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Inclusion Design and Functionalities of a Personalized Virtual Coach for Wellbeing to Facilitate a Universal Access for Older Adults

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Abstract. The current research proposes a technological system "NESTORE"
designed for and with older adults in four different countries in order to improve and
sustain their wellbeing. The system personalized activities and architecture, co-
designed interfaces, and its multilingual aspect aim to establish an 'inclusion'
criterion based on the user's sociocultural profile and health condition.

Keywords: Virtual Coach, Conversational Agent, Inclusive Design, Wellbeing, Older
adults

1   Introduction

1.1   Problem Statement

In Europe, the population of older adults is increasing. ICT can help older adults to
improve their lifestyle and therefore their health.
NESTORE is a virtual coach, co-designed with older adults in four different countries
(Italy, Spain, The Netherlands and UK). The coach aims to help older adults in five
domains of wellbeing: physical, nutritional, social, cognitive and emotional. The
whole intervention is based on a behavioral change model called HAPA [2]. It is also
supported by a decision support system [1] to make the system personalized
according to user's preference, needs and short- and long-term habits. The virtual
coach comes in different types of interfaces: a mobile application, a chatbot and the
tangible coach[5], a physically embodied vocal assistant co-designed and built in the
frame of the NESTORE project. The NESTORE coach is also connected to different

sensors, environmental sensors, beacons and bracelets to get different type of information about the user during his or her day lifestyle.

Older adults are a heterogeneous group with different preferences, needs and lifestyles. This prompted us to adopt an inclusive design based on the users' sociocultural profile and health conditions. However, recognizing the resource and timeframe of the project, it was determined that NESTORE might have to be developed in a staged approach providing varying formats and functionalities to be able to target diverse social groups. In addition, NESTORE would not target users with severe chronic health conditions, where users should seek expert medical help, although it could provide additional healthy lifestyle support. Thus, NESTORE e-coach is designed to be universal through its personalized wellbeing activities, co-design process and its multilingual capacity.
The goal of this paper is to present a virtual coach that is suitable for all older adults with different needs, preferences, user profile and capacities.

1.2 Co-Design Process for an Inclusive Design

Co-design is an approach to design, which actively involves all stakeholders in the design process to help ensure the result meets their needs and is usable. According to [4], stakeholders cannot only serve as a need-forecasting group but also show us actively new and upcoming possibilities. The traces they leave help us to detect general patterns and could determine which artefacts should be – or should not be – designed as universal design products. In particular, co-design process has seen used in several previous work to older adults [6,7,8]. Several works have also shown that co-designing products or services for older adults are successful [9]. Moreover, older adults' inputs are very important to create ideas during the co-design process and older adults shows enthusiasm during co-design [10]. Hence, co-designing can help at the end to create an inclusion design to facilitate a universal access to users.
NESTORE therefore adopts co-design tools and methods that will seek to engage and elicit information related to perception, acceptance and usability of technology to support healthcare. It is co-designed in four different countries whereas each country has its own language and culture, with users with different opinions, gender and ethnicity. Thus, this will lead to have an inclusive design that works with different communities of different culture and language. First of all, we created a multi-lingual survey and sent it to four different countries to understand coaching activities preferences, pathways interest and the number of hours of interaction interest with a virtual coach. Second, we conducted five workshops in the four countries mentioned above, where we codesigned with users the virtual coach interfaces. Finally, we created an interface to translate all the messages that are fed to the conversational agents according to each countries culture of language and famous expressions. The tangible coach and the chatbot are based on Natural Language Understanding technology, powered by the RASA framework, and were manually trained with expressions from each country to detect the different intents, i.e., questions that the coach is able to answer. Section 2 presents the methodology steps used to create a universal coach; Section 3 presents the results of some of the experiments mentioned in the methodology section.

