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IE403: Human-Computer Interaction

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Study Mobile phone interaction patterns among elderly and propose prototypes for easier screen-based interaction

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● Introduction

The global population of older people is rapidly increasing. According to the UN Population Division, the population of elderly people is expected to grow at a level of 1.9 percent every year. They expect that the elderly population will grow from 264 million in 2009 to 416 million in 2050. According to predictions, the elder people population will increase by more than 50% in developed regions in the next four decades. In absolute numbers, this age group will rise from 605 million to two billion over half a century. This means that many children will get to know their grandparents.

Users of the elder age are increasing rapidly, and therefore their demands for mobile technology also increased. According to Statista, smartphones will be about 3.5 billion in 2020. Worldwide data show that one in every five people owns a smartphone. Because of their connectivity and computational capability, smartphones play an essential part in daily life. Smartphones are essential in the lives of both the elderly and the young. Smartphones can perform many tasks apart from making a call or sending texts; they can do functions like Internet access, information sharing, multimedia, etc. Today's technology increases day by day, and now your mobile is your radio, calculator, watch, recorder, computer, telephone, camera, etc. The latest mobile technology is sometimes complex to understand and use, so there is a need to work on design, especially for elder people. Technology and the internet help everyone daily; elder adults use it by communicating in their social circle.

On the other hand, the elderly are unfamiliar with smartphone technology and have difficulties using it. Because of their poor immunity, the elderly are more likely to get sick, and the most common diseases observed in the elderly are cancer, diabetes, and dementia. Their growing population and illness rate make it very difficult to provide them with care, satisfy their requirements and expectations, and provide them with communication facilities with their surroundings. This raises the question of whether the elderly, like other generations, will be able to adapt to virtual communication. We know that the most common way of communication among people is mobile phones. Mobile phones have the potential to fill the communication gap between elderly patients and their relatives.

As a result, the causes of many issues are explored from two perspectives. First, their age-related problems, i.e., cognitive, physical abilities, short-time memory, etc., make it harder for them to interact with new technologies. Older adults face chronological changes, including a difference in their vision, hearing, motor, and cognition skills that affect their use of mobile applications. The second problem is software design in that the designers do not carefully design applications regarding elderly user needs and requirements. The interface of the existing smartphones is primarily complex and is developed by targeting mainly the young people and not the elders. Elderly users are neglected in the design phase of smartphone applications, and the designers do not concentrate on the needs and requirements of elderly people. Previously, limited attention has been given by the designer to developing smartphone applications for elderly users.

There are many different mobile phone brands in the market, but it is tough for the elderly to understand their complex functionality regarding their software interface. The user interfaces for mobile phone applications were designed exclusively for the younger generation. The elder people have problems when they use mobile phone software interfaces, and most of the elderly only use the essential tasks such as dialing the numbers or clicking pictures, etc. There are only a few mobile phone manufacturers on the market focused on the needs and requirements of the elderly. Because of the complex interface and lack of knowledge about mobile phones, the elderly cannot avail the benefits of mobile phones. Many elders feel difficulty using mobile technology; they make themselves away from it and fear using it because of a lack of technical knowledge and less interest in the digital society.

A combination of design guidelines and heuristic evaluation is a valuable tool for designing a less expensive, low resource, and quick tool for developing age-friendly interfaces for mobile applications. The design process is more critical to the developer to know the users of the target elderly product suitable usable must be taken in unique needs. When dealing with visual and hepatic issues of smartphones, button size, color contrast, and textual interface should be easy for the elderly. UI should be improved for better vision of the elderly, especially the content structure of the screen, color filter, contrast, and clear fonts.

- **Data collection from elderly people**

To study how elderly people interact with mobile phones, we approach some elder people of more than 60 years whom we know and who use mobile phones. Among them, very few use smartphones. Some of them do not use mobile phones, and we asked them for a reason, and they replied that mobile phones are challenging for them to use, so they use mobile phones just for calling services. Some of them replied that these technologies are not suitable for them.

