Accessible and Inclusive Mobile Application for Social Support and m-Health in Forced Isolation: SAFE TALK

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Abstract. The condition of forced isolation due to the Covid-19 Pandemic clearly highlighted the importance of social support. Indeed, the absence of interaction with families and friends in the presence can lead to feelings of loneliness, abandonment, psychological discomfort, anxiety, and depression, especially for the elderly. On this premise, adopting a user-centered approach, an app for social and professional support SAFE TALK was created and evaluated involving end users. The participatory activities involving elderly informed the design of the app prototypes, while at a second stage two samples of target users (i.e., elderly and psychologists) were involved in the evaluations of the SAFE TALK app. The performance, usability, accessibility, and user experience of the app were tested. Findings showed that despite a slightly lower performance of the elderly, both groups of individuals positively evaluated the usability, accessibility, and user experience of the app. SAFE TALK was appreciated by the elderly as a potential supportive tool in case of forced isolation to reach their social sphere and eventually a professional. Psychologists reported the relevance of the app as a tool to remotely support people in conditions of need.

Keywords: m-health, accessibility, elderly.

1 Introduction

1.1 Impact of forced isolation

The Pandemic has brought to evidence the need for social support in case of forced isolation related to lockdowns. The maintenance of relationships that matter with family members and friends helps to face these adverse situations. The same type of speech

applies to long-term care. Besides, loneliness can exacerbate mild anxiety and depression symptoms, and forced isolation can prevent the possibility of asking for help from professional figures.

1.2 Mobile applications for psychological and social support

Several mobile applications have been designed and developed to remotely support people's psychological health even before the Covid-19 Pandemic [1,2]. These tools are also called telehealth technologies [3]. In some cases, these apps comprised thematic group interventions with psychotherapists during the Covid-19 Pandemic [4], which showed how this kind of assistance effectively ameliorated the overall psychological state of participants. A recent paper [5] focused on the future of mental health services mentioning digital mental health and hybrid systems referring to remote mental health when there was a lack of this type of service in specific areas (e.g., rural). Besides, the authors reported the quick acceleration in adopting these digital services related to the recent Pandemic. Information and communication technologies are promising for reducing isolation among the elderly. Czaja and colleagues [6] suggested that access to digital technologies can improve social connectivity, reduce loneliness among old individuals, and change their attitudes toward technology.

Jarvis and collaborators [7] highlighted the prevalence of a sense of loneliness among the elderly in residential care facilities. Isolation is often accompanied by maladaptive cognition that can affect the establishing and maintaining meaningful social connections [7]. A review conducted by Abbaspur-Behbahani and colleagues [8] explored the use of mobile health (i.e., m-health) solutions in the elderly population during the Pandemic. These digital instruments provided real-time communication channels and video calls to support a more comprehensive interaction as the exchange includes verbal and non-verbal communication [9] differently from text messaging. Perdana and collaborators [10] underlined that these digital tools are already widespread among the elderly. However, it could be further encouraged by family members and peer groups [10]. Regarding m-health solutions, their acceptance, i.e., the degree to which an individual intends to adopt these tools continuously, plays a crucial role. Indeed, a lower acceptance will result in a reduced intention of technologies/digital services' usage, overall experience and satisfaction, and an unlikely actual use [11]. In the following sections, there will be a description of the user-centered approach adopted to develop a mobile application, i.e., SAFE TALK, created mainly for the elderly and people weakened by long periods of hospitalization to support the maintenance of active interpersonal relationships with their own social sphere (i.e., family, friends). Besides, the app will also allow contacting caregivers and or psychologists.

2 SAFE TALK

The application SAFE TALK was designed and developed, involving final users by adopting a user-centered design approach in the context of the SAFE PLACE project [12, 13]. This project designs and develops smart living and environments based on the

paradigm of the Internet of Things characterized by salubrity and safety to fight pandemics. SAFE TALK aims at reflecting the highest standard of usability (e.g., ease of use), accessibility, and user experience.

