all seniors over 85 years of age stressed that “it would be very difficult to live without TV”.

The relationship with the device is even more affective when it comes to the elderly who live alone, away from their families. “Time wouldn’t pass if I didn’t have television to watch. I don’t know what I would do in my days,” said a 90-year-old participant. “I’m alone all day. TV is a great companion for me. I wouldn’t live without it,” said an 87-year-old participant. “I watch all the shows and so my day goes faster,” said a 95-year-old participant.

Notifications Built into iTV

The third part of the questionnaire sought to understand the group’s perception of a possible display of notifications on the television screen. To contextualize the participants, especially those who are not so familiar with technology, a short-animated video was



Fig. 4. Example of message exchange with TV as an intermediary.

displayed (Fig. 4) giving an example of the use of notifications in a television context. In the animation created, a granddaughter sends a message (by mobile phone) to her grandmother, who is in front of the television. When notified, the older woman has the possibility to interact by pressing the “ok” button or reacting by voice. A heart emoji is automatically sent to the granddaughter, connecting the two generations in a more streamlined way.

Among the respondents, 25% (5) were resistant to the use of television notifications – these participants are 60, 66, 68, 77 and 87 years old. The 87-year-old approved the idea but was concerned about the data privacy displayed on TV. “Can more people see it? I’m afraid to expose my data”, she said.

In general, participants aged 60, 66 and 68 who were resistant to the TV notifications, stated that it is because they already use the cell phone to send and receive messages and access social media apps. Therefore, they do not believe that the display of notifications on television would be a benefit. “On the contrary, it would hinder my experience. When I have the TV on, I want to disconnect from everything, enjoy that moment without interference”, said the participant of 60 years. “I believe it’s a good idea for older people with greater difficulty using electronic devices. But for me, it wouldn’t make that much difference. Besides, I think the messages are very personal. I wouldn’t want to share them with my daughter” said the 68-year-old.

Another participant (66 years old) who was opposed to the feature said that the feature could invade her privacy, since she would not like to see her messages displayed on television while you were with more people in the room. “You should have a possibility to configure the type of message you want to receive. Example: I didn’t want my WhatsApp notifications to appear there,” said.

For the individuals who approve messages on television (75% or 15 people in total), there was a consensus that this type of functionality is welcome because it is a well-known device to the elderly. That is, older people would easily send and receive messages. “I’m already used to television, and it would be very interesting to be able to receive messages, see photographs or inform myself through TV. Also, as I suffer from sight loss, it would be easier to read the messages on a larger screen,” said a 95-year-old participant. In addition to this user, the screen size was mentioned by another participant, 90 years old. “On the phone everything is too small to read, I can hardly see the messages. On TV it would be a lot easier,” she said. “I find it very interesting to receive messages on TV especially for elderly people who do not have access to technology and have difficulties. This kind of resource would add a lot to the lives of older people. They would feel welcomed,” said a 63-year-old participant.

When asked about the type of content they would like to receive, among the 15 individuals who were receptive to notifications, all stated that they would like to have access to messages related to their family and friends. “What I would be most interested in receiving on television are pictures of my son to know what he has done and if he is well,” said a 90-year-old participant. “I have a daughter who lives in another country and a son who works from Sunday to Sunday. I think it would be an easy way to be in touch with them,” said an 87-year-old participant.

Still in the context of bringing people together, two participants (one of 69 and another of 81 years) said that it would be interesting to have the possibility of making

video calls via television. “So, I could talk to my children and grandchildren more easily, besides being a bigger screen than the phone. I’d love to,” said the 81-year-old.

Another feature well received by respondents was sending notifications to alert when the cell phone is ringing. Of the total number of people who approved the notifications, 80% (12) said they would like to be warned on television whenever a family member is calling on their mobile phone. “Often, I don’t have my phone in my hands or don’t listen it. It would be an asset,” said an 81-year-old participant.

In addition, this same group of interviewees stated that it would be interesting to have an explanatory tutorial on the use of notifications on TV. “If it were in video format, I’d be easier to learn,” commented an 88-year-old participant.