There are two types of mobile phone users. First are those who are graduates and like to use smartphones, and the second is those whose children or grandchildren give mobile phones for convenience. Now we look into their replies about mobile phones. One elderly person is a mechanical engineer whom we met. He is good at using his smartphone and does not seem to have much difficulty using it. Since he knows English, he does not have trouble with the language problem. His only difficulty was adapting new apps and features. It takes time for him to learn about those unused apps and features.

We approached another elderly person in one of our group members' neighborhoods. He is working at a bank. We told him to use Google pay, and he was a little bit familiar with the app because he often uses it with others' help. First, we told him to use the app independently, but he hesitated because he was concerned about money/banks. He also had navigation difficulties. He was clueless about the UPI step. But he was able to finish payment on Google pay by instructions. Then we asked him about other problems that he faces while using his mobile phone. He mentioned that he needs tutorials or someone's help to learn about new apps or features till he learns them properly. He also had some visibility problems, and due to them, he faced difficulties with readability. He needs his glasses while reading from his mobile phone. He said that it is not easy for people like him to use mobile phones as our generation, and it requires too much effort to understand and learn about new features. They cannot understand or learn these new things independently, but they need someone's help or tutorials.

One elderly person is the grandfather of our friend. He also uses a smartphone. He primarily uses YouTube and a Gujarati news app. He doesn't have any problems while using the Gujarati news app. But he faces some troubles while using YouTube, like the small voice search button size, problems with English, etc.

- **Problems and barriers**

There are many types of problems that the elderly face during interaction with phones, like sensory problems, cognitive problems, motor problems, etc. Below are the most common problems faced during screen-based interaction by the elderly.

- **Small font, screen size, font type, buttons and color contrast**

The most common barrier in elderly people. Various issues like small font size can be caused due to sensory problems; confusing menus can be caused due to cognitive problems. Due to vision loss problems, elder people are not comfortable with some color combinations of the interface in mobile phones. Display screen space is very small, and these are crowded with many contents and functions that confuse the users. The Elderly use vast amounts of time to complete the task on their phones because they face problems reading with the small font on a small screen display. The elderly have more difficulty sorting and matching colors.

- **Menu and navigation issue**

This is the second most barrier for elder people while using their mobile phones. They face low spatial abilities, confusing experience, or a lack of experience. They also feel lost when they use the menu and navigation features of their phones.

- **Lack of experience and knowledge**

The elderly face this problem when they experience the existing smartphone applications. This problem also brings low usage of those applications among the elderly. Elder people are not aware of new mobile interfaces and they have zero experience or knowledge. Poor language understanding is also one of the main problems. Most elder people do not have an academic degree so the language barrier can be considered a major barrier.

➤ **Unlabeled and unfamiliar icon size**

The elderly have relatively little knowledge about modern devices, so they often have less understanding of icons and their use. Less familiarity with smart icons makes it hard for them to use. Additionally, elder people face more problems when interacting with icons without labels.

➤ **Vision loss: visibility and poor readability**

Elderly people's most common problem is less visibility and poor readability. Most elder people have the disease of vision loss which makes their vision power low. When they read text on phones, they face difficulties due to these problems. Browsing on a small screen can cause a problem for them because of visibility problems, vision loss, soft focus, poor understanding, etc.

➤ **Frustration from technology**

The elderly are not familiar with technology, so they feel technology fear and lack confidence while using them. They quickly get frustrated when they can't find their answers quickly, and they would be angry about that. Lack of education on electronic devices can be a reason for this problem.

- **Solutions**

- **Font, button and icon size**

According to Fitt's law, text, buttons, and icon size should be large for easy access and reading. Read or click features should be scaled up. Icon size should be at least 9.6mm when measured diagonally. Increasing that size for apps and websites improves usability. Icons and buttons should be placed with a minimum spacing of 44 pixels for clear touching. Font should be selected based on readability factors rather than narrow or decorative fonts. Using bold fonts only for keywords or titles would be best. Sans serif font types with a minimum size of 16px are suitable for on-screen readability. There should be a size-changing facility for text, buttons, or icons. Any website or application should be tested by all types of users before making it public. Clickable links should be underlined unless displayed differently.

