AMBIENT ASSISTED LIVING, AAL

JOINT PROGRAMME

ICT-BASED SOLUTIONS FOR ADVANCEMENT OF OLDER PERSONS' INDEPENDENCE AND PARTICIPATION IN THE "SELF-SERVE SOCIETY"

D2.3

Intermediate Evaluation Report

Project acronym:	**GeTVivid**
Project full title:	**GeTVivid - Let's do things together**
Contract no.:	**AAL-2012-5-200**
Author:	**PLUS**
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TERMINOLOGY & ABBREVIATIONS

E.g. ..... Example given

HbbTV ..... Hybrid Broadcast Broadband TV

ViA ..... Values in Action

SUS ..... System Usability Scale

1. EXECUTIVE SUMMARY

1.1 Link with the objectives of the project

In the GeTVivid project a user-centred design approach is applied that is combined with the Values in Action (ViA) approach. For the intermediate evaluations in T2.3 and the pilot studies in T2.4 the research goals and the evaluation procedure were defined in D2.1 (see Figure 1). The values for the Values in Action (ViA) approach were derived from the user requirements. They build the basis for the different evaluations and the iterative development. In T2.3 four evaluation rounds with users and experts will conducted before the final pilot studies in order to ensure a high quality towards the end of the project.

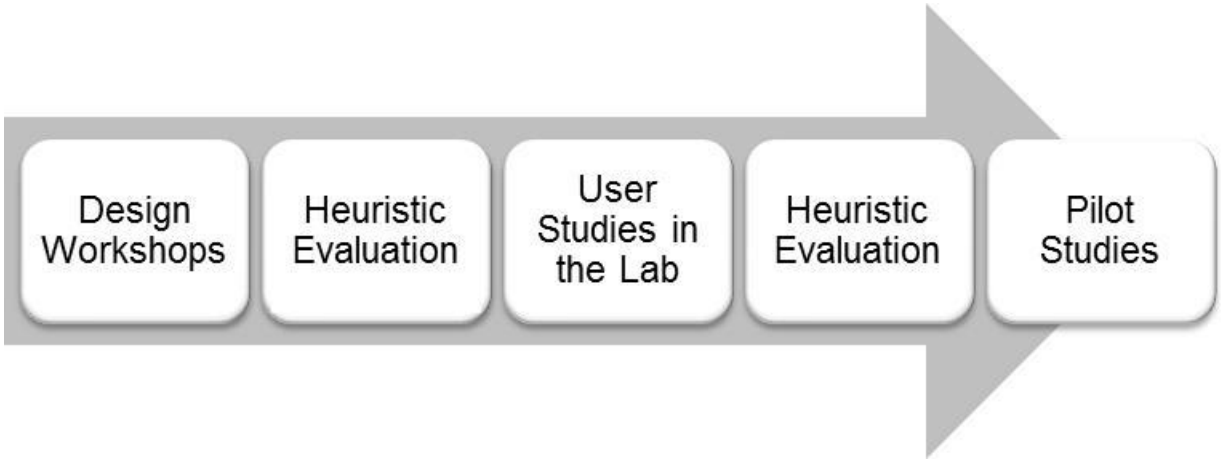


Figure 1: Evaluation Procedure

1.2 State of the art

In the following user-centred design, values and Values in Action approach are described.

1.2.1 User-centred design

The user-centred design [Norman and Draper, 1986] is a multidisciplinary design approach and philosophy, which describes a prototype-driven software development process, where the user is integrated during the design and development process. User-centered design is based on the active involvement of users and refers mainly to the usefulness and usability of a product [Mao et al., 2001]. It enables emergent interaction between designers & developers and users, and finally enhances users' acceptance.

The approach consists of several stages, which are iteratively executed: Requirements analysis, design/ implementation, and evaluation. It is a multi-stage problem solving process that not only requires designers to analyse and foresee how users are likely to use a product, but also to test the validity of their assumptions with regard to user behaviour in real world tests with actual users.

1.2.2 Values

Values are "*desirable transsituational goals, varying in importance, that serve as guiding principles in the life of a person or other social entity*" [Schwartz, 1994, p.21]. Values define what a user considers important in life [Friedman et al., 2008]. Values are centred in people and refer to the properties or features of the desired objects (e.g., technologies) [Fuchsberger et al., 2012].

1.2.3 Values in Action (ViA)

The Values in Action (ViA) approach aims to support value- and user-centred design in AAL projects. ViA is based on the consideration that values can include both the user's perspective (e.g., emotions or experiences), as well as technological aspects, which are important for AAL projects. It assigns needs from the requirements analysis to different factors related to usability, user experience, and user acceptance and the six different values (i.e., functional, social, emotional, epistemic, interpersonal, and conditional).

Fuchsberger et al. [2012] developed the ViA approach in order to find a suitable evaluation approach that combines usability, user experience and user acceptance and assesses users' requirements and needs. ViA is based on the consideration that values can include the user's perspective (e.g., emotions or experiences) as well as technological aspects (e.g., accessibility or adaptivity), which are important for AAL projects. ViA can also provide a valuable input for the business perspective in terms of helping to define the value proposition [Moser et al., 2014]. In D2.1 the different values and factors for GeTVivid are described (see also Figure 2).

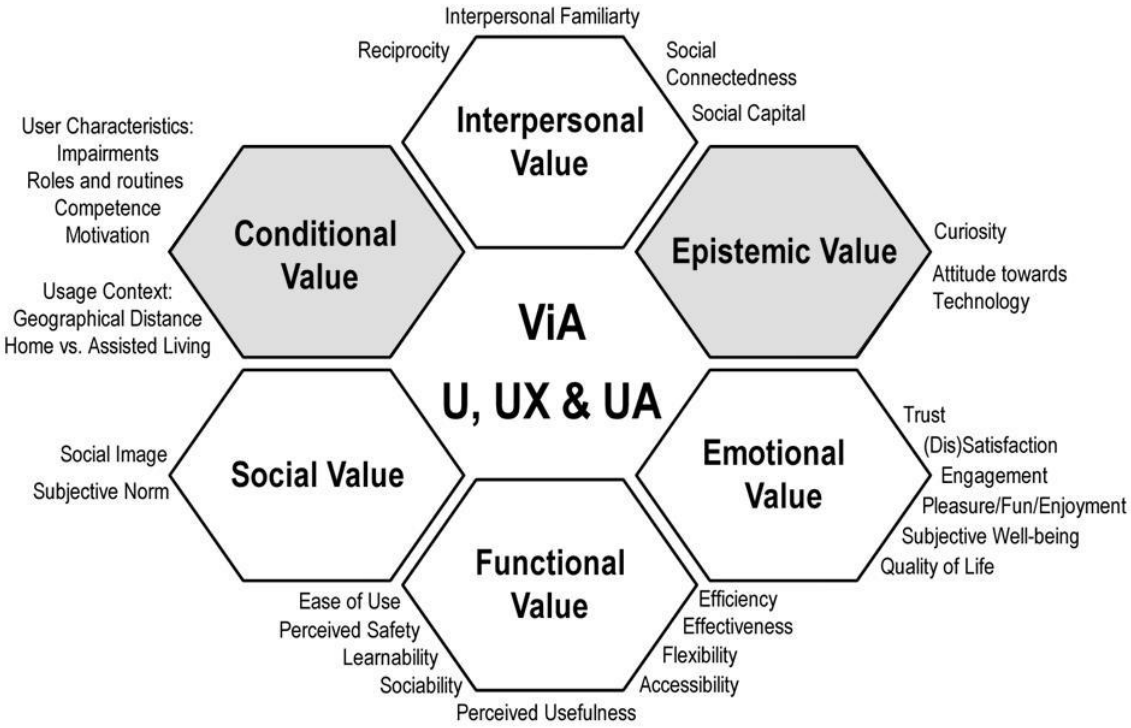


Figure 2: ViA for GeTVivid

2. DESIGN WORKSHOPS

Based on the findings from the requirements analysis first design sketches for the mobile device (i.e., a click PDF for the tablet) were developed and iterated with the partners. Afterwards, a video prototype was created to illustrate a possible interaction between the TV and mobile device. The design sketches illustrate different functionalities by showing several exemplary screens. As a first evaluation activity, workshops took place in Austria, Switzerland and Germany. In Switzerland two workshops were conducted, in Austria and Germany one in each case. The participants of the workshops were asked to evaluate the appropriateness of these sketches in an exploratory manner.

2.1 Research Goal and Questions

The workshops aimed at evaluating the ideas and concepts for the GeTVivid platform by means of mock-ups and design sketches to gather first insights from an end user perspective. The design sketches illustrated different functionalities the platform provides. Based on scenarios participants were asked to evaluate to what extent the system meets their needs regarding support in activities of daily living. Accordingly, the following main research questions were defined addressing different values of the ViA model.

Functional value:

RQ 1: How complete can users perform a defined task on the system? (Effectiveness)

RQ 2: To which degree do the users believe that the system will meet their expectations? (Perceived usefulness)

RQ 3: To which degree do the users believe that the system would facilitate achieving their goals? (Perceived usefulness)

Emotional value:

RQ 4: How satisfied are the users with the functions and usage of the system? (Satisfaction)

RQ 5: What attitudes do the users have towards the system? (Satisfaction)

Epistemic value:

RQ 6: To what extent does the usage of the platform provoke the user's curiosity about and interest in the system and its content? (Curiosity, interest, preferences)

2.2 Methodological Approach

Our design workshops were based on the idea of participatory design, the approach of involving users through a design process [Read et al., 2002]. The structure of the workshop allowed users to express themselves and provide feedback on first design sketches for the GeTVivid platform. Small videos, design sketches, etc.

encouraged participants to reflect on different functionalities. The aim was to get an embracing picture of opinions, likes and dislikes in order to improve the ideas and concepts with feedback from the end users in an early stage of the development process. The workshops are part of an iterative evaluation, trying to improve developments during the implementation. The workshops were carried out at the EUOs place, in Austria, Germany and Switzerland. EURAG and VMKN carried out one workshop and CURAVIVA two workshops, each lasting for approximately 1.5-2 hours including a short coffee break of 15 minutes. All workshops were recorded with in order to prepare the transcripts, which were the basis for the analysis, carried out by PLUS.

2.3 Participants

In the workshop 24 older adults (4 male and 20 female) participated (EURAG recruited 6 and VMKN 7 older adults related to Frank and CURAVIVA recruited 11 older adults related to Anna). Older adults related to Frank (N = 13, 2 male and 11 female) were between 57 and 79 years old (mean 72,46 years) and older adults related for Anna (N = 11, 2 male and 9 female) were between 77 and 91 years old (mean 85,70 years). In the following the participants were divided and are representing our two personas Anna and Frank.

Anna is living in assisted living houses and has lost her husband. She is not convinced that in general new technologies enhance her life. She was thinking several times to buy a new tablet. She has no computer, but a mobile phone without internet access and appraises her computer as well as mobile phone skills as rather bad. She also has a TV without internet access, appraises her skills as rather good and watches 1-3 hours TV. Regarding activities of daily living, she receives help from others (i.e., no family, friends or acquaintances).

Frank is living at home with his wife. He is convinced that new technologies enhance his life. He had recently bought a new telephone. He has a computer with internet, but a mobile phone without internet access and appraises his computer as well as mobile phone skills as middle. He also has a TV without internet access, appraises her skills as rather good and watches 1-3 hours TV. Regarding activities of daily living, he receives support from different people, for example, from the family or the household help for household activities.

2.4 Results

In the following the findings for the different values and research questions will be presented.

2.4.1 Functional value

RQ 1: How complete can users perform a defined task on the system? (Effectiveness)

As Anna had no or little pre-experience with tablet, she struggled with the usage of the prototype on the tablet (e.g., did not know how to get back). She also believes that the text entry is strange on the tablet (as there is not tactile feedback) and with motor impairments it might be very problematic on the TV. She was wondering:

- Who is everyone? Who is trustful in the system?
- Why similar existing offers/demands are displayed when entering a new one?
- Whether the displayed time and date are the current one?
- What does “Nr. of Requests” mean in the offer form?

- What does “Edit” in the profile mean?
- What are tags? Icons were also not clear for Frank.
- What to do with old offers and demands in the profile? Frank was also wondering about this and would hide them in the history.
- What is possible to change in the settings?

Frank had problems to recognize all the items correctly (e.g., the location and time icon when posting an offer or demand, the three lines next to settings caused problems, the bell or alarm icon) and was confused about the difference of category and tags when posting an offer or demand. He was missing more information about the offers and demand (i.e., not only when but also where). In the profiles he was wondering how the platform knows what the favourite activities are (otherwise just call it activities). He would prefer other colours for the categories in the search function and would like the possibility to rearrange the categories in order to customize the interface. Anna and Frank would prefer more information in the calendar not just points, for example, appointment should contain text. Anna would like to add also other appointment.

RQ 2: To which degree do the users believe that the system will meet their expectations? (Perceived usefulness)

Anna having no or little experience with the computer prefers the usage of the system on the TV, but would be willing to also use the tablet in combination (which is of particular interest for the care institutions offering assisted living). Frank could imagine to use the platform also only on the tablet, as the usage would be easier, more intuitive, more comfortable and place independent. Using the platform only on the TV was not very interesting for Frank, as he expects it to be rather complicated (e.g., to write or setup the internet on the new TV). Both would rather not buy a new TV in order to be able to use the platform.

Anna and Frank believe that the platform enables simple and not binding support. However, Frank is worried how well the platform would work on the countryside (where not so many people are living) and if there are enough people willing to offer support for free (i.e., without getting paid).

RQ 3: To which degree do the users believe that the system would facilitate achieving their goals? (Perceived usefulness)

For Anna and Frank the platform in general is useful, as it enables a simple and not binding support. For Anna, in particular, the notification function is very useful. For Frank, in particular, the nearby function is very useful.

2.4.2 Emotional value

RQ 4: How satisfied are the users with the functions and usage of the system? (Satisfaction)

Frank believes that the usage of the platform requires technical skills to set it up and use it. However, he is satisfied with the usage, as it gets clear while trying out (using error and trial principle). He likes the possibility to select recipients, as not everybody should always receive everything. He was also wondering, where friends can be added or certain recipients be cancelled or blocked.

Both are satisfied with the size and colour of the icons on the tablet and like the possibility to limit the offers/demands with categories. Anna likes the logical and neat structure. She appreciates to know where people are coming from and how old they are. However, she is not familiar with writing messages and can therefore not imagine how this function would work.

RQ 5: What attitudes do the users have towards the system? (Satisfaction)

The platform addresses the problematic of aging well. However, some older adults are already very well connected (using telephone, social networks or seeing each other at meetings). Anna and Frank are worried about the security, the potential users of the platform (i.e. want to know them) and who is behind the platform. One suggestion was certificating the users on the platform in order to raise trust, in order to avoid wrong information in profiles. Another one was to enable blocking of users. Other issues raised by Frank and Anna were:

- Where can be information about the platform found?
- What happens in case of an accident or fraud?
- What about the costs? (e.g., how to cover the costs for a new TV and tablet in case of a small income)
- Who is responsible for user management?
- How can we trust in other users that we don't know?

2.4.3 Epistemic value

RQ 6: To what extent does the usage of the platform provoke the user's curiosity about and interest in the system and its content? (curiosity, interest, preferences)

Anna is interested in the platform and can imagine posting demands. However, if older adults are already well connected the proposed solution will not bring any additional benefit and people would not use it then. Meaning, the platform is more suitable for users that are already living in residential homes.

Anna and Frank like that help can be demanded for little things without asking professionals all the time. Additionally, looking through offers can be interesting. They also like the ratings of the users and thinks this is interesting.

2.4.4 Misc.

Franks was wondering whether there is an emergency button on the platform that can be used to receive help. Both were wondering, where the dos and don'ts are described on the platform (e.g., how can I get in contact with someone?; how to behave on the platform?).

The care institutions that organized the workshops with Anna in the residential care homes would like to use the platform.

The video prototype illustrated very well the combined usage of the TV and tablet. This helped Anna and Frank to understand a possible usage of the platform.

2.5 Implications

The design workshops revealed a variety of interesting insights on participants' satisfaction and attitudes towards the system as well as problems they experienced when trying to complete the defined tasks (e.g., post an offer or demand). Moreover, information about the perceived usefulness of different functionalities and interest in the platform was gained.

In general, both believe that the platform enables simple and not binding support and are satisfied with the usage of the platform. They provided a lot of improvement suggestions in order to increase the understandability. For Anna the intended usage of the platform is mainly new, as she has little experience with computer. Therefore, she raised a lot of issues related to task completion (e.g., it was unclear how to get back or the meaning of different labels was not clear). Frank had also minor problems to understand certain icons on the platform. Additionally, Anna and Frank would like to get more information on offers/demand and in the calendar at first sight. The biggest concerns were raised by both related to security and trust, which highlighted the importance of addressing them on the platform.

The following table gives a brief overview of the central results and possible implications. The document is structured according to the content on the GeTVivid platform.

Content	Problem/Missing	Implication/Improvement suggestion
General	Anna and Frank are worried about the security on the platform.	Investigate security mechanism
	Anna and Frank were missing an information page about platform.	Provide an information page about platform and also dos and don'ts should be described
	Anna was wondering, who it trustful on the platform.	Investigate trust mechanism
	Anna did not know how to come back.	Improve the back arrow
	Frank had problems to recognize items (e.g., bell and alarm).	Improve icons
	Frank was missing information about location of offers and demand.	Provide date and location information
	Frank was missing an opportunity to handle contacts and groups.	Provide possibility to add and remove contacts, as well as to create and edit groups
Offer/Demand	Anna wonders why similar existing offers/demands are displayed.	Move them from the middle to the right
	Anna wonders whether the displayed time and date are the current one. Frank had also problems to understand the icons.	Improve labelling and icons
	Anna did not understand "everyone".	Rename to "all users"
	Anna and Frank were not sure about the difference of tags and categories.	Improve labelling and icons
	Anna did not understand "Nr of requests".	Improve labelling
	Frank was wondering, if there is a possibility to cancel selected recipients.	
Profile	Anna was not sure what "edit" means in the profile for offers and demands.	Improve labelling

	Anna was wondering what to do with old offers and demands.	Make them accessible via a history icon
	Frank did not understand the 3 lines icon (e.g., for settings).	Improve icon
	Frank was confused about the meaning of favourite activities and how they are selected.	Rename to “most common activities”
Calendar	Anna and Frank would prefer more information in the calendar not just points.	Provide appointment text like in other calendars
	Anna would like to add other appointment.	
Search	Frank would like to have the possibility to rearrange the categories.	
Notification	-	
Messages	-	

Table 1: Central design implications

In a next step, the design is modified towards the identified implications. It is intended to involve experts and end users (e.g., for the iteration of the labelling and icons) in order to ensure to actually meet the target groups’ needs.

