

IST Amigo Project Deliverable D4.7

Intelligent User Services

8 -Interaction Design & User-based Multiple- lab Evaluation

IST-2004-004182

Public



Project Number	:	IST-004182
Project Title	:	Amigo
Deliverable Type	:	Report

Deliverable Number	:	D4.7
Title of Deliverable	:	8 – Interaction Design and User-based Multiple-lab Evaluation
Nature of Deliverable	:	Public
Internal Document Number	:	amigo_8_d4.7_final
Contractual Delivery Date	:	30 November 2007
Actual Delivery Date	:	14 January 2008
Contributing WPs	:	WP4
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Abstract

Amigo WP4 Task 4.7 consisted of two related subtasks: task 4.7.1. 'Interaction Design' and task 4.7.2 'User-based multiple lab evaluation'. The end-result of the first task is described in deliverable D4.4, the end-result of task 4.7.2 is described in this document.

The goal of subtask 4.7.2 was to develop a methodology to test each mock-up, to develop the actual environment to execute the tests, to recruit the required test people, to run the actual tests, analyze the testing results, and provide feedback to the WP5, 6 and 7 for application development. This document provides information about the mock-up testing methodology as well the results that were obtained during the test.

Keyword list

Tangible user interfaces, awareness, presence, user evaluation, social user interfaces, social radio, awareness globe, pocketwall

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1 Introduction

Amigo WP4 Task 4.7 consisted of two related subtasks: task 4.7.1. 'Interaction Design' and task 4.7.2 'User-based multiple lab evaluation'. The end-result of the first task is described in deliverable D4.4, the end-result of task 4.7.2 is described in this document.

Amigo's subtask 4.7.1 addressed the overall interaction design exploiting the different services and modalities contributing to the experience of the users. We investigated the issues by relating especially the results from WP1 and task 4.5 to the creation of form factors of physical devices. To this end, a set of smart artifacts with intuitive and natural interfaces has been designed and implemented, based on the scenarios and user-requirements identified in WP1 and subsequent investigations and adjustments of scenario details.

Mock-ups were created in order to experiment with different form factors and interaction paradigms. Mock-ups are proofs of concepts to evaluate the interaction between technical systems and between systems and users.

As a next step, these mock-ups were tested by end users in order find out whether the goals that have been addressed during design are actually reached and the form factors and interaction paradigms match the needs of real users. This testing was the main task of work package 4.7.2.

This work package WP4 is of central importance to the overall design of the project because it has a bridging function linking the WPs 1, 2, and 3 with the WPs 5, 6, and 7. On one hand, it builds on (and depends on) the results of the work packages providing the user requirements defining the type of user services needed and the underlying middleware infrastructure. On the other hand, it provides the intelligent user services as building blocks for the three different application prototypes. For acceptance of the connected home environment by the end-user this work package is of vital importance as it works on intelligent user services, which are visible for the end-user and for a large part determine the attractiveness of the system for him/her.

The goal of subtask 4.7.2 was to

- Develop a methodology to test each mock-up
- Develop the actual environment to execute the test
- Recruit the required test people
- Run the actual tests
- Analyze the testing results
- Provide feedback to the WP5, 6 and 7 for application development.

This document provides information about the mock-up testing methodology as well the results that were obtained during the test.

2 Awareness Globe

2.1 Responsible person

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2.2 Description of the mock-up

As part of the Amigo project the mock-up named "Awareness Globe" has been developed in the Amigo task 4.7.1 'Interaction Design'. The overall goal of this mock-up was to make a tangible interface to the Awareness & Notification service. The current section describes the result of the user experience test that has been conducted in order to test and validate this mock-up.

2.3 Study Methodology

Our user experience test aimed to define the feelings and experiences that people had when interacting with the Awareness Globe. It was tried to define the exact feelings and emotions, its way of interaction, as well as the perceived usefulness of the Awareness Globe. We also specifically looked at their context of use, and possibly alternative solutions they already know or use.

2.3.1 Hypothesis

The Awareness Globe is expected to address two specific needs:

- Awareness: being able to see whether people are at home and whether they are available for contact
- Notification: being able to get into contact with your friends and family and set your status to such a level that you receive notifications if your friends and family try to contact you

The hypothesis was that a tool like the Awareness Globe significantly eases to be aware of the availability of other people, to easily adjust the users own availability to the outside world (acting as a 'social firewall') and also improves the ways how to keep in touch and share with your friends and family. We expected to see different acceptance and preference results for different groups of people.

2.3.2 Participants

During WP 1 (deliverable 1.1) of the Amigo project, thorough people research has been conducted, and six different personas have been created. Based on this input, we selected four personas to base on the selection of respondents. In total, 349 respondents participated in the research.

Age range	sex	# of people	special properties	time per person	remarks
50-60	69% female	86	Mother with children living outside the home	30 min	Persona Anne
35-50	82% female	86	Mother with children living at home	30 min	Persona Susan
15-20	79% female	86	Child living with parents	30 min	Persona Roberto
25-35	69% female	91	Living alone or with partner, no children	30 min	Persona Diego

Table 1: People that participate in the tests of the Awareness Globe

2.3.3 Test apparatus

The Awareness Globe is at a stationary position in the house. It's the place where people leave their Amigo keys when at home. By leaving their key on the Awareness Globe people give themselves access to in-house services and applications. By interacting with the Awareness Globe people can control their availability to interact with the outside world. So-called Amigo-enabled devices can be used for various applications. An extensive description of the Awareness Globe can be found in report 'Task 4.7.1: Specification of Philips Design's "Awareness globe" concept'.



Figure 1: Picture of the Awareness Globe.



Figure 2: Picture of the Awareness Globe's GUI

The Awareness Globe consists of a mock-up with a display, a token reader and a user-identifying token. The experience demonstrator (e.g. test apparatus) that has been tested in the current research only consisted of the GUI, and in some cases also a mock-up.

2.3.4 Procedure

Testing took place between 06-06-19 and 06-07-12.

The mock-up has been tested both quantitative via an online digital questionnaire (340 respondents) as well as qualitative (face-to-face, 9 respondents). During the quantitative sessions respondents interacted with the GUI only, and during the qualitative sessions respondents also were confronted with the hardware.

The qualitative sessions took place at Philips Design (The Netherlands); quantitative testing took place at the respondents' homes (The Netherlands).

For both types of sessions, respondents were confronted with the exact same procedure. This procedure was fixed in a questionnaire format, through the combination of fixed explanations, fixed interaction with the flash file of the GUI, and fixed questions. These three steps were automatically linked to each other, making the sessions feel as a continuous flow of just one questionnaire. In doing so, we controlled the process of explaining the Awareness Globe step by step while also being able to ask specific questions after each step to measure people's experiences. Eventually, the goal was to define for each part of the Awareness Globe what people exactly experienced, and what aspects of the Awareness Globe triggered these experiences.

In short, the procedure can be represented in the following parts:

1. Selection questions based on demographic information
2. Short introduction followed by questions
3. Short explanation of the Awareness Globe followed by questions
4. ONLY IN QUALITATIVE SESSIONS: show hardware of the Awareness Globe, followed by questions
5. Explain logging on, log on yourself (via automatic link to flash file), followed by questions (automatic link back to questionnaire)
6. Explain changing status, change status yourself (via automatic link to flash file), followed by questions (automatic link back to questionnaire)
7. Explain messages function, open & read a message (via automatic link to flash file), followed by questions (automatic link back to questionnaire)
8. Explain the notification function, receive a notification (via automatic link to flash file), followed by questions (automatic link back to questionnaire)
9. Explain extra function (dependent upon persona group), start-up this function yourself (via automatic link to flash file), followed by questions (automatic link back to questionnaire)
10. Final questions

During quantitative sessions (online), answers were automatically saved in a database. The results of the qualitative sessions were captured by pencil-and-paper, and also a document was created for each respondent that contained quotes of the remarks they made during the interview. Completing the questionnaire took approximately 25 minutes.

2.3.4.1 Questionnaire

See above

2.3.4.2 Measurements

See above

2.3.5 Data analysis

We interpreted the data based on descriptive statistics (e.g. frequencies, percentages) and based on the qualitative data. In addition, we conducted ANOVA tests in order to identify significant differences between the four user groups.

2.4 Results

Part 1 shortly presents the overall results of the experience test, by describing people's general evaluation of the Awareness Globe. This general evaluation is split into a paragraph that summarizes the responses of all respondents, and a paragraph that presents the responses per persona-group.

Part 2 describes the results of the experience test in detail, for each of the aspects of the Awareness Globe.

Finally, part 3 discusses the findings related to the evaluation of the Awareness Globe.

Part 1: Management summary – General evaluation

In this part we give a short summary of the experience test results of the Awareness Globe. First, the overall results will be described for the Awareness Globe in general. Second, we describe the results per persona in order to sketch an idea of the acceptance by each of the user groups.