- **Use of labels and subtitles**

Icons are the basic features of mobile phones. Icons should be labeled with text for elder people. This makes the purpose of icons clear to everyone. Those who don't need labels aren't likely to be offended by them, but those who need labels might get lost without them. When elder people want to enjoy audio or video content for vital communication, subtitles should be included. This is good for people to enjoy without any disturbance or headphones.

- **Gestures**

For better interaction, every interaction part needs to be kept easy to understand and complete. Elderly people's motor skills tend to decrease with their age, making things like complex gestures more challenging. So more senior people stumble at complex gestures of touchscreen technology. Typing, particularly on mobile phones, makes it difficult for them. When designing interfaces for elder people, the designer should keep gestures simple. Forget complex gestures which require more than two fingers. Since simple horizontal, vertical, or diagonal movements are all-natural would be fine for elderly people. Avoid complex gestures like quick movements, difficult positioning, or gestures using both hands and more than two fingers.

➤ **Color contrast**

As we know, contrast sensitivity and color discrimination decrease with aging elderly people feel difficulty in interacting with mobile phones. Designers should keep three attributes in mind while designing the interface: hue, lightness, and saturation. The designer should avoid high bright, fluorescent, or vibrant colors, which can tire the eyes of the user. Stronger color contrast is suitable for elderly people. Avoid similar colors adjacent to the foreground and background colors to maximize the contrast. The recommended contrast ratio is at least 4.5:1, or it would be best to stay around 7:1.

➤ **Picking the correct vocabulary and language**

“Sign in” or “Sign up” words may be hard to understand for some users. Elder people find it more difficult to understand. Using descriptive words like “Create an account” instead of “Sign in” can make things clear for elderly people. The use of feedback messages is a good example. Display feedback messages after the user performs any task to avoid confusion. The language translation feature would suit those who don’t understand a particular language.

➤ **User guide**

A user guide would be the best feature for elderly people. As we know, most elder people do not know how to use new apps or features; they have to learn from someone else. They cannot learn it on their own, so a user guide can be used to teach them how to use particular apps or features. By user guide, elderly people can learn on their own, and they do not have to rely on others.

➤ **Do user testing**

We need to know about the user experience about the user interface before making it public. User experience cannot be done without contacting end users. All design choices should be tested with all types of end-users. First, create a plan on how we are going to test it. Then we need to keep some questions in mind: Are you testing your prototype with real users? What will you do with the prototype after the test? Will you work on the interface after testing, and how? Test plan results often may give some information about problems or bugs in the interface. We can work on them before making the interface public. So knowledge of user experience makes us design nearly perfect interfaces.