3. 1ST HEURISTIC EVALUATION

The development started with sketches for the mobile device (click dummy for the tablet) that were iterated with the partners. Afterwards, a video prototype was created to illustrate a possible interaction between the TV and mobile device. The iterated design sketches illustrated different functionalities by showing several exemplary screens. As a first evaluation activity, four workshops with end users took place in Austria, Switzerland and Germany. The participants of the workshops were asked to evaluate the appropriateness of these sketches in an exploratory manner. Based on the feedback a redesign was done and implemented for the TV and mobile device. As a next step the first prototypes will be evaluated with experts from different domains by conducting a heuristic evaluation.

3.1 Research Goal and Questions

We want to take advantage of the heuristic evaluation as it already can be conducted in an early phase of the development process in contrast to user tests. The main goal is to find usability as well as accessibility problems by having experts evaluating the interface while accomplishing predefined tasks. Based on scenarios participants are asked to evaluate to what extent the system meets their needs regarding support in activities of daily living. Thus major problems can be identified in advance in order to provide a properly working interface for the user studies. The following main research questions were defined addressing different values of the ViA model.

Functional value:

RQ 1: How does the platform enable the users to learn how to use it? (ease of use / learnability)

RQ 2: To which extent do the users believe that the platform would facilitate achieving their goals? (perceived usefulness)

RQ 3: How much effort is it for the users to perform a task in relation to the accuracy and completeness? (efficiency)

RQ 4: How accurate and complete can users perform a defined task on the platform? (effectiveness)

RQ 5: How flexible is the platform regarding individual needs and preferences as well as contexts of use? (flexibility)

RQ 6: To what extent does the platform address age related limitations (e.g., cognitive or physical) in terms of understanding, navigation, and interaction with the platform? (accessibility)

Epistemic value:

RQ 7: To what extent does the usage of the platform provoke the user's curiosity about and interest in the system and its content? (curiosity, interest, preferences)

3.2 Methodological Approach

Yet the development of technologies has been focused on usability for younger and skilled people. Now people with impairments or older citizens represent a growing group of active users. Thus the design of interfaces has to be rethought. It is important to take into account the needs and limitations of older people already in the development process [Duh et al., 2010]. As mentioned before, older people can be challenging participants in user tests. Hence it is recommended to conduct inspection methods, such as heuristic evaluations or cognitive walkthroughs prior to user tests.

According to Nielsen [1994] a heuristic evaluation is a discount method for evaluating an interface in an easy and cheap way. This method involves having some usability experts inspecting the interface in order to find any violations of the usability. A set of heuristics is used to assign the identified problems to them. The experts rate the problems concerning their severity for the application. The main advantage is that this method can be conducted in an early phase of the development process in order to find obvious usability problems and to prepare the interface for user tests. The heuristic evaluation will be combined with a cognitive walkthrough, where software developers or usability experts accomplish predefined tasks and look for any potential problems by empathizing with developed personas [Wharton et al, 1992], i.e., the system is examined in a more "natural" way form a user perspective. The experts will complete predefined tasks as it is important that to not only focus on violations of heuristics. The emerged problems will be assigned to pre-defined heuristics for the GeTVivid project and rated. The heuristics, personas, and an EXCEL sheet will be provided. In the EXCEL sheet the experts can note the found problems, which will be combined afterwards and rated in the last step.

Heuristics and Guidelines

The structure of the heuristics is split in three parts:

- System logic:
  All heuristics concerning the understanding of the user as well as the consistency of the system is listed under this point.
- User System Interaction:
  Heuristics once a user gets into direct interaction with the systems are listed under this point.
- Visual Design:
  Heuristics about the visual design asks for the graphical implementation.

The full collection can be found in the Annex A.

System Usability Scale (SUS) [Brooke 1996]

The SUS [Brooke 1996] is a simple, ten-item scale giving a global view of subjective assessments of usability. Despite being a self-described "quick and dirty" usability scale, the SUS has become a popular questionnaire for end-of-test subjective assessments of usability. Scoring the questionnaire yields a usability score in the range of 0–100, i.e., 80 to 100 users likes the system, 60 to 79 users accept the system and 0 to 59 users dislike the system. SUS items are:

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

Accessibility

It means that users with specified disabilities or limitations can perceive, understand, navigate, and interact with the system in a specified context and thereby achieve certain goals with the same effectiveness, efficiency and satisfaction of use as non-disabled people or people without limitations [Brajnik, 2008]. Accessibility items from a self-developed questionnaire are:

1. The labels (i.e., wordings) of functionalities in the platform were clear.
2. The meanings of the icons used in the platform were clear.
3. Important information was highlighted in the platform.
4. The colours used in the platform were well differentiable.
5. Selecting functionalities in the platform was not a problem.
6. The contrast between the foreground (e.g., text) and the background in the platform was high enough.
7. All necessary information to use the platform was provided in the system.
8. The navigation in the platform was always clear enough to proceed.
9. The main elements of the platform (e.g., menus or buttons) were highlighted well.
10. The warning signals (e.g., sound or visual signals) were helpful in order to use the platform.
11. Sufficient feedback was provided in the platform, to know whether my operations were correct or not.
12. A lot of choices were needed in order to reach a goal.
13. It was very challenging to interact with the platform, due to too much information on it.

3.3 Participants Profile

10 experts with various background participated (e.g., 3 HCI, 2 technical, 2 teacher for older adults, and 2 care), whereof 4 were male and 6 female aged between 29 and 50 years. 3 experts represented Frank (i.e., 2 HCI and 1 teacher) and the other 7 represented Anna (i.e., 1 HCI, 2 technical, 1 teacher and 2 care). We chose to have more experts to represent Anna, as she will have more problems to interact with the GeTVivid platform due to her missing expertise with new technologies. The expertise can be split into two different groups. Experts with the HCI background as well as the technicians have daily contact with systems and setups. The other group is more focused at the user and understand therefore the needs and requirements for elderly people.

They all agree that new technologies enrich their lives and that they are not critical towards new technologies. Most of them have bought new devices with touch functionalities recently. The mean rating of their PC and mobile phone expertise (with internet) as very good and their TV expertise as good (although 2 do not have a TV and 4 do not regularly watch TV).

3.4 Results

In the following the usage problems and findings for the values will be presented.

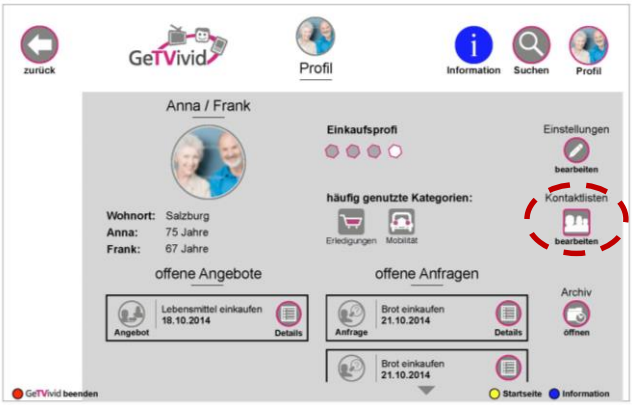
3.4.1 Usage Problems

The problems are described according to the mean severity ranking of the experts and the improvement suggestions were mainly provided by the experts and elaborated by the user interface designer from the project (i.e., they represent also the design implications for the next iteration)

Serious Usability Problem – Usability Catastrophe (4 – 3,5): High Priority		
Heuristics	Problems	Improvement Suggestions
	none	

Table 2: Serious usability problems – usability catastrophes

Major Usability Problem (3,4 – 2,5): Medium Priority		
Heuristics	Problems	Improvement Suggestions
User-System Interaction (3 + 6)	The TV on-page navigation structure was not clear (e.g., is there a clear order how to navigate? how do lists behave when navigating down? why does the system sometime jump to the next field and sometimes not).	Improve alignment of icons for better navigation with arrows on the TV and also reconsider the pre-selection of icons
Visual Design (2 + 5) System Logic (4)	On the TV the highlighting of selected objects is too low (i.e., sometimes it is not clear what can be selected and what is selected, why are categories icons other highlighted).	Improve highlighting with movement (i.e., change the size of selected icons for more attention on the TV)
User-System Interaction (1) System Logic (2)	It is unclear when and if message is sent (see Figure 3).  **Figure 3: Messaging service**	Provide timestamps and separate text entry from sending the message

System Logic (1 + 3)	There is a contradiction in the labelling (e.g., the red button does not mean exit but exit GeTVivid).	Revise and improve the colour coding of green
Visual Design (1. + 3 + 4)	Missing white space between different areas in the interface (e.g., between labels of icons, groupings, too much information/icons) - interface sometimes seems to be overloaded (see Figure 4).  **Figure 4: Offer Confirmation Screen**	Improve readability by providing more white space between groups of icons or columns of content or by reducing the icon size (use 2 instead of 3 different sizes)
User-System Interaction (4 + 6)	It was hard to find the function for managing groups (see Figure 5) and there is the possibility to manage groups while sending messages missing.  **Figure 5: Profile page – edit contact lists**	Change labelling from “contact list” to “groups” and provide access to group management also from messaging service
User-System Interaction (3)	The handling of circuit for all users was perceived to be complex and whether it can be used for all groups (see for example Figure 6).  **Figure 6: Selection of circuit for all users**	Offer the circuit for all user groups and not just for all users

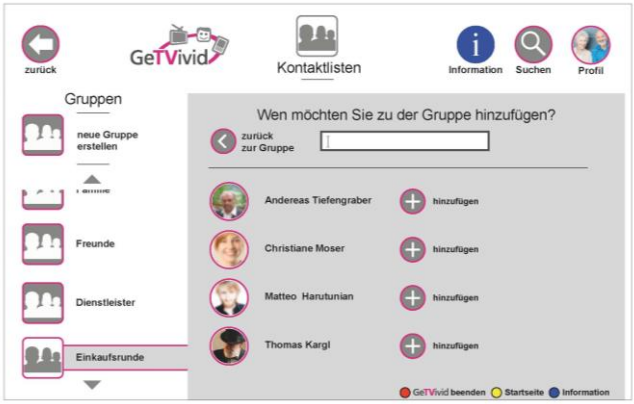
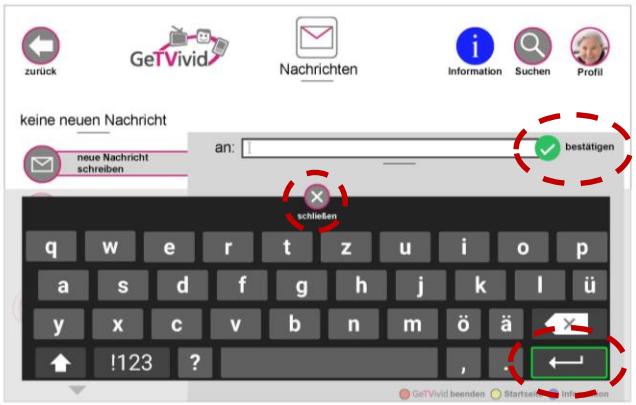
System Logic (4)	Missing consistency in the design of lists (e.g., unclear how long they are, bad line breaks, not alphabetical – see Figure 7).  **Figure 7: List examples in sending messages**	Define clear rules for the interface design in the style guide
User-System Interaction (3 + 6)	The procedure to create a group and to add members is not logical (i.e., it is not clear in which step the user is – see Figure 8), i.e., the task order to add a new groups is confusing and not logical (e.g., why is the second step directly adding users and not the group overview page, the search field was not recognized as such).  **Figure 8: Creating a new group of users**	After creating the group start with the empty group screen and not directly with adding new users
System Logic (3)	The group messaging function might be confusing as it is not a group chat function.	-

Table 3: Major usability problems

Minor Usability Problem (2,4 – 1,5): Low Priority		
Heuristics	Problems	Improvement Suggestions
User System Interaction (3)	The home button on the TV is hard to recognize and find (see Figure 9).	Make a button out of the Logo and provide a label

	 **Figure 9: Screen to create an offer**	
System Logic (3)	There was confusion regarding icons with similar functionalities (e.g., close and read for notification, close and send for messages - i.e., impression to send empty message with green button of the remote control, close and confirm for adding or deleting contacts – see Figure 10).  **Figure 10: Selection of a user to send a message**	For example, separate the steps of closing the keyboard and sending a message or remove the close button and only provide a cancel button
User System Interaction (5)	It was unclear what time and date in offers/demands are referring to (i.e., when the offer is posted of the offer is offered).	Provide more details on the different steps to make clear that date and time are entered in the second step
System Logic (3)	On the TV it is unclear how not visible content is indicated (e.g., how long lists are).	Provide scroll bars
System Logic (1)	The difference between messages and notifications is unclear.	-
User System Interaction (2)	The field to type text messages is too small in order to type longer text and see display it properly.	Increase size of text entry field
User System Interaction (1)	There are labels for number input is missing (e.g., hours or minutes).	Provide labels for all fields
User System Interaction (2)	The position of error messages (i.e., parts of the interface are not accessible any more) is disturbing (see Figure 11)	Should not cover parts of the interface, i.e., better to cover it completely or provide only highlighting and explanations

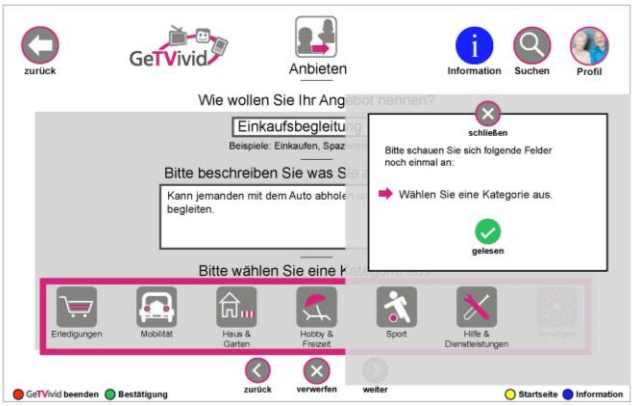
	 **Figure 11: Error message – user has forgotten to select a category**	
User System Interaction (3)	The positioning of next and back buttons is problematic as well as the positioning and meaning of step 1 to 4 in the offer/demand wizard.	Improve step by step navigation with labels
System Logic (3 + 4)	There is an inconsistent number entry (e.g., numbers vs. +/-).	Number entry either with predefined selection fields or numbers
System Logic (3)	Inconsistent labelling (most of the time below, but sometimes also on the side).	-
User System Interaction (3)	There is too much information on the profile page.	-
System Logic (1)	Inquiry is to similar to offer/demand.	Better use “send message”
System Logic (2)	It was unclear if the information button is the help function.	Use a “?” instead of the “i”

Table 4: Minor usability problems

Cosmetic Usability Problem (1,4 – 0): No Priority		
Heuristics	Problems	Improvement Suggestions
Visual Design (1)	Some icons look to technical.	-
Sociability (4)	Provide more details in the profile.	-

Table 5: Cosmetic usability problems

3.4.2 Functional value

RQ 1: How does the platform enable the users to learn how to use it? (ease of use / learnability)

The experts trying out both the TV and mobile client had more problems with the interaction of the GeTVivid platform on the TV. As the mobile client provided only limited functionalities and the PDF lacked full interactivity, there were also problems experienced by the experts.

RQ 2: To which extent do the users believe that the platform would facilitate achieving their goals? (perceived usefulness)

The rating concerning the usefulness of the platform was split in two parties. Those who thought that the service would help users achieving their goals thought about social isolated people. Those who were in doubt of the usefulness thought it would be easier to make a phone call. For sure therefore you need to have a social integration. So the platform can also help to overcome social isolation. Another main point why users could refuse the system is the complexity in handling. The navigation and as special the inputs on the TV application were mention as very difficult and exhausting.

RQ 3: How much effort is it for the users to perform a task in relation to the accuracy and completeness? (efficiency) and

RQ 4: How accurate and complete can users perform a defined task on the platform? (effectiveness)

The current version of the TV client is not accepted by the experts and has a poor usability (i.e., the mean SUS score is 38,13 N=4). They like the mobile client more than the TV client and the usability is ok for them (i.e., the mean SUS score is 55,50 N=10). For more details regarding the SUS ratings for the two personas Anna and Franks see Figure 12.

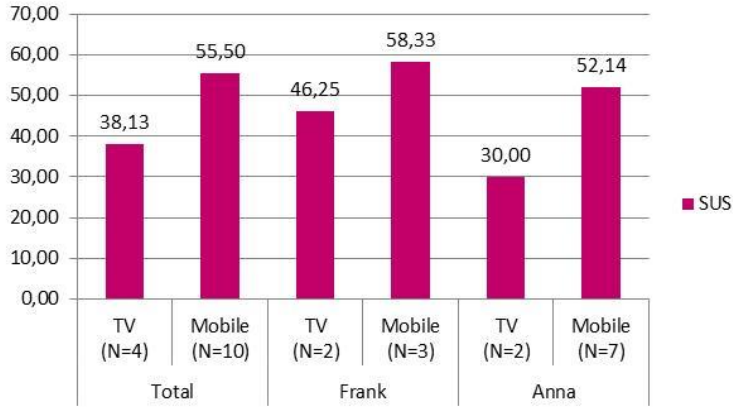


Figure 12: SUS scores (0-50 not acceptable, 50-70 user like it, 70-100 user accept it)

RQ 5: How flexible is the platform regarding individual needs and preferences as well as contexts of use? (flexibility)

The experts criticised that for most of the functions there is only one way to use it. As the navigation in general is a weak point of the system functions should be available more flexible. A number of experts recommended making more use of the remote control options a buttons. Number inputs should be free of choice for the remote control as well as for a keyboard. The text input was seen as the most inflexible part.