2.4.1.1 Overall evaluation, all respondents

Emotional level

Overall, the respondents were not very surprised or excited by the Awareness Globe. When we asked to rate for example feelings of surprise, beautifulness, and fun-ness, ratings were generally mixed. This indicates that there was no clear univocal 'wow' effect.

Interactional level

Interaction with the Awareness Globe as it is currently worked out is generally experienced as very easy. Only 12.5% of the respondents experienced it to be difficult. Especially the option that the Awareness Globe sends notifications, and the total overview of the user interface make interaction with the Awareness Globe to be experienced as simple.

Important to note is that respondents indicated that the current version of the Awareness Globe they interacted with was clear and had a good overview. If, however, the number of contacts increases (which is very likely for the younger participants) or when the number of messages increases, the overview is expected to decrease dramatically.

Rational level

Only 43% of the respondents considered the Awareness Globe attractive, which is not a high score. Even 30% considered the Awareness Globe a redundant device.

Looking more specifically to the respondents in each of the four different profiles, it becomes clear that Roberto and Diego consider the Awareness Globe to be more attractive than the older Susan and Anne (see Table 1).

Figure 1 also shows that there is a clear difference between the two generations regarding the **usefulness** of the Awareness Globe.

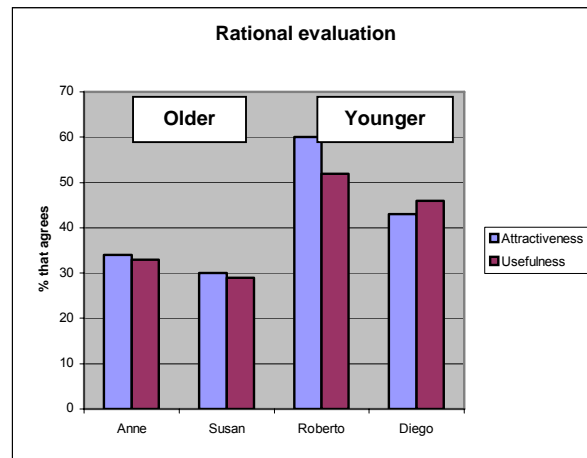


Figure 3: Graph Rational evaluation of Awareness Globe

In order to determine what aspects of the Awareness Globe gave it a useful and attractive experience, we looked at the specific applications (or benefits) that the Awareness Globe offers.

It appeared that there was not a very clear preference for either one of the **functions of the Awareness Globe**. As can be seen in *Figure 4*, the instant communication-function (e.g. messages, video call, chatting) was generally received the best for all of the respondents.

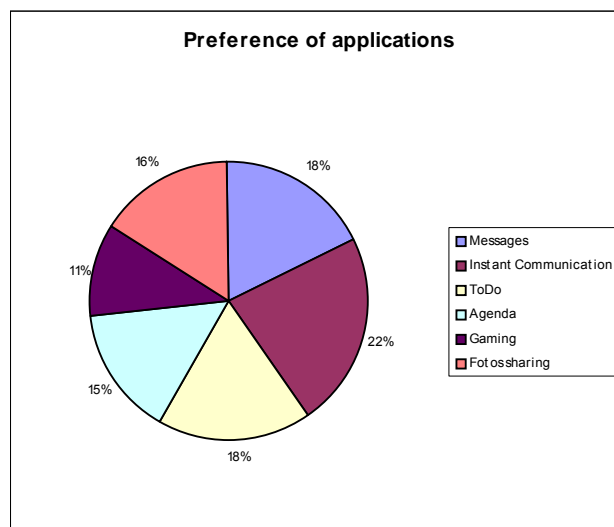


Figure 4: Overall preference of the applications

We also looked more specifically whether the preference for the applications differed between the four profiles (see Figure 5), but this was not the case.

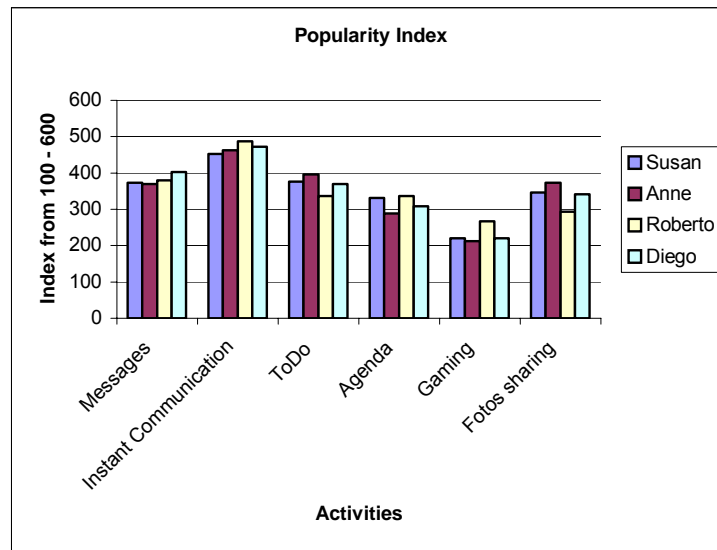


Figure 5: Preference for applications (Note: the index ranges between 100-600)

Barriers to the Awareness Globe

Resulting from the test results, we identified three different main reasons that decreased the experienced attractiveness and usefulness of the Awareness Globe.

- **Redundancy:** often stated comments by the respondents is that the Awareness Globe doesn't offer anything new. It contains applications that already exist, and can be done with other devices. The added value of being able to see whether your contacts are at home and are available for contact (e.g. Awareness and Notification) thereby functioning as a source of inspiration for interaction is not recognised. The respondents didn't experience this option to be useful. We will focus on this notion more in detail in part 3.
- **Privacy:** a big concern, especially for the older generation of respondents, is the risk of losing one's privacy. People don't want other people to know whether they are at home, and a big group also don't want to be available all the time for others. At least not for most of their contacts. They get the 'big brother is watching you' feeling.
- **Security:** as the Awareness Globe is connected through the Internet, the risk of hackers poses a barrier to some of the participants. Also, it is feared that the 'wrong people' (e.g. burglars) can use the Awareness Globe in order to see whether people are at home.

2.4.1.2 Evaluation per profile

In this paragraph we tried to look at the four profiles in order to highlight differences in what they experienced during interaction with the Awareness Globe. This can help steering future improvements.

Each section starts with a short summary of the persona, based on the research conducted in WP1. Subsequently, some demographic variables of the respondents in the current experience test are presented. We then describe their overall evaluation of the Awareness Globe.

Persona Anne, devoted mother

Anne is aged 57 and is married for almost 27 years now. She has 3 kids, two of them **living on their own**. Anne is a devoted mother who always tries to get **the best out of her children**. Next to that, Anne tries to

have **everything in order**. This means that she arranges the shopping, and she takes care of the paper work like bills (administrative) and the family appointments.



Results from experience test:

Average age	56
Gender	69 % is female
Household composition	92 % lives in a two-person household, and all of them have children living out of the home
Employment	41 % is currently employed

In their everyday life, Anne respondents most often use their (mobile) phone and email for communication. Both text messages as well as instant messenger services are used by only half of the respondents in this group.

The most important need that she has in her everyday life is the '*need to be a good parent by supporting my children as good as possible*'. Her second most important need is the '*need for contact with my friends*'.

Overall, just like the other profiles, the first impression of the Awareness Globe is that it is pretty surprising, and pretty exciting.

At first sight, the Awareness Globe sounds like a moderately interesting product to her. However, showing that you are at home, the main functionality of the Awareness Globe, is not so interesting. Moreover, it is for her also a greater invasion to her privacy. Especially if sensors would log her on automatically would invade her privacy a lot. Anne would like to control this process very consciously, so she can decide when and to whom to show whether she is at home. She also doesn't need to be available all the time.

It is also not really interesting for her to see whether her contacts are available for contact. It is also an invasion to her privacy. Being able to change her general status is also not really useful to her.

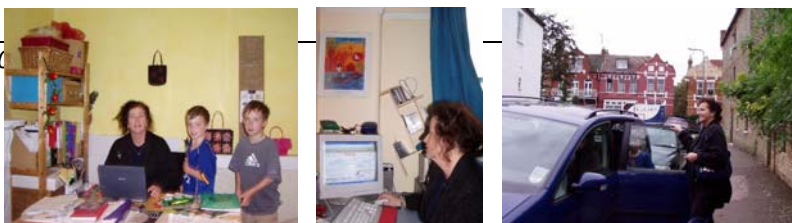
Interaction with the Awareness Globe was generally experienced as being relatively easy, though on some aspects she is less enthusiastic than Roberto and Diego (e.g. overview of the main screen, managing the messages application).