2.1 Participatory design

Sessions of participatory design were organized to involve end users (i.e., the elderly) to gather their needs, expectations, and desires. The objective was to incorporate such elements in the design of the application. Two Focus Groups (FG) were conducted using Zoom, due to the pandemic situation and since the involved users were all elderly. The participants were recruited by the ninth author of the manuscript.

Method.

Participants. Thirteen elderly were recruited on a voluntary basis ($Range_{age}$ = 68-89; M_{age} = 78.15; F = 6). All participants did not report physical or cognitive disabilities. Only one participant reported having an experience with long-term care.

Procedure. On the days of the FGs, participants were welcome in one quiet room set up to allow the remote connection with the Human Inspired Technology (HIT; University of Padova) research group considering using a good quality web camera and microphone. Both zoom sessions were recorded to permit the subsequent transcription of the group discussions to integrate the notes taken by the observer during the FGs. In Figures 1 and 2, the setting of both FGs is depicted. It is possible to observe that all participants followed the anti-Covid 19 safety regulations, and they were wearing masks. The second author led the FGs, while the fourth author was the observer. During the Focus Groups, different questions were asked concerning the usage of communication tools (e.g., phone, tablet, etc.) and which kind of applications (es., WhatsApp, Skype, Zoom) were used to stay connected with their social sphere (i.e., family, friends) during the Pandemic lockdowns. Besides, the moderator asked questions about the psychological experience of forced isolation and if they felt the need to contact a professional (e.g., a psychologist). In the second phase of the FG, the moderator asked the elderly to imagine a mobile app that could support the maintenance of social relationships when it is not possible to communicate and interact in the presence with their social sphere or a professional figure and report which kind of features and functionalities this application needed.

At the end of the FGs, the moderator summarized the activities and the outcomes and asked the participants for any additional comments that they may have.

Fig. 1. First Focus Group (Zoom).

Fig. 2. Second Focus Group (Zoom).

Analysis and Results Considering the usage of communication tools, all the elderly use a mobile phone (100%) to call and/or send messages (86.61%), and around half of the sample utilized the phone to make video calls, surf the web and watch videos (46.15%). Regarding how the participants felt during the forced isolation, five participants (38.46%) reported a feeling of sadness linked to the lack of physical contact with relatives and friends (i.e., "*…I missed the hugs*…"), and two participants reported the anxiety connected to the risk of new Pandemic waves that could come.

To what pertains the characteristics and functions that an app to support the maintenance of important relationships in forced isolation, the following information emerged (in parenthesis the percentage of participants): a) the app needs to be easy to use (100%); b) the presence of simple and clear information (100%); c) the app permits to contact family (100%) and emergency numbers (100%) rapidly; and d) having the opportunity to contact a psychologist for support (33,33%).
The outcomes of these research activities informed the design and development of various mock-ups (Fig. 3).

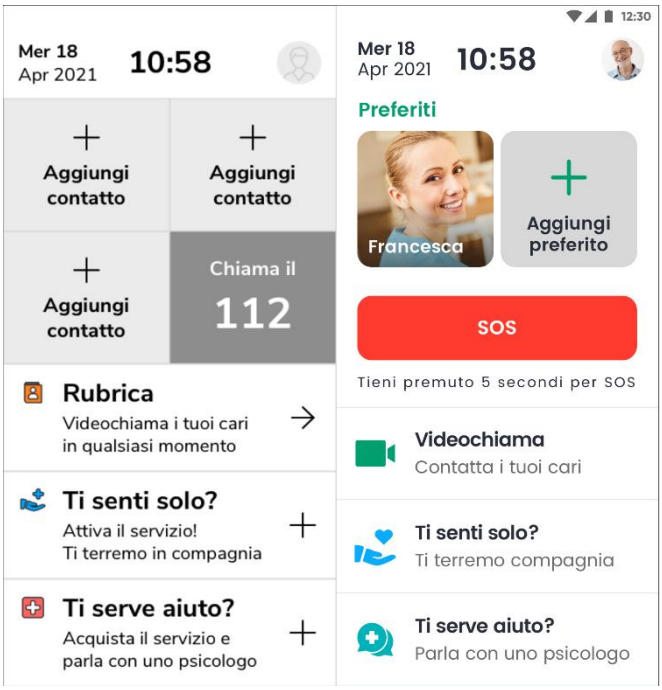

Fig. 3. First (left) and Second Mock-ups (right).