RQ 6: To what extent does the platform address age related limitations (e.g., cognitive or physical) in terms of understanding, navigation, and interaction with the platform? (accessibility)

The mobile client was in general perceived to be more accessible than the TV client (see Table 6). In particular, there were problems with the navigation and interaction with interface elements perceived, for example:

- important information was not highlighted enough on the TV;
- the navigation was not clear enough on the TV;
- selecting functionalities was a problem and there were a lot of choices needed on the TV;
- the main elements (e.g., menus or buttons) were not highlighted well enough on the TV;
- there was not sufficient feedback provided in order to know whether the interaction was correct on the TV.

Positively perceived was that all necessary information was provided to use the platform, the meaning of the icons, and the used colours as well as the contrast between elements were sufficient enough.

Accessibility Items	TV Client			Mobile Client		
	Total (N=4)	Frank (N=2)	Anna (N=2)	Total (N=10)	Frank (N=3)	Anna (N=7)
The labels (i.e., wordings) of functionalities in the platform were clear.	**2,75**	3,00	2,50	**2,60**	3,33	2,29
The meanings of the icons used in the platform were clear.	**2,00**	2,00	2,00	**2,30**	2,33	2,29
Important information was highlighted in the platform.	**3,50**	3,00	4,00	**2,80**	2,67	2,86
The colors used in the platform were well differentiable.	**2,25**	1,00	3,50	**2,30**	1,33	2,71
Selecting functionalities in the platform was not a problem.	**3,75**	3,50	4,00	**2,90**	2,00	3,29
The contrast between the foreground and the background in the platform was high enough.	**2,00**	2,50	1,50	**2,20**	2,33	2,14
All necessary information to use the platform was provided in the system.	**2,00**	1,50	2,50	**1,90**	1,00	2,29
The navigation in the platform was always clear enough to proceed.	**3,75**	3,00	4,50	**3,00**	2,33	3,29
The main elements of the platform (e.g., menus or buttons) were highlighted well.	**3,50**	3,00	4,00	**2,60**	2,33	2,71
The warning signals (e.g., sound or visual signals) were helpful in order to use the platform.	**3,25**	3,00	3,50	**3,20**	3,00	3,29
Sufficient feedback was provided in the platform, to know whether my operations were correct or not.	**3,50**	3,50	3,50	**3,10**	3,00	3,14
A lot of choices were needed in order to reach a goal.	**1,75**	1,50	2,00	**2,40**	2,67	2,29
It was very challenging to interact with the platform, due to too much information on it.	**2,75**	2,50	3,00	**3,10**	4,00	2,71

Table 6: Accessibility Questionnaire Items (1 = strong agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strong disagree)

3.4.3 Epistemic value

RQ 7: To what extent does the usage of the platform provoke the user's curiosity about and interest in the system and its content? (curiosity, interest, preferences)

The general demand is rated as very high. So the experts also value the interest for the platform as high. But the experts mentioned some key aspects as critical:

- Trust to strangers will get a challenge
- First experiences and user performance will influence the image
- A minimum of technical knowledge will be required
- Introduction to the platform and the usage should be made

One of the points that will enhance the interest is the social perspective. Due to the experts it will get more interesting if groups start to use the platform and not just single person. The issue will be if an active group (critical mass) uses the platform or not. The social aspect is important and so pages like the profile page will attract users' attention. As the value of the platform fit the users demand advertisement should be made to inform about the platform.

3.5 Implications

The expert evaluation revealed a long list of usability problems, whereof several were rated by the experts to be major problems that need to be solved before the upcoming lab studies. For example, the navigation, selection of functions and highlighting on the TV client needs to be improved. Other issues addressed the limited space and, therefore, oft missing white space for a better separation of information on the screen. In general, the sending of group messages and editing of groups can be improved, in order to provide more flexibility (e.g., see the new group member at once). All the problems that need to be addressed in the next iteration were explained in detail above and also improvement suggestions were provided for most of them.

Overall, the experts nearly accept the GeTVivid platform on the mobile, but not on the TV. Therefore, major improvements needs to be done. The experts highlighted the importance of building up trust and a proper introduction to the platform (e.g., tutorial videos). Concluding, the experts revealed a list of problems, whereof most can be solved with improvements in the prototypes during the next development cycles before the lab studies with real end users.

4. USER STUDIES IN THE LAB

The development started with sketches for the mobile device (i.e., a click dummy for the tablet) that were iterated with the partners. Afterwards, a video prototype was created to illustrate a possible interaction between the TV and mobile device. The iterated design sketches illustrated different functionalities by showing several exemplary screens. As a first evaluation activity, four workshops with end users took place in Austria, Switzerland, and Germany. The participants of the workshops were asked to evaluate the appropriateness of these sketches in an exploratory manner. Based on the feedback a redesign was done and implemented for the TV and mobile device. As a second step the first prototypes were evaluated with experts from different domains by conducting a heuristic evaluation. Afterwards, the prototypes were improved and the development continued. As a next step, the second prototype (containing already most of the planned features and functionalities) is evaluated with end users in a lab setting at the EUOs organization.

4.1 Research Goal and Questions

The user studies in the lab aimed at evaluating the second prototypes together with users in a laboratory (i.e., controlled) setting. The prototypes provided different functionalities that were evaluated to find out how well they satisfy users' needs. The user studies in the lab took place in Austria (organized by EURAG and PLUS), in Germany (organized by VMKN and PLUS), and Switzerland (organized by CURAVIVA and PLUS) with a total of 35 end users.

In the following, the central research questions are defined. They are structured according to different values as well as usability (U), user experience (UX) and user acceptance (UA) factors (as described in the evaluation framework document D2.1) that were addressed in the study.

Functional value:

RQ 1: How accurate and complete can users perform a defined task on the platform? (Effectiveness)

RQ 2: How much effort is it for the users to perform a task in relation to the accuracy and completeness? (Efficiency)

RQ 3: RQ How flexible is the platform regarding individual needs and preferences as well as contexts of use? (Flexibility)

RQ 4: To which extent do the users believe that using the platform is free of physical and mental effort? (Ease of use)

RQ 5: How does the platform enable the users to learn how to use it? (Learnability)

RQ 6: To what extent does the platform address age related limitations (e.g., cognitive or physical) in terms of understanding, navigation, and interaction with the platform (Accessibility)

RQ 7: To which extent do the users believe that the platform would facilitate achieving their goals? (Perceived usefulness)

RQ 8: To what extent does the platform support security and safety regarding safe use of different functions? (Perceived safety)

Emotional value:

RQ 9: To what extend do users trust other users and the system? (Trust)

RQ 10: To what extent are users (dis)satisfied when using the platform? ((Dis)Satisfaction)

Epistemic value:

RQ 11: To what extent does the usage of the system provoke the user's curiosity about and interest in the system and its content? (Curiosity)

RQ 12: To what extent does the attitude towards technologies change when using the platform? (Attitude towards technology)

4.2 Methodological Approach

We will apply a formative user study, which is usually characterized as a method to investigate the usability of interactive systems in order to design the respective system suitable in the users' sense. The main distinction between a formative and a summative study is set in the iterative nature of formative testing and the overall goal to improve the system's design [Tullis and Albert, 2008]. In the following, questionnaires and models are described, whereof items will be selected that are appropriate to answer the RQS and assess different factors (see also mapping in Section 1.4).

System Usability Scale (SUS) [Brooke 1996]

The (SUS) [Brooke 1996] is a simple, ten-item scale giving a global view of subjective assessments of usability. Despite being a self-described "quick and dirty" usability scale, the SUS has become a popular questionnaire for end-of-test subjective assessments of usability. Scoring the questionnaire yields a usability score in the range of 0–100, i.e., 80 to 100 users likes the system, 60 to 79 users accept the system and 0 to 59 users dislike the system.

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

Learnability

Learnability is about the easiness for users to accomplish basic tasks the first time they encounter the design [Nielsen, 1993] and the ease with which new users can begin effective interaction and achieve maximal performance [Dix, 2003]. Ease of use describes the extent to which an individual believes that using a particular system would be free of physical and mental effort [Chutter, 2009]. The easier the use of a system, the more likely is an acceptance by the user [Davis, 1989].

1. I need to learn a lot about the platform before I could effectively use it. (SUS)
2. I think I would need support of a technical person to be able to use this platform. (SUS)
3. I would imagine that most people would learn to use this platform very quickly. (SUS)
4. The information (texts, content) on the platform was easy to understand.
5. The icons and labels used were easy to understand for me.
6. It was difficult for me to learn how to use the platform.
7. Learning to operate the platform was easy for me.
8. I found it easy to get the platform to do want I want it to do.
9. My interaction with the platform was clear and understandable.
10. I found the platform flexible to interact with.
11. It was easy for me to become skillful at using the platform.
12. I found the platform easy to use.

Accessibility

It means that users with specified disabilities or limitations can perceive, understand, navigate, and interact with the system in a specified context and thereby achieve certain goals with the same effectiveness, efficiency and satisfaction of use as non-disabled people or people without limitations [Brajnik, 2008].

1. Important information was highlighted in the platform.
2. The colors used in the platform were well differentiable.
3. Selecting functionalities in the platform was not a problem.
4. The contrast between the foreground (e.g., text) and the background in the platform was high enough.
5. All necessary information to use the platform was provided in the system.
6. The navigation in the platform was always clear enough to proceed.
7. The main elements of the platform (e.g., menus or buttons) were highlighted well.
8. Sufficient feedback was provided in the platform, to know whether my operations were correct or not.
9. A lot of choices were needed in order to reach a goal.
10. It was very challenging to interact with the platform, due to too much information on it.

Perceived usefulness

It is the extent to which an individual believes that using a particular system would enhance performance [Chutter, 2009]. "*A system high in perceived usefulness … is one for which a user believes in the existence of a*

positive use-performance relationship" [Davis, 1989, p. 320]. The following items were derived from Davis [1989] and Chutter [2009]

1. Using the platform for my daily activities would enable me to accomplish them more easily.
2. Using the platform would improve my daily life.
3. Using the platform would enhance my effectiveness on the daily activities.
4. Using the platform would make it easier to do my daily activities.
5. I would find the platform useful for my daily activities.

Perceived safety

It describes the user's perception of the level of danger when interacting with a system, and the user's level of comfort during the interaction [Bartneck et al., 2009]. The following items were derived from McNamara et al. [1997] and Kreijns et al. [2007].

1. The platform enables me to easily contact with other people.
2. The platform enables me to get a good impression of other people.
3. I worry that I may be cheated on the platform.
4. I would be less likely to use the platform, if everyone could register on the platform.
5. I feel safe, as everyone has to register by the community manager.

Trust

It has been defined as "*the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party*" [Mayer et al., 1995, p 712]. A trustor's decision on whether or not to trust a trustee is a composite construct composed of the trustor's interdependent assessments of the trustee's benevolence, integrity, and ability, as well as their own propensity to trust, and any previous experiences they may have had [Mayer et al., 1995]. The following items derived from McKnight et al. [2002].

1. I think that people really do care about the well-being of others.
2. A user on the platform is sincerely concerned about the problems of others.
3. I think that people care enough to try to be helpful, rather than just looking out for themselves.
4. I think that most people keep their promises.
5. I think that people generally try to back up their words with their actions.
6. I think that most people are honest in their dealings with others.
7. I usually trust people until they give me a reason not to trust them.
8. I generally give people the benefit of the doubt when I first meet them.
9. My typical approach is to trust new acquaintances until they prove I should not trust them.
10. I believe that people on the platform would act in my best interest.
11. If I required help, people on the platform would do their best to help me.
12. People on the platform are interested in my well-being and not just in their own.
13. I believe that most (professional) people do a very good job on the platform.
14. Most people are very knowledgeable in their chosen field.

15. A large majority of (professional) people on the platform are competent in their area of expertise.

User satisfaction

It is the sum of feelings (positive and negative) or affective responses from using a system. Feelings, like satisfaction, lead to intentions of behaviour that themselves lead to actions (use). Subjective satisfaction refers to how pleasant a user finds it to use a computer application or a website [Nielsen, 1993]. The following items were derived from Nielsen [1993].

1. Using the platform was a very frustrating experience.
2. I worry that many of the things I did on the platform may have been wrong.
3. The platform provides everything I think I would need.
4. The platform is very pleasant to work with.

Curiosity

Hu et al. [2005] investigated curiosity and defined it as the tendency of users to seek for something novel. This is a condition for sustained interest and a prerequisite for users to focus their attention. Curiosity is also an important motivator for exploratory behaviour to gain new information. The following items were derived from Renner [2006].

1. I'm interested in the people on the platform.
2. I would like to learn about the habits of others with the help of the platform.
3. I would like finding out what others are doing on the platform.
4. I would like to look into other people's profiles.
5. When I see new offers and demands on the platform, I would take a look at them.
6. I'm interested in other people's thoughts and feelings.
7. Other people's life stories interest me.

Attitude toward using a technology

The attitude toward using a technology is defined as an individual's overall affective reaction to using a system, whereby the attitude toward behaviour, intrinsic motivation, affect toward use, and affect are important drivers [Venkatesh et al., 2003]. Once activated, attitudes and intentions will automatically guide behaviour without the need for conscious mental activities [Venkatesh et al., 2012]. The following items were derived from Venkatesh et al. [2003].

1. Using the system is a bad/good idea.
2. The system makes work more interesting.
3. Working with the system is fun.
4. I like working with the system.

4.3 Participants Profile

We conducted 26 lab studies, whereof 5 studies were pair testing's and 21 single testing's. For the lab studies 35 older adults were recruited by the three EUOs according to our persona profiles of Frank and Anna. Unfortunately, 10 recruited participants turned out to represent our Anti-Persona, whereof 5 could not finish the study due to mental overload. Therefore, we excluded them from the analysis of the findings and participants profile. From the remaining 30 participants 17 represented Frank (mean age 60,88), 8 Anna (mean age 77), and 5 our Anti-Persona (mean age 86,8 – see Figure 13).

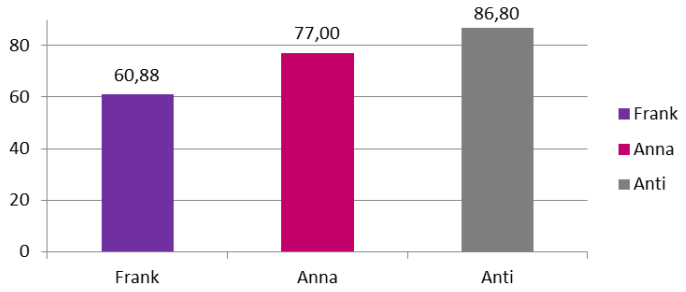


Figure 13. Mean age distribution of participants according to personas.

The participants representing Frank are still living at home mostly with their spouse. The participants representing Anna are living partly at home or still rather independent in assisted living houses. The participants representing the Anti-Persona are living alone in assisted living and receive professional assistance when needed. For more detailed information take a look at Figure 14.

Figure 14. Living situation of the personas

The participants representing Frank own a computer with internet and perceive themselves as experienced users. Two third of them own a mobile phone internet (the others without internet) and perceive themselves as (very) experienced users. Two third also own a TV with internet (the others without internet) and perceive themselves as rather experienced users.

The participants representing Anna mainly own a computer with internet and perceive themselves as rather neutral experienced users. All of them own a mobile phone without internet and perceive themselves as experienced users. Nearly all of them own a TV with without internet and perceive themselves as experienced users.

The participants representing the Anti-Persona do not own a computer and are not really experienced. However, they own a mobile phone without internet and perceive themselves as experienced users. They also own a TV with without internet and perceive themselves as rather neutral experienced users.

For more detailed information take a look at Figure 15, Figure 16, or Figure 17.

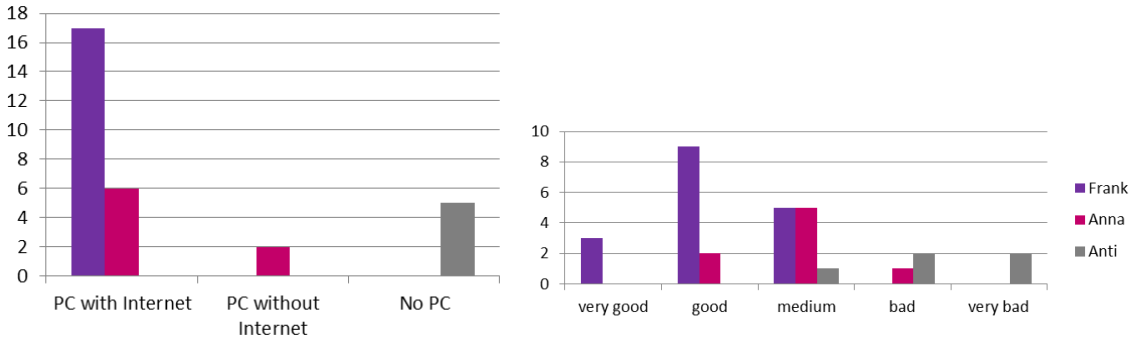


Figure 15. Computer usage per persona

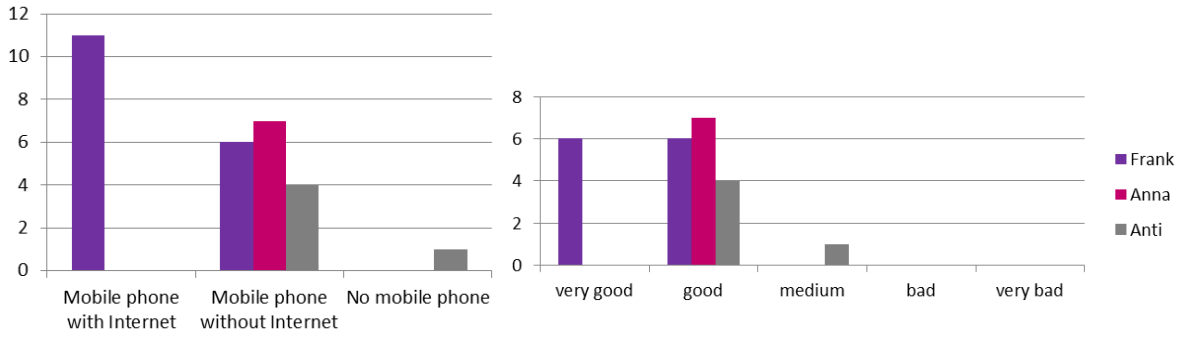


Figure 16. Mobile phone usage per persona

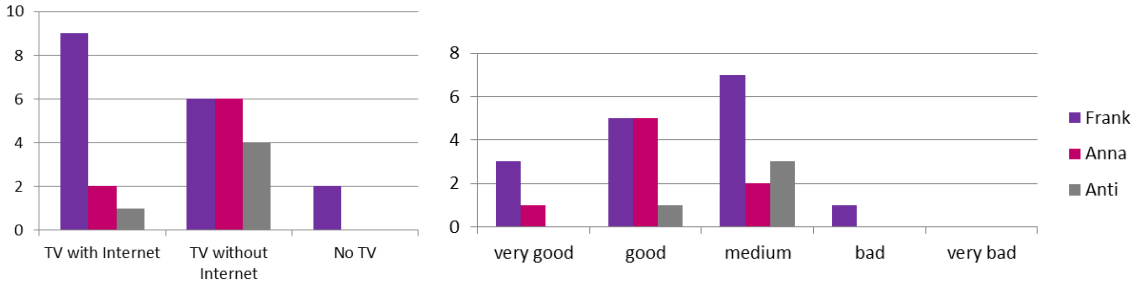


Figure 17. TV usage per persona

The demographic data shows that the two EUOs successfully recruited participants that represent our two main personas. We will include also the recruited Anti-Persona in the findings, in order to provide more comprehensive findings. In the following, the findings are described for Frank, Anna, and the Anti-Persona, in order to illustrate possible differences for our target groups.