2 Methodology

This section describes three main activities that were carried out to take into account the sociocultural differences of the NESTORE users: 1) to provide coaching activities that are valid and appreciated by the target users, we conducted a survey about their usual activities and the activities that they would do in NESTORE; 2) to provide usable coach interfaces, we conducted several co-design workshops; 3) to tailor the coaching content, we developed a translation interface where project partners could manually adapt the system to the local language and their typical expressions.

2.1 E-coaching Activities Survey

The complete coaching plan, activities, path and recommendations are backed by a decision support system personalized to each user according to her/his needs, preferences, and conditions [3]. In fact, the virtual coach follows each user's journey by collecting data from sensors, beacons and environmental sensors and through also its main conversational agents' interfaces: the "chatbot", which is a text messaging application, and a "tangible coach", which is a vocal assistant in a physical device [4]. To understand user preferences in the different activities of wellbeing, we conducted a survey in four different countries (11 participants from Spain, 7 from UK, 6 from the Netherlands and 2 from Italy). The survey aimed at prioritizing the development of the preferred coaching activities and goals based on user's feedback. Figure 1 shows a part of the survey sent to the user. A shortened version of the survey is also included in the system in order to tailor the recommended activities according to the user preferences.

Figure 1: E-coaching Activities Survey

2.2   User Interface Co-Design Workshops

We held five workshops in four countries (Italy, Spain, UK, Netherlands) where we co-designed with users the virtual coach interfaces. The aim of the first workshop was to build understanding of design features of current digital interfaces that participants find helpful/unhelpful. Each participant was invited to place counters with either a tick or a cross by particular technology interfaces they found particularly helpful or unhelpful and record with the camera. Figure 2 shows the participants giving opinions about the different digital interfaces.

The aim of the second workshop was to find out the persona users would like to have in the coach. We showed video clips to users that brings life to existing personas and to support the technologists in understanding the audience for whom NESTORE would reach. Figure 4 shows the different personas that the virtual coach can have. The aim of the third workshop was to map out the potential pathways NESTORE could provide to guide how a user might navigate the system. Participants were presented with a series of cards as examples of scenarios of use based on users' profile, their needs/requirements and activities. For instance, the e-coach would need to understand who the user is, male or female, and maybe whether the system is being used by an individual or couple. The e-coach needs to understand the intent of the user as to whether they wish or choose to improve their health and engage in familiar activities, or whether there is recognition that a behavior change is needed, and they will need a motivational and suggestive prompt. The workshop presented opportunity to visualize a systematic approach to mapping out and creating different pathways and scenarios for NESTORE from a user perspective. Figure 3 shows the creation of pathways through real-life scenario.

The aim of the fourth workshop is to set the tangible coach in context. Participants were encouraged to present an imaginary day based on activities that might in reality happen over a longer period of time. These were mapped on a template created by the design team.

The aim of the fifth workshop is to co-design the tangible coach physical appearance and features with older adults.

Figure 2: Analysis of digital probes WSP4   **Figure 3: Pathway Creation**
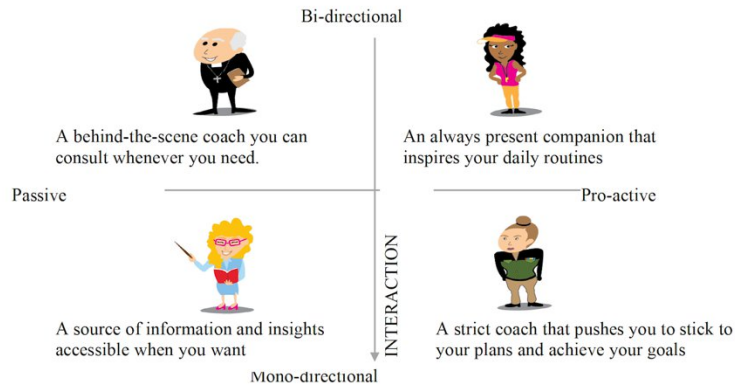
Figure 4: E-coach personas

2.3 Translation Interface

We designed an interface to translate all the conversations in the mobile application, chatbot and the tangible coach and the intents and entities words to have natural conversations with our two conversational agent interfaces (chatbot and the tangible coach). This will lead to make our system as much flexible as possible with user's native language. This has also helped us also to write conversations depending on user's culture. The system allows also to adapt the content to the user's gender. Figure 5 and 6 shows respectively the web application interface for conversations and intents.