All participants were asked if they preferred to receive and respond to notifications using voice commands instead of typing responses. Among participants over 80 years of age (40% or 8 in total), the possibility was seen as an added facility. “I have difficulty typing, it takes me a long time to complete a sentence. I believe that talking, just by pressing a remote-control button, would be a good idea,” said an 87-year-old participant. “I cannot type on the phone; the buttons are too small. The control ones are bigger, but I still think I’d have difficulties. So, I think talking instead of writing could be a good alternative,” said a 90-year-old participant. Among participants under 80 years of age (60% or 12 in total), the possibility did not arouse much interest. “I’d rather type to talk. I’m not used to send voice messages through my cell phone and I think I wouldn’t do the same on TV,” commented a 69-year-old respondent.

In general, therefore, it can be verified that older interviewees were more receptive to the use of notifications in the television ecosystem. The highest rejection rate in the comparison between groups can be seen among participants aged 60 to 75 years (34%). It was possible to notice that, as age increases, the rate of rejection of notifications drops and, consequently, the acceptance rate grows (Fig. 5).

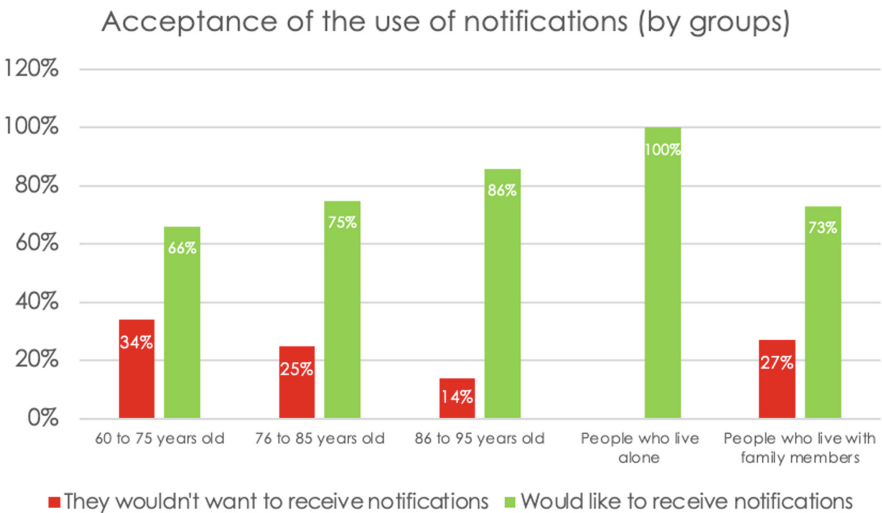


Fig. 5. Acceptance percentages by groups of interviewees.

The main reasons for the greater acceptance among older individuals were familiarity with the device, the size of messages that will be displayed on the screen (larger than on the mobile phone, which facilitates understanding) and the possibility of having easier access to content produced by their family members.

For respondents living alone, acceptance was the highest in the comparison between groups: 100%. For individuals living with other people (family members or partners), there was 27% rejection and 73% acceptance. These indicators show that respondents living alone are more receptive to the use of notifications in the television ecosystem. As we have seen before, these were also the ones that were most dependent on the device. Table 2 presents a compilation of some phrases separated by themes to facilitate understanding of user perception.

Table 2. Most significant phrases mentioned by users.

Main themes	Phrases mentioned by users
Acceptance	<ol style="list-style-type: none"> 1. "It is an interesting resource, especially for older people. They would feel welcomed" (63-year-old participant) 2. "I don't think it's interesting because I see my notifications on my cell phone and when I go to watch TV I want to rest" (60-year-old participant) 3. "I really like the idea because television is something I've been using for many years. I think it would be easier" (90-year-old participant)
Proximity to family members	<ol style="list-style-type: none"> 1. "It would be a way to be closer to my family, especially my grandchildren who live in another country" (87-year-old participant) 2. "I would love to be able to receive video calls also on television. I think it would be an interesting resource" (81-year-old participant)
Privacy	<ol style="list-style-type: none"> 1. "I wouldn't want my messages to appear on the TV screen. I may be watching shows with other people and that would be a problem for me" (66-year-old participant) 2. "I don't think it would be interesting to see messages on TV. It's a kind of invasion of our privacy" (68-year-old participant) 3. "I would be afraid about privacy issues. Will more people have access to messages? It would have to be something well explained so that we can accept it or not" (87-year-old participant)