4.4 Results

The findings are structured according to the values of the ViA Model [Fuchsberger et al., 2012], which are concepts or beliefs that direct human behaviour to specific actions (e.g., using a technology/system/application or refusing it), and support judging and justifying actions (e.g., the decision for a technology/system/application). Values are cantered in people and refer to the properties of the objects (e.g., technology) they desire, i.e. users seek to achieve their values.

4.4.1 Functional value

RQ 1: How accurate and complete can users perform a defined task on the platform? (Effectiveness)

This research question will be broken down for the different tasks performed, in order to provide more detailed insights.

Task 1 – Login on the TV and tablet; Connect TV and tablet

Frank could not solve this task without assistance (see Figure 18), i.e., around 3 assistance tips were given. For example, the navigation was hard to understand and the input fields as well as keyboard on the TV were not clear. From the milestones (see Figure 19) we can see that Frank managed to login (with assistance), but sometimes did not have enough time to find the profile and settings, in order to connect the devices.

Anna could not solve this task (see Figure 18), even with 2 assistance tips, like how to navigate on the TV (within the keyboard) and tablet. As entering and correcting the username and password took her so long, she did not have time to finish this task (see Figure 19). This task could not be fulfilled by the anti persona (for more detailed information take a look at Figure 18 and Figure 19).

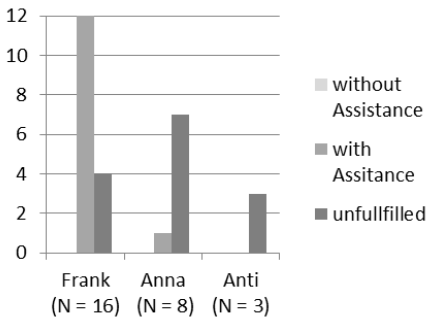


Figure 18. Task completion per persona

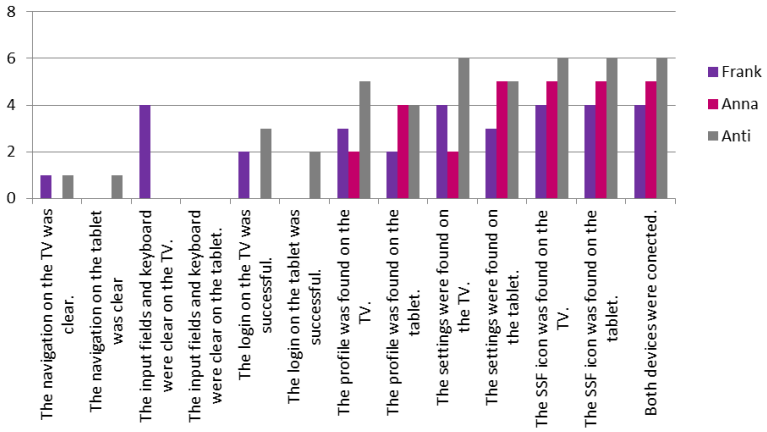


Figure 19. Unfulfilled milestones per persona

Task 2 – Create Group and send message on the tablet

Frank could only partially complete this task (see Figure 20), sometimes he did not have enough time to send the message (see Figure 21). He needed assistance, for example, with scrolling in the list of participants. Anna could not complete this task (see Figure 20), as finding, setting up the group, and adding the different members took too long, i.e., she did not have enough time to send the message (see Figure 21). The anti persona could also not complete the task and even struggled with adding members to the group (for more detailed information take a look at Figure 20 and Figure 21).

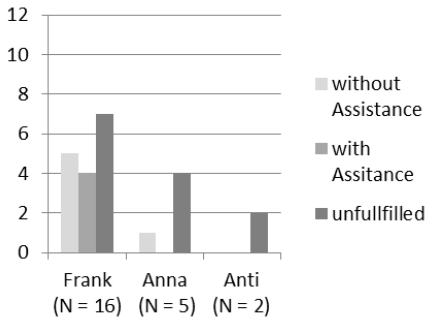


Figure 20. Task completion per persona

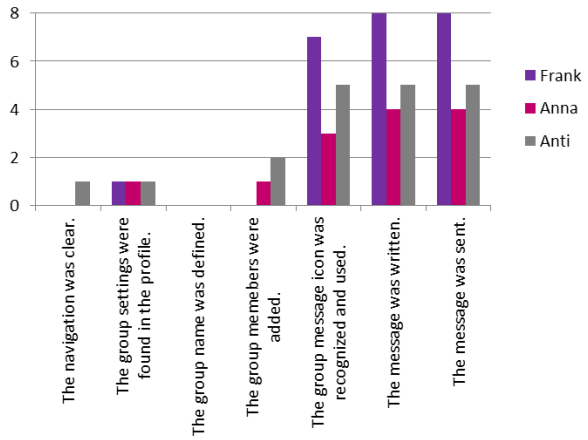


Figure 21. Unfulfilled milestones per persona

Task3 – Create offer on the TV

Frank could only partially complete this task (see Figure 22), sometimes getting to the first wizard page and entering the title as well as the description took so long that there was no more time to complete the task (see Figure 23). He needed assistance, for example, to find and start the offer creation process and to close the keyboard. Anna could hardly complete this task (see Figure 22). She struggled with starting the offer creation process and entering longer text like in the description. Therefore, she ran out of time and could not complete the task (see Figure 23). This task could also not be fulfilled by the anti persona (for more detailed information take a look at Figure 22 and Figure 23).

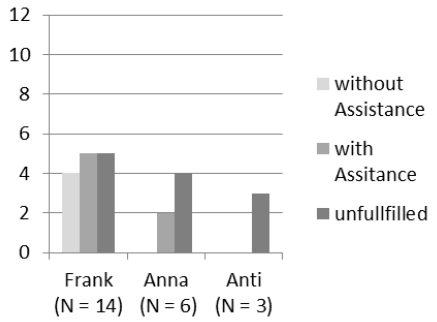


Figure 22. Task completion per persona

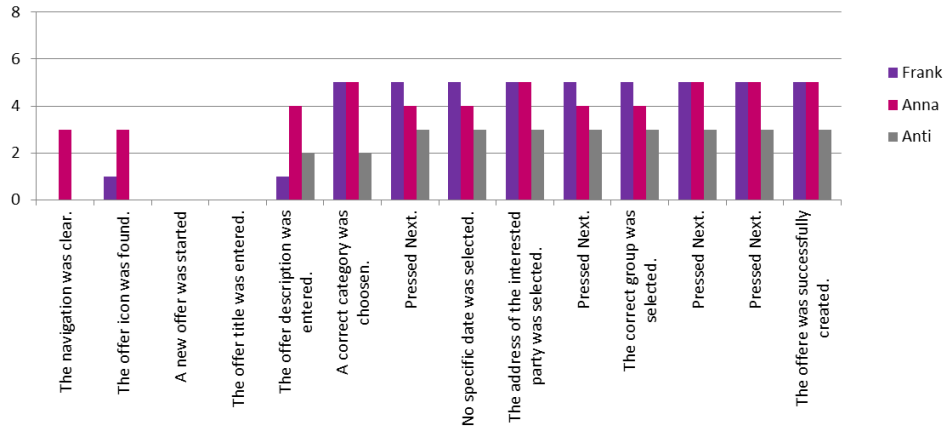


Figure 23. Unfulfilled milestones per persona

Task 4 – Create demand on the tablet

Frank could complete this task partly alone and partly with assistance (see Figure 22). He needed assistance to start the demand creation process on the start page. Anna could mostly partially complete this task (see Figure 24), sometimes getting to the first wizard page and entering the title as well as the description took so long that there was no more time to complete the task (see Figure 25). She also needed assistance to start the demand creation process and she had problems to understand the group selection. This task could also be partially fulfilled by the anti persona with assistance, like getting started with the demand creation process or finding the keyboard (for more detailed information take a look at Figure 24 and Figure 25).

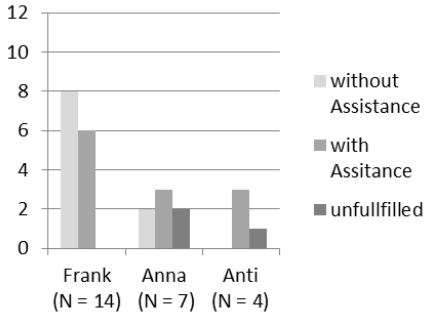


Figure 24. Task completion per persona

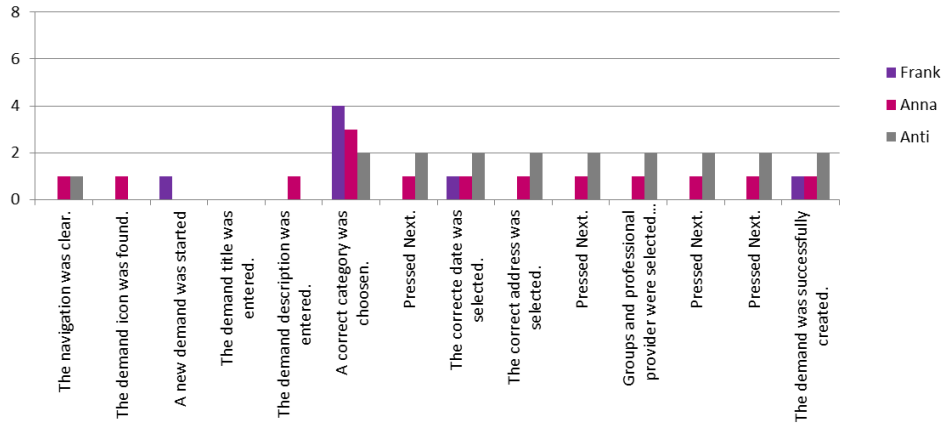


Figure 25. Unfulfilled milestones per persona

Task 5 – Accepting an offer on the TV in the newsfeed

Frank could mainly solve this task with assistance (see Figure 26), for example, by showing him the newsfeeds on the start page and supporting the correct date entry. Whereas, Anna could not really complete this task (see Figure 26). She struggled with understanding the newsfeed, getting back from the profile, or accepting the offer (e.g., the labelling "confirm" caused insecurity whether there would be an additional step coming or the offer is directly accepted). Therefore, she did not have enough time to finish this task (see Figure 27). This task could not be fulfilled by the anti persona (for more detailed information take a look at Figure 26 and Figure 27).

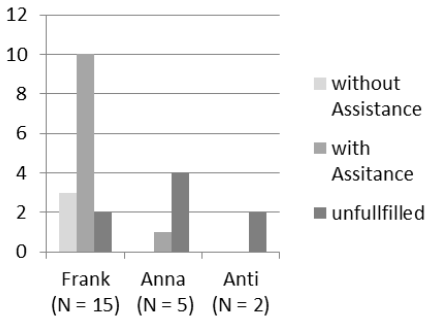


Figure 26. Task completion per persona

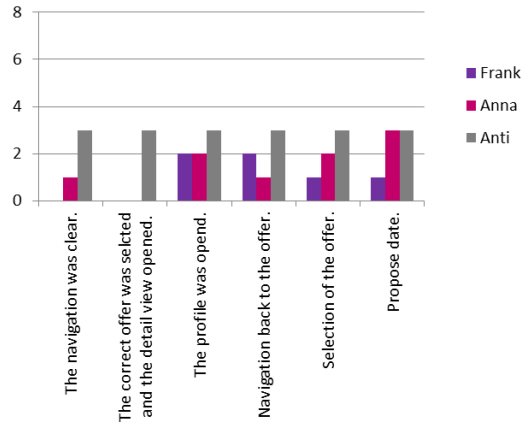


Figure 27. Unfulfilled milestones per persona

Task 6 – Matchmaking for demands and accepting a professional offer on the tablet

Frank could mainly solve this task with assistance (see Figure 28), for example, by explaining him how the matchmaking is working on the platform (i.e., starting a new demand and entering the title, see Figure 29) and again how to close the keyboard. Anna could partially complete this task (see Figure 28). She also needed an extra explanation how the matchmaking is working on the platform and how to interact with the keyboard. Again, she hardly did have enough time to finish this task (see Figure 29). This task could not be fulfilled by the anti persona (for more detailed information take a look at Figure 28 and Figure 29).

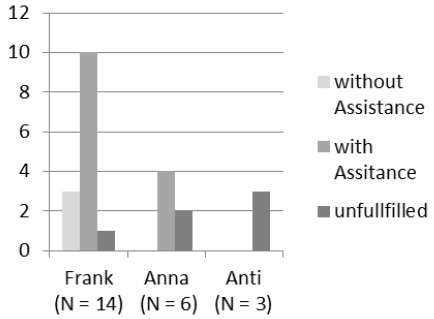


Figure 28. Task completion per persona

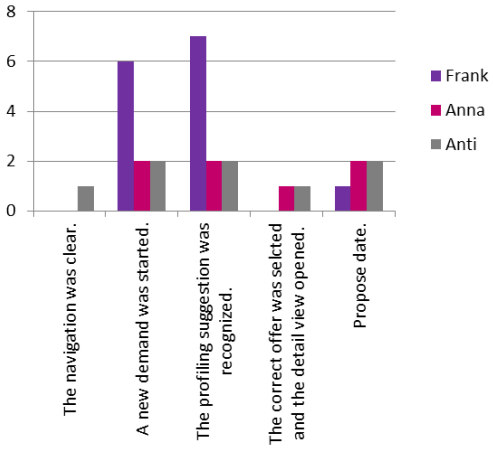


Figure 29. Unfulfilled milestones per persona

Task 7 – Free exploration on the TV or tablet

For the free exploration mainly the tablet was selected (only one Anna preferred the TV). Frank and Anna took a look at the messaging history and read the new message they had received. Sometimes they were also taking the additional actions needed for the appointment coordination (like sending the address, or answering to a comment). In this task a lot of extra explanations were provided to answer all the questions Frank and Anna had.

RQ 2: How much effort is it for the users to perform a task in relation to the accuracy and completeness? (Effectiveness)

In the following, the observed problems from the different tasks are summarized, described, and categorized according to their severity (i.e., how much they effected the efficiency). The listed problems disabled an efficient usage of the GeTVivid platform on the TV and tablet and need to be improved (therefore, improvement suggestions are provided). The findings are not split between Frank and Anna, as most problems affected both.