As can be seen in Figure 3, for instance, based elderly's needs and expectations collected in the FGs, in the second mock up designer and developers added on the home screen the possibility to quickly contact selected numbers (e.g., family members, friends) in a "favorites section" (i.e., *Preferiti*) and a red button was inserted (must be pressed for a specific time to avoid errors) to call for an emergency in the second mock-up (Fig. 3 right). In addition, the need to quickly contact families and friends (i.e., video calls) and the desire to contact a psychologist and the possibility of video calls to caregivers were maintained across mockups.

Based on the FGs and the first design and developing phases (i.e., mockups) the SAFE TALK app was created. As it was stated in Introduction of the manuscript, this application is intended mainly for elderly individuals, people in long-term care or home

residences, and those with mild cognitive impairment to maintain interpersonal relationships with their family, friends, and colleagues, and to contact caregivers and psychologists. The final prototype of SAFE TALK that was released meets the latest standards of accessibility and usability. It will provide novel support for video communication and spending quality time with loved ones. It presents an intuitive and straightforward interface and different services. Indeed, end users can video call their contacts, select caregivers to speak with someone freely, and psychologists in case they need professional support. The app provided only video calls to reduce the complexity of usage related, for example, to writing text messages or recording audio messages.

In addition, one simple versions of the app (i.e., *professionals*) have been realized respectively for caregivers and psychologists that will have the opportunity to provide their availability with times and days. Finally, the application could be used by single individuals and/or in wider programs to avoid isolation considering nursing homes, long-term hospital services, and residential facilities for people with mild mental disabilities.

2.2 Preliminary evaluation involving end users and stakeholders

An experiment was conducted with the purpose of evaluating the usability, accessibility, and user experience of the first release of SAFE TALK involving elderly and psychologists.

Method.

Participants. Ten participants were recruited on a voluntary basis. Five elderly ($Range_{age}$ = 70-76; M_{age} = 74; F = 3) and five psychologists ($Range_{age}$ = 25-53; M_{age} = 36.8; F = 3) of the SCUP - University Centre for Psychological University Clinical Services of the University of Padova. All participants did not report physical or cognitive disabilities.

Equipment and materials. The following equipment was used in the experiment:

- a smartphone with installed the app SAFE TALK for the elderly (i.e., Samsung Galaxy A13; 6,6'' screen; display resolution: 2408×1080 pixels);
- a smartphone with installed the app SAFE TALK for the psychologists (i.e., Samsung S8; 5.8'' screen; display resolution: 1440×2960 pixels);
- a GoPro Hero 5 to allow the video recordings of the experimental sessions for the subsequent video analysis;
- a laptop was utilized to present the questionnaire and instructions for the experimental tasks (i.e., Huawei MateBook X Pro; 13.9'' screen; display resolution: 3000 x 2000 pixels).

Considering the materials:

- Demographic questionnaire. This tool was used to collect general information about the participants (i.e., age, gender, education).

- Usability and accessibility checklist. To assess SAFE TALK usability, some of the Nielsen's heuristics were considered (Nielsen & Molich, 1990; Nielsen, 1994; Nielsen & Norman, 2014). Furthermore, the accessibility was evaluated with *ad hoc* items. In total, the checklist included 19 items and the following usability dimensions:

  - Aesthetic and minimalist design (e.g., sufficient colors contrast, absence of irrelevant information, etc.);
  - Match between system and the real world (e.g., presence of clear and accurate information, familiar language, etc.);
  - Recognition over recall (e.g., presence of icons and labels immediately recognizable, etc.);
  - Navigation (e.g., ability to easily navigate between the various screens, etc.).