Overall, the Awareness Globe is not really attractive for Anne, though she thinks it might be slightly useful in her everyday life. She mainly sees the Awareness Globe as a tool to get in contact with her friends, which might explain that she likes the option to get in contact with her friends best (e.g. messages, video call, chatting).

For Anne the fact that the Awareness Globe uses the Internet and therefore can be hacked poses a big risk for her. This feeling is stronger for her than for Roberto and Diego.

Susan, mother and part-time employed

Susan is married and has young kids. Next to that she is part-time employed as a project manager. At home she also feels as if she is **the manager**, the one who organizes everything. She brings the kids to school, changing turns with the neighbors, and she has support in doing the household chores. It is important to Susan to always **do 'the right thing'**. For example, she stimulates her children to play outside, because that's healthy. Susan always try to stay up to date on her friends and family, her **social network**.



Results from experience test:

Average age	41
Gender	82 % is female
Household composition	88 % lives in a household with 3 or more people (she is a parent and has children living at home)
Employment	62 % is currently employed

Susan often uses her (mobile) phone and email, 80% uses text messages, and just like Anne only half of the respondents use instant messenger services.

For her, *'the need to be a good parent by showing my children the right example'* is most important in her everyday life, followed by the need *'for contact with my friends'*.

Also for Susan the first impression is moderately positive, though her reaction is somewhat more tempered (less excited, and less surprised).

The fact that the Awareness Globe can show that she's at home is not so interesting, and it is a bit of an invasion to her privacy. Showing whether you are available for contact is marginally interesting, though it is also a bit of an invasion to her privacy.

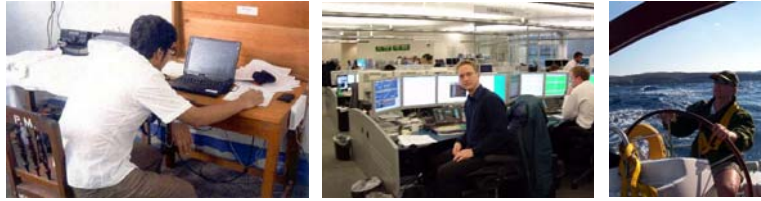
As for the other profiles, interaction with the Awareness Globe was on average rather easy.

Overall, the Awareness Globe is not really attractive to Susan. Also the usefulness is expected to be low.

Anne mainly sees the Awareness Globe as a tool to get in contact with her friends (e.g. messages, video call, chatting) and not as a tool to stay aware of the availability of her contacts. It might be, though, a good tool to better manage the family, as it can be used to send messages to her kids to give tasks according to one of the respondents.

Diego, young and ambitious

Diego is aged 32 and not too long from now his girlfriend is going to move in to his apartment. Diego has learned to **do his best** in order to get somewhere. He is doing a great job at work and thinks it is important to deliver good results. Diego always strives to **learn new things**, being intellectually stimulated. At home his apartment is very organized and clean, so he can find everything easily. Diego always feels very responsible and thinks he must do everything very **well-considered and accounted for**.



Results from experience test:

Average age	28
Gender	69 % is female
Household composition	81 % lives alone, and 10 % lives with a partner (Diego has no children)
Employment	72 % is currently employed

Almost all of the Diego's use their (mobile) phone, email, text messages, and instant message service.

Their main need is the '*need for contact with my friends*', and the '*need to be intellectually stimulated*' is second most important to them.

Diego's first impression is rather positive.

Being able to see whether your contacts are at home is somewhat interesting, and it is also interesting to see whether his contacts are available. Both options are only marginally an invasion to his privacy.

Also for Diego interaction with the Awareness Globe was relatively easy.

Overall Diego considers the Awareness Globe to be slightly interesting, but not really a useful product.

Also Diego mainly sees the Awareness Globe as a tool to get in contact with his friends (e.g. messages, video call, chatting), but also as a tool to see their contacts' availability. Diego, as for the other profiles, likes the option to get in contact with his friends best (e.g. messages, video call, chatting).

Roberto, scholar and enjoys socializing with friends

Roberto is aged 17, and lives with his parents. He has a younger brother and a little sister. Roberto often **hangs out with his friends** after school, and is in constant contact with them via **text messages** and the **MSN Messenger**. He is always up to date on the latest music, and is always online when doing his homework. Sometimes he grabs his little brother's playstation to game. As Roberto is the oldest child in the family, he feels quite **responsible**. He tries to behave more and more **independent**.



Results from experience test:

Average age	18
Gender	79 % is female
Household composition	97 % lives in a household with 3 or more people (Roberto lives there with his parent(s))
Employment	52 % is currently employed, though it is uncertain whether this is a way to make a living or whether it is a student job.

Roberto uses all four types of communication products.

He mainly has the need *'for contact with my friends'* and the *'need to hang out with friends, to socialize'*.

Roberto's first impression of the Awareness Globe is that it is pretty surprising and pretty exciting. Roberto considers it a bit handy to see whether his contacts are at home and whether they are available for contact.

Interaction is generally easy.

Overall, Roberto is more positive about the Awareness Globe than Anne or Susan. He also considers it more attractive and more useful than them.

For Roberto it is clear that the Awareness Globe is a tool to get in contact with friends, and to stay aware of their availability. However, it is probably less clear for him that it is a family product, as he would like to place it in his bedroom.

The risk of the Internet is also less pronounced than that Susan and Anne think.

2.4.2 Part 2: Results – Specific evaluation of the Awareness Globe

This part presents the specific results for the different aspects of the experience test, and describes the feedback in the same order as it was presented to the respondents in the questionnaire.

2.4.2.1 Everyday communication products

The first question of the experience test asked respondents to indicate the type of products they use in their everyday life. We also asked them to indicate the main reasons why they use each product.

As can be seen in *Figure 6*, the (mobile) phone and email are means of communication that are used by almost all of our respondents. The use of text messages and instant messenger services is limited. Especially, there is a clear distinction between the older generation (Anne and Susan) and the younger generation (Roberto and Diego).

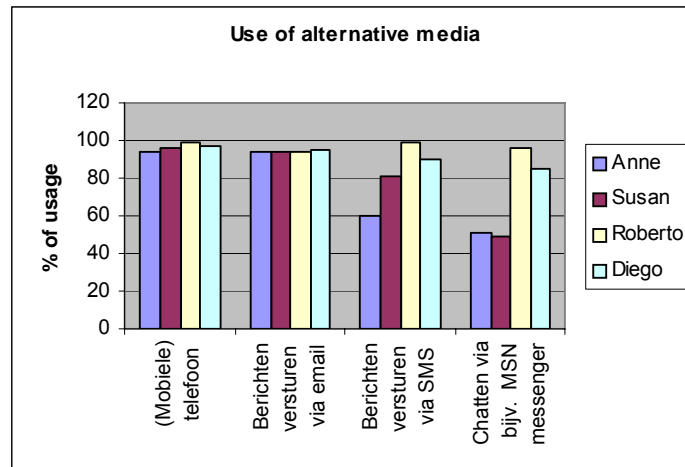


Figure 6: Usage of alternative means of communication

The reason to use each of the means of communication also significantly differs between the different tools:

Communication tool	Reason to use
(Mobile) phone	<i>'to have a quick chat' & 'to make plans'</i>
Email	<i>'just say hi'</i>
Text messages	<i>'leave short messages'</i>
Instant Messenger	<i>'to have a quick chat'</i>

2.4.2.2 Everyday life needs

We asked respondents to indicate the most common needs they have in their everyday life. Based on the personas that have been created we presented persona-specific needs, and we added the two needs that the Awareness Globe is supposed to address.

The two specific needs that the Awareness Globe is supposed to address are 'The need to be aware of the availability of my friends' and 'the need for contact with my friends'. It appeared that the respondents generally have a great need 'for contact with my friends'; on average 78% claimed to have this need. However, the respondents did not have a need to 'be aware of the availability of my friends' (only 31% do have this need).

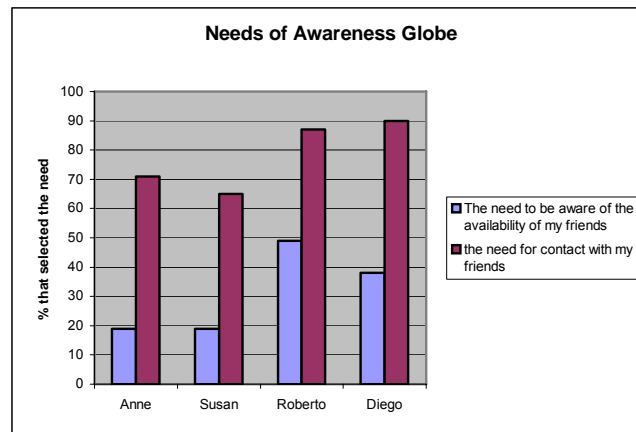


Figure 7: needs of the Awareness Globe

Looking more specifically at the whole range of needs people could select from, the most important need per profile is:

Persona	Most important need
Susan	<i>'the need to be a good parent by showing my children the right example'</i> (87%)
Anne	<i>'the need to be a good parent by supporting my children as good as possible'</i> (78%)
Roberto	<i>'the need for contact with my friends'</i> (87%)
Diego	<i>'the need for contact with my friends'</i> (90%)

Interestingly, both the respondents in the Susan profile as well as the Anne profile claimed that 'the need for contact with my friends' was the second most important need for them.