Serious Usability Problem – Usability Catastrophe – High Priority		
Device	Problem	Improvement Suggestion
TV	The text entry on the TV caused serious problems, most users wanted to use T9 provided on the remote control; The navigation and confirmation of letters, deleting them, upper case writing, or numbers caused problems	Offer T9 and qwertzi keyboard selection; when selecting a category pre-written text could be provided, or drop down list to choose titles and descriptions from (i.e., reduce writing effort)
Both	The consequences and meanings of fields and buttons were not always clear (i.e., users did not know what to do next and asked for a step by step explanation)	Provide "mouse over" or additional information after 5-10 sec of no interaction with fields
Both	The difference between offers and demands was not understood on the start page (e.g., Newsfeed)	Redesign of start page and subpages, show separate lists of offers and demands where possible
Tablet	Standard app behaviour rules are different in some cases (e.g., get the keyboard with a swip gesture from the side, or the number rotational input)	Improve the client by using standard elements and behaviour
Both	Keyboard hides important information (i.e., matching offers or demands)  **Figure 30. Exemplary keyboard**	Redesign - Other layout or 2 steps (type in field than back to the main screen)

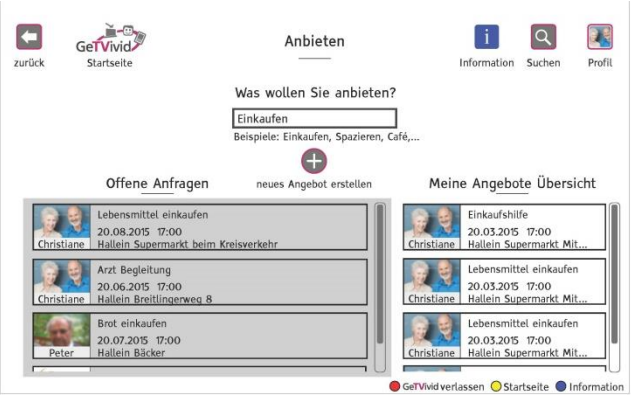
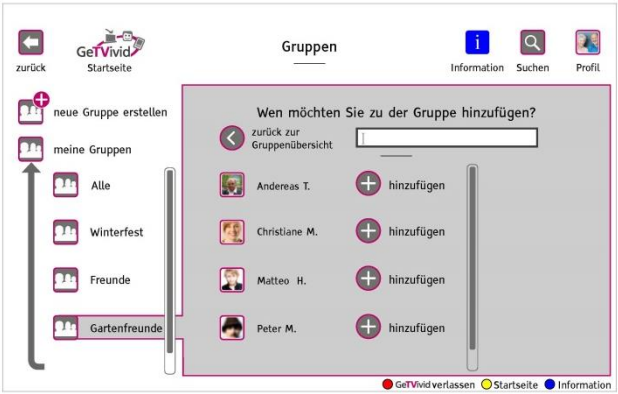
Both	Starting the demand – offer wizard with the button: “neuer Anfrage erstellen” was not understood  **Figure 31. Starting a new offer**	Redesign - Visual integration of the app into the wizard as step number 1

Table 7. Serious usability problems

Major Usability Problem – Medium Priority		
Device	Problem	Improvement Suggestion
TV	On the TV the highlighting of selected objects was sometimes confusing (i.e., sometimes it was not clear what is selected – purple was perceived as red sometimes, which was not interpreted as conform that is typically “green”) Overall, the main control buttons: ”next”, “confirm”, “delete” were badly recognized	New highlighting colour and rules (maybe “blink” effect) The main control buttons should be more outstanding (i.e., apply a green forward logic)
Both	Groups - adding and searching someone as well as the navigation and orientation caused problems  **Figure 32. Adding someone to a group**	Redesign - More information about the current status and direct interaction possibility (i.e. skip profile selection when adding someone), provide additional info (person X was added)
TV	Opening and closing the keyboard was hard to recognize	Text in empty fields should contain a message like “OK to open Keyboard” or user should be able to directly type with T9 Close button should be better integrated in the keyboard, maybe shortcut to close the keyboard
Both	Wizard: • Guide / bridge from one field to another was asked	The main control buttons should be more outstanding (i.e., also apply a green forward logic)

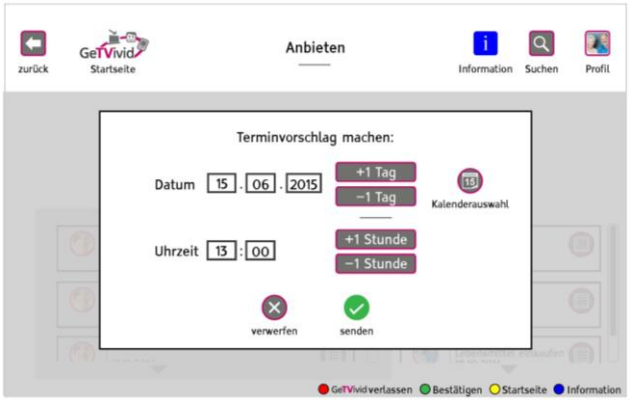
	• Title - everything was typed in here in the beginning, as it was not clear that there was a wizard	
Both	Appointment coordination process: the time proposals caused errors, it was not understood to put in a logical time proposal and +1/-1hour and day were sometimes understood as possibility to add a time span  **Figure 33. Time proposal**	Stronger focus on the importance of this field, information text: This is the time you propose for the event to take place!
Both	It was not recognized that • a message was not send • a demand/ offer was not made • a person was not added	Information in both cases: • "Message successfully send" • "do you really want to leave the message – it was not send yet"
Both	Responsibility, insurance, contracts, i.e., all legal aspects are not clear and not transparent, therefore, more information for professional offers is needed	Detailed service description and pricing, possibility to link to rules of agreement (see Amiona)
Both	Convenience of use and state of the art are not seen as appropriate  **Figure 34. Competitor cubigo**	Our challenge is to compete with e-mail, (mobile) phone calls, Facebook, etc.
Tablet	The SSF connection screen leaded partially to confusion	Support a corporate Design possible and better synchronisation of inputs
Tablet	Opening other Tablet functions in an extra bar at the bottom and not recognizing them as external functions	Is it possible to deactivate the bar on the tablet?

Table 8. Major usability problems

Minor Usability Problem – Low Priority		
Device	Problem	Improvement Suggestion
Both	Real time and date is missing (i.e., would be helpful when making appointments)	Implementation at least in the calendar or at screens where to choose a time
Both	Proposals of offers/ demands while creation process were badly recognized	Make the suggestion more prominent through redesign
Both	The main control buttons in popup windows were badly recognized (e.g., ”next”, “confirm”, “delete”)	Better highlighting, use green as positive forward guidance and “confirm” only if confirming a summery such as amazon purchase, as last step to get full control of the action
TV	There are 3 different types of radio buttons	Use new button design consistent
Both	While accepting an offer / demand it needs 2 steps to get back to the starting page	Provide an “exit” button
Both	Logo and claim were mentioned as misleading and the language mix was disturbing  **Figure 35. Logo and claim**	Only use logo without claim
TV	If there is a green Button to be used the naming for the function need to be the same as at the bottom line legend	Adopt the bottom line legend to be flexible in naming the function
Both	Wording problem in appointment coordination process, i.e., “comment” does not fit to reply to an question	
Both	The appointment coordination process history and hierarchy within an appointment is confusing, not clear what the current status is, less trust if it will really take place	Just show the latest status / information, most important first

Table 9. Minor usability problems

RQ 3: How flexible is the platform regarding individual needs and preferences as well as contexts of use? (Flexibility)

The participants hardly used the provided flexibility (e.g., the different possibilities to access functionalities), which is mainly due to the kind of tasks they were asked to perform. They sometimes used the SSF in the pair testing (e.g., while one participant was interacting on the tablet, the second one was observing on the TV), but hardly in the single testing (e.g., as the text was larger on the TV for Anna, it was read there and then the interaction happened on the tablet).

RQ 4: To which extent do the users believe that using the platform is free of physical and mental effort? (Ease of use)

For Anna the GeTVivid platform was rather easy to use, whereas for Frank neither/nor (see Figure 36), which might be due to the more assistance that was provided for Anna. Frank in particular neither/nor found it easy to get the platform to do what he wants it to and the interaction with the platform was also not always clear to him. Therefore, he neither/nor would easily become skilful at using the platform. Anna found it also neither/nor easy to learn operating the platform and getting it to do what she wants it to do. The anti persona would rather not learn how to operate the platform or get it to do what s/he wants it to do. Therefore, the anti persona would rather not get skilful at using the platform. For further information see Table 10.

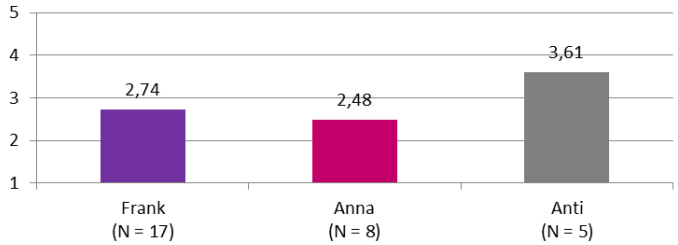


Figure 36. Mean ease of use per persona

	Overall					
	Frank		Anna		Anti	
	Mean	SD	Mean	SD	Mean	SD
The information (texts, content) on the platform was easy to understand.	2,59	1,18	2,38	0,52	3,00	0,82
The icons and labels used were easy to understand for me.	2,35	1,11	2,25	0,46	2,75	1,26
*It was difficult for me to learn how to use the platform.	2,65	0,93	2,25	1,04	3,00	0,82
Learning to operate the platform was easy for me.	2,76	1,20	**3,00**	1,29	4,20	0,84
I found it easy to get the platform to do want I want it to do.	**2,94**	1,14	**3,13**	0,99	4,00	1,41
My interaction with the platform was clear and understandable.	**2,88**	1,27	2,25	0,89	3,00	1,00
I found the platform flexible to interact with.	2,76	1,15	2,25	0,89	3,75	0,96
It was easy for me to become skilful at using the platform.	**3,00**	1,17	2,50	0,76	4,00	0,82
I found the platform easy to use.	2,71	1,10	2,50	0,76	3,50	1,73

Table 10. Questionnaire items for ease of use [Davis, 1989],
5-point Likert Scale (1 – agree, 2 – rather agree, 3 – neither/nor, 4 – rather disagree, 5 – disagree)
*** means the scale was inverted, i.e., the item is not negative anymore**

RQ 5: How does the platform enable the users to learn how to use it? (Learnability)

Frank and Anna perceive that the GeTVivid platform is rather easy to learn (see Figure 37). They would be able to use the platform after a while and feel rather competence in using it. However, they would be neither/nor satisfied with their performance on the currently tested platform. The anti persona would not be satisfied with the own performance and would also not become skilful in using the system. For further information see Table 11.

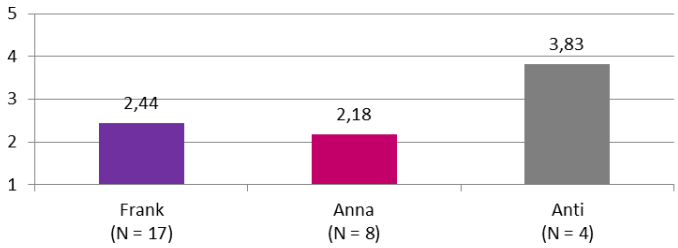


Figure 37. Mean perceived competence per persona

	Overall					
	Frank		Anna		Anti	
	Mean	SD	Mean	SD	Mean	SD
I think I would be pretty good in using the system.	2,59	1,18	2,00	0,76	4,25	0,50
After working with the system for a while, I would feel pretty competent.	**1,71**	0,77	**1,75**	0,71	2,67	0,58
I would be satisfied with my performance while using the system.	3,00	1,27	2,75	0,71	4,50	0,58
I would be pretty skilled in using the system.	2,88	1,20	2,63	0,74	4,33	0,58
*I won't be able to use the system very well.	**2,06**	1,25	**1,75**	1,04	2,33	1,53

Table 11. Questionnaire items perceived competence [Deci and Ryan n.y.],
5-point Likert Scale (1 – agree, 2 – rather agree, 3 – neither/nor, 4 – rather disagree, 5 – disagree)
*** means the scale was inverted, i.e., the item is not negative anymore**

RQ 6: To what extent does the platform address age related limitations (e.g., cognitive or physical) in terms of understanding, navigation, and interaction with the platform? (Accessibility)

Anna and Frank perceive the GeTVivid platform to be rather accessible (see Figure 38). For Frank and Anna the contrast and used colours are good differentiable. For Anna also the main elements are good highlighted. However, for both the navigation was not always clear enough and caused several problems. Frank also slightly struggled with the provided necessary information and the insufficient feedback. Anna struggled sometimes with the highlighting of important information, as too much information was provided. For the anti persona too many choices were needed for the interaction, not sufficient feedback was provided, and the navigation was not clear. For further information see Table 12.

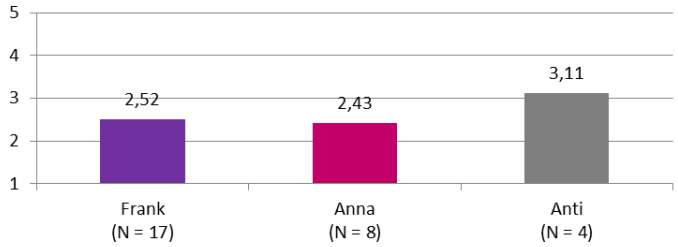


Figure 38. Mean accessibility per persona

	Overall					
	Frank		Anna		Anti	
	Mean	SD	Mean	SD	Mean	SD
Important information was highlighted in the platform.	2,53	1,23	**2,75**	1,16	2,67	0,58
The colours used in the platform were well differentiable.	**1,88**	1,17	**2,00**	1,31	2,33	0,58
Selecting functionalities in the platform was not a problem.	2,76	1,25	2,38	1,19	3,00	1,00
The contrast between the foreground (e.g., text) and the background in the platform was high enough.	**1,82**	0,95	**2,00**	1,31	2,67	1,53
All necessary information to use the platform was provided in the system.	**2,82**	1,38	2,38	1,19	2,67	1,15
The navigation in the platform was always clear enough to proceed.	**2,94**	1,30	**3,00**	1,07	3,33	0,58
The main elements of the platform (e.g., menus or buttons) were highlighted well.	2,59	1,00	**1,88**	0,83	2,50	1,29
Sufficient feedback was provided in the platform, to know whether my operations were correct or not.	**3,29**	1,36	2,63	1,30	3,33	0,58
*A lot of choices were needed in order to reach a goal.	2,41	1,23	2,50	1,60	3,50	1,00
*It was very challenging to interact with the platform, due to too much information on it.	2,12	0,86	**2,75**	1,16	3,00	0,00

Table 12. Selection of questionnaire items for accessibility [Brajnik, 2008],
5-point Likert Scale (1 – agree, 2 – rather agree, 3 – neither/nor, 4 – rather disagree, 5 – disagree)
*** means the scale was inverted, i.e., the item is not negative anymore**

RQ 7: To which extent do the users believe that the platform would facilitate achieving their goals? (Perceived usefulness)

Frank perceives the GeTVivid platform neither/nor useful (see Figure 39). GeTVivid would not really enhance the productivity of daily life activities, as he primarily lives independent and is currently not really in need of support. Whereas, Anna who is already in need of some support, perceives the platform to be rather useful (see Figure 39), in order to accomplish activities easier and thereby improve daily life. The anti persona is between both opinions, but as these people already receive professional support for daily life activities, the platform is neither/nor useful for them. For more information see Table 13.

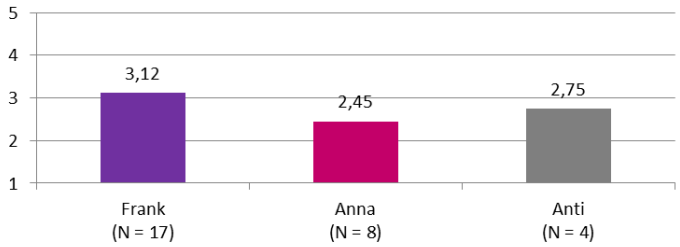


Figure 39. Mean perceived usefulness per persona

	Overall					
	Frank		Anna		Anti	
	Mean	SD	Mean	SD	Mean	SD
Using the platform for my daily activities would enable me to accomplish them more easily.	2,82	1,01	**2,38**	1,06	2,00	1,00
Using the platform would improve my daily life.	3,18	1,13	**2,25**	1,16	3,00	1,00
Using the platform would enhance my effectiveness on the daily activities.	**3,29**	1,05	2,50	1,07	2,67	1,15
Using the platform would make it easier to do my daily activities.	**3,29**	1,16	2,63	1,19	3,00	1,00
I would find the platform useful for my daily activities.	3,00	1,22	2,50	1,07	2,75	0,96

Table 13. Selection of questionnaire items for perceived usefulness [Davis, 1989] and [Chutter,2009], 5-point Likert Scale (1 – agree, 2 – rather agree, 3 – neither/nor, 4 – rather disagree, 5 – disagree)

RQ 8: To what extent does the platform support security and safety regarding safe use of different functions? (Perceived safety)

Anna perceives the GeTVivid platform slightly more secure than Frank (see Figure 40). Frank and Anna both have doubts that the platform enables them to get a good impression of other people. Whereas Frank has some more doubts about the easy contact with other people on the platform, Anna is slightly more optimistic on that issue. They also would less likely be using the platform, if everyone could register (i.e., the registration through the community manger makes them only feel slightly safer). All this is also true for the anti persona. For more information see Table 14.

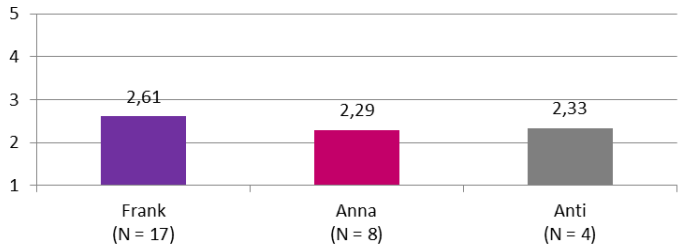


Figure 40. Mean perceived safety per persona

	Overall					
	Frank		Anna		Anti	
	Mean	SD	Mean	SD	Mean	SD
The platform enables me to easily contact other people.	2,47	1,07	1,75	1,04	2,25	0,50
The platform enables me to get a good impression of other people.	**3,12**	1,05	**2,63**	1,69	2,67	0,58
*I would be less likely to use the platform, if everyone could register on the platform.	2,00	0,94	1,63	0,74	3,00	0,82
I feel safe, as everyone has to register by the community manager.	2,24	0,83	**2,50**	1,31	2,33	0,58

Table 14. Selection of questionnaire items for perceived safety [McNamara et al, 1997] and [Kreijns et al., 2007],

5-point Likert Scale (1 – agree, 2 – rather agree, 3 – neither/nor, 4 – rather disagree, 5 – disagree)

*** means the scale was inverted, i.e., the item is not negative anymore**

Summary functional value

According to the overall SUS score (see Figure 41), Frank slightly dislikes the system and Anna starts accepting it. In comparison to the SUS scores of the heuristic evaluation from the experts, the overall scores for Frank and Anna significantly improved. However, we have to keep in mind that Anna needed a lot of assistance and could hardly complete the tasks in the given time.

The main reason, why Frank slightly dislikes the system and Anna starts accepting it, was the cumbersome interaction with the TV interface using the remote control (e.g., for typing text). The user studies revealed several serious and major usability problems that affect the efficiency to use (e.g., missing feedback and unclear consequences of fields and buttons, hiding of important information behind the keyboard, unclear start of offer and demand creation, or navigation and orientation problems, like the missing highlighting of next steps/important information). However, the platform was perceived to be rather easy to learn, use, and accessible (in particular, learning how to use the platform or getting to do what they wanted it to do was neither/nor easy).