(continued)

Table 2. (continued)

Main themes	Phrases mentioned by users
Voice features	1. "I think it would be easier to say than to type. The buttons are small and could take longer to respond" (90-year-old participant)
Accessibility	1. "It would be a feature that would allow me to see the messages, since I have sight loss and cannot see text on the mobile" (95-year-old participant) 2. "I would like to see photos and messages on television because the TV screen is bigger than that of the mobile phone" (90-year-old participant)

In short, there is a variation in the perception of the elderly in relation to the use of notifications, greatly impacted by age and experiences.

5 Conclusions and Future Work

The analyzed studies pointed out the relevance of notifications in promoting interaction with other people, universes and themes, stimulating the search for information, the use of technological resources and health-related care. In addition, the prototypes presented contributed significantly to facilitating interactions with family and friends among the studies focusing on social isolation.

Articles focused essentially on health also contributed in a certain way to social integration since they present information that goes beyond that the elderly are accustomed to receiving, favoring the feeling of belonging to communities. Regarding the design of the messages, [19] and [26] showed that diversifying formats can contribute to the good acceptance of this audience. Voice interactions, for example, facilitated access to information sent by notifications and were still seen by the elderly as a companion, especially in studies involving the use of personal assistants. Notifications were also considered relevant when inserted in Smart Home systems, reminding the elderly about tasks to be done.

Therefore, this analysis has demonstrated the existence of relevant studies in this context. This survey also identified suitable methodological designs to discuss the theme, with analyses that suggested good practices and preferences of the elderly. Some of the studies presented here specifically addressed the contribution of TV in reducing social isolation, showing that the device can stimulate the contact of the elderly with other people, especially from different generations in the family. For this reason, it is understood the topic requires further studies, primarily involving tests done with real users in real contexts of usage. This mapping, therefore, was the first stage of this study, being crucial to identify aspects that were included in a questionnaire that a group of elderly has answered.

These interviews were conducted with elderly people between 60 and 95 years old to identify the following aspects considered relevant to the study: familiarity with technological resources, television consumption habits and perceptions regarding the usage of notifications in this ecosystem.

In general, a more positive reception was identified by the elderly who are over 80 years old or those who live with people of this age group. Notifications were mentioned as a mechanism capable of stimulating the exchange of messages between people of different generations. That is, since TV is already a known device of this audience, using it as an intermediary is an efficient way to promote interactions, especially among people who have difficulty using technological resources. Moreover, in general, television was pointed out by most users interviewed as a companion. Those over the age of 80, for example, said they “wouldn’t know what their lives would be like without TV.” Therefore, integrating new features into the device, such as notifications, proved to be a consistent way to reduce loneliness rates, especially among those who are older and live alone.

In addition to the results of the literature review, the data from the interviews conducted with the group of elderly also contributed to the identification of relevant factors that will support the creation of scenarios to be tested, throughout the work, with the elderly. These scenarios aim to evaluate the User Experience (UX) related to the use of notifications in the television ecosystem and show their potential to personalize information and promote interactions between individuals.

The results of these tests will be presented in future works and support the development of a prototype to be evaluated by the senior public and their relatives or caregivers. The prototype mentioned here aims to test the use of notifications, with real users, within the television ecosystem.

In a way, this study identifies that the television ecosystem has great potential to connect generations and promote exchanges between individuals of different ages, which is a gain for the elderly, since historically they have more difficulties related to the use of electronic devices. That is, TV, besides being considered a companion can contribute effectively to reduce the rates of loneliness.

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