Note, however, that we presented the respondents with a very limited list of needs that they have to choose from. This question gives a *hint* on what needs are more important relative to the other needs in this list.

2.4.2.3 First expectation of the Awareness Globe

After the short textual introduction to the Awareness Globe, we asked respondents to rate the attractiveness of the Awareness Globe at first sight.

The proposed solution is not an immediate catchy idea. Generally, the respondents considered the concept idea of the Awareness Globe to be moderately interesting. On average, 44% considered it an interesting product, and 23% thought it wouldn't be interesting, 33% did not have a clear opinion (yet).

Regarding the notion of Awareness and Notification:

Functionality	Evaluation
Being able to see whether your contacts are at home	-
Being able to see whether they are available for contact	-/+
Managing your own status to the outside world	-

Again, the younger generation (Roberto and Diego) was somewhat more positive than the older generation.

Reasons for the not so positive first impression generally came down to the fact that the Awareness Globe is not expected to be 'new'. It is considered rather similar to for example the MSN Messenger, therefore it is a redundant product.

Example quote Diego: *"It is not unique. You can already do these things with existing products"*

Furthermore, people fear that the product diminishes their privacy

Example quote Diego: *"I don't have many friends with whom I want to have this close contact"*

2.4.2.4 Logging on

After we measured the respondents' first impressions and expectations we asked them to log on to the Awareness Globe.

Using a token to log on is generally nice and fun to do. It is considered a very easy way of logging on (76%), and the action gives a rather good overview of the interaction (53%). On average, only 8% considered the way of logging on to be unclear.

On the other hand, only 39% of the respondents considered logging on with a token a handy way of logging on, as the token might be easily lost or easily falls off the Awareness Globe.

Example quote Roberto: *"Looks like a nice method, though you can pretty easily loose the token"*

However, using special **sensors to automatically log on** upon arrival at home is generally considered not to be an improvement (64% considered it to be redundant). The main reason for this is that one loses one's privacy. Especially the older generation considered it to be a greater barrier.

Example quote Anne: *"I want to control when to log on. Using a token you can decide yourself whether you want people to see you are at home"*

2.4.2.5 Mock up

In the separate face-to-face interviews we showed respondents a mock up of the Awareness Globe. Generally, the mock up is not received well. It is much bigger than expected, even too big. The screen is too small relative to the rest of the mock up.



Figure 8: Picture of the mock up

Most of the respondents would like a portable version of the Awareness Globe, for example a version on their mobile phones.

Example quote Diego: *"I thought it would be something small that you would be able to take with you"*

Some respondents considered it simple and modern, though others think it is just ugly.

Example quote Roberto: *"It looks like a scale!"*

2.4.2.6 Main screen

On average, the main screen of the Awareness Globe is considered to be clear, only 20% thought it didn't have a good overview, and just 10% thought that the screen was complicated.

Resulting from the face-to-face research data, the screen was considered big enough though the space around it was relatively big (redundant). Also, there is a general concern that the screen is not big enough when there are more contacts than presented in the example.

Example quote Roberto: *"Some people already have over 80 people active on the msn. I have 100 contacts, and usually 20 active when I'm online. So the screen is too small"*

Other respondents mentioned that they like the playful way that the contacts are represented as bubbles.

Example quote Anne: *'I like the little satellites'*

Another side-remark is that the number of application-buttons on the bottom of the screen can be reduced. It gives for example 3 times the option 'more', and respondents would like to have only those buttons present of the applications they use most often.

2.4.2.7 Managing status

After the first exploration of the main screen, respondents were asked to change their general status. Roberto and Diego were also asked to change their status for a specific contact.

Changing your **general status** is considered to be not very difficult, though neither very easy. Especially seeing what you have done after you changed your status was not so clear.



Figure 9: Screenshot of changing one's **general status**

Resulting from the qualitative sessions, this is mainly due to the fact that the blue box that line in ones status did not really stand out (e.g. a blue box against a blue background).

Example quote Anne: *"The blue box: that's a bit too subtle"*

Also, the fact that the personal icon jumps back after you dragged it to a status-plane is not considered very friendly or consistent with other ways of interaction with the Awareness Globe

Example quote Anne: *"You would expect the icon to stay once you dragged it somewhere, this is a bit annoying"*

The action to change your status **per contact** is reasonably easy to do (56% thought it was easy). However, it is a bit deviant from changing your general status, therefore it is less clear to most of the respondents.

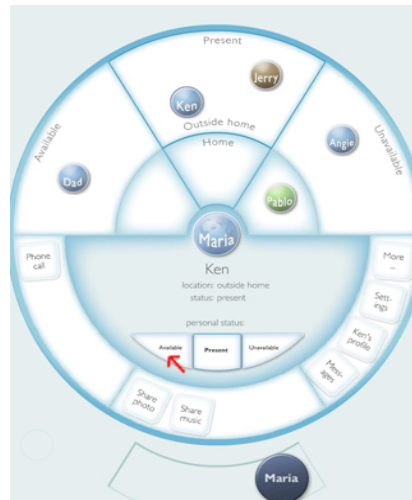


Figure 10: Screenshot of changing one's **status per contact**

The respondents indicated that it is not visible what you have changed your status to for a specific contact once you're back in the home menu. This needs to be improved

Example quote Diego: *"When I'm back in the home menu I can't see anymore that I've changed my status only for Ken"*

Changing your general status is not considered particularly useful, though changing your status per contact was experienced to be a bit more useful.

Example quote Anne: *"The possibility to be selective is **very** important. Like the situation when your wife picks up the phone, then you can whisper you are not at home"*

As can be seen in Figure 11, respondents in the four personas differed regarding the perceived usefulness and experienced invasion to their privacy.

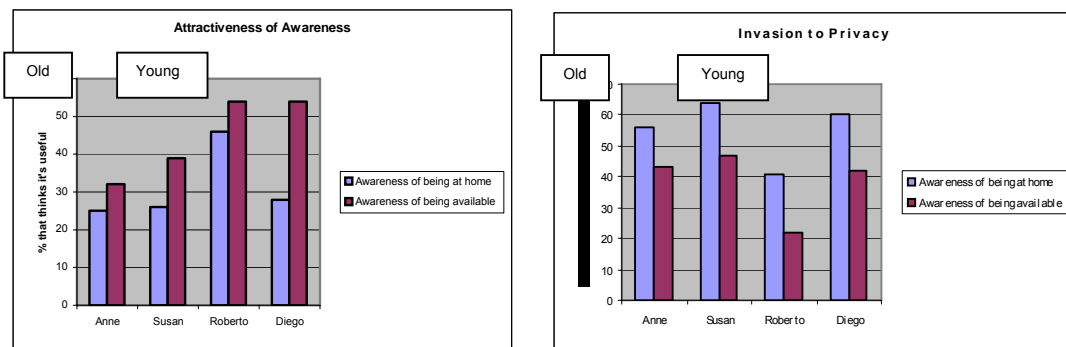


Figure 11: evaluation of the idea of 'Awareness'Messages

2.4.2.8 Messages

We explained the application of sending loose messages to your contacts, and we let the respondents open a few messages.

The design of the messages function was not perceived to be very surprising. According to one of the respondents, that should not be considered a negative thing:

Example quote Susan: *"I don't think that the messages-function is surprising, but that's positive. It just works"*

Overall, 49% of the respondents considered the message function to be useful. This is not a very high score, which might be explained by the fact that there are already alternative solutions that do the same:

Example quote Roberto: *"The function is similar to hotmail. Well, it might be handy. If hotmail didn't exist yet it would be handy"*

The messages function is considered simple (58%), though regarding the overview of the messages answers are a bit mixed. Some respondents noted that the overview could become very messy in case there are (a lot) more messages sent by ones' contacts.

Example quote Roberto: *"It depends on the amount of messages you have got. That decreases the overview"*

Next to the fact that most respondents liked the design of the messages function, other respondents mentioned that they think it is confusing that the messages are worked out the same as the contacts (as being colored bullets).

Respondents also would like the messages to be a bit more clearly structured.

Example quote Diego: *"I would like to have seen a distinction between todo messages and messages of others. I would also liked to have my messages listed by date and time"*

2.4.2.9 Notifications

During the experience test, we simulated a notification of the fact that one of the contacts became available.

