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FRAUNHOFER CENTER FOR ASSISTIVE INFORMATION AND COMMUNICATION SOLUTIONS – AICOS

REPORT

Switch button usability testing
GoLivePhone / SmartCompanion

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1 Summary

System and objectives

GoLivePhone / SmartCcompanion (https://www.aicos.fraunhofer.pt/en/our_work/projects/SmartCompanion.html) is a user interface redesign for Android smartphones that targets the older audience. During this evaluation we tested the switch button to turn on or off privacy settings of the applications. This button is expected to be used by seniors and should therefore be understandable to the user group.

Method

This experiment was divided into two stages: one was conducted at a specific day care center with nine participants, and three different designs were tested. The second stage was conducted with 12 participants at a different day care center and four different designs were tested. Despite having two different groups of users, a within-group design approach was used, i.e. each participant was exposed to the multiple designs and results were measured individually. The designs tested with the second group resulted from the re-design and improvement of the first tested designs.
Independent variables for this experiment were the different switch buttons designs and we measured two completion rates for each design: recognizing the button state and changing the button state.

Results

During the first test the design D1- Yes / No Buttons was excluded for having the lower average completion rate (62.5%). As a result of the second test, the design D4 – Radio Buttons was considered the best option due to its highest completion rate (92.3%) and consistency of single task completion rate (both scored 92.3%).

2 Introduction

2.1 System description

GoLivePhone / SmartCompanion (https://www.aicos.fraunhofer.pt/en/our_work/projects/SmartCompanion.html) is a user interface redesign for Android smartphones that targets the older audience. It also includes several applications designed to improve their daily activities. During this experiment we tested the switch button to turn on or off privacy settings of the applications. This button is expected to be used by seniors and should therefore be understandable to the user group.

2.2 Test objectives

This test had the specific goal of evaluating several switch buttons options in order to assess which option is the most effective for seniors. To measure effectiveness two questions were addressed:

1. Can the user recognize the current state of the switch button?
2. Can the user change the state of the switch button?

The test focused on this specific interface element because the remaining interfaces had already been tested before and switch buttons could, if not well designed, be ambiguous.

3 Method

3.1 Test facility

The tests were conducted in day care centers, in a non-private environment, i.e. their common areas. For this reason, there was a possibility that results could be compromised by participants watching other participants perform the test. As such, we did not perform the test with participants that were seated directly side by side or across from each other.

3.2 Equipment

The experiment used a Samsung Galaxy Nexus smartphone with a 4.65 inch touchscreen display and 1280x720px resolution. The used text size was 28sp and targets' size was 40dp.

3.3 Procedure

The sequence of events from greeting the participants until their dismissal was the following:

- Participants were greeted by the facilitators.
- They were given an informed consent to sign (available at section **Error! Reference source not found.** of the Annex)
- A short background questionnaire (age, profession, previous experience with touchscreens) was administered.
- Information about the test was read aloud from the script (available at section **Error! Reference source not found.** of the Annex) by one of the facilitators. Participants were asked to try and complete the task as if the facilitator was not present, but to ask for help if they felt they were stuck or did not understand the task description.
- Participants were read the task instructions sequentially.

- The facilitators thanked and dismissed the participants.

Participants were not compensated.

3.4 Tasks

A typical usage of a switch button includes the identification of the button's status and changing that state. Therefore, the tasks we asked participants to perform included these two steps. The only information given to the participants was the confirmation that one of the options was previously selected and the context in which the button is used – to turn on or off a privacy setting on the phone. To measure the effectiveness of the buttons we recorded completions rates for both tasks. The buttons tested for each phase were:

3.4.1 Phase 1

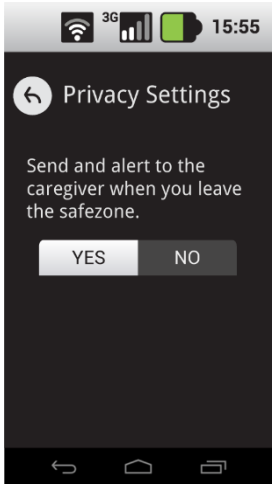

Figure 1. D1 - Yes / No Button

D1 – Yes / No buttons

In this design, the selected option was darker (in the image the No is selected) and the non-selected option was lighter and used the same color scheme as other buttons in the application (e.g. the back button). To select an option the participant should touch the light grey button area around the non-selected option.

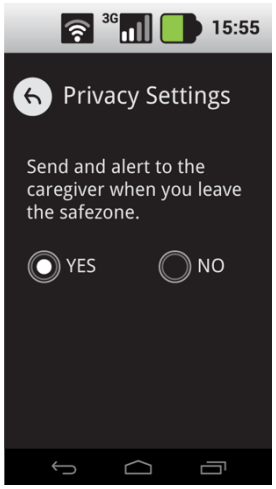

Figure 2. D2 - Radio Buttons

D2 – Radio Buttons

In this design, the selected option is identified by the white spot inside the radio button (in the image the Yes is selected). To select an option the participant should touch the circles to the left of the non-selected option.

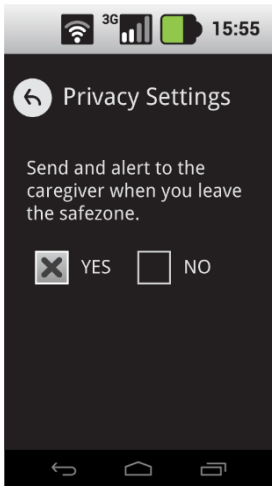

Figure 3. D3 - Square Cross Button

D3 – Square Cross Buttons

In this design, the selected option is identified by the cross inside the square (in the image the Yes is selected). To select an option the

participant should touch the empty square to the left of the non-selected option.

3.4.2 Phase 2

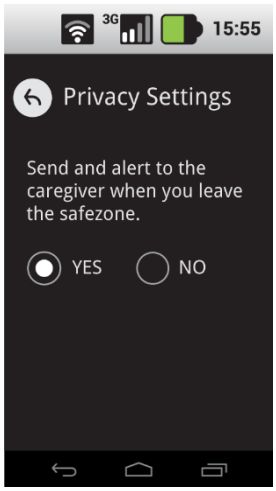

Figure 4. D4 - Radio Buttons

D4 – Radio buttons

This design was an improvement of design D2 – Radio buttons. During the first test it was noticed that the two circles that formed the button were confusing to the participants, therefore the design was simplified to a single circle. The interaction with these buttons is the same as D2's.

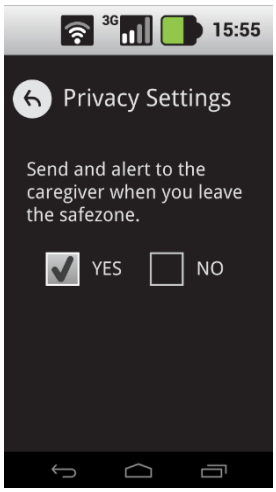

Figure 5. D5 - Square Check Buttons

D5 – Square Check Buttons

This design is a variation of D3 – Square Cross buttons. During the first test it was noticed that sometimes participants thought that the cross had a negative connotation, indicating that the option was not selected. Therefore, we decided to test the design using a check that should have a more positive connotation. The interaction with these buttons is the same as D3's.

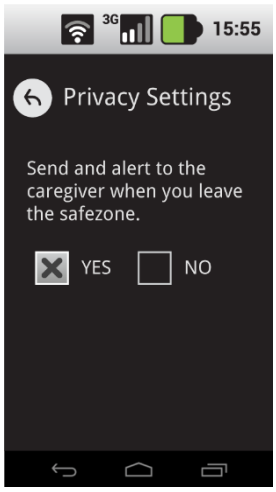

Figure 6. D6 - Square Cross Buttons

D6 – Square Cross Buttons

This design is the same as D3. It is duplicated because it was retested during the second test.

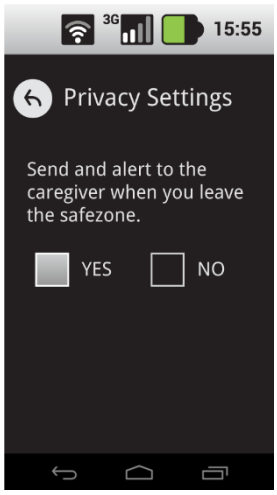

Figure 7. D7 - Square Buttons

D7 – Square buttons

This design is a variation of both D5 and D6. Its purpose was to test the importance of having the cross or check. The selected option is the one with the empty square (in the image the No is selected) whereas the non-selected option had a grey square, similar to buttons across the application.

3.5 Usability metrics

3.5.1 Effectiveness

Effectiveness relates the goals of using the product to the accuracy and completeness with which these goals can be achieved. To measure the effectiveness of each design, the facilitator recorded binary information regarding completion data. If the participant was unsure on how to perform a task and required assistance the completion rate for that task

was considered null. This was decided considering how small and simple each task was.

4 Results

4.1 Participants

4.1.1 Phase 1

In the first phase of the evaluation we recruited nine participants, one male, eight females, with an average age of 79 (SD = 7.75). Minimum age was 69 and maximum age 88.

Participant	Age	Gender	Previous experience with touchscreens
P1	87	F	None
P2	73	F	None
P3	69	F	None
P4	77	F	None
P5	81	F	None
P6	88	F	None
P7	74	F	None
P8	86	F	None
P9	82	M	During previous tests

Table 1. Participants (phase 1)

4.1.2 Phase 2

In the second phase of the evaluation we recruited 12 participants, two male and 10 females. The average participant age was 76.65 (SD = 8.39). Minimum age was 63 and maximum 90.

Participant	Age	Gender	Previous experience with touchscreens
P10	71	M	During previous tests

P11	87	F	During previous tests
P12	69	F	During previous tests
P13	76	F	During previous tests
P14	74	F	During previous tests
P15	85	F	During previous tests
P16	85	F	During previous tests
P17	74	F	During previous tests
P18	90	F	During previous tests
P19	63	M	During previous tests
P20	77	F	None
P21	69	F	None

Table 2. Participants (phase 2)

4.2 Performance results

For each task (Recognizes State and Changes State) the moderator recorded binary information: Completed representing 100% completion rate and Not completed representing 0% completion rate. Considering the simplicity of the tasks, no in between states were considered. The two tasks were independent, i.e., a participant could fail the recognition of the button state but still be able to change its state, by correctly identifying the interaction with the given button. The results were collapsed for each task by counting the frequency of positive and negative results.

4.2.1 Phase 1

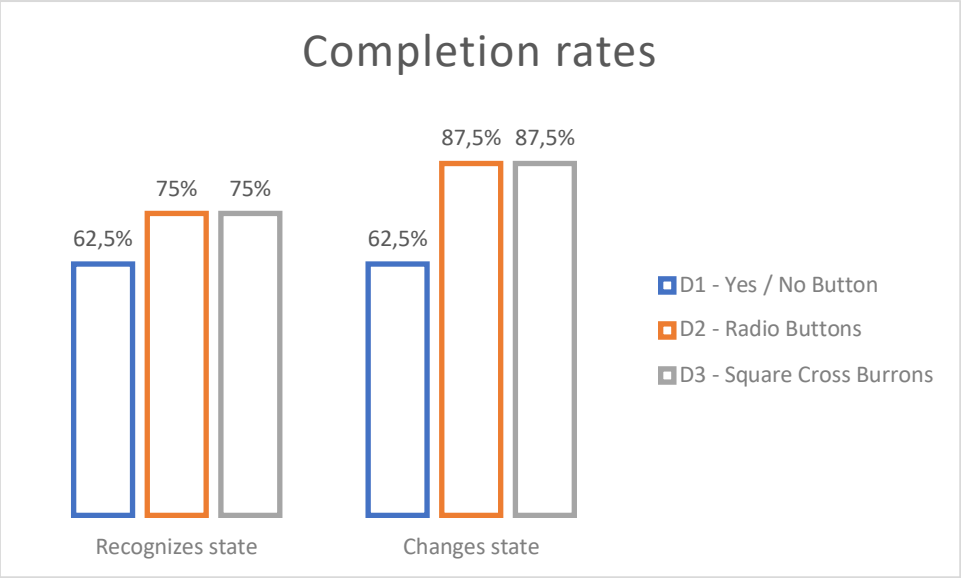

Figure 8. Completion rate per task for each button

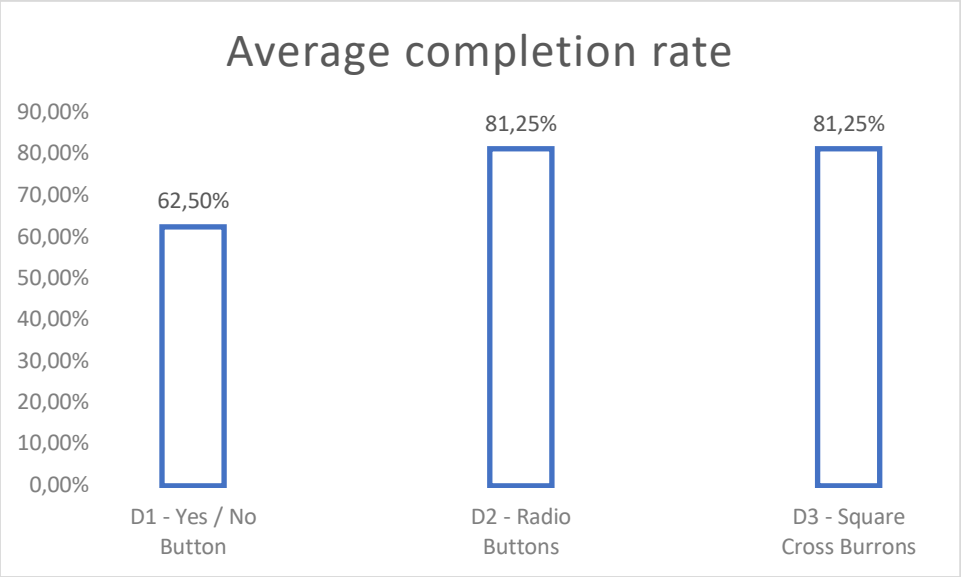

Figure 9. Average completion rate for each button

After the first phase of testing, the option D1 – Yes/No Button was excluded since it had the lowest single task completion rate and average completion rate. Options D2 and D3 were improved and re-tested during the second phase.

4.2.2 Phase 2

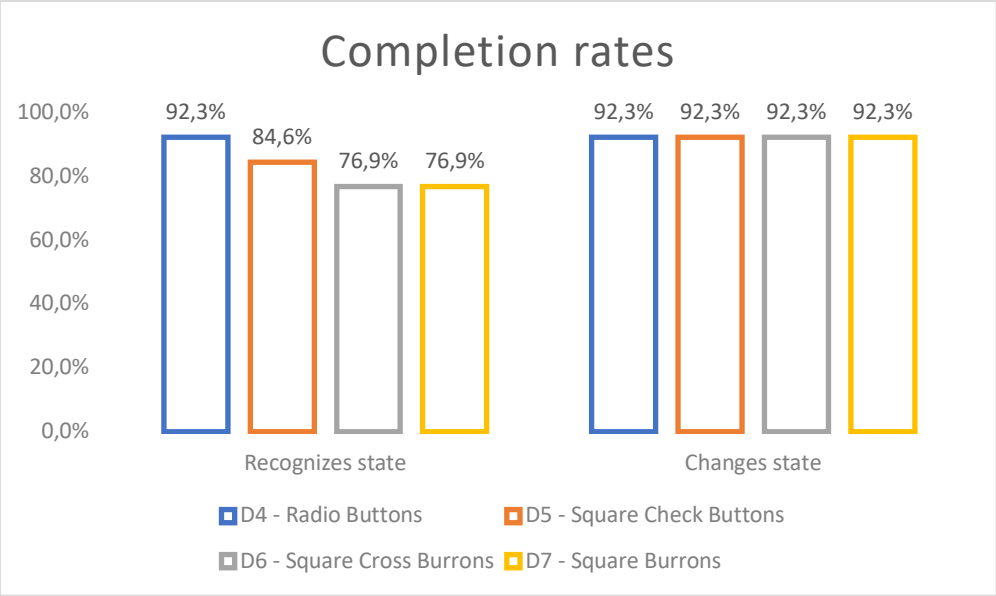

Figure 10. Completion rates per task for each button

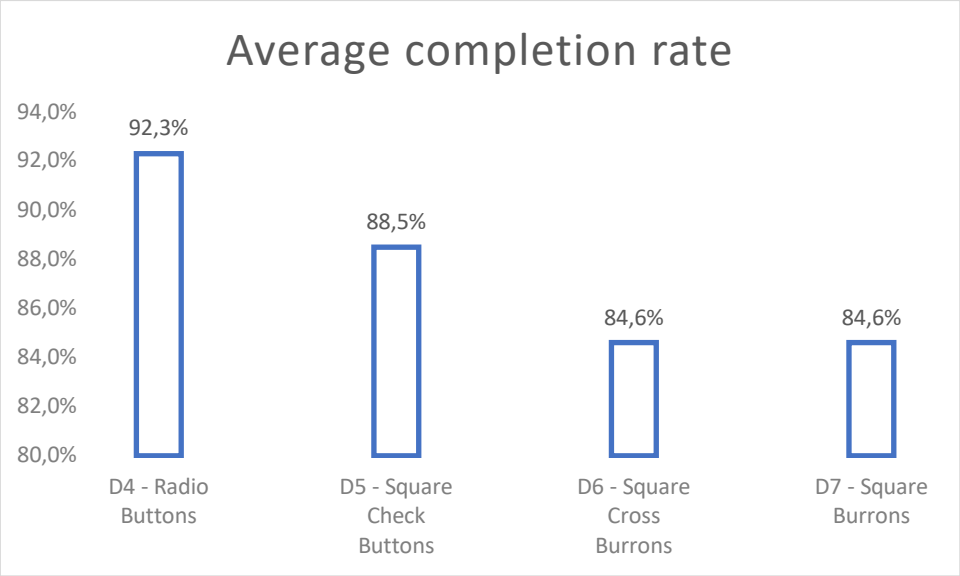

Figure 11. Average completion rate for each button

After the second phase it was decided, based on the results presented above, that option D4 – Radio Buttons was the most suitable for an

on/off button in an application designed for senior novice technology users.

5 Recommendations

During this experiment it was very clear to the investigators that even the slight detail could endanger the usability of an entire system. For a functionality so important such as turning on and off the privacy settings of the application, it is crucial that users are able to perform this action independently and are well aware of their choices. As such, testing this button provided us with fundamental information to build a better product for its intended target audience.

The results of this test indicate that the solution D4 – Radio Buttons (see **Error! Reference source not found.**) was the most appropriate and should be used for all functionality that implies turning on and off a feature.

6 ANNEX

6.1 Instructions to participants

6.1.1 Introduction

Introduction: *Hi, my name is Ana and I would like to ask for your help in evaluating some user interface elements for a smartphone. In this test I will ask you to perform some tasks to assess the usability of the designed interfaces. Please be aware that there is no right or wrong answer, all malfunctions that may occur will not be your fault and that we are not evaluating your performance, rather we are evaluating the designs we are presenting you. We greatly appreciate your participation and you are free to stop us any time you want.*

[Present each of the switch buttons]

I have pre-selected one of the two options available on the screen. Can you tell me if I selected the Yes or the No option?

Can you please change to the [Yes or No] option?

6.1.2 After the test

Thank you very much for helping us, we greatly appreciate your participation and feedback.

6.2 Informed consent (Portuguese)

A *Associação Fraunhofer Portugal Research* faz trabalho de investigação destinado a encontrar soluções que promovam o bem-estar da população.

No âmbito do projecto GoLivePhone pretendemos avaliar a usabilidade de diferentes botões de ligar/desligar uma funcionalidade de forma a desenvolver uma solução adaptada às necessidades dos utilizadores finais. Para o estudo, iremos proceder à recolha de dados relativos ao processo de usabilidade dos diferentes botões apresentados.

Gostaríamos de contar com a sua participação nesta fase da nossa investigação. A participação não envolve qualquer prejuízo ou dano material e não haverá lugar a qualquer pagamento. Os dados recolhidos são confidenciais. A *Associação Fraunhofer Portugal Research* tomará todas as medidas necessárias à salvaguarda e protecção dos dados recolhidos por forma a evitar que venham a ser acedidos por terceiros não autorizados.

A sua participação é voluntária, podendo em qualquer altura cessá-la sem qualquer tipo de consequência.

Agradecemos muito o seu contributo, fundamental para a nossa investigação!

O participante:

Declaro ter lido e compreendido este documento, bem como as informações verbais fornecidas e aceito participar nesta investigação. Permito a utilização dos dados que forneço de forma voluntária, confiando em que apenas serão utilizados para investigação e com as garantias de confidencialidade e anonimato que me são dadas pelo investigador. Autorizo a comunicação de dados de forma anónima a outras entidades que estabeleçam parceria com a Associação Fraunhofer Portugal Research para fins académicos e de investigação científica.

Nome: _____

Assinatura: _____ Data ___ / ___ / _____

Investigador responsável pelo projecto "GoLivePhone":

Nome:

Telefone:

E-mail