  The possible responses were "Yes", "No", and "N/A" (i.e., not applicable). Besides, in the case of "Yes"/"No" responses, participants were asked to provide comments. The checklist was administered only after the interaction with the version of SAFE TALK for elderly.

- Ad Hoc User Experience (UX) questionnaire. The tool was exploited to assess the user experience related to both versions of SAFE TALK. the dimensions of pleasantness, engagement, satisfaction, and support were considered. For the support dimension, the items were slightly different, referring respectively to support the maintenance of the relationships with families and friends (i.e., app version for elderly) or to support their work (i.e., app version for psychologists). A 5-point scale was used for the responses (from 1 = not at all to 5 = completely).

Experimental tasks. To assess the participants' interaction with the SAFE TALK app for elderly the following experimental tasks were administered:

1. Favorites. Adding Patrik Pluchino to the favorites section by selecting him among your numbers;
2. Invite to SAFE TALK. Inviting Carlo Di Sarli to use SAFE TALK by selecting him among your numbers;
3. Video call. Video calling Patrik Pluchino by selecting him among your numbers. Turn off the video camera. Then, ending the video call;
4. "Ti senti solo?" service. Using the service and video calling Filippo Zordan by selecting him among the list of available operators. Then, ending the video call;
5. Personal Information. Accessing the personal information screen. Inserting the personal data and taking a picture. Saving the changes;
6. Receiving a video call. Answering a video call. Then, terminating the call;
7. "Ti serve aiuto?" service. Activating the service allowing the localization. Setting Padova as the city of residence and choosing the 10-day subscription;
8. SOS. Utilizing the SOS button to access the screen in which is possible to contact the emergency number.

Besides, to evaluate the participants' interaction with the SAFE TALK app for psychologists the following tasks were considered:

1. Personal Information. Accessing the personal information screen and verifying that the name and last name are Filippo Zordan;
2. Biography. Accessing the biography section and modifying the text by inserting "This is a test";
3. Availability. Accessing the profile screen to insert some time availability (e.g., Monday morning, 9:00-12:00 a.m.; Friday afternoon, 2:30-4:30 a.m.) and save the changes.

At the end of all tasks, participants were asked to return to the Home screen.

In Figure 4, there are some SAFE TALK screens.

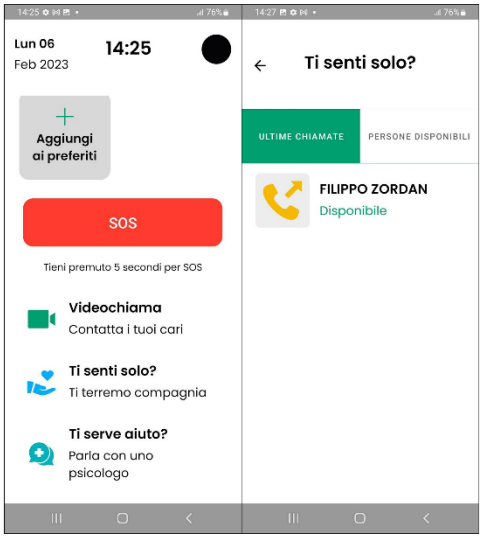

Fig. 4. SAFE TALK Home Screen and screen for the "Ti senti solo?" service.

Procedure. The experimental sessions were conducted in the presence. The sample of psychologists was tested at the Department of General Psychology, while the elderly in one of the venues of Cooperativa "L'Incontro".

At the beginning of the experiment, the participants were administered an informative note (which contained general details about the research, the procedure, etc.), informed consent, and the demographic questionnaire. Then, considering both versions of the SAFE TALK apps (i.e., elderly and psychologists), the tasks were presented in a randomized order except for the SOS task, while using the elderly version, which led participants to exit the application. Besides, considering only the psychologists, which interacted with both versions, the presentation of SAFE TALK apps was randomized.

The researcher read the instruction for each task to the participants. However, the instructions were always available for participants as they were presented on the screen of the experimental laptop.