The notification was clear to more than half the respondents, and setting the notification was generally easy to do. The fact that the exterior would start to glow would be a useful addition for more than half of the respondents. However having a lamp in the living room that would start flickering is innovative and surprising, though is too much for almost 70% of the respondents.

Example quote Susan: *"We live with 5 people in one home, how do we know who's the notification for? It's like when the telephone rings, it always differs who the call is for"*

An important concern that was brought forward is that one is not always behind the Awareness Globe, so notifications can easily be overseen.

Example quote Roberto: *"I expected to hear a sound. Now, you only notice the notification if you are with the product. So a sound would be better. Or the thing should send me a text message"*

Receiving a notification for the fact that one of your selected contacts has become available is not really useful (only 41% considered it useful). Some respondents explained that they rather directly send their contact a message, instead of waiting until somebody comes available:

Example quote Susan: *"I just want to talk to the contact, I'm not going to sit and wait for the notification"*

2.4.2.10 Profile-specific applications

The last task in the experience test was to start one of the remaining applications. We selected a specific application for each of the four profile groups, based on the information in the personas:

Persona	Specific application
Anne	Video phone
Susan	Shared agenda
Roberto	Play game
Diego	Shared agenda

The specific functions that we selected for each of the profiles were generally experienced as useful functions. The way of starting up the applications was also considered to be easy. However, as the applications haven't been worked out people generally don't know what to expect from it.

Example quote Susan: *“Starting up the agenda is easy, but it matters more how the agenda is worked out”*

2.4.2.11 Expected added value of the Awareness Globe

On the question where respondents would place the concept in their own home, most of the respondents chose the living room (44.5%).

Example quote Anne: *“I would put it central in my home. A spot where you always drop your stuff”*

Also, 25% of the Roberto respondents indicated that they would like to have an Awareness Globe in their bedroom. This may reflect the fact that they would consider the Awareness Globe a personal device, rather than a family device.

Important to note, is that on average 30% indicated that they don't want an Awareness Globe in their living room. When looking more specifically at the different profiles, especially the older generation doesn't want an Awareness Globe at all (43%) compared to 17% of the younger generation.

Looking at the needs that the Awareness Globe is **experienced to address**, all of the respondents indicated that the Awareness Globe best addresses the *‘need for contact with my friends’* (on average 64%).

Moreover, for three of the four profile groups (Roberto, Diego, and Susan), respondents indicated that the second most important need that the Awareness Globe typically addresses is the *‘need to be aware of the availability of my friends’*. This is the other need that the Awareness Globe is supposed to address. However, remember that this latter need is **not** a need that respondents generally have in their everyday life according to the second question in the questionnaire.

The group-specific needs that we selected for each of the different profile groups that were derived from the personas were less experienced to be addressed by the Awareness Globe.

Regarding the question whether they thought that other members of their household would consider the Awareness Globe useful, both generations had negative expectations (on average 35% thought it would be interesting for other members of their household).

In conclusion, the Awareness Globe is experienced to address the two needs that it was designed to address. One of these two needs is indeed important to them in their everyday life, but the other isn't. Moreover, a substantial group of respondents indicated that they do not want an Awareness Globe at all.

2.4.3 Part 3: Discussion of Awareness Globe

Looking at the test results, overall scores of the Awareness Globe generally were not very positive. Below, we discuss our findings and highlight aspects that may have caused the low scorings.

2.4.3.1 Clearly defined value propositions

The concept idea of the Awareness Globe has not been built on predefined and well-researched needs that it should aim to address. It does touch upon some of the needs of the personas, though it has been tried to design it as a product that connects to ‘everybody’. As no clear target audience with specific needs has been selected, important information such as specific needs, the specific contexts of use, and the main drivers of behaviour have been ignored. As a result it has become a product that doesn't really fit to any of the four personas.

2.4.3.2 Family product

In principle, the Awareness Globe has been designed as family tool. It makes a distinction between contacts in the home, and contacts outside the home, and multiple people within the family can use it. However, test results indicated that the Awareness Globe was mostly seen as an individual tool, and the focus was mainly on communication with external contacts (friends and acquaintances).

This contradictory finding may be due to the fact that the Awareness Globe is not explicitly designed around household-user scenarios. As no clear target audience had been chosen in order to create a clear context of use in a household situation, people may have overseen this functionality.

Another reason for the mismatch is that two of the persona groups are part of a two-person household (Diego and Anne), and there is generally no need for within household communication if you only have one other person to take into account.

2.4.3.3 The added value of Awareness and Notification

The needs that the Awareness Globe is supposed to address are the need for Awareness and the need for Notification. However, the way the Awareness Globe has been currently worked out doesn't resonate the added value of the Awareness need and Notification need.

The **Awareness need** was not an important need for most of the respondents, and after the experience with the Awareness Globe people indicated that they indeed didn't like this functionality as currently designed. Especially the older respondents (Anne and Susan) indicated that they don't want to sit down and wait for spontaneous contacts. Because of their busy lives they just contact someone whenever it suits, either spontaneously or not. If somebody is not available they start doing something else and don't want to be interrupted again. For this checking of availability they don't need a new system, they just make a phone call. On top of that, showing your availability is for many Anne and Susan respondents a great invasion to their privacy. It gives them the feeling that they are constantly watched, and that everybody knows where they are.

On the other hand, Roberto is somewhat more interested in the idea of Awareness and Notification. This might be explained by the fact that he is already used to similar services like the MSN Messenger. However, the Awareness Globe is mostly experienced as a nicer and newer version of the MSN messenger that has some additional applications. Therefore, this group is not convincingly interested in the Awareness Globe as it offers things they already have.

Although respondents do have the **need for Notification** (contact with friends), and this need was perceived to be addressed by the Awareness Globe, people still gave the Awareness Globe low ratings on attractiveness and usefulness.

This might be explained by the fact that the Notification applications that next to the Awareness application are offered are not new functionalities to them, and they can already be done with existing solutions they currently have (telephone, email, instant messenger services, web cam). Applications that may be somewhat new (merely a new way of interaction) are a shared agenda and the option to play an online game. However, they are not interesting to all of the respondents. More importantly, as they have not been clearly worked out it was impossible for respondents to image the true added value that those applications may bring.

In conclusion, the Awareness Globe offers nothing new, and the newness it does offer (awareness) is not experienced to be useful.

2.4.3.4 Mature experience demonstrators

The experience demonstrator that has been presented to the respondents was a visual and partly interactive user interface, and in some cases also a mock up of the Awareness Globe was included. As it was not possible to integrate these two parts into a fully workable demonstrator, it might have been difficult for respondents to fully experience and imagine the true added value of the concept idea. It is therefore possible that long-term testing of a fully workable experience demonstrator may provide different, more positive, results. During long-term testing with fully workable demonstrator people are enabled to use the solution within their own context of use, and this may enable them to better imagine and experience the added value of the Awareness Globe.

2.4.3.5 Recommendations

The results that have been gathered thus far constitute very good results for improvement of the concept. They may also trigger designers to explore possibly other areas of use, such as for example the area for elderly users who mainly live in elderly/nursing homes, or focus more on specific contexts of use within the family household environment.

2.5 Effects on other work packages / tasks

The overall results of this user test affect the whole basis of Amigo, as it is not only the mock-up that has been tested but also the overall concept of Amigo, in particular the Awareness & Notification service. As well, the Awareness Globe is not only a single standalone device, but also the central entry point to all your Amigo services in the house. Therefore the whole work package of WP4 is being affected by these test results.

It is required that all participants in WP4 (IUS) read the Management summary of this user test, and mainly those responsible and working for the task Awareness & Notification and Privacy & Security, the results

show that there are some main issues with the basis of the principles of these workpackages. But not only these task participants should read the summary, as this test focussed on the user requirements, it is a good idea for all to read and refocus on their tasks in WP4.

The Awareness Globe will be further developed in WP7, in the combined prototypes development. The Awareness Globe is a proposal for a central entry point, as described in WP7 as a PAPS device (responsible: France Telecom). The results of this user test will enable to further develop and enhance such a device for WP7. As the PAPS device is central in the WP7 prototype environment, all participants for WP7 should take into account the overall results.

3 PocketWall

3.1 Responsible person

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3.2 Description of the mock-up

PocketWall is a physical mock-up created to test the attractiveness of a single mobile device which integrates the concepts of Ambient Intelligence and Context Awareness, with an innovative design and ergonomic study.