- **Elderly mode themes(Android smartphones)**

- **BaldPhone**

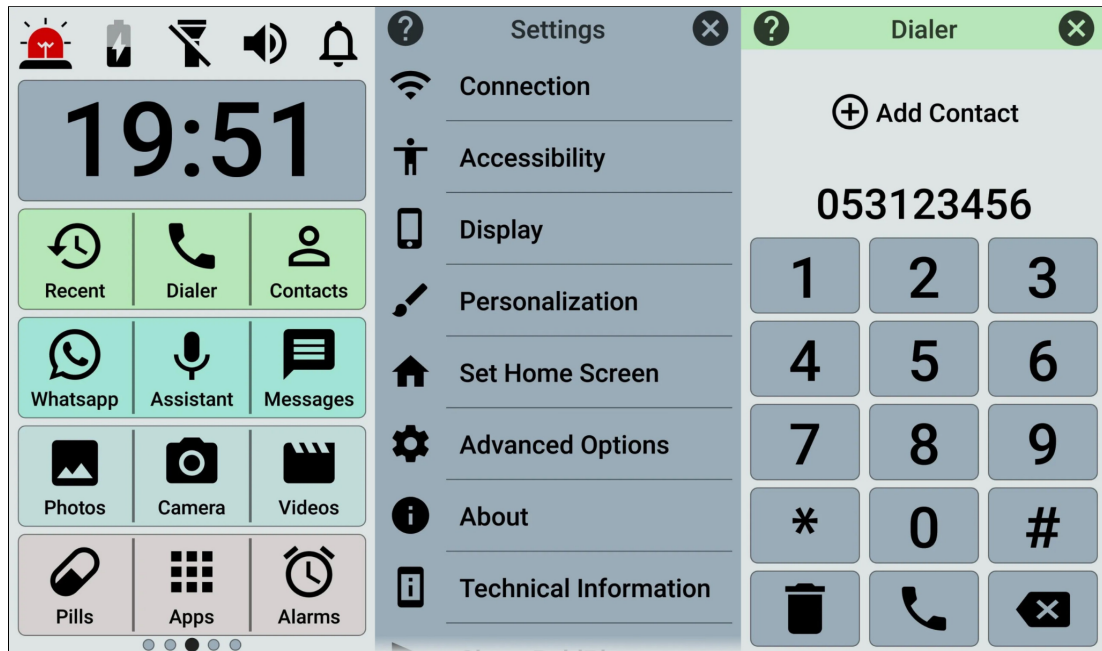


Figure 3.Interface of BaldPhone([reference](#))

BaldPhone is a platform that replaces the phone's interface with a larger, simpler, and friendlier one. It is specially made for elderly users and people with motoric or sight problems. It is free for all and completely open-source. It is ads-free. It is made out of a desire to help the elderly community. It's recommended for people who have difficulty in typing. BaldPhone has its own special keyboard. BaldPhone replaces the phone's launcher. The interface of BaldPhone is big, simple, and accessible for the elderly. It contains a launcher, alarms, reminders for pills, a dialer, contacts, photos and videos, a notifications area, etc. BaldPhone is highly customized to match elderly and seniors' specific needs.

➤ Oldery: Big Launcher App



Figure 4. Interface of Oldery [\(reference\)](#)

Oldery simplifies the operation with the smartphone, making it suitable for older people, children, and people with vision problems, totally blind or motorized. You can also configure the size of the buttons from small to huge and display or not the labels with the action of the button, as well as the display or not of the indicator panel where the user will be provided in an easy, large and visible way the status of the battery, connectivity, current date and time, giving direct access to the system's calendar and alarm clock applications. The notifications are presented in a more simplified interface. Oldery has a feature that can change the size of the fonts of any application that is launched. Oldery is free for all.

Here we have discussed only two examples for elderly people. There are more good examples mentioned in article reference number 7. You can check the article for more information.

● Conclusion

Today's mobile phones are beneficial to the elderly in maintaining a healthy and secure lifestyle. These technologies allow them to communicate with their loved ones, improving their quality of life. Elderly people cannot use it independently, so we are motivated to identify and research the barriers and problems they face while interacting with their mobile phones. In this research, the most problems faced by elderly people are the small font, screen size, font type, small buttons, color contrast, navigation issue, small icons, lack of knowledge and experience, poor visibility and readability, etc. By using the HCI heuristic and design principles, designers can make the age-friendly design of mobile phones with appropriate interfaces. Designers need to consider these ideas while developing the interface for elderly people, like bigger font, button, and icon size; use of labels and subtitles; simple gestures, high color contrast, user guide, user feedback, voice commands, etc. It makes devices compatible and easy to use for elderly people. There are many mobile applications and launchers available accessible for elderly people, and they are specially designed for elderly people. The HCI heuristics and design principles are used to make them. These applications and prototypes are beneficial for elderly people, and they make the screen-based interaction easy for them.

● Contributions per member

Group member	Contribution
Himanshu	Research, Introduction, Approach to elderly people, Problems and barriers
Shubham	Research, Introduction, Problems and barriers, Solutions, Elderly mode themes, Conclusion
Gargey	Research, Introduction, Conclusion