

KNOTS

D2.4 – Evaluation Report of the 2nd Evaluation

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Deliverable 2.1
The following deliverable gives details about the procedure, methods and the results of the second evaluation of the KNOTS (A knowledge transfer-system for persons in care) system in Germany and Sweden.

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1 Introduction

The final evaluation of the KNOTS project took place in 2017. After the input of the Midterm review (MTR) in April 2016 and of the second review in Brussels in November 2016 the consortium finalized the KNOTS application (according to the decisions made during the KNOTS review process) and generated the final information for the database. To start the evaluation, the responsible partners made different pre-tests to make a specific plan of the final testing scenarios. Also, videos and text descriptions were prepared and uploaded in the KNOTS application. In parallel the partners contacted participants and prepared guidelines and general information for the evaluations. Table 1 gives an overview about the work that has been done by JUH and HTK.

Table 1: Roadmap of the KNOT evaluations (end of 2016 till 2017).

		November 2016	2017				
			Jan	Feb	Mar	Apr	May
JUH	MTR in Brussels	Testing of the KNOTS application and creation of final requirements for developing	Recording of videos and creating of descriptions for the KNOTS knowledge database	Recording of videos and creating of descriptions for the KNOTS knowledge database	Pretests of application and reporting of modification requests	Evaluation of Scenario 2 (smart home with elderly)	Evaluation of Scenario 1a (connecting AmbiAct to emergency system)
			Partner meeting in Goslar to re-create mock ups	Partner meeting in Goslar to re-create mock ups	Pretests for installation of smart home technologies		
		Collecting of information for the database					
HTK			Partner meeting in Goslar to re-create mock ups	Acquisition of test persons	Acquisition of test persons	Pilot test of installation in home of test person(s)	Final evaluation of scenario 1b in Stockholm & Falun
				Recording of videos and creation of descriptions for the database	Recording of videos and creation of descriptions for the database		

In the subsequent chapters, the different steps of the final evaluation phase **are** reported.

2 Final requirements and technical preparation for final evaluation

2.1 Technical Adaptation to the KNOTS App

To discuss the final functions for the evaluation, a project meeting with all KNOTS partners took place in February 2017 in Goslar, Germany. The JUH presented the final scenarios, which were discussed at the mid-term-review and explained the requirements for the app. As the user group had to deal more with the installation of AAL technology and no longer with the coordination of volunteers, an adaption of the data and navigation structure was agreed on (within the app). For example, it was decided that the app's "home page" was to display the knowledge database. The proposals and discussions were sketched on a flipchart and as new requirements to the developers and then implemented before the evaluations started.

Important adaptations regarding the homepage which were agreed between the partners during the Goslar meeting (based on feedback by KNOTS partners and internal test users (acquired from staff of KNOTS partners not involved in the KNOTS development)):

- The add button was always visible and the content was to be added from each position.

- A magnifying glass was to be displayed to make the search function easier to find
- Users should always know in which subcategory they were located
- More familiar pictograms were used generally
- In the search area, the results were displayed directly (live Search)

Important additions to the "Add menu" were:

- Icons instead of text for words 'save' and 'cancel'
- More information about what had to be written in what field

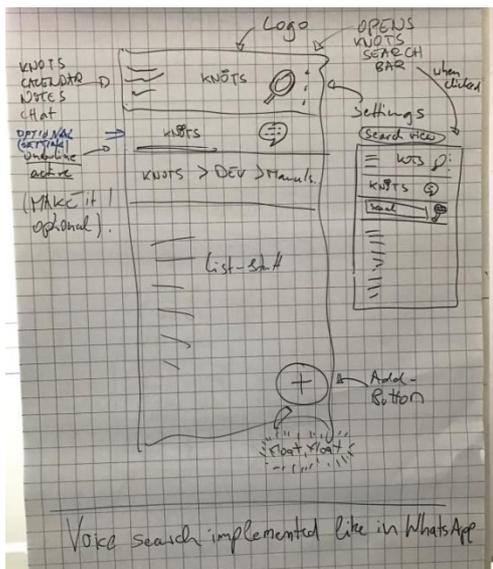


Figure 1: Ideas about new start page

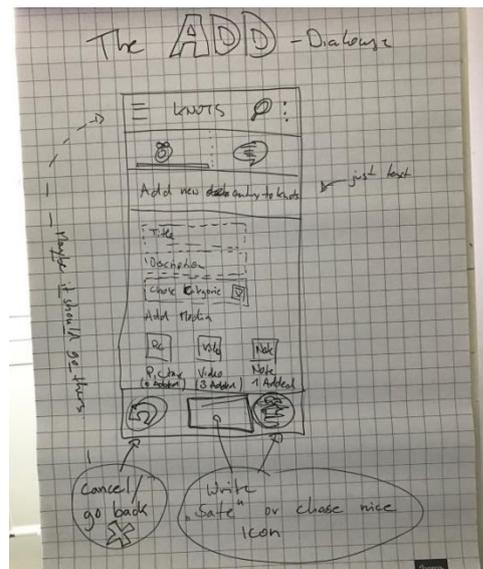


Figure 2: Ideas about the 'Add-Content' function

After the February meeting in Goslar, the developers at the technical KNOTS partners worked on the improvements. Within an iterative process, the partners JUH and FhG tested each available version and gave immediate feedback. All in all, five new versions of the app (versions 1.1.2 - 1.1.6; see Figs. 3-5) were created and internally released in the period until April 2017. A list of all changes can be found in Appendix 5.1. The final version was finally tested in a pre-test to ensure fulfilled all the requirements of the evaluation.