Considering the version for the elderly, after the experimental tasks, the usability and accessibility checklist and the UX questionnaire were administered. Regarding the version for psychologists, after the experimental tasks, only the UX questionnaire was completed.

The experimental sessions lasted 35-40 minutes for the elderly and 45-50 for the psychologists.

Measures. The following quantitative measures were analyzed:

- time needed to complete each task (i.e., average time on task);
- number of interactions to complete a task (i.e., average number of taps);
- responses to the usability and accessibility checklist (i.e., mean percentage);
- responses to the UX questionnaire (i.e., mean scores).

Analyses and Results. Overall, the statistical analyses were performed using RStudio [14]. The independent variable was the group (i.e., elderly vs. psychologists). In case of multiple comparisons, the *p*-values were adjusted using BH correction [15].
Performance (time on task in sec). Considering the time necessary to complete a task, a series of Mann-Whitney tests were conducted. The elderly appeared to be slower than the psychologists in carrying out the tasks, but due to the variability in the data, no differences emerged between the groups (all $p_s > .05$).

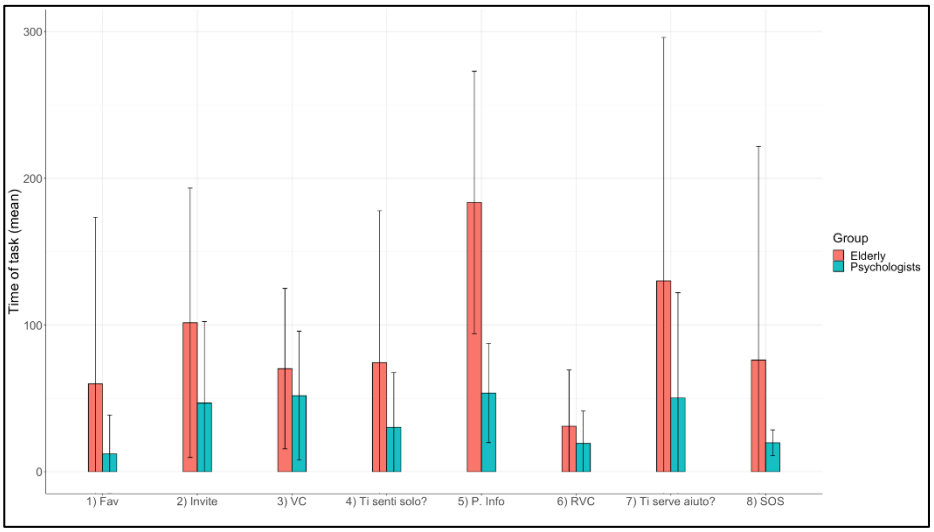

Fig. 5. Average time (sec) needed to complete the tasks (the SD_s are plotted).

Performance (number of taps). Regarding the number of taps needed to accomplish a task, a series of Mann-Whitney tests were run. Similarly, to the time on task variable, the mean number of taps was not different between the two samples (all $p_s > .05$), although some tasks showed higher differences (e.g., task Personal Information).