The PocketWall summarizes different concepts:

- Context Awareness: the device is able to recognize the context and to adapt itself to it; so it could be used both in home/mobile domain and workplace domain;
- Notification system: the device is able to unobtrusively notify the user the information he/she wants to be constantly notified of, for example, information related to the home domain;
- Gesture recognition: the PocketWall is able to recognize gesture and to perform different tasks according to different movements (for example, to run multimedia contents on a large screen or to recognize devices by pointing at them);
- Remote control: the PocketWall could be used as a unique remote control for the devices of a defined environment (for example, to run a display by pointing the PocketWall at it, the PocketWall automatically displays the keyboard on its touch screen);
- Ambient Communication: PocketWall is a personal device which could be used to automatically start an implicit/explicit communication being recognized by an audio-video system located in a specific environment (for example, in the Privacy Bubble, a specific area of the workplace dedicated to private communication).

During the tests, a questionnaire was filled up by two different kinds of people, differentiated by the level of their technical background and age, in order to measure the different users' acceptance level and interaction with the PocketWall.

As PocketWall prototype doesn't have actual functionalities, except the Notification system, the aim of the test is not an evaluation of the actual device, but of the concepts the PocketWall bases on.

The issues investigated were:

- Attractiveness of the different possible functionalities of the PocketWall;
- Applicability of the PocketWall concept in everyday life;
- Possible improvements and new fields of application for the PocketWall.

The test shall generate feedbacks to investigate how a versatile device like the PocketWall would be accepted and used in different situations and with different purposes in everyday life by people with both low and high technical background. Additionally, as the PocketWall summarizes different concepts related to Amigo project, some results could measure the attractiveness and applicability of fundamental concepts as Context Awareness and Ambient Communication in everyday life and different contexts (not only home domain, but workplace domain as well).

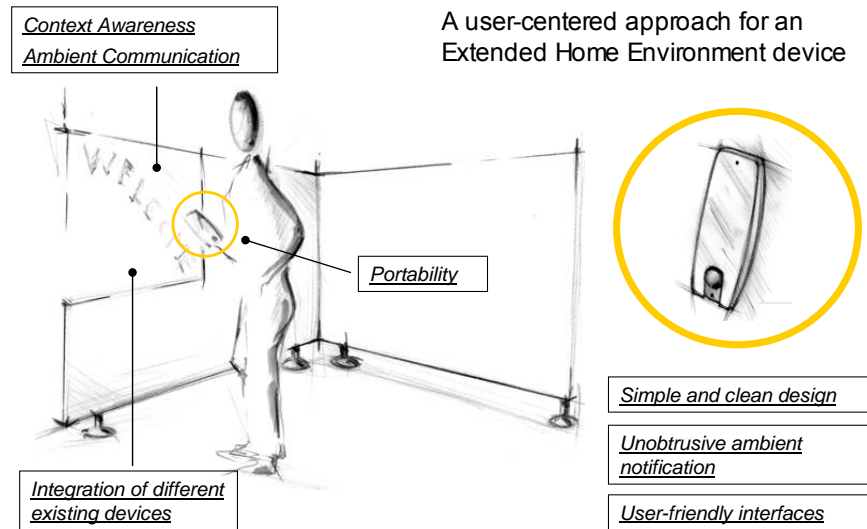
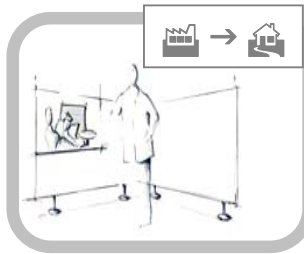


Figure 12: PocketWall mock-up features

3.3 Study Methodology

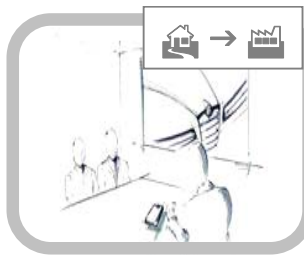
The test started with a brief presentation of Amigo project and objectives. Then, a brief presentation of the concepts of the PocketWall was shown. As PocketWall prototype doesn't have actual functionalities, except the Notification system, the aim of the test was not to evaluate the actual device, but the concepts brought by the PocketWall. This evaluation has been performed by illustrating to the users four different possible applications of the device, which were explained by a short description and pictures.

The four use cases that describe PocketWall possible applications are the following:



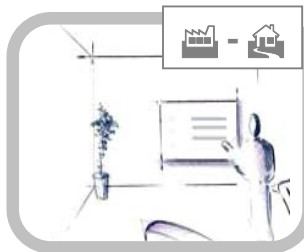
Ambient Communication - Privacy Bubble interaction

The user is at work. He/she goes to the Privacy Bubble, an area of the workplace environment specifically dedicated to Ambient Communication, as he/she wants to communicate with his/her Home. As the user is carrying his/her PocketWall, the Privacy Bubble recognizes him/her and proposes to him/her the possibility of communicate with different domains (Home, relative's home...), and different activities according to his/her preferences. The user decides to communicate with his/her Home.



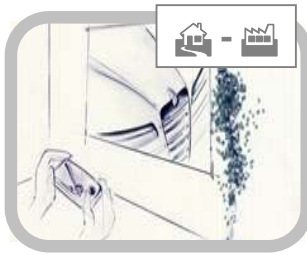
Ambient Notification

The user is at work. PocketWall light turns on. PocketWall notifies him/her, in an unobtrusive and implicit way, of all the information the user wants to have a continuous update. An example is notifying all the information from home environment, like unexpected events.



Context Awareness - Integration with existing devices

The user is at home. He/she selects a device (for example, a large display) by pointing it with the PocketWall. The PocketWall recognizes the device and automatically becomes the remote control of it, visualizing the keyboard of the device on the touch screen surface. The user can easily go through the device menu by using the touch screen surface.



Sharing information

The user is handling his/her PocketWall, looking a set of photos on his/her PocketWall display. While he/she gets close to a large display, the images on the PocketWall are automatically displayed on the large screen.

Figure 13: PocketWall Use Cases

The four use cases were illustrated by means of an interactive presentation which focused also on PocketWall interfaces.

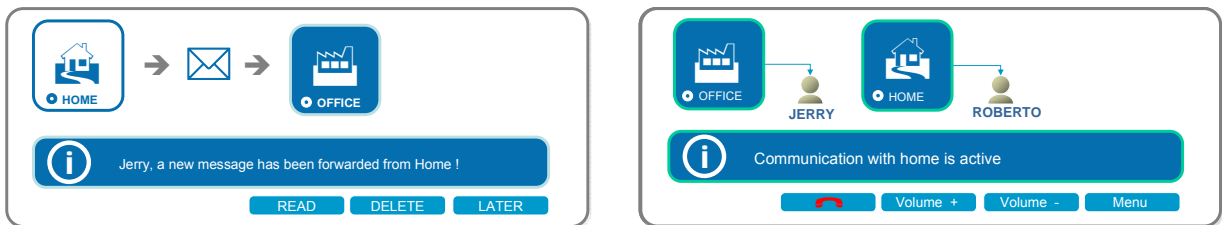


Figure 14: Example of PocketWall interfaces

After the presentation, the users were asked to answer a questionnaire.

3.3.1 Hypothesis

The test was meant to measure the attractiveness and applicability of the PocketWall concept in every day life. The users were expected to easily interact with PocketWall and accept the idea of having a single mobile device that should be used in different locations for different purposes. In particular, in Workplace, PocketWall could be used for improving productivity; in Home domain, it could be used to control different Home devices and for entertainment

3.3.2 Participants

To test PocketWall concept, several people from different departments have been involved.

People have been chosen according to their technical background and age. It has been supposed that people of 25-30 age range are more likely to accept innovative concepts and devices and have a higher technical background, whereas people of 30-40 age range are more unwilling to accept them and are, probably, more concerned about privacy issues.

Age range	sex	# of people	special properties	time person	per
25-30	M	4	High technical background	4 hours	
30-40	M,F	4	Low technical background	4 hours	

Table 2: People that participate in the test of the Pocket Wall

3.3.3 Test apparatus

The mock-up is an object with a unique transparent and translucent surface, which the user can decide to personalize. PocketWall has a very simple and clean design.