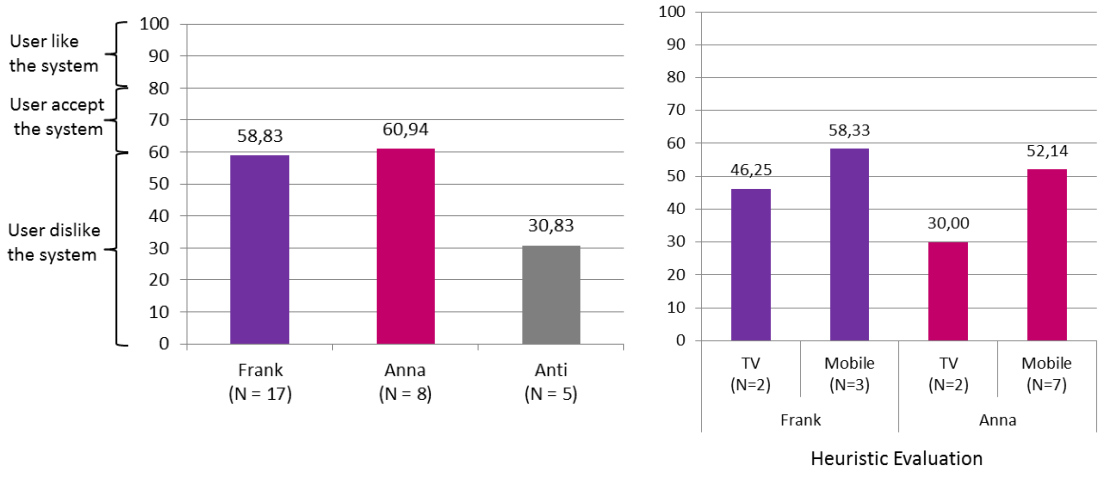


Figure 41. SUS score per persona in comparison to SUS score of expert heuristic evaluation

4.4.2 Emotional value

RQ 9: To what extend do users trust other users and the system? (Trust)

Frank and Anna trust the users and the GeTVivid platform, only the anti persona has slightly less trust (see Figure 42). Frank and Anna believe that most people will keep their promises and try to back up their words with actions. Therefore, they usually trust people and new acquaintances until they give them a reason not to trust them. Anna also believes that people on the platform would act in her best interest and would do their best to help her. She believes that most (professional) people do a very good job on the platform. The anti persona also believes that people care enough to try to be helpful, rather than just looking out for themselves, and that a large majority of (professional) people on the platform are competent in their area of expertise. For further information see Table 15.

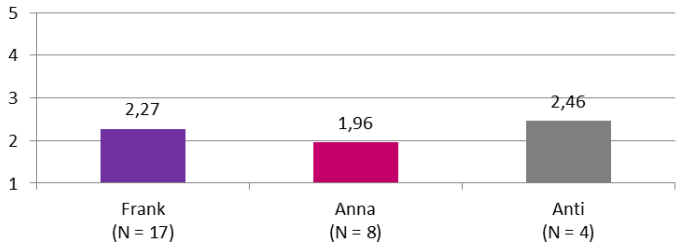


Figure 42. Mean trust per persona

	Overall					
	Frank		Anna		Anti	
	Mean	SD	Mean	SD	Mean	SD
I think that people really do care about the well-being of others.	2,41	0,94	2,00	0,76	2,00	1,00
A user on the platform is sincerely concerned about the problems of others.	2,35	0,93	2,13	0,64	2,33	0,58
I think that people care enough to try to be helpful, rather than just looking out for themselves.	2,29	0,69	2,25	0,71	1,67	0,58
I think that most people keep their promises.	**1,82**	0,53	**1,75**	0,46	2,33	0,58
I think that people generally try to back up their words with their actions.	**2,06**	0,56	**1,88**	0,35	2,67	0,58
I think that most people are honest in their dealings with others.	2,47	0,72	2,00	0,53	2,50	1,00
I usually trust people until they give me a reason not to trust them.	**2,00**	0,61	**1,63**	0,74	2,33	0,58
*I generally give people the benefit of the doubt when I first meet them.	2,41	0,87	2,25	1,16	3,33	1,53
My typical approach is to trust new acquaintances until they prove I should not trust them.	**1,88**	0,86	2,00	1,15	3,33	0,58
I believe that people on the platform would act in my best interest.	2,47	0,72	**1,88**	0,35	2,50	0,58
If I required help, people on the platform would do their best to help me.	2,47	0,87	**1,57**	0,53	2,75	0,96

People on the platform are interested in my well-being and not just in their own.	2,53	0,62	2,00	0,58	3,00	0,82
I believe that most (professional) people do a very good job on the platform.	2,18	0,64	**1,88**	0,64	2,25	0,50
A large majority of (professional) people on the platform are competent in their area of expertise.	2,47	0,72	2,13	0,64	2,00	0,00

Table 15. Selection of questionnaire items for trust [McKnight et al.,2002],
5-point Likert Scale (1 – agree, 2 – rather agree, 3 – neither/nor, 4 – rather disagree, 5 – disagree)
*** means the scale was inverted, i.e., the item is not negative anymore**

RQ 10:To what extent are users (dis)satisfied when using the platform? (Satisfaction)

Overall, Anna is satisfied with the GeTVivid platform, whereas Frank is neither/nor satisfied and the anti persona is in-between (see Figure 43). Anna is satisfied with the usage experience and finds working with the platform pleasant. Frank is satisfied with the functionalities of the platform and he is rather not worried that his interaction with the platform might have been wrong. However, sometimes the interaction was frustrating for him and not very pleasant. The anti persona is worried that many of the interaction with the platform are wrong and, therefore, it is neither/nor pleasant to work with the platform. For further information see Table 16.

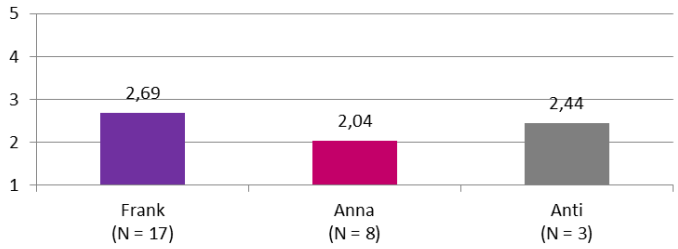


Figure 43. Mean satisfaction per persona

	Overall					
	Frank		Anna		Anti	
	Mean	SD	Mean	SD	Mean	SD
*Using the platform was a very frustrating experience.	2,71	1,31	**1,63**	1,19	2,33	1,15
*I worry that many of the things I did on the platform may have been wrong.	**2,47**	1,18	2,75	1,75	4,00	1,00
The platform provides everything I think I would need.	**2,47**	1,28	2,38	0,92	2,33	0,58
The platform is very pleasant to work with.	2,88	1,27	**2,13**	0,99	2,67	1,53

Table 16. Questionnaire items for satisfaction [Nielsen, 1993],
5-point Likert Scale (1 – agree, 2 – rather agree, 3 – neither/nor, 4 – rather disagree, 5 – disagree)
*** means the scale was inverted, i.e., the item is not negative anymore**

Summary emotional value

Overall, Frank and Anna trust the users and the GeTVivid platform. They believe that most people will keep their promises and try to back up their words with actions. Therefore, they trust people and new acquaintances until they give them a reason not to trust them. Anna is also satisfied with the usage experience and finds working with the platform pleasant. Whereas, Frank is satisfied with the functionalities of the platform, he is sometimes frustrated about the not very pleasant interaction.

4.4.3 Epistemic value

RQ 11: To what extent does the usage of the system provoke the user's curiosity about and interest in the system and its content? (Curiosity)

Anna and Frank are rather interested in the GeTVivid platform (see Figure 44), similar to the anti persona. In particular, they interested in new offers and demands, as well as in other people's thoughts and feelings. Whereas Anna is generally interested in the people on the platform, Frank is more interested in other people's life stories. The anti persona is rather interested in the platform and people's thoughts, feelings, as well as life stories. For further information see Table 17.

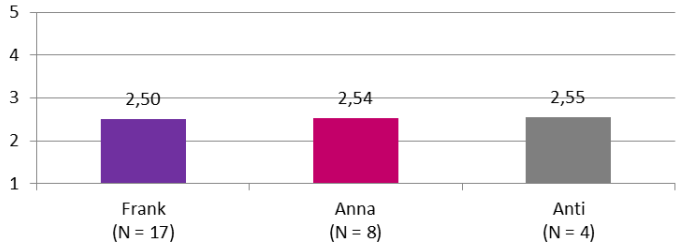


Figure 44. Mean curiosity per persona

	Overall					
	Frank		Anna		Anti	
	Mean	SD	Mean	SD	Mean	SD
I'm interested in the people on the platform.	2,47	1,12	**2,25**	1,04	2,67	1,53
I would like to learn about the habits of others with the help of the platform.	2,88	1,22	2,88	1,55	3,00	1,73
I would like finding out what others are doing on the platform.	2,88	1,27	3,13	1,25	3,00	1,73
I would like to look into other people's profiles.	2,47	1,23	2,75	1,04	3,33	2,08
When I see new offers and demands on the platform, I would take a look at them.	**2,18**	0,88	**2,13**	0,83	2,67	1,53
I'm interested in other people's thoughts and feelings.	**2,29**	0,77	**2,25**	1,04	2,50	1,73
Other people's life stories interest me.	**2,35**	0,79	2,38	1,06	2,50	1,91

Table 17. Selection of questionnaire items for curiosity [Renner, 2006],
5-point Likert Scale (1 – agree, 2 – rather agree, 3 – neither/nor, 4 – rather disagree, 5 – disagree)

RQ 12: To what extent does the attitude towards technologies change when using the platform? (Attitude towards technology)

Frank and Anna have a very positive attitude towards new technologies (see Figure 45). They believe that using technologies is not a bad idea and makes daily life more interesting and fun (see Table 18). The anti persona has a slightly positive attitude towards new technologies (see Figure 45) and also believes that technologies rather make the daily life more interesting and fun (see Table 18).

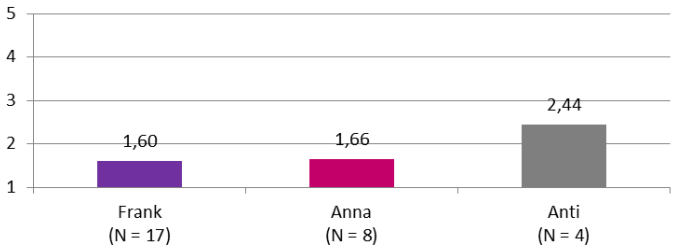


Figure 45. Mean attitude towards technology per persona

	Overall					
	Frank		Anna		Anti	
	Mean	SD	Mean	SD	Mean	SD
*Using technologies is a bad idea.	**1,18**	0,53	1,57	0,79	2,33	2,31
Technologies make daily life more interesting.	1,71	1,05	**1,38**	0,74	2,00	1,15
Using technologies is fun.	**1,59**	0,62	**1,38**	0,74	2,00	1,73
I like working with technologies.	1,94	0,66	2,25	1,16	2,75	2,06

Table 18. Refined questionnaire items from UTAUT [Venkatesh 2008],
5-point Likert Scale (1 – agree, 2 – rather agree, 3 – neither/nor, 4 – rather disagree, 5 – disagree)
*** means the scale was inverted, i.e., the item is not negative anymore**

Summary epistemic value

Frank and Anna have a positive attitude towards technologies and rather interested in (curios about) the GeTVivid platform. This is good starting point for further investigation of the epistemic value during the longer field studies.

4.5 Implications

For the user studies, we decided to provide the participants as few information as possible beforehand about the GeTVivid platform, its functionalities and interaction possibilities, in order to explore how intuitive it is to learn and use, but also to find out where we have to provide support and introductory materials for the field studies (i.e., where are the problems).

The functional value revealed the most areas for improvement for the next iteration, whereas, the emotional and epistemic value already indicated slightly positive experiences of users while interacting with the platform. Overall, Frank could solve most of the tasks with or without assistance, whereas Anna needed a lot of

assistance and often ran out of time to fulfil the tasks. Thereby, we could identify a list of serious problems that need to solved before the field studies (e.g., missing feedback and unclear consequences of fields and buttons, hiding of important information behind the keyboard, unclear start of offer and demand creation, or navigation and orientation problems, like the missing highlighting of next steps/important information). Frank and Anna neither/nor found it easy to get the platform to do what they wants it to, as the interaction with the platform was also not always clear to them. In particular, Frank was often hasty while interacting with the platform, i.e., not reading all the provided details. Therefore, Frank was neither/nor satisfied with the usage. Whereas, Anna was satisfied with the usage experience and finds working with the platform pleasant. The suggested improvement presented in Table 7, Table 8, or Table 9 will increase the learnability, ease of use, and satisfaction.

Frank did not perceive the platform as very useful, although he likes the idea behind it (i.e., he is rather interested). This is mainly due to the reason that the platform would not really enhance the productivity of daily life activities, as he primarily lives independently and is currently not really in need of support. As Anna is already in need of some support, she perceives the platform to be rather useful to accomplish activities easier and thereby improve daily life. She is also rather interested in the usage although she struggled with getting started to use the platform and needed a lot of assistance. Therefore, the content of the tutorial videos and personal introduction events are very important for the field studies. From the lab studies we learnt here a lot.

Regarding the emotional value, Frank and Anna would rather trust the platform and the users and perceive the GeTVivid platform, therefore, as rather safe. The gathered insights once more undermine the importance of the foreseen community manger (e.g., granting access to members on the platform and organizing events to get to know each other). From the epistemic value, we learnt that Frank and Anna have a positive attitude towards technologies and rather interested in (curios about) the GeTVivid platform.

In a next step, the TV and tablet client (WP3 and WP4) will be iterated and the suggested improvements presented beforehand will be addressed, in order to improve the functional value. Afterwards, a final heuristic evaluation is planned in order to test again all improved functionalities before the field studies are going to be performed in Austria, Germany, and Switzerland.

5. 2ND HEURISTIC EVALUATION

The development started with sketches for the mobile device (click dummy for the tablet) that were iterated with the partners. Afterwards, a video prototype was created to illustrate a possible interaction between the TV and mobile device. The iterated design sketches illustrated different functionalities by showing several exemplary screens. As a first evaluation activity, four workshops with end users took place in Austria, Switzerland and Germany. The participants of the workshops were asked to evaluate the appropriateness of these sketches in an exploratory manner. Based on the feedback a redesign was done and implemented for the TV and mobile device. As a next step, the first prototypes were evaluated with experts from different domains by conducting a heuristic evaluation. After another round of improvement and implementation the user studies in a lab setting were conducted. In order to approve the final improvements before the field studies, another round of expert evaluation was conducted.

5.1 Research Goal and Questions

We want to take advantage of the heuristic evaluation as it is a fast and quick evaluation method to get feedback of possible problems and to approve the final improvements done after the lab studies. The main goal was to find usability as well as accessibility problems by having experts evaluating the interface while accomplishing predefined tasks. Based on scenarios participants were asked to evaluate to what extent the system meets their needs regarding support in activities of daily living. Thus major problems can be identified in advance in order to provide a properly working interface for the user studies. The following main research questions were defined addressing different values of the ViA model.

Functional value:

RQ 1: How does the platform enable the users to learn how to use it? (ease of use / learnability)

RQ 2: To which extent do the users believe that the platform would facilitate achieving their goals? (perceived usefulness)

RQ 3: How much effort is it for the users to perform a task in relation to the accuracy and completeness? (efficiency)

RQ 4: How accurate and complete can users perform a defined task on the platform? (effectiveness)

RQ 5: To what extent does the platform address age related limitations (e.g., cognitive or physical) in terms of understanding, navigation, and interaction with the platform? (accessibility)

Epistemic value:

RQ 6: To what extent does the usage of the platform provoke the user's curiosity about and interest in the system and its content? (curiosity, interest, preferences)

5.2 Methodological Approach

Yet the development of technologies has been focused on usability for younger and skilled people. Now people with impairments or older citizens represent a growing group of active users. Thus the design of interfaces has to be rethought. It is important to take into account the needs and limitations of older people already in the development process [Duh et al., 2010]. As mentioned before, older people can be challenging participants in user tests. Hence it is recommended to conduct inspection methods, such as heuristic evaluations or cognitive walkthroughs prior to user tests.

According to Nielsen [1994] a heuristic evaluation is a discount method for evaluating an interface in an easy and cheap way. This method involves having some usability experts inspecting the interface in order to find any violations of the usability. A set of heuristics is used to assign the identified problems to them. The experts rate the problems concerning their severity for the application. The main advantage is that this method can be conducted in an early phase of the development process in order to find obvious usability problems and to prepare the interface for user tests. The heuristic evaluation will be combined with a cognitive walkthrough, where software developers or usability experts accomplish predefined tasks and look for any potential problems by empathizing with developed personas [Wharton et al, 1992], i.e., the system is examined in a more "natural" way form a user perspective. The experts will complete predefined tasks as it is important that to not only focus on violations of heuristics. The emerged problems will be assigned to pre-defined heuristics for the GeTVivid project and rated. The heuristics, personas, and an EXCEL sheet will be provided. In the EXCEL sheet the experts can note the found problems, which will be combined afterwards and rated in the last step.

Heuristics and Guidelines

The structure of the heuristics is split in three parts:

- System logic:
  All heuristics concerning the understanding of the user as well as the consistency of the system is listed under this point.
- User System Interaction:
  Heuristics once a user gets into direct interaction with the systems are listed under this point.
- Visual Design:
  Heuristics about the visual design asks for the graphical implementation.

The full collection can be found in the Annex of this document.