Figure 3: Home screen first version (v 1.1.2)

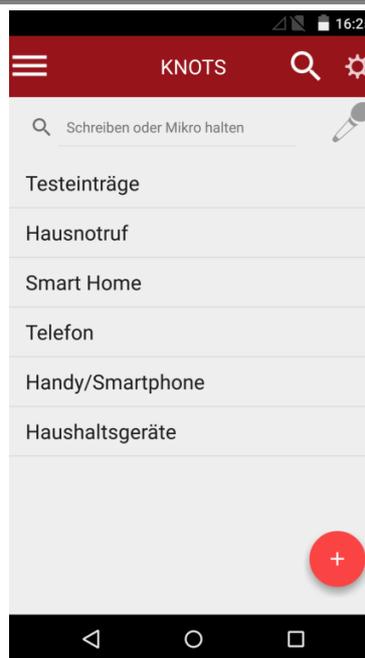


Figure 4: Home screen final version (v 1.1.6)

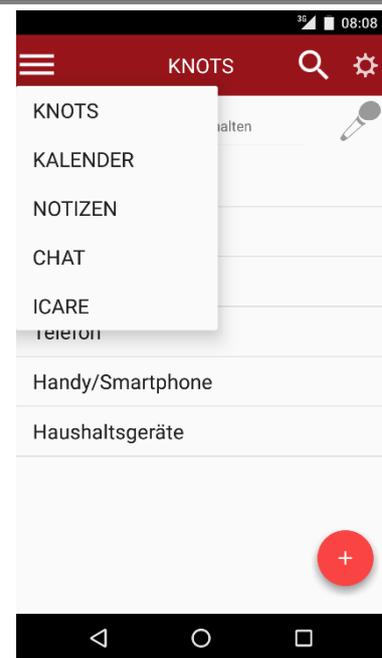


Figure 5: Home screen final version menu (v 1.1.6)

2.2 Creating input for the KNOTS knowledge database

For the installations of the different scenarios, information material was compiled and categorized in the KNOTS app. In general, the compilation of the videos and texts always met the criterion of comprehensibility. Since the evaluation took place in Germany and Sweden, all input for the specific scenarios were created with regard to the in the respective languages. Most content was translated; however some (country specific) material is only available in single languages.

2.2.1 Input for Test Scenario 1a: Support by installing AAL-devices

The AmbiAct¹ is an AAL add-on module for care phones developed by the company oldntec. At the time of the KNOTS evaluations, JUH technicians were trained to install this system. However, since the information was mostly printed on paper, technicians reported that they would not always have all information available. For this purpose, existing information sheets and manuals were compiled and uploaded in the KNOTS app. In addition, guide videos about the installation procedure were created; see Figs. 6-8 (German text). AmbiAct can be connected to care phones of various manufacturers. Therefore, content was compiled for installation on NEAT and Telealarm systems exemplarily. Although the KNOTS knowledge database contains info about various devices which can be found in home of

¹ AmbiAct is a plug adapter and recognizes the usage of electronic devices. If these devices are not used for an untypically long time, AmbiAct wirelessly initiates an alarm through an available care phone. See also <http://www.oldntec.eu/en/#oldntec-ambiact>

elderly, the installation of AmbiAct in homes of elderly provided a real-world evaluation scenario for the KNOTS partners.

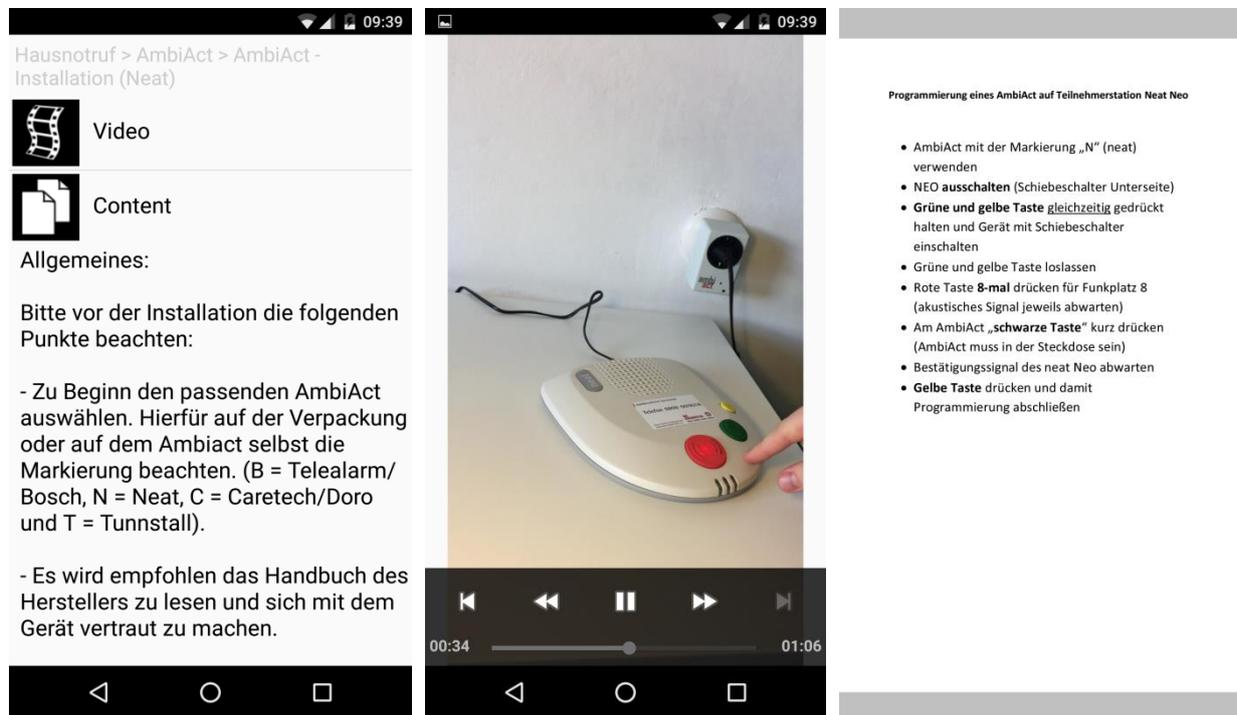


Figure 6: General Information.

Figure 7: Video instruction.

Figure 8: Text instruction.