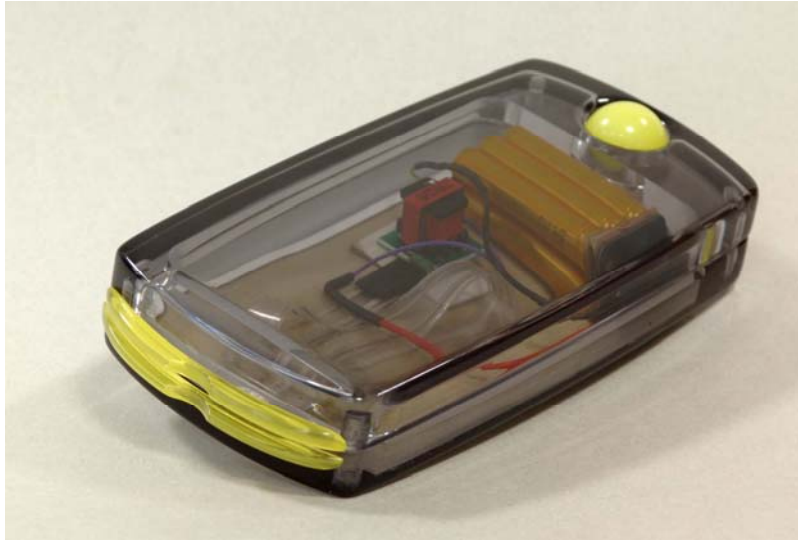


Figure 14: PocketWall mock-up

The surface of the PocketWall is intended to be a touch screen surface that, according to the context and to user's preferences, adapts itself displaying different application menu. For example, the PocketWall could be used as a remote control of a specific device, as it is intended to be able to display the selected device menu on its touch screen.

The mock-up doesn't have actual functionalities, apart from the light notification. The foreseen functionalities of the PocketWall have been simulated and explained by means of interactive presentations.

3.3.4 Procedure

The test took place in IDG premises. The session lasted four hours.

The PocketWall was presented by means of a presentation. The mock-up was presented through a brief presentation, describing the aims and objectives of PocketWall in the Amigo project, and four different use cases involving PocketWall functionalities. During the session, the user handled the device in order to evaluate it from an ergonomic and design point of view, and was invited to ask questions and express opinions about the device.

There was no need of control the execution of the test, as the aim of the test was to measure a concept and not an actual object.

After the presentation, a questionnaire was given to users. They filled it immediately. Then, test results were collected and analyzed.

3.3.4.1 Questionnaire

The PocketWall concept was tested by a pencil-and-paper questionnaire. The questionnaire was divided in two different sections: one investigating general information about the users (to measure his/her technical background level), the other about PocketWall concept attractiveness and usability.

The questionnaire was filled out just after the presentation of the project and the PocketWall and after an interactive session with users, when they were invited to handle the device, ask questions and express opinions. The users filled out the questionnaire in about half an hour.

The questionnaire investigated both PocketWall scenarios and general concepts, it aimed also to involve the users in expressing opinions about imperfections and possible foreseen improvements.

The choice of a questionnaire to test PocketWall results was driven by:

- Easiness to gather information;
- Easiness to analyze the gathered information;
- Reliability of the results.

The goal of the questionnaire was to test, in a reliable way, PocketWall concept attractiveness and usability in everyday life. The acceptance and attractiveness of this mobile device, integrating different functionalities, was measured by the questionnaire.

For this reason, several different questions were made about PocketWall possible application domains, both in a Home and Workplace environment.

Questionnaire results are a reliable measure of these topics, because a pen-and-pencil questionnaire gives the user time to reflect and weigh up his/her answers. The possibility of asking questions and receive answers about interesting topics gave the user the possibility to interact and solve all the possible misunderstandings.

For the questionnaire, see Appendix 1.

3.3.5 Data analysis

Questionnaires have been analyzed in terms of attractiveness and usability of the device. Particular attention has been paid to open answers and foreseen possible improvements.

Each question has been carefully analysed, and results have been sort out.

As the aim of the test was to evaluate PocketWall concept and not the actual device, which doesn't have real functionalities, it was not possible to test it by means of performance metrics. This is the reason why no procedures have been applied to the data.

3.4 Results

In the section, the results of the evaluations are presented. First, a summary of the results are shown. Thereafter a more detailed analysis of the feedback from the tests is discussed.

3.4.1 Management summary – General evaluation

PocketWall concept has been accepted and appreciated as it would help users in daily activities, both in Home and Workplace domain.

In particular:

1. The possibility of having a single device able to become the remote control of all the devices in Home/Office by automatically recognizing them has been evaluated as very interesting. It would be comfortable to have a single, user-friendly tool able to control all devices, not only TV or CD player, but also fridge, washer machine, etc.
2. The possibility of having a specific area dedicated to private communication (Privacy Bubble) within the Workplace, to be accessed during working breaks and easily exploited by PocketWall, has been evaluated as useful. It has been suggested to apply the concept of Privacy Bubble not only within the Workplace, but also in other domains, i.e. the airport. Nevertheless, some concerns have been arisen about privacy issues.
3. The possibility of having an unobtrusive notification system, able to propose the user all the information he/she wants to be constantly notified of (for example, information from home) has been evaluated as very interesting. Users appreciated the feeling of safety brought by such a tool, that would also give them the possibility of immediately react in emergency cases. According to users, particular attention should be paid on the selection of information they want to be notified of in order to avoid uninteresting information notification.
4. The possibility of using the PocketWall to visualize and run multimedia contents on a large display, both in home and workplace domains has been evaluated as very interesting. It would give the users the opportunity to easily and quickly run contents in work domain, and would be very useful for entertainment purpose at home. Some concerns have arisen about the risk of unintentionally displaying personal data in work context (privacy issue).
5. The PocketWall concept applicability in daily life has been positively evaluated. PocketWall has been considered a versatile tool, as it could be used in different domains with different purposes. In

particular, its practicality has been positively evaluated. Users have seen possible improvements in PocketWall potentialities by using it also in other domains, i.e. the airport.

6. Users identified several possible improvements in PocketWall functionalities and appearance:

- Using PocketWall in different domains (i.e. the airport);
- Adding new functionalities PocketWall for different purposes (such as: satellite navigator, health care, badge within workplace, payments...);
- Improving PocketWall appearance to make it nicer, younger and more comfortable to carry;
- Identifying means to eliminate or at least reduce privacy issue risks.

To sum up the questionnaires, PocketWall concept has been positively evaluated. The results obtained by means of the questionnaire matched the expected results and hypothesis.

PocketWall is incontestably an interesting concept, but it needs a deep study to be summed up in an actual and functional device.

3.4.2 Detailed analysis

In the following a more detailed analysis with respect to the four major issues: usefulness of ambient communication, ambient notification, context awareness, and sharing information on a large display are shown.

Ambient Communication - Privacy Bubble interaction

The test persons were asked what they think of having a specific area dedicated to private communication (Privacy Bubble) within the Workplace, to be accessed during working breaks. Further, they were also asked whether it would be useful to them of having such an area, in a working context able to exploit innovative technologies.

As can be seen from Figure 15, the participants were very interested in the ambient communication feature. 87% of the people were interested in it and nearly 50% of the people rated their interest to be 'very high'. Users suggested to extend the target purpose of the Privacy Bubble also to other places like airports, train stations, etc. However, there were concerns about privacy issues, related to the possibility of displaying private information in a public place.

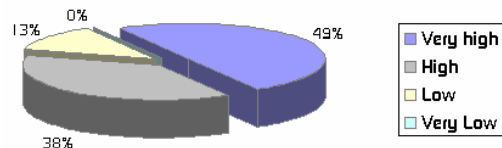


Figure 15: Usefulness of a 'Privacy Bubble'

Ambient notification

For the context awareness feature the acceptance of the test persons was also evaluated. To this end, they were asked what they think of the possibility of having an unobtrusive notification system, able to propose the user all the information he/she wants to be constantly notified of (for example, information from home).

All test people stated that this kind of notification system is of high or very high interest to them. Users appreciated the feeling of safety brought by such a tool, that would also give them the possibility of immediately react in emergency cases. However, they stated that it will be of major importance to be able to easily select which kind of information shall be forwarded in order to avoid of being interrupted by 'useless' notification messages.

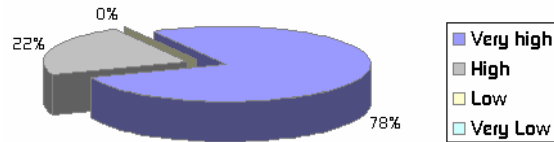


Figure 16: Usefulness of 'ambient notification'

Context Awareness - Integration with existing devices

The possibility of having a single device able to become the remote control of all the devices in Home/Office by automatically recognizing them was also addressed within the questionnaire. To this end, people were asked about the usefulness/attractiveness of having such a tool.

As can be seen from Figure 17, having such a tool is of high interest to all people. That is, 50% replied to be very highly interested and the other half to be highly interested in it. Users said it would be comfortable to have a single, user-friendly tool able to control all devices, not only TV or CD player, but also fridge, washer machine, etc.

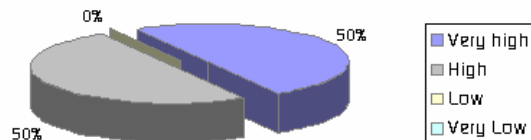


Figure 17: Usefulness of a 'single remote control'

Sharing Information

In order to assess the use of Pocket Wall to share information the following questions were asked: What do you think of the possibility of using the Pocket Wall to visualize and run multimedia contents on a large display, both in home and workplace domains? What would be the usefulness/attractiveness of having such a tool?