System Usability Scale (SUS) [Brooke 1996]

The SUS [Brooke 1996] is a simple, ten-item scale giving a global view of subjective assessments of usability. Despite being a self-described "quick and dirty" usability scale, the SUS has become a popular questionnaire for end-of-test subjective assessments of usability. Scoring the questionnaire yields a usability score in the range of 0–100, i.e., 80 to 100 users likes the system, 60 to 79 users accept the system and 0 to 59 users dislike the system. SUS items are:

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

Accessibility

It means that users with specified disabilities or limitations can perceive, understand, navigate, and interact with the system in a specified context and thereby achieve certain goals with the same effectiveness, efficiency and satisfaction of use as non-disabled people or people without limitations [Brajnik, 2008]. Accessibility items from a self-developed questionnaire are:

1. The labels (i.e., wordings) of functionalities in the platform were clear.
2. The meanings of the icons used in the platform were clear.
3. Important information was highlighted in the platform.
4. The colors used in the platform were well differentiable.
5. Selecting functionalities in the platform was not a problem.
6. The contrast between the foreground (e.g., text) and the background in the platform was high enough.
7. All necessary information to use the platform was provided in the system.
8. The navigation in the platform was always clear enough to proceed.
9. The main elements of the platform (e.g., menus or buttons) were highlighted well.
10. The warning signals (e.g., sound or visual signals) were helpful in order to use the platform.
11. Sufficient feedback was provided in the platform, to know whether my operations were correct or not.
12. A lot of choices were needed in order to reach a goal.
13. It was very challenging to interact with the platform, due to too much information on it.

5.3 Participants Profile

6 experts with various background participated (i.e., 2 HCI, 2 technical, 1 TV, and 1 care), whereof 5 were male and 1 female aged between 28 and 52 years (mean 40 years). 3 experts represented Frank (i.e., 2 technical and 1 TV) and the other 3 represented Anna (i.e., 2 HCI, and 1 care). They all agree that new technologies enrich their lives and that they are not critical towards new technologies. The mean rating of their PC and mobile phone expertise with internet is very good and the TV expertise is good.

5.4 Results

In the following the usage problems and findings for the values will be presented.

5.4.1 Usage Problems

The following problems were collected by all experts and rated according to their severity, in order to have ranking of the problems for the next iteration of the prototypes.

Serious Usability Problem – Usability Catastrophe (4 – 3,5): High Priority		
Heuristics	Problem	Improvement Suggestion
	none	

Table 19. Serious problems

Major Usability Problem (3,4 – 2,5): Medium Priority		
Heuristics	Problem	Improvement Suggestion
Privacy	It is unclear that a group message, will be sent as single messages to all members – UI does not clearly indicate to whom the message has been sent, i.e., the user has to check this manually	
Information architecture	It was hard to find the settings in the profile; editing groups does not fit very well there	Provide separate icon on the start page (e.g., below the search icon that brings the user to the setting tab next to the profile), or offer an group icon on the start page
Standards	In Popup messages, the focus is on “cancel” green and for “approve” orange	
User feedback	After the device connection, it is unclear that the devices are really connected (missing status feedback)	Show the connection status
User feedback	Expectation that the text entry would be synchronized letter by letter and not only at the end	
Size and position	On the tablet the icons and labels are two small for older adults with visual impairments	Icons should be bigger and size should be adaptable in the settings
Information architecture	The search function is not intuitive, why is the search field at the bottom and what the icons above good for	
Information architecture	The separation of the two lists for offers and demands on the start page is not good enough, the scroll bar is the only separation	Use more white space between lists
Help	The current implementation of help is confusing and unclear	
User feedback	Once an offer has been made on the tablet, the confirmation screen is only visible on the tablet and on the TV there is the loading screen (this is confusing and causes insecurity)	Provide the message on both clients
Navigation	The user only gets an overview about all selected users for the group after saving it	Show a separate list of added users
Flexibility	It is inconvenient that users can only be deleted when editing the group	Delete users directly
Flexibility	It is inconvenient on the tablet that the time cannot be	Enable time selection

	directly selected in the calendar, but only the day	
Standard	Problems with auto correction on the tablet for entering an email address as user name	User extra keyboard layout for email addresses

Table 20. Major problems

Minor Usability Problem (2,4 – 1,5): Low Priority		
Heuristics	Problem	Improvement Suggestion
Size and position	The back button in the calendar is on the wrong place (it is typically there where the user can browse through the weeks)	
User feedback	It is confusing that the connection button is still displayed on the log in screen, although the devices are connected	Only show the button, if not connected
Error prevention	It is not clear on the start page who is logged in	Provide a clear indication who is logged in on all pages
Language	The label “edit groups” is confusing, when the user as no groups	Better label might be “show groups”
Information architecture	It is not clear, which offers and demands are new on the start page	Provide a colour coding
Flexibility	On the tablet it is not possible to continue after a text entry without clicking on the green hook	Also support the enter/open key on the keyboard
Error message	The error message is not prominent enough	Use better highlighting
Metaphor	It is not clear which are professional offers	The € symbols indicates costs, but there might also be free professional offers
Flexibility	The selection of the number bubble positioned on the message history is not possible	When selecting the bubble sort messages and show new message on the top
Standards	The password is not shown with stars on the TV client	Show the letter for 1 sec and turn it into a star
Auto completion	There is no auto completion when entering the title for offers and demands	Provide auto completion
Colour and contrast	The focus of active elements was not clear at first sight on the TV	
Navigation	There are lots of clicks needed on the TV in order to navigate	
Colour and contrast	Inconsistency in colour coding on the TV, typically highlighting is orange except for green button, which appear green with an orange boarder	
Information architecture	The colour buttons on the TV client are not placed very prominently	
Metaphor	The green hook is perceived not be an active element on the tablet	
Size and position	The logo on the start page should be positioned on the same place as on the other pages	
Colour and contrast	The progress bar in the wizard was overlooked, therefore, the time and date was initially entered in the description field	Use different colouring for more contrast
Flexibility	Then opening the calendar in the wizard it can only be closed when selecting a date but not when clicking	

	somewhere on the white space on the tablet	
Information architecture	When organizing own offers it should be possible to cancel them without having to open the details view	
Information architecture	When making a new calendar entry, it would be convenient to directly select the time in the left column	
User feedback	Once a video comes to the end the user again sees the start image	Offer possibility to switch to next video
User feedback	There is no timeline for videos	
Language	"Private reminder" is misleading, as also the other appointments are private and not public	Better "personal reminder"
Colour and contrast	The selection of users is hard to see	Show also an orange boarder next to the orange transparent overlay
Information architecture	In the calendar the user expects to be able to navigate up and down in the time	
Auto completion	There is no auto completion for offers and demands, e.g., when selecting a category	Show auto text when selecting a category

Table 21. Minor problems

Cosmetic Usability Problem (1,4 – 0): No Priority		
Heuristics	Problem	Improvement Suggestion
Size and position	In the search function the list for demands is not justified with the label (as the scroll bar is not always visible)	Scrollbar should be not under the label
Flexibility	When entering the time not every minute must be shown – takes too much effort for scrolling	
Error prevention	The details should not be mandatory when entering a calendar entry	

Table 22. Cosmetic problems

5.4.2 Functional value

RQ 1: How does the platform enable the users to learn how to use it? (Ease of use / Learnability)

The mobile client was very easy to learn and use for Frank and Anna, although it had several bugs. The TV client was perceived by one expert representing Frank to be not easy to use and by another expert representing Anna to be easy to use and learn in particular in combination with the tablet.

RQ 2: To which extent do the users believe that the platform would facilitate achieving their goals? (Perceived usefulness)

Nearly all of the experts perceived the GeTVivid platform to be useful for older adults. It has the potential to foster collaboration in local neighbourhoods. How well the combination of TV and tablet will work out, will the field studies have to proof, as the expert evaluation revealed diverse impressions from the experts regarding the usefulness.

RQ 3: How much effort is it for the users to perform a task in relation to the accuracy and completeness? (Efficiency) and

RQ 4: How accurate and complete can users perform a defined task on the platform? (Effectiveness)

Overall, the GeTVivid platform is accepted by the experts. When taking a closer look, we found out that two of three experts representing Frank still dislike GeTVivid, as one struggled with a not well functioning mobile client and the other one disliked the TV client. However, all three experts representing Anna now not only accept GeTVivid but also like it. For more details regarding the SUS ratings for the two personas Anna and Franks (see Figure 12).

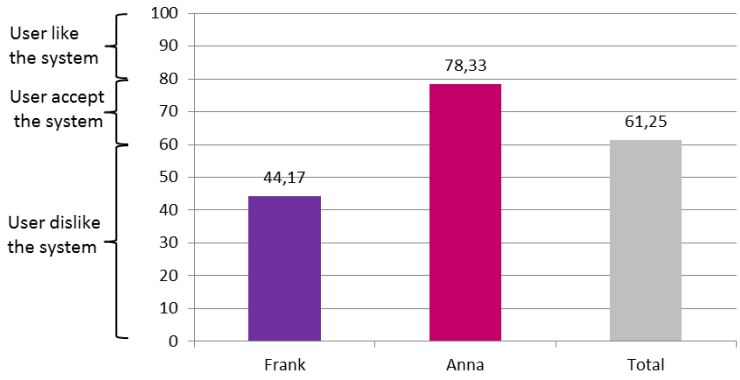


Figure 46. SUS scores (0-59 not acceptable, 60-79 user accept it, 80-100 user like it)

The experts representing Frank would rather not like to use the system, whereas Anna would like to. For Frank the platform was not easy to use, as the functions were not well integrated. He found the platform rather cumbersome to use and did not feel confident while using it. Therefore, he could not imagine that most people would learn to sue the system very quickly. The experts representing Anna perceived all these issue quite the opposite.

RQ 5: To what extent does the platform address age related limitations (e.g., cognitive or physical) in terms of understanding, navigation, and interaction with the platform? (Accessibility)

For the experts representing Frank the GeTVivid platform is neither/nor easy or difficult to access, which may be due to the two experts that struggled with a not well functioning mobile client and the other one disliked the TV client. However, the experts representing Anna found the GeTVivid good accessible. Overall, the GeTVivid platform is rather accessible for older adults (see Figure 47).

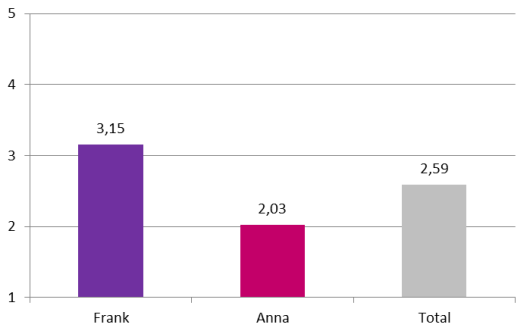


Figure 47. Mean accessibility score

(1 = strong agree, 2 = agree, 3 = neutral, 4 = disagree, 5 = strong disagree)

When taking a closer look at the items, Frank struggled with the meaning of the icons, the highlighting of important information, the navigation and selection of functionalities, and the bad warning signals. The warning could also be better for Anna, as well as the selection of functionalities (see Table 6).

Accessibility Items	Frank		Anna	
	Mean	Std.	Mean	Std.
The labels (i.e., wordings) of functionalities in the platform were clear.	3,00	1,00	2,00	1,00
The meanings of the icons used in the platform were clear.	**4,00**	0,00	1,33	0,58
Important information was highlighted in the platform.	**3,67**	1,53	2,33	0,58
The colors used in the platform were well differentiable.	2,00	1,00	2,00	0,00
Selecting functionalities in the platform was not a problem.	3,33	1,53	**2,67**	0,58
The contrast between the foreground and the background in the platform was high enough.	2,67	1,15	1,67	0,58
All necessary information to use the platform was provided in the system.	**3,67**	0,58	2,00	0,00
The navigation in the platform was always clear enough to proceed.	**3,67**	0,58	1,67	0,58
The main elements of the platform (e.g., menus or buttons) were highlighted well.	2,00	0,00	1,67	0,58
The warning signals (e.g., sound or visual signals) were helpful in order to use the platform.	**4,33**	1,15	**3,00**	1,73
Sufficient feedback was provided in the platform, to know whether my operations were correct or not.	3,33	1,15	1,67	0,58
A lot of choices were needed in order to reach a goal.	3,33	1,15	2,00	1,00
It was very challenging to interact with the platform, due to too much information on it.	2,00	0,00	2,33	0,58

Table 23. Accessibility Questionnaire Items

5.4.3 Epistemic value

RQ 6: To what extent does the usage of the platform provoke the user's curiosity about and interest in the system and its content? (Curiosity, interest, preferences)

The experts see potential that GeTVivid will raise interest in the beginning, but it will be essential to have a large and active enough neighbourhood, in order to keep the interest up. This undermines once more the importance of the community manager role in the beginning.

5.5 Implications

The expert evaluation revealed a list of smaller usability problems, whereof several were rated by the experts to be major problems that need to be solved before the upcoming field studies. For example, the connection status of devices and corresponding functionalities needs to be improved, as well as the synchronisation between the devices for text input and the offer congratulation message, in order to avoid confusion.

Other issues addressed the limited space and, therefore, oft missing white space for a better separation of information on the screen. In general, the sending of group messages and editing of groups can be improved, in order to provide more flexibility (e.g., see the new group member at once). All the problems that need to be addressed in the next iteration were explained in detail above and also improvement suggestions were provided for most of them.

Overall, the experts accept the GeTVivid platform (Anna even starts to like it) and perceive it as useful as well as interesting for older adults. The experts highlighted once more the important role of the community manager, in order build up the community and get people active and involved in the beginning.

Concluding, the experts revealed a list of problems, whereof most can be solved with minor improvements in the prototypes. This shows that the major improvements after the user lab studies were successful and improved the usability and accessibility of the platform.

6. PILOT STUDIES CONCEPT

The development started with sketches for the mobile device (click dummy for the tablet) that were iterated with the partners. Afterwards, a video prototype was created to illustrate a possible interaction between the TV and mobile device. The iterated design sketches illustrated different functionalities by showing several exemplary screens. As a first evaluation activity, four workshops with end users took place in Austria, Switzerland and Germany. The participants of the workshops were asked to evaluate the appropriateness of these sketches in an exploratory manner. Based on the feedback a redesign was done and implemented for the TV and mobile device. As a second step the first prototypes were evaluated with experts from different domains by conducting a heuristic evaluation. Afterwards, the prototype was improved and the development continued. As a next step the second prototypes (containing already most of the planned features and functionalities) were evaluated with end users in a lab setting at the EUOs organization. Before the final field studies, the iterated third prototypes were evaluated with experts from different domains by conducting a second heuristic evaluation. Finally, they will be evaluated over 10 weeks with up to 60 end users

6.1 Research Goal and Questions

The user studies in the field aim at evaluating the final prototypes together with users in a real-life setting. The prototypes provide different functionalities that are evaluated to find out how well they satisfy users' needs. The user studies will take place in Austria (organized by PLUS and EURAG), in Germany (organized by PLUS and VMKN), and Switzerland (organized by PLUS and CURAVIVA) with up to 20 end users per country.

In the following, the central research questions are defined. They are structured according to different values as well as usability (U), user experience (UX) and user acceptance (UA) factors (as described in the evaluation framework document) that are going to be addressed.

Functional value:

RQ 1: To what extent does the platform address age related limitations (e.g., cognitive or physical) in terms of understanding, navigation, and interaction with the platform (Accessibility)

RQ 2: To which extent do the users believe that using the platform is free of physical and mental effort? (Ease of use)

RQ 3: To which extent do the users believe that the platform would facilitate achieving their goals? (Perceived usefulness)

Interpersonal value:

RQ 4: What characterizes the support exchange on platform in terms of reciprocity? (Reciprocity)

RQ 5: To what extent does users' experience of social connectedness increase when using the platform over a longer period of time? (Social connectedness)

RQ 6: To what extent do the users believe that other users on the platform are similar to them? (Interpersonal familiarity)

RQ 7: To what extent do users believe that social capital can evolve when using the platform over a longer period of time? (Social Capital)

Social value:

RQ 8: To what extent does social image of user change when using the platform over a longer period of time? (Social image)

RQ 9: Which subjective norms do users perceive when using the platform (e.g., expectations)? (Subjective norm)

Emotional value:

RQ 10: To what extent does subjective well-being change when using the platform over a longer period of time? (Subjective well-being)

RQ 11: To what extend do users trust other users and the system? (Trust)

Epistemic value:

RQ 12: To what extent does the usage of the system provoke the user's curiosity about and interest in the system and its content? (Curiosity)

6.2 Methodological Approach

We will apply a formative user study, which is usually characterized as a method to investigate the usability, user experience and acceptance of interactive systems in order to design the respective system suitable in the users' sense. The main distinction between a formative and a summative study is set in the iterative nature of formative testing and the overall goal to improve the system's design [Tullis and Albert, 2008]. In the following, questionnaires and models are described, whereof items will be selected that are appropriate to answer the RQS and assess different factors (see also mapping in Section 2.2).

System Usability Scale (SUS) [Brooke 1996]

The SUS [Brooke 1996] is a simple, ten-item scale giving a global view of subjective assessments of usability. Despite being a self-described "quick and dirty" usability scale, the SUS has become a popular questionnaire for end-of-test subjective assessments of usability. Scoring the questionnaire yields a usability score in the range of 0–100, i.e., 80 to 100 users likes the system, 60 to 79 users accept the system and 0 to 59 users dislike the system. The following items are from the SUS:

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
5. I found the various functions in this system were well integrated.

6. I thought there was too much inconsistency in this system.
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use.
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system.

Accessibility

It means that users with specified disabilities or limitations can perceive, understand, navigate, and interact with the system in a specified context and thereby achieve certain goals with the same effectiveness, efficiency and satisfaction of use as non-disabled people or people without limitations [Brajnik, 2008]. The following items are self-developed and validated:

1. Important information was highlighted in the platform.
2. The colours used in the platform were well differentiable.
3. Selecting functionalities in the platform was not a problem.
4. The contrast between the foreground (e.g., text) and the background in the platform was high enough.
5. All necessary information to use the platform was provided in the system.
6. The navigation in the platform was always clear enough to proceed.
7. The main elements of the platform (e.g., menus or buttons) were highlighted well.
8. Sufficient feedback was provided in the platform, to know whether my operations were correct or not.
9. A lot of choices were needed in order to reach a goal.
10. It was very challenging to interact with the platform, due to too much information on it.

Ease of use

It describes the extent to which an individual believes that using a particular system would be free of physical and mental effort [Chutter, 2009]. The easier the use of a system, the more likely is an acceptance by the user [Davis, 1989]. The following items were derived from Davis [1989] and Chutter [2009]:

1. Learning to operate the platform was easy for me.
2. I found it easy to get the platform to do want I want it to do.
3. My interaction with the platform was clear and understandable.
4. I found the platform flexible to interact with.
5. It was easy for me to become skilful at using the platform.
6. I found the platform easy to use.