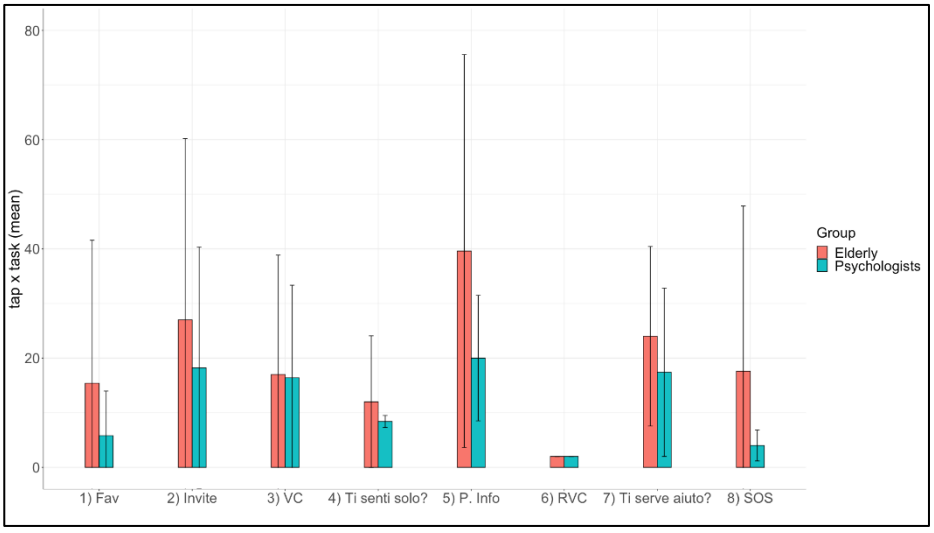

Fig. 6. Mean tap to accomplish the tasks (the SD_s are plotted).

Usability and accessibility. To evaluate the difference in the percentage of the usability and accessibility scores, a series of beta regressions were conducted. Overall, differences between groups were not shown (all $p_s > .05$).

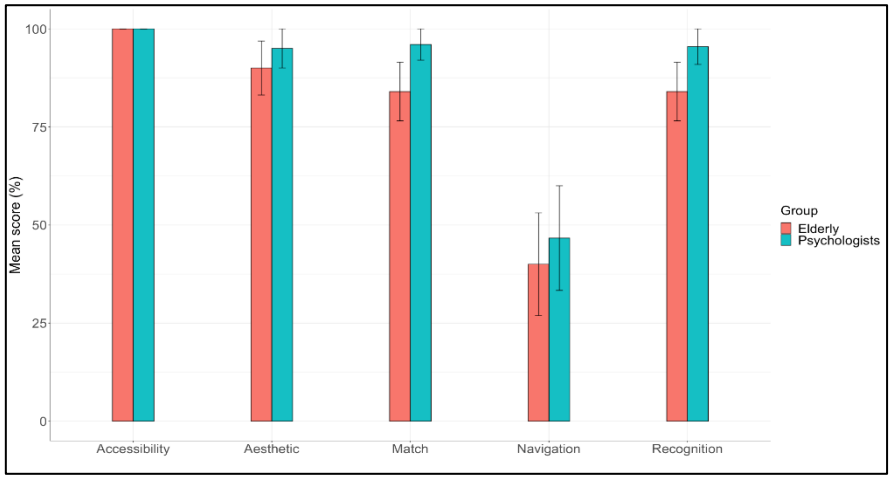

Fig. 7. Mean scores (in percentage) to the usability and accessibility checklist (se_s are plotted).

User experience (elderly app). To evaluate the difference in the scores, a series of Mann-Whitney tests was carried out. No differences were highlighted between groups (all $p_s > .05$) considering all the UX dimensions.

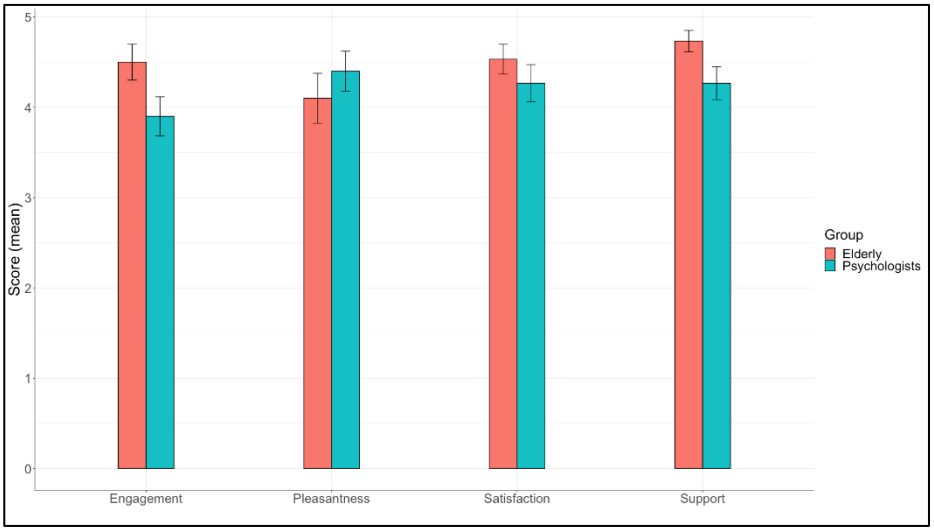

Fig. 8. Mean scores to the user experience questionnaire (app for elderly).