Only 25% of the people had a low interest in this kind of functionality whereas 75% were highly or very highly interested in it (see Figure 18). Users appreciated the opportunity to easily and quickly run contents in work domain, and like the idea of using the PocketWall at home for entertainment purposes. Similar to the ambient communication functionality, there were some concerns about privacy issues when displaying multimedia content at publicly available places.

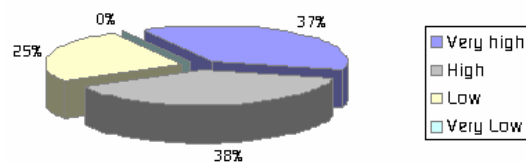


Figure 18: Usefulness of the Pocket Wall to share information

To sum up the questionnaires results, strengths, weaknesses, opportunities, and threats involved in PocketWall concept have been identified, according to the SWOT analysis principles, as shown in the following figure.

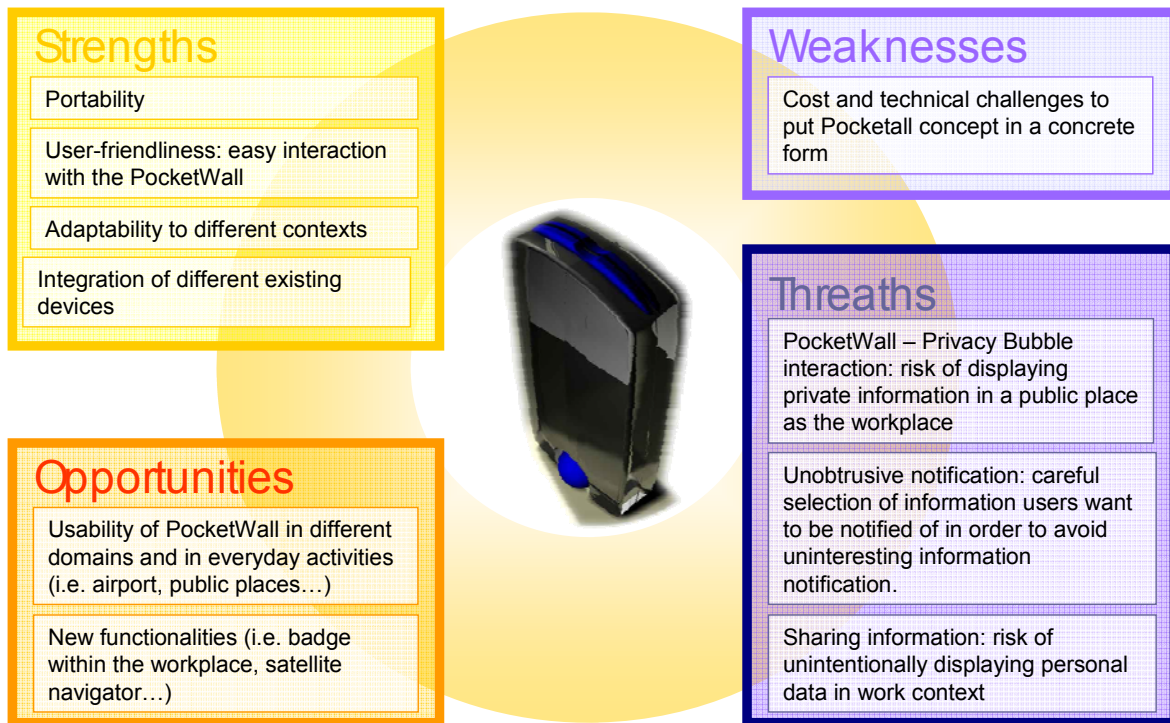


Figure 19: SWOT analysis results

3.4.3 Effects on other work packages / tasks

The results of PocketWall tests strengthen and confirm some of Amigo objectives and issues:

- The need of integrating different devices from different domains (i.e. CE, Mobile, Home Automation and PC domains) into a single user-friendly system, easy and quick to access, specifically devised for the connected home environment;
- Extended Home concept as an extension of traditional Home concept: users particularly appreciated the possibility of having a single device to be used in both Home and Workplace domains, and saw as a possible great improvement the possibility of extending PocketWall use in other places (i.e. the airport). As stated by Amigo project, the Extended Home environment should be centred on the user and not on the physical definition of Home, as users need to be always in touch with their relatives and friends community;
- Furthermore, concepts linked to Extended Home environment, as Privacy Bubble and its interaction with PocketWall have been positively evaluated; provided that Amigo system is able to guarantee privacy to the users;
- The possibility of sharing presence and feelings between different domains in an unobtrusive way has been positively evaluated: in particular, PocketWall notification system has been appreciated giving the user a feeling of security and safety in an implicit way.

The results of PocketWall test raise also some concerns about privacy issues. The risk of unintentionally share information is high and has been deeply analyzed in Amigo project.

To sum up, PocketWall tests confirm and strengthen Amigo issues and concerns.

3.5 Appendix – Questionnaire

General Information

Name:

Surname:

Age: Male ☐ Female ☐

Department:

Position:

How many hours a day do you usually spend using electronic devices at work?

A ☐ More than 4

B ☐ From 2 to 4

C ☐ Less than 2

What is the rate of information shared at work?

A ☐ Very high

B ☐ High

C ☐ Low

D ☐ Very low

What are the more used tools to share information?

A ☐ e-mail

B ☐ File exchanged

C ☐ Common repositories

D ☐ Other (specify):

Questions

1. Do you think that it would be useful to have a single device able to become the remote control of all the devices in Home/Office by automatically recognizing them? What would you be the usefulness/attractiveness of having such a tool?

☐ A. Very high

☐ B. High

☐ C. Low

☐ D. Very Low

Please, give a short explanation:

.....

2. What do you think of having a specific area dedicated to private communication (Privacy Bubble) within the Workplace, to be accessed during working breaks? What would you be the usefulness of having such an area, in a working context able to exploit innovative technologies?

☐ A. Very high

☐ B. High

☐ C. Low

☐ D. Very Low

Please, give a short explanation:

.....

3. What do you think of the possibility of having an unobtrusive notification system, able to propose the user all the information he/she wants to be constantly notified of (for example, information from home)? What would be the usefulness of such a tool?

- ☐ A. Very high
- ☐ B. High
- ☐ C. Low
- ☐ D. Very Low

Please, give a short explanation:

.....

4. What do you think of the possibility of using the PocketWall to visualize and run multimedia contents on a large display, both in home and workplace domains? What would be the usefulness/attractiveness of having such a tool?

- ☐ A. Very high
- ☐ B. High
- ☐ C. Low
- ☐ D. Very Low

Please, give a short explanation:

.....

5. What do you think of the applicability of the PocketWall in daily life? What would be its usability in everyday activities?

- ☐ A. Very high
- ☐ B. High
- ☐ C. Low
- ☐ D. Very Low

Please, give a short explanation:

.....

6. How do you think PocketWall functionalities should be improved? Can you imagine other scenarios the PocketWall would be useful for?

.....

4 Social Radio

4.1 Responsible person

Organization / Company: Fraunhofer IPSI, Fraunhofer IMS

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4.2 Description of the mock-up

As part of the Amigo project the mock-up named “Social Radio” has been developed in the Amigo task 4.7.1 ‘Interaction Design’. The goal of social radio is to enable friends to stay connected to each other. To this end, Social Radio enables persons to share their presence, availability and mood with each other. The application consists of multiple smart artefacts that use ambient light and sound in order to unobtrusively communicate this information to the user. One artefact represents one remote friend. Each person has several artefacts at home that represent their circle of friends.

The presence of a friend is displayed by using ambient light. If a friend is at home the artefact that represents this friend lights up. The mood of a remote person is indicated via music. If a friend in a remote smart home is listening to music, the artefact representing this friend is replaying this music. The artefact is also able to replay music that the friend has lately listened to, in case the remote person is not listening to music at the moment. An underlying assumption is that the music a person is currently listening reflects the mood of this person.

Each artefact can be controlled via a tangible user interface (TUI). If it is positioned upright the sound system is active. If it is turned and the translucent part is up, only ambient light is active. In all other positions the artefact is off. It was paid attention to make the interaction design very simple and intuitive.

4.3 Study Methodology

Our tests aimed analysing user experience and the perceived usefulness of the Social Radio. That is, the outcome of the tests is expected to answer crucial questions regarding the design and interaction design of Social Radio. The results of this user test will feed into the demonstrators that will be created in subsequent work packages of the Amigo project.

4.3.1 Hypothesis

The Social Radio is expected to enable persons to share their presence, availability and mood with each other. From the tests following hypothesis shall be tested:

- A tool like the Social Radio significantly eases to