Perceived usefulness

It is the extent to which an individual believes that using a particular system would enhance performance [Chutter, 2009]. "*A system high in perceived usefulness … is one for which a user believes in the existence of a*

positive use-performance relationship" [Davis, 1989, p. 320]. The following items were derived from Davis [1989] and Chutter [2009]:

1. Using the platform for my daily activities would enable me to accomplish them more easily.
2. Using the platform would improve my daily life.
3. Using the platform would enhance my effectiveness on the daily activities.
4. Using the platform would make it easier to do my daily activities.
5. I would find the platform useful for my daily activities.

Reciprocity

It is the behavioural response to a perceived kindness or unkindness [Falk and Fischbacher, 2003]. Reciprocity is based on the principle that people match behaviours they experienced from others with the actions they perform for others. It is about the extent to which it comes to reciprocal actions between users and implies that user often match behaviours experienced from others with actions performed for others in proportion to what they receive [Carr, 2006].

Social connectedness

It is the sense of belongingness that is based on having sufficient close contacts, which depends on the satisfaction with the size and quality of one's social network. Loneliness is the counterpart of social connectedness and belongingness [Van Bel et al., 2008 or Visser et al., 2010]. The quantitative aspect is constituted by the size of one's social network as well as the amount of interactions with the members of the network. The qualitative aspect comprises the degree of closeness in one's relationship [Van Bel et al., 2008]. The following items were derived from Lee and Robbins [1995]:

1. I feel disconnected from the world around me.
2. Even around people I know, I do not feel that I really belong.
3. I feel so distant to people.
4. I have no sense of togetherness with my peers.
5. I do not feel related to anyone.
6. Even among my friend, there is no sense of brother/sisterhood.
7. I do not feel I participate with anyone or any group.

Interpersonal familiarity

It deals with an understanding of the current actions of other people or of objects [Luhman, 2000]. Strauss et al. [2001] explained the "similar-to-me" hypothesis, which was first introduced by Byrne [1971]. The hypothesis says that people will be rated higher the more similar they are or believed they are to the rater. The following items were derived from the personality with the Big Five Inventory [Rammstedt and John, 2007]:

I see myself as someone who …

1. … is reserved
2. … is generally trusting
3. … tends to be lazy
4. … is relaxed, handles stress well
5. … has few artistic interests
6. … is outgoing, sociable
7. … tends to find fault with others
8. … does a thorough job
9. … gets nervous easily
10. … has an active imagination

Social capital

It is related to the resources, which are embedded and emerge in social relationships, and is non-proprietary to each of the interacting parties [Bourdieu, 1986]. These relationships are characterized by norms of trustworthiness and reciprocity that arise from connections among individuals or social networks [Putnam, 2000]. Putnam [2000] distinguishes between bridging and bonding forms of Social Capital. Whereas bridging forms facilitate the access to external resources and identity of big social groups, bonding forms increase cohesion and identity of small groups. We will use an adapted version of the Facebook Intensity Scale from Ellison et al. 2007 in order to assess users' frequency of use and the integration of the platform into their everyday life.

1. The GeTVivid platform is part of my everyday activity
2. I am proud to tell people I'm using the GeTVivid platform
3. The GeTVivid platform has become part of my daily routine
4. I feel out of touch when I haven't used the GeTVivid platform for a while
5. I feel I am part of the GeTVivid community
6. I would be sorry if the GeTVivid platform shut down
7. Approximately how many TOTAL friends/contacts do you have on the GeTVivid platfrom?
8. In the past week, on average, approximately how much time PER DAY have you spent actively using the GeTVivid platform?

Social image

It is defined as the extent to which users may derive respect and admiration from peers in their social network [Lin and Bhattacherjee, 2010]. It is however more important in the case of interactive systems, where the systems act as the media for communication and social interaction [Venkatesh et al., 2003]. It is the degree to which one perceives that the usage of the technology can enhance the status within a social group [Chismar and Wiley-Patton, 2002]. It is a central factor that influences the adoption of an innovation. The following items were derived from Moore and Benkast [1991]:

1. Using the platform improves my image within the community.
2. People in my community who use the platform have more prestige then those who do not.
3. People in my community who use the platform have a good reputation.
4. Using the platform is a status symbol in my neighbourhood.

Subjective norm

Kowalcyk [2008] defines it as an individual's perception of what important others feel about adopting an innovation. Subjective norm refers to the normative influence (e.g., direct or indirect pressure) exerted by significant referent others such as peers, friends and family members on a person's intention or opinion to perform a specific behaviour (e.g., [Peker, 2010] or [Lin and Bhattacherjee, 2010]). The following items were derived from Kowalczyk [2008]:

1. People who influence my behaviour think I should use the platform.
2. People who are important to me think I should use the platform.
3. My close friends think I should use the platform.
4. My peers think I should use the platform.
5. People whose opinions I value prefer that I use the platform.

Subjective well-being

It can be defined by ten features, i.e., competence, emotional stability, engagement, meaning, optimism, positive emotion, positive relationships, resilience, self-esteem, and vitality. High levels of well-being have been shown to be associated with a range of positive outcomes, including effective learning, productivity and creativity, good relationships, pro-social behaviour, and good health and life expectancy [Huppert and So, 2013]. The following items were derived from Huppert and So [2013]:

1. Most days I feel a sense of accomplishment from what I do.
2. (In the past week) I felt calm and peaceful.
3. I love learning new things.
4. I generally feel that what I do in my life is valuable and worthwhile.
5. I am always optimistic about my future.
6. Taking all things together, I'm happy with my life.
7. There are people in my life who really care about me.
8. When things go wrong in my life it generally takes me a long time to get back to normal. (reverse score)
9. In general, I feel very positive about myself.
10. (In the past week) I had a lot of energy.

Trust

It has been defined as "*the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to*

monitor or control that other party" [Mayer et al., 1995, p 712]. A trustor's decision on whether or not to trust a trustee is a composite construct composed of the trustor's interdependent assessments of the trustee's benevolence, integrity, and ability, as well as their own propensity to trust, and any previous experiences they may have had [Mayer et al., 1995]. The following items derived from McKnight et al. [2002].

1. I think that people really do care about the well-being of others.
2. A user on the platform is sincerely concerned about the problems of others.
3. I think that people care enough to try to be helpful, rather than just looking out for themselves.
4. I think that most people keep their promises.
5. I think that people generally try to back up their words with their actions.
6. I think that most people are honest in their dealings with others.
7. I usually trust people until they give me a reason not to trust them.
8. I generally give people the benefit of the doubt when I first meet them.
9. My typical approach is to trust new acquaintances until they prove I should not trust them.
10. I believe that people on the platform would act in my best interest.
11. If I required help, people on the platform would do their best to help me.
12. People on the platform are interested in my well-being and not just in their own.
13. I believe that most (professional) people do a very good job on the platform.
14. A large majority of (professional) people on the platform are competent in their area of expertise.

Curiosity

Hu et al. [2005] investigated and defined it as the tendency of users to seek for something novel. This is a condition for sustained interest and a prerequisite for users to focus their attention. Curiosity is also an important motivator for exploratory behaviour to gain new information. The following items were derived from Renner [2006].

1. I'm interested in the people on the platform.
2. I would like to learn about the habits of others with the help of the platform.
3. I would like finding out what others are doing on the platform.
4. I would like to look into other people's profiles.
5. When I see new offers and demands on the platform, I would take a look at them.
6. I'm interested in other people's thoughts and feelings.
7. Other people's life stories interest me.

6.3 Recruiting Profile

At each EUO user studies with 20 participants/households are intended. They are recruited according to the profile of the two personas that were developed within the requirement analysis. Whereby, EURAG and VMKN will mainly recruit participants related to Frank and CURAVIVA related to Anna. Additionally, EURAG and VMKN can also recruit younger participants to build up a running neighbourhood network for the studies.

The main characteristics for Frank are the following:

- Demographics:
  - Living in a house or flat, live independently and need sporadically help
  - Restricted in the mobility (e.g., not allowed to carry heavy things)
- Technology usage:
  - Usage of computer, internet and has a smartphone/tablet
  - Usage of a TV
- General interest in being there for others and requesting support when needed

The main characteristics for Anna are the following:

- Demographics:
  - Living in a flat in assisted living, live independently but needing help
  - Suffering from age related impairment as well as her husband
- Attitude towards technology:
  - Technologies enrich the everyday life
  - Affinity for technology/interested in different technologies
- General interest in being there for others and getting support

6.4 Place and Duration

The user studies will be carried out in 60 households in Vienna (Austria), Nürnberg (Germany), and Basel (Switzerland) to evaluate the final prototypes on the TV and tablet. The three pilot studies will run independently and will start/end in different calendar weeks:

- Vienna: 15.02. – 22.04.
- Nürnberg: 22.02. – 29.04.
- Basel: 29.02. – 06.05.

6.5 Study Plan

The following setup will be applied for each pilot study.

Time	Process
Installation and pre-interview (week 1)	
5 min	Introduction of the team (study lead, community manager, technical support)
5 min	Contact sheet & pre-questionnaire
5 min	Introduction to GeTVivid project, description of the study procedure and instructions for the pilot study, etc.
2 min	Permission for data collection
30 min	Pre-Interview
10 min	Flat/House tour observation
15 min	Short introduction to GeTVivid platform running on the TV and tablet

Platform Testing (week 2 - 9)	
all weeks	Diary for recording activities on GeTVivid
week 3	Questionnaire I
week 5	Questionnaire II
Week 6	Telephone interview
week 7	Questionnaire I
week 9	Questionnaire II
De-installation and post-interview (week 10)	
5 min	Post-questionnaire
30 min	Post-interview
5 min	Debriefing

Table 24: Study plan

7. OVERALL CONCLUSION

The four iterative evaluation rounds have successfully be conducted with the support of the EUOs and some technical partners. The first two evaluations showed that we were on a good way, but we had to solve severe issues and problems raised by the 24 older adults and 10 experts. After the first evaluation a major redesign was performed to improve the understandability of the GeTVivid platform (e.g., add missing information to complete offers and demands). The changes and the further development increased the complexity of platform, which resulted in major navigation problems on the TV revealed by the first heuristic evaluation performed with experts. However, these usability problems could be solved with another round of revisions of the user interface design (as indicated in the improvement suggestions).

For the user studies in the lab, we provided the 38 end users as few information as possible about the GeTVivid platform, its functionalities and interaction possibilities, in order to explore how intuitive it is to learn and use it is. The improvements after the first heuristic evaluation resulted in a prototype that Frank could easily use, but Anna needed a lot of assistance. The study revealed still some interaction problems with the TV and missing highlighting of next steps/important information. Frank liked the idea behind the GeTVivid platform and was rather interested in it, but had doubts about the usefulness for his daily life, as he was still living very independently. For Anna the platform is very interesting and also useful. The needed improvements could be easily solved with minor revisions of the user interface. In order to guarantee proper running prototypes for the pilot studies, we decided to run a second heuristic evaluation with six experts. The heuristic evaluation revealed again a list of this time smaller usability problems that could easily be addressed in minor revisions of the prototypes and that the major improvements after the user lab studies were successful and improved the usability and accessibility of the platform. Still improved should be, for example, the connection status of devices and corresponding functionalities needs to be improved, as well as the synchronisation between the devices for text input and the offer congratulation message, in order to avoid confusion.

The iterative evaluations involved 16 experts and 62 end users throughout the development phase of the GeTVivid platform for the TV and tablet. This procedure proved to be very valuable and showed significant improvements regarding the usability and accessibility of the platform for the target group. In a final step, pilot studies with up to 60 end users are planned in three different European countries, which will reveal if the user requirements of D2.2 were successfully met and we could develop a platform that support the development of a neighbourhood support exchange network within 8 weeks. The final results are provided in D2.4.

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ANNEX A - HEURISTICS

System logic

1. Language:
The information and interface components have to be understandable [Affonso, 2010]. Instead of using jargon and technical terms the interface should speak the users' language. It should use words that the majority of older adults know. If there are technical words or jargon the interface should assist the users in learning what the terms mean [Chisnell et al., 2006]. As the user should not be forced to learn new icons, they should have explanation text connected to them. A command prompt should be formulated in an understandable question then in keywords on the platform.

2. Metaphors:
The technology should make use of virtual objects and actions as metaphors for objects or actions in real world. A classic example of a software metaphor is the folder: Since people put things in folders in the real world, they immediately understand the idea of putting files into folders on a computer [Apple, 2012]. Metaphors should not be used to have another meaning than in real world (e.g., the folder should not be used as a recycle bin). Well-known icons used in social media or on popular websites cannot be seen as familiar for the target group. All Icons need to be rethought.

3. Standards:
The appearance of a control that performs a standard action should not be changed radically. Moreover, the interface should follow the recommended usages for standard user interface elements. It should be avoided that standard buttons and icons mean something else, as otherwise the users may be confused [Apple, 2012]. Internal standards for icons should be consistence regarding function, look, size, and positioning.

4. Consistency:
The interface should not use different words, labels, or actions for the same thing [Nielsen, 1993]. Additionally, it is important to have the same controls on the same position in the whole interface.

User System Interaction

1. User feedback:
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time. In addition, the feedback should be adapted to different tasks [Nielson, 1993]. Regarding the navigation and user orientation, the system should always inform the user where s/he is.

2. Error messages and error prevention:
An error message should explicitly indicate what has gone wrong in a human-readable language. Furthermore, it should provide a precise description of the problem as well as a constructive advice on how to fix it. Through a careful design the user should be prevented from making errors [Nielsen, 1993].

3. Navigation
For the navigation she shallowest possible information hierarchy should be implemented, i.e., or any given task a reasonable length (2-5 clicks) should be given. Furthermore, the navigation should be easy and predictable. The path through the information should be logical and easy for users to predict. If there are more than 2 steps necessary to complete one option there should be an information bar (e.g., step1 out of 3). In addition, markers should be provided on each screen, such as titles and back buttons [Apple, 2012]. Clicking the back button should always go back to the page the user came from [Chisnell et al., 2006]. The user should always have the option to go back to the main page. If there is an upcoming keyboard the user should have the possibility to close it and go back to the previous site.

4. Flexibility
The platform should provide a logic and easy to learn structure as well as a flexible fast interaction for experienced users [Nielsen, 1993].

5. Information architecture and memory load
Regarding the information architecture it is important to make the interface easy to skim and to scan, as well as increase the focus on main information [Apple, 2012], [Chisnell et al., 2006]. The pages should look well organized (versus cluttered or busy) and there should be a clear visual starting point to the page. Moreover, if the interface is dense with content, it should be grouped to show what is related. Frequently used topics should be before all others [Chisnell et al., 2006]. Only necessary information should be present and irrelevant information should be avoided [Ligons et al., 2011].

6. Control
The user needs to be in control of all input (e.g., a keyboard needs to appear whenever there is a text input, all letters and symbols needed for an input must be provided, icons need to be big enough to be selected, input text should not be hidden by an overlaying the keyboard). Before changes to the system or effective inputs are made there should be a confirmation [Gamberini et al., 2006] (e.g., delete someone from a group or make a new offer).

7. Gesture and handling
All inputs should be made by a single click or by pressing one button. There should not be complex gesture such as double click or long pressure on one button for any kind of input.

8. Search and autocomplete functions
For the search function and for any text field the text input should be supported with an autocomplete whenever it makes sense. This is the case if something already exists in the system (e.g., search for an offer with: SHO, this than should be autocompleted to SHOpping). Only actual and information, which is relevant to the user, should be shown (e.g., offers that already ran out should not be shown).

9. Help and Documentation
Help should be provided wherever needed. As the devices can play videos this should be used. Help provided should be efficient gentile and easy to understand. If someone wants to learn the platform interaction with documentation he or she should be able to do so [Nielsen, 1993].

Sociability

1. Communicating freely
The Platform should support a natural and free way of communication. Direct communication should be provided whenever necessary [Geerts, 2009]. In the same moment the system options should prevent conflict situations such as misunderstandings.

2. Personal and Group privacy
As there are no possibilities for the user to change privacy settings the platform should secure both personal as well as group privacy. All information shown should be reasonable as well as necessary for social interaction and trust [Geerts, 2009].

3. Notify the user of incoming events and news
In any kind of social interaction the user need to be informed by the platform. This belongs to incoming messages, offers, demands, changings and request [Geerts, 2009].

4. Interaction with other users
The computer-mediated communication is very sensitive, as a high number of users are not used to communicate with other persons via computer devices [Preece, 2001] With profile pages, pictures, and other interface options users should get motivated to overcome doubts [Maloney-Krichmar and Preece, 2005]. In the same moment the platform should make clear that respect among the users is respected. Behavior with the intention to be offensive against the system will effect other users. This should be prevented in advance.

Visual Design

1. General

The Design should be aesthetic and minimalistic. The focus should be on relevant information and reduction in information [Nielsen, 1993]. Nevertheless, the design should not evoke the feeling of incompetence at any time. The emotion communicated should not indicate that the users belong to a different group than standard users [Morris, 1994]. Basically, the design should be friendly and should transmit trust to the platform.

2. Color and contrast

The color contrast should be great [Gamberini et al., 2006] and the contrast for different layers should be easy to recognize. The appearance and the choice of colors should make sense and should be consistent. A diverse set of color also can help to prevent confusion [Faisal et al., 2014] and can support the navigation. The use of contrast for highlighting information should help to make an information hierarchy.

3. Size and Position

Important Information should rather be placed in the center minimizing the use of peripheral vision [Gamberini et al., 2006]. Icons with functions need to be big enough to push them. Gaps in between icons need to be big enough to make a clear selection. Icons without function need to be readable in size. Important information and input areas should not be too close to the edge.

4. Text

All text parts have to be easy to read. That needs to be fulfilled within a minimum distance of 3 meters for the TV application. Size, color, font, surrounding and background need to support the readability. Text should not lead to visual fatigue or intensive head or eye movement.

5. Motion

Whenever a layout of a page changes (e.g., when the keyboard appears) the motion should not be disruptive. The orientation should not be disturbed by motion in the layout. Therefore, fixed elements should help to stay oriented.