User experience (psychologists app). The scores assigned to the user experience related to the SAFE TALK app for psychologists reported a low level of engagement (i.e., ~2), and intermediate levels of pleasantness and satisfaction (i.e., ~ 3). Differently, the support dimension was evaluated positively (~ 3.5).

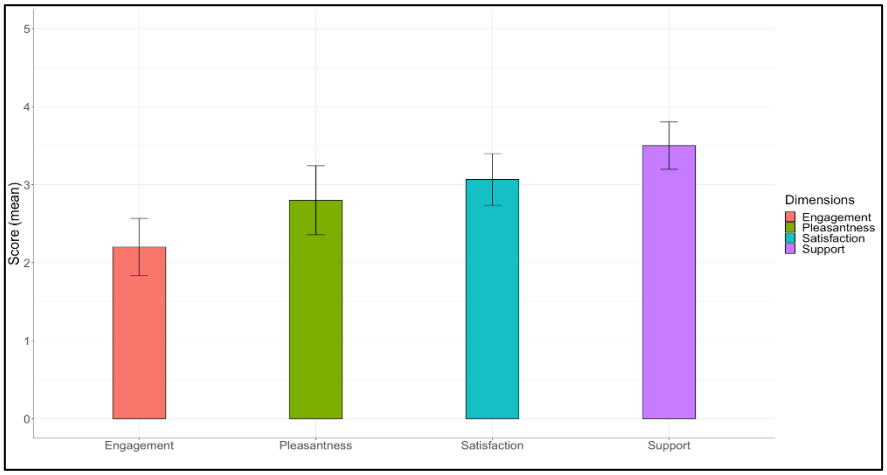

Fig. 9. Mean scores to the user experience questionnaire (app for psychologists).

General Discussion. The paper described the process of design, development, and evaluation of an app SAFE TALK, created to support people in forced isolation in maintaining the relationship with their social sphere. Different target users (i.e., elderly and psychologists) were involved. The first participatory design phases with the elderly informed the designer on how to modify the initial mock-up and, consequently, the SAFE TALK app. The second phase pertained to the evaluation of two versions of the app (i.e., elderly and psychologists).

Considering the time needed to accomplish a task and the number of interactions (taps), it appeared that the elderly group was slower and required a higher number of taps to complete the tasks. It is a matter of fact that the ageing process is linked to a lower speed and ability to use technologies that may be due to cognitive and perceptual demands that are difficult to manage for the elderly [16].

Regarding the accessibility and usability of the app for the elderly, both groups reported the highest level of accessibility (100%) and high levels of usability (all dimensions showed mean values > 75%). The exception of the low scores assigned to the navigation dimension (means < 50%) can be explained by the reduced number of screens of the app and the specific tasks that had to be carried out, which required a limited navigation. High levels of accessibility and usability are to technology adoption especially considering the elderly [17].

Elderly and psychologists assigned positive scores to the user experience linked to the app (all values > than the scale median, i.e., 3). They found the app engaging, pleasant, supportive (i.e., for the elderly to stay connected to their social sphere), and satisfactory to use. These findings are also related to the design elements that were included in the SAFE TALK [18].

Regarding the app for psychologists, the low number of screens and the absence of many aesthetic features (i.e., colors, pictures, menu, etc.) negatively affected the levels of engagement, pleasantness, and satisfaction. Nevertheless, the supportive dimension (i.e., to remotely support people in conditions of need) was positively evaluated by the professionals.

The limited number of participants involved in the evaluation phase has certainly affected the performed analyses. The authors planned have already planned to recruit more individuals of both target groups (i.e., elderly and psychologists) for more consistent results.

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