Figure 5: NESTORE Translation Page (Conversations)

Figure 6: NESTORE Translation Page (Intents)

3 Results and Discussion

3.1 Results of the E-coaching Activities Survey

We collected and then analyzed the data from our survey. Results were preliminary. However, we established some differences and similarities between each individual and each country. According to our survey, it seems that each country has preferred activities that is very culturally understandable. In fact, 6 out of 6 of older adults from Netherlands already cycle and walk however, they do not dance nor run whereas in Spain, 9 out of 11 of older adults like to dance and walk and do not cycle at all. In fact, it is widely known the importance of cycling in the Netherlands and the culture of dancing in Spain. In terms of pathways, older adults from Spain rated "Improve or maintain body flexibility" as their first choice to tackle whereas the other countries rated "Improve or maintain aerobic fitness" as their first choice. In the cognitive domain, "Improve or maintain memory" were the most wanted in UK and Italy whereas "Improve or maintain broader thinking skills" were mostly wanted by Spain and the Netherlands. One can conclude that users have different goals. Moreover, participants were also interested to try new things: In Spain, 6 participants out of 11 said they already write, however "engaging in commercial brain training app" was something Spanish people were interested in. In the social part, Spanish older adults (8/11) volunteers with others and would like to maintain doing this activity. After analyzing the whole results of the survey, we implemented these preferred activities in the system to propose them to users. In addition, we created a different pathway design where each user will have the ability to choose what pathway he or she would like to tackle in each domain of wellbeing [2].

3.2 Outcomes of the User Interface Co-Design Workshops

Multiple themes emerged through the first workshop in relation to the design facets of existing technologies, user requirements, and virtual coach design interfaces. Participants understood the necessity to input personal data to the system but were cautious and considerate about the amount of data that were willing to share. Positive characteristics of existing technological interfaces included easy access of information, voice activated, convenience of portability and gestural control. There

were mixed responses from the group with respect to multi-function products. Some people liked to have many functions in one device whereas others preferred a customized one. However, one common thing was the importance to have a full consultation with end-users before creating a product.

During the second workshop, feedback suggested that the personas should provide a better gender and ethnic balance. Plus, the e-coach is helping to improve the health of older adults; however, it is not a doctor but simply a coach.

Next, the cards used in the third workshop have provided an important co-design tool and tangible interface that ensured that the NESTORE partners have adopted a collective and coherent understanding of the complex variables presented in the system.

The outcomes of the fourth workshop were related to issues concerning the appearance, interaction, coaching style and data. Participants commented that they would prefer an e-coach that can "blend into the environment", "beautiful", "a piece of art", and is also controlled by the user, telling it what to do. Participants also suggested that the tangible coach should be "a knowledgeable peer" and its attitude might be different in different activities. Finally, participants felt that the data provided by the tangible coach needs to be meaningful and relevant to the user. Figure 7 shows the final prototype of the tangible coach design, co-designed with users by the using the double diamond-process for creating inclusive designs [11] in the fifth workshop.

Figure 7: Tangible Coach Design

4   Conclusion

NESTORE is a virtual coach designed for older adults' wellbeing. Our study proposes a universal model by co-designing the virtual coach with older users. In our process, we carried out surveys to discover user's preferences wellbeing activities in order to create a personalized coaching system. Moreover, we conducted five workshops in order to create the different pathway intervention, e-coach interfaces and capacities and e-coach persona and design. Finally, our virtual coach can adapt to each user's culture and language thanks to a translation interface. Hence, this made the e-coach an inclusive design accessible universally. The system has been tested since October

2020 on a 3-month pilot study in Italy, Spain and the Netherlands. Results of the pilot will be reported in a further publication.

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