2.2.2 Input for Test Scenario 2: Support for people like neighbors, relatives or informal care givers during installation of AAL- devices

For the evaluation of the second scenario, information about the installation of smart home components was compiled. For this purpose, the consortium agreed on the manufacturer HomeMatic for the final evaluation, since the system has a great variety of functions and does not result in monthly costs. The base station (HomeMatic CCU2) of the system was pre-configured so that the participants were able to install individual modules via the web interface of the HomeMatic CCU2 and to combine them with each other. In the KNOTS database, all freely available manuals were uploaded and in addition, guidance videos and brief explanations were created, cf. Fig. 9 for an example video instruction from the KNOTS database.

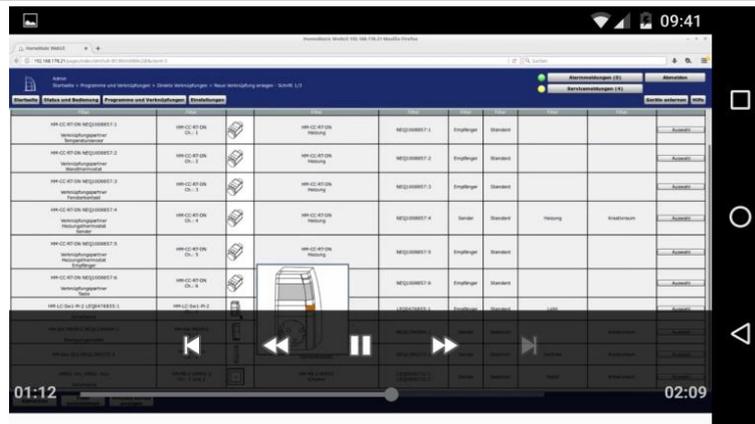


Figure 9: Video instruction.

3 Final evaluation

Questions to be answered during the planned evaluations were identified to be:

- Are the planned processes useful when using the app in case of assistance?
- Are the instructions in the KNOTS app sufficiently described?
- Are inexperienced users able to install and / or solve problems of emergency call devices or Smart home technology with the help of the app?

3.1 Methodology

Various evaluation methods were used for the evaluation. So, the end user groups in tackling subjects were asked to express their thoughts aloud. The statements were recorded using a dictation device. This so-called 'thinking aloud'-method is a well known procedure to evaluate the usability of a user interface [1]. The tasks focused rather on the general operation of a device than of a correct and rapid implementation. After every test, the participants were asked to discuss the relevance of such an application.

3.1.1 Questionnaire about technical affinity (Scenario 1a and 2)

In many empirical studies, the technical affinity of the users of electronic devices is collected, without a standardized method for the detection of this construct existing so far. Karrer et al. [2] developed a questionnaire for the measurement of technical affinity TA-EG and examined it in two studies.

Technological affinity (TA) is defined as a personality characteristic that expresses itself in a positive attitude, in a person's enthusiasm and trust in technology. It is associated with interest in and acceptance of technology and has a positive effect on the knowledge about and the experience with technology. The focus is on electronic devices (in German: elektronische Geräte, EG), which are known in everyday use, such as mobile phones, computers, personal digital assistants (PDA), digital cameras, Mp3 players and navigation systems.

To collect data regarding TA an item pool was created by students and experts in human-machine interaction, who focused on the theme groups of technical experience, technical trust, technology competence, anxiety of technology, attitude to technology, technology knowledge, technology interest and technology acceptance.

In the course of the two studies, the extent was successively reduced to the most meaningful items. Consequently, the instrument then comprised 19 items covering four subscales: enthusiasm for technology (Q.: 1, 3, 8, 10, 15; see Appendix 5.2 for a translation of the questionnaire), competence in handling technology (Q.:4, 14, 17, 18), positive technology sequences (Q.: 2, 6, 7, 13, 16) and negative technology sequences (Q.: 5, 9, 11, 12, 19).

The participants answered on a Likert scale [3] of five whether they totally agreed, rather agree, partly, did not agreed or strongly disagreed with the statements of the four subscales. A numeric value (1-5) enabled the operationalization of the participants' technical affinity by computing the average of the values measured: The higher the values per subscale (and in total) the higher their TA.

As a result, the scales used were reliable and supported the validity of the instrument, for example, through important correlations with convictions in the handling of technology or innovative excitement.

The TA-EG was developed as a reliable, valid and in its application as an economic questionnaire for the detection of technical affinity: it has been validated on a large, heterogeneous sample; it captures more than one facet of technical affinity and refers generally to electronic devices, not only a class of devices such as computers.

3.2 Procedure

To gather the relevant information regarding the user behavior and function of the KNOTS app a method combination of guided interview and observation was applied in both scenarios. This allowed for an efficient data collection without exposing the subjects to additional stress or deflection factors. After the experiment, the technical affinity of the subjects was also determined by a questionnaire in order to be able to infer conclusions about their behavior during the experiment by means of background information.

Scenario 1a: Procedure

All participants had to integrate an AmbiAct in the installation with the home emergency device. During the execution, the time was stopped and the errors were counted by the moderator. After the task, the participants were asked about the advantages and disadvantages of the KNOTS app. In addition, the following questions about the general usability were asked by using a five point assessment similar to the Likert scale:

- I consider such a system meaningful when installing unknown devices

-
- Operation of the app was simple
 - It was a pleasure to operate with the app.

Once all tasks and questions were completed, the respondent received the technical affinity questionnaire.



Figure 10: Setting for installation of AmbiAct with support of the KNOTS app.

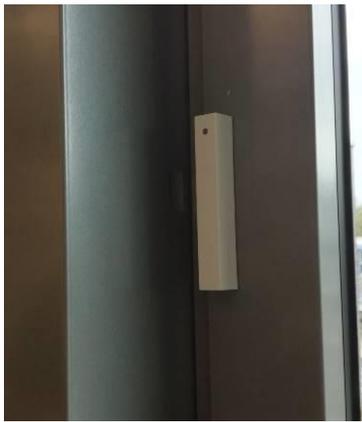
Scenario 1a: Participants

All nine participants were employees of JUH. They used a smartphone and had never installed an AmbiAct before. The age of the participants was between 25 and 45.

Scenario 2: Procedure

After the welcome and explanation of the project KNOTS, the subjects received two tasks. At first they had to change a battery on a HomeMatic window contact. The second task was to use the Knots App to help install and connect a HomeMatic wall switch with a HomeMatic socket adapter.

While the two tasks it was also noted if the subjects' comments on anything relevant.



**Figure 11: Setting Task 1
(window sensor)**

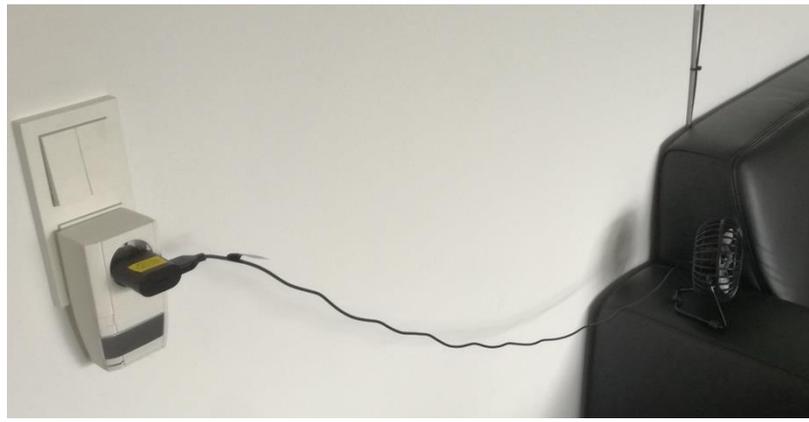


Figure 12: Setting Task 2 (socket adapter with connected ventilator)

Subsequently, and if possible during the tasks, the participants were asked to answer further questions:

- What do you think of the concept, is it sensible?
- What is good?
- What could have been better?
- What do you prefer most, video or text?
- Could you imagine recording your own video or using the app in general?

Once all tasks and questions were completed, the respondent received the technical affinity questionnaire. If necessary, further questions were clarified and further information about the project was discussed.

Scenario 2: Participants

For this scenario 12 persons, taken from the database of 'House of Hearing, Oldenburg' were tested. They all had the following socio-demographic characteristics:

- Age: Between 50 and 60 years
- Experiences with smartphones
- Overall there were six women and six men

4 Results of the evaluation

4.1 Test Scenario 1a: Support by installing AAL-devices (Germany)

4.1.1 Results of questionnaire

Out of the results, all participants were categorized into two different groups. Therefore, the median was calculated for each subscale. Participants with a value under the median were categorized as "less" and the others as "high". As the results showed, most of the

participants in scenario 1a were less enthusiastic for technologies. In all other sub-scales the group was more neutral.

<u>Subscale</u>	<u>Median</u>		<u>Less enthusiasm</u>	<u>High enthusiasm</u>
enthusiasm for technology	2	▶	1-2	2,5-5
<u>Subscale</u>	<u>Median</u>		<u>Less competence</u>	<u>High competence</u>
competence in handling technology	3,5	▶	1-3,5	4-5
<u>Subscale</u>	<u>Median</u>		<u>Less positive sequences</u>	<u>High positive sequences</u>
positive technology sequences	3	▶	1-3	3,5-5
<u>Subscale</u>	<u>Median</u>		<u>Less negative sequences</u>	<u>High negative sequences</u>
negative technology sequences	3,5	▶	1-3,5	4-5

4.1.2 Procedure: Installation of an AmbiAct

In the beginning the participants were informed about the KNOTS project and how the AmbiAct works. Subsequently the task for the participants was to select the right AmbiAct for a NEAT emergency system, connect it with a lamp and to combine it with the emergency system. All necessary information for this task was to be found in the KNOTS App.

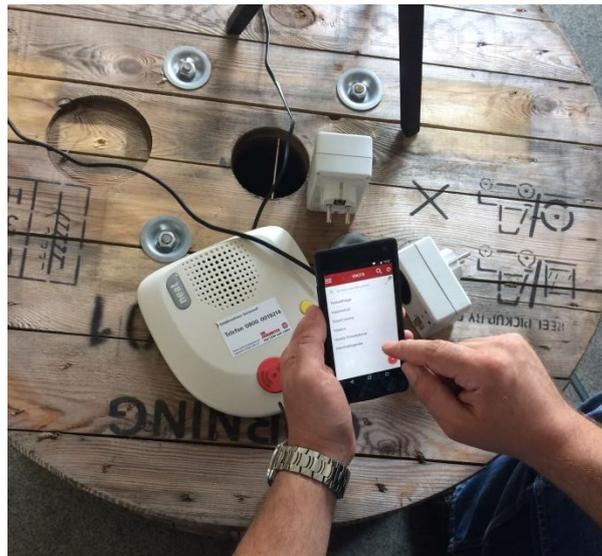


Figure 13: Procedure of installing an AmbiAct.

4.1.3 Results: Installation of an AmbiAct

All participants were able to solve their task within a maximum of 8 minutes. The faster ones needed about five minutes or less. The total time of the tutorial video was 2:19 minutes (blue line in Fig. 14); the green line indicated the mean value of the task fulfillment.

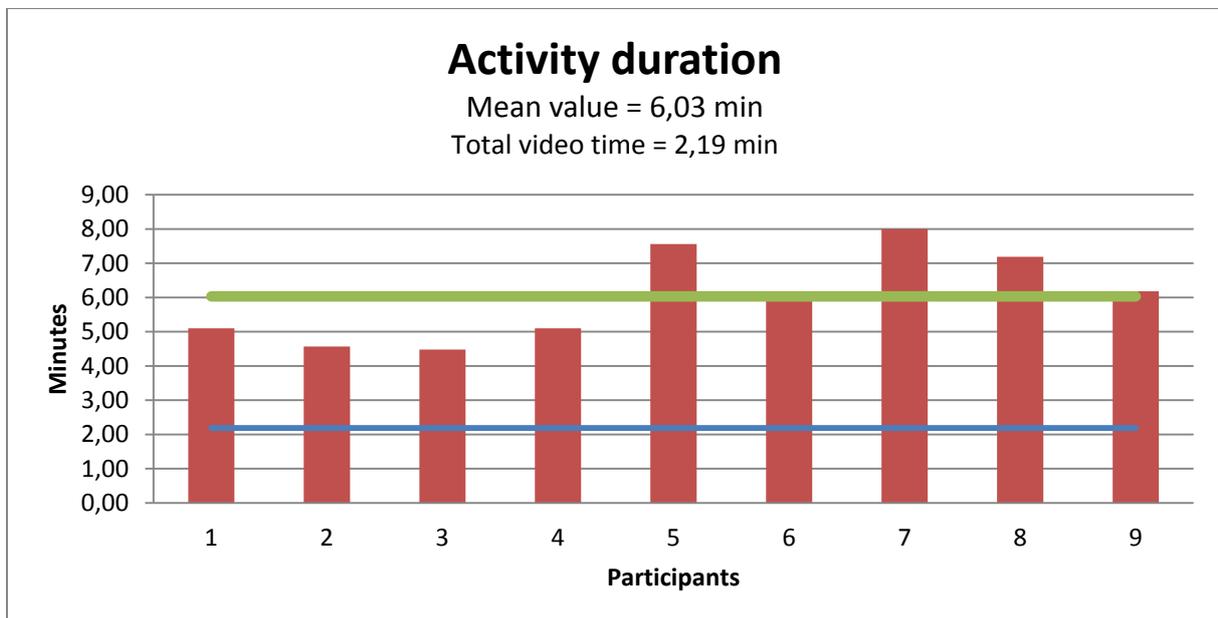


Figure 14: Activity duration by installing an AmbiAct

The categories were not directly comprehensible for four persons. Three of the four first searched for the necessary information in the household appliances category.

In the right category, all but two participants read the tutorial text.

Seven persons mentioned, that the app would have a simple design. The other two asked for more icons and pictures in the app.

After the test procedure, the participants filled out three more questions about the general usability. More than half of the people thought that KNOTS could be helpful by installing unknown devices. No one thought it is useless.

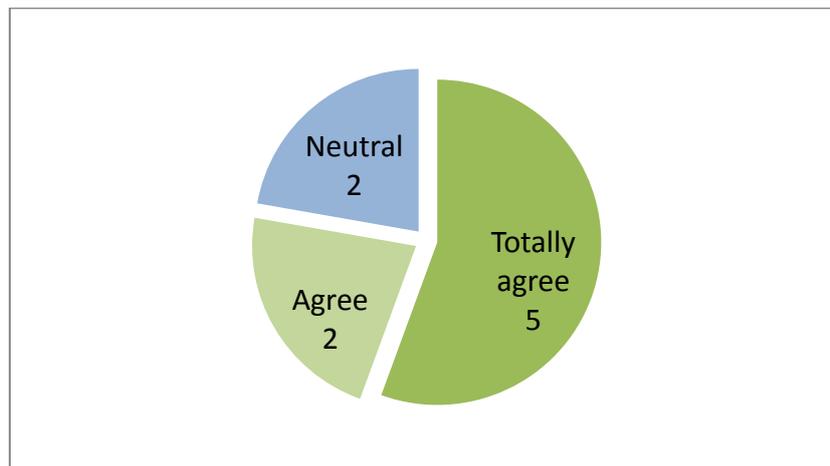


Figure 15: I consider such a system meaningful when installing unknown devices.

Two of the participants thought that it is not easy to use the app and one answered it with neutral. These three persons were the ones that searched in the wrong category for the necessary information by installing AmbiAct.

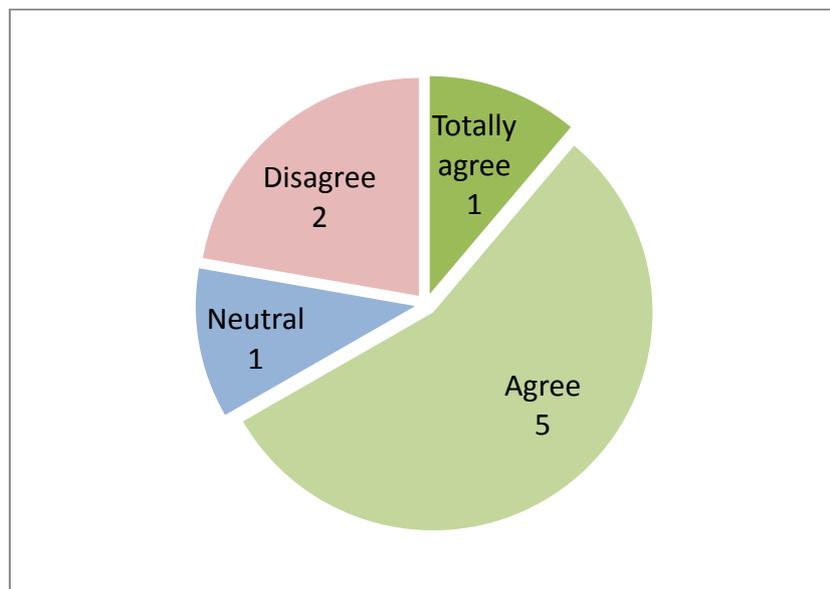


Figure 16: To operate with the app was simple

Nearly all participants had fun by operating with the app. Only two selected neutral here.

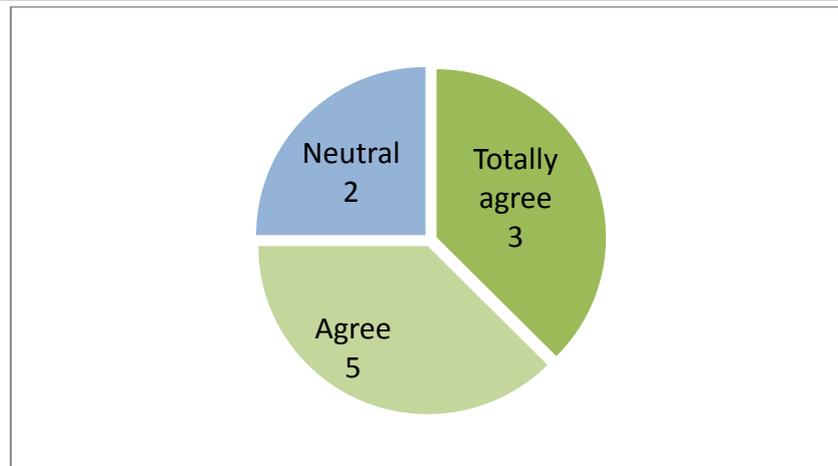


Figure 17: To operate with the app has been fun

The results indicated a comparatively high acceptance of the KNOTS app, despite the fact, that the users showed relatively low scores for enthusiasm for technology, an indicator for an acceptance of broader groups of technicians and good acceptance of the KNOTS app.

4.2 Test Scenario 1b: Support for technicians and care staff from DORO and HTK by installing AAL devices (Sweden)

4.2.1 Procedure

Technicians installed the app at the homes of the end-users following the instruction video. The elderly persons managed to be able to handle the solution themselves after five times.

The test persons were asked and volunteered to participate. After installing the app the following devices were tested; fire alarm, bed alarm, care phone and door alarm. Firstly, The video was shown first and the test persons operated the system themselves afterwards.

4.2.2 Results:

- Search function could be easier to handle. Not intuitive enough.
- Subtitles were not applicable for Swedish version.
- Sorting categories was acceptable.
- Video option was highly appreciated.
- Majority preferred the app to generate the content.
- It was relatively cumbersome to use the app to solve issues arising.

4.2.3 Conclusion

Technicians are better equipped than elderly adults and other end-users to handle the app. So the outcome of the previous tests could not be fully transferred to the later ones.

4.3 Test Scenario 2: Support for people like neighbors, relatives or informal care givers by installing AAL- devices (Germany)

4.3.1 Results of questionnaire

As already described in Chapter 4.1.1., out of the results of the questionnaires the median was calculated and served to categorize the participants in different groups. As the results show, most of the participants had a relatively high enthusiasm for technologies. However, the participants were also critical of technologies, what was reflected in the results too. A gender differences could not be recognized.

<u>Subscale</u>	<u>Median</u>		<u>Less enthusiasm</u>	<u>High enthusiasm</u>
enthusiasm for technology	4	▶	1-4	4.5-5
			<u>Less competence</u>	<u>High competence</u>
competence in handling technology	3,25	▶	1-3,25	3.5-5
			<u>Less positive sequences</u>	<u>High positive sequences</u>
positive technology sequences	3	▶	1-3	3.5-5
			<u>Less negative sequences</u>	<u>High negative sequences</u>
negative technology sequences	4	▶	1-4	4.5-5

4.3.2 Procedure: Task 1: Battery change in a window sensor

For this purpose, the participants were provided with all the necessary materials: the packaging, incl. the manual, a computer / smartphone for research. The task was observed. The participants' solutions were recorded. Did she/he use the Internet to find out how the battery change is working? Did she/he look into the manual or tried it directly at the window contact to solve the problem?



Figure 18: Task 1 - Procedure while changing the battery

4.3.3 Results: Task 1: Battery change in a window sensor

More than half of the participants tried it directly at the window sensor (8). All of them had a high positive technology sequence. Two of them could not figure out how to change the battery and looked at the manual. Four of the participants first looked at the manual. Expect from one those participants were less enthusiastic.

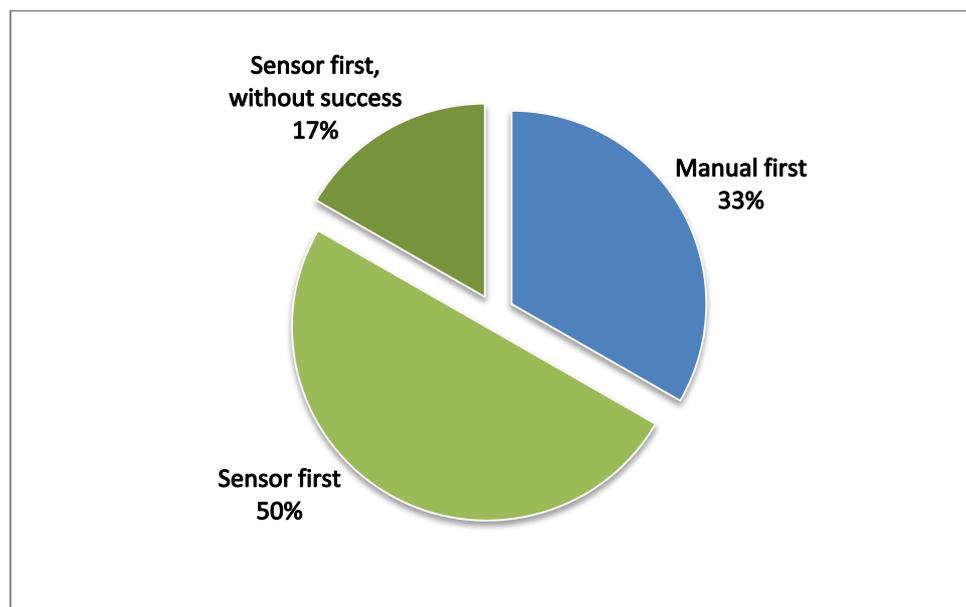


Figure 19: Results of the procedure while battery change

After the participants changed the battery, they searched for a solution in the internet. The Internet was the at least favored option. As this target group found it more complicated to check it on the web than to try it directly. All participants used google to find the necessary information. Most of the subjects were looking for the brand and the model or product type while browsing the web. This means that we should keep the categorization as intended.

Only two participants searched the internet directly for video help. The rest wanted a digital manual. The following figure shows the recorded search keywords.

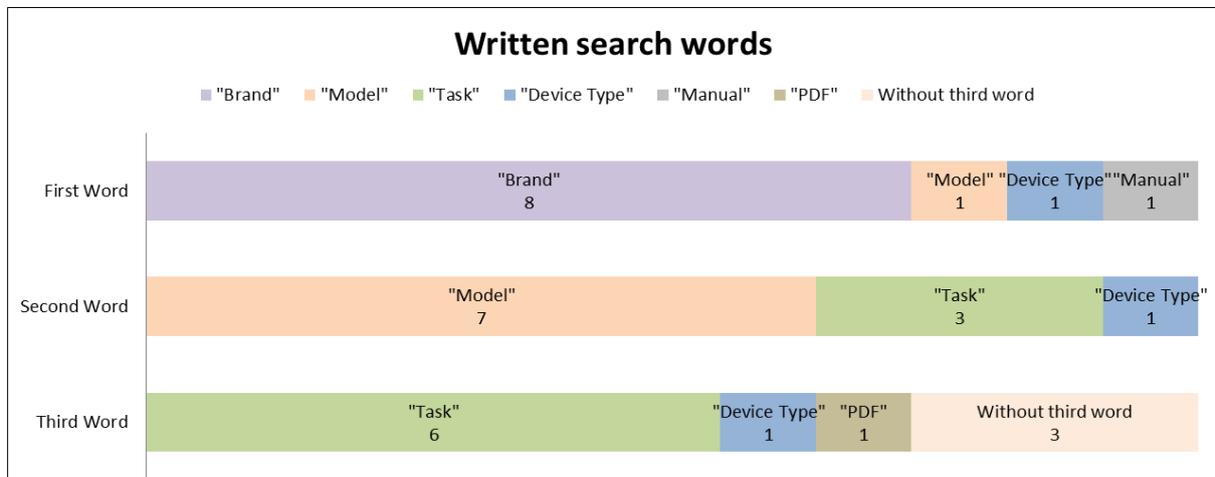


Figure 20: Results of search keywords

4.3.4 Procedure: Task 2: Installation of smart home devices

For this purpose, the participants used the KNOTS app and a computer to combine a HomeMatic wall switch with a HomeMatic socket adapter. All necessary information like a video and documents could be found in the KNOTS app. In advance, the moderator explained generally the features of the available smart home technologies. As in task 1, the test was observed and it was recorded which path in the Knots app was chosen. Comments were written down. Considering the path helps to build a user experience that is based on users demand.

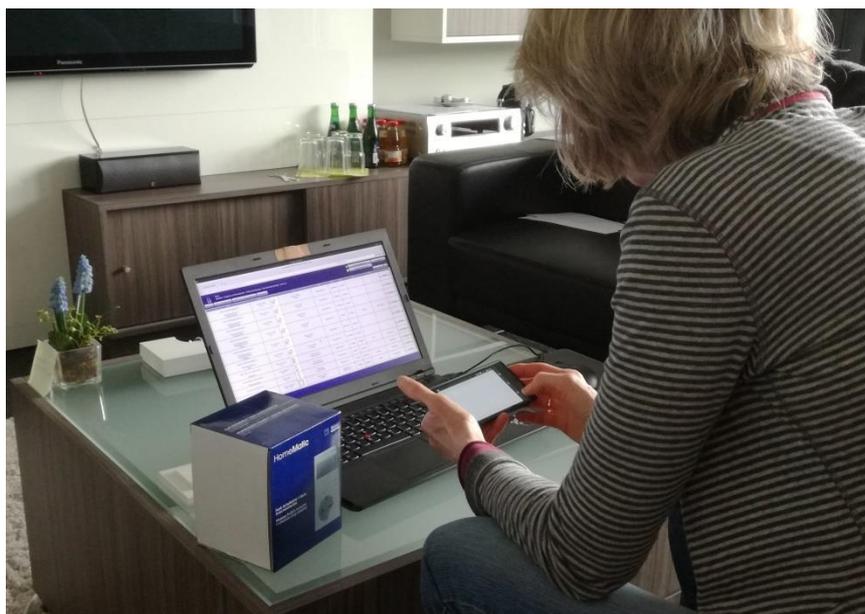


Figure 21: Task 2 - Procedure while combining smart home devices

4.3.5 Results: Task 2: Installation of smart home devices

Half of the participants ignored the explanation text within this option. It can be concluded from the feedback of the participants, that in the app the respective information should be displayed above the selection of content and video to be first seen and shorter to not be demotivating. The simultaneous use of smartphone and PC was sometimes too complex / strenuous for the target group. Most participants thought that subtitles in the video could be helpful. However, some test persons only listened to the video instead of watching it. They worked simultaneously with the PC. It was easier for many of the test persons to watch the video step by step and work parallel with the PC.

There was no difference between men and women, and also regarding the groups of enthusiasm for technology and competence in handling technology in solving Task 1. Both sexes tended to try it directly at the device at first. However, men seemed to be less afraid to use the PC and smartphone at the same time or to explore the App by themselves.

4.3.6 Results of the interviews

The test persons were interviewed about their opinion regarding the KNOTS system after finishing the tasks. The compressed results were:

- 8 of 12 persons rated the subtitles in the video as very useful for hearing impaired people.
- 7 of 12 persons assessed the search function is necessary but easily to be overlooked. It should be highlighted.
- Sorting categories should be according to frequency or alphabet
- Almost everyone liked the option of the videos (10 of 12 persons). However, for some only the text would also be sufficient (4 of 12 persons).
- The option to disable subtitles was rated as useful, however, should be selectable directly in the video. (4 of 12 persons)
- Two-third could imagine using an App like this to generate the content. But they were rather shy. Photo or text was more pleasant to generate.
- Three persons would use the app just to create notes for themselves. They did not want to share them with others.

4.4 Conclusion and further improvement

The evaluation showed that users were able to install complex technical systems using the KNOTS application. During former usability tests, the test persons asked for additional functions or optical improvements. In Scenario 2, eight of 12 persons said that the App should have more icons instead of text. In scenario 1a this was mentioned by four of nine persons. Especially the categories should have an additional pictogram. For simple use, pop ups with information about the functions are recommended at the beginning. Some test persons mentioned that the wording is not always clear. Especially 'Content' is not typically used in German for files like manuals or other information. Sometimes the back button switched directly to the start screen instead of to the screen before that should be fixed. In

addition to the videos or text files, a clear icon should be displayed; for example a 'play button' for videos. Using the videos a 'pause-button' should always be displayed, which would make it easier for users to work step by step. Finally, all test persons succeed by installing the different technologies. Summarized, it can be said that the results were very positive and the application was accepted.

References

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5 Appendix

5.1 List of application improvements (timeline: January - April)

General:

- The three tabs have been separated more clearly, the chosen tab is highlighted
- 'Add' was always displayed as an option, even if there was nothing to add.
- 3-dot menu from android were not recognizable as settings. Symbol has been changed
- Size of the font could not be changed in the app, only in general setting of the phone. Now possible in the app
- Selection of the surface language was not reliable
- No Swedish or Slovenian language integrated
- (Smartphone) Under 'Normal' for font size, Calendar and Knots Tabs were small, while Chat, Notes, and iCare were much larger, however, 'Normal' in landscape mode was working fine. Scaling was not correct.
- Content upload was not possible
- The 'Knots' lettering, which was always visible, was not recognizable enough as a 'real' logo. Looked exactly the same as the enlarged *Add*. It was not clear which of these was a button or a selectable action.
- App started in Knots-Tab and showed keyboard, as it was already in search function. You had to hide the keyboard by press 'Back' on the Phone. Keyboard did not disappear, if you switched to Chat or Calendar

Calendar:

- Dark red on event and black font of the date was difficult to read
- Marking of an event and the actual day was impossible to recognize separately
- In event saving disc and abort X to narrow to click exactly
 - o Red X difficult to recognize on red background
 - o No consistency – in other functions it was written 'save' no saving disc shown
- Slide gesture for changing the month was irritating, because in the other tabs a slide switches to another tab. Sliding the months in calendar tab was deactivated

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- Keyboard was always displayed and disturbed the view and orientation
 - Events could not be edited
 - It was not clear how to delete an event. Option only showed up after holding the finger down on the display for two seconds.
 - In new event saving looked like a headline and was not recognizable as an option
 - Calendar was reorganized in the hamburger menu. Knots is now shown initially

Chat function:

- Font size too small, had to be changed and colored black
- 'Send' button was too small
- While changing from landscape to portrait mode, the written text disappeared. Also vice versa.
- Keyboard was displayed initially. That disturbed the reading of content
- Chat was reorganized in the hamburger menu. Knots is now shown initially

Knowledge transfer database:

- Add was shown twice with same function. Reduced to one
- Reorganized the input interface for a new entry, it was not clear what to do first
- Saving was always possible, even if there was no information added
- Viewing a picture was always and only possible in editing mode
- No enlarging was possible
- There was no saving button, if information was added as a title for a picture and always going back was irritating
- While writing a description for an entry the keyboard hid the content you have written. Now displayed content scrolls up and responds to input
- Videos should start with navigation buttons displayed
- Subtitles did not work. They can now be enabled and disabled in the settings
- The magnifying glass symbol in the context of small characters was recognizable as a magnification option and not as a search function. Now a mark is placed around the input line
- Editing or deleting an Entry was not possible

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- Files could not be added to an existing entry
 - If data was changed and stored (in the Database), the message was not clear whether it was an error or a normal operation of saving
 - Video viewing on the tablet and smartphone distorted aspect ratio in the landscape mode
 - The list of videos of an entry always took place in portrait mode. Even if the smartphone was held sideways the app changes to portrait
 - Improved search functionality, to work with on all category levels
 - Search text to be smaller
 - Fixed crash on orientation changed in video
 - Showing close app or going back with BACK button

Other improvements in the different application versions:

KNOT_Unsigned_1.1.1

- In this version the current pages (Knots,Calendar,..) for changed functionality has prepared
- Testing what needs to be done

KNOT_Unsigned_1.1.2

- Improved search functionality, to work with on all category levels.

KNOT_Unsigned_1.1.3

- Version where you can click on top text, where you can see the path and you can go 1 level back.
- Also added text to content view.

KNOT_Unsigned_1.1.4

- search text to be smaller
- added subtitles On/Off to settings(at the bottom)
- fixed crash on orientation changed in video

KNOT_Unsigned_1.1.5

- Showing Close app or going back with BACK button

KNOT_Unsigned_1.1.6

- Fixed going back in "Add new item" window

5.2 TAEG- Questionnaire

	Totally agree	Rather Agree	Partly	Rather disagree	Strongly Disagree
1. I love to own new electronic devices.					
2. Electronic devices make you sick.					
3. I like to go to retailers for electronic devices.					
4. I have or would have understanding problems when reading electronic and computer magazines.					
5. Electronic devices enable a high standard of living.					
6. Electronic devices lead to mental impoverishment.					
7. Electronic devices make things much more complicated					
8. I inform myself about electronic devices, even if I do not intend to purchase them.					
9. Electronic devices make me independent.					
10. It is fun to try an electronic device.					
11. Electric devices make everyday life easier for me.					
12. Electronic devices increase security.					
13. Electronic devices reduce personal contact between the people.					
14. I know most of the features of the electronic devices I own.					
15. I am thrilled when a new electronic device comes onto the market.					
16. Electronic devices cause stress.					
17. I know about electronic devices.					
18. It is easy for me to learn how to operate an electronic device.					
19. Electronic devices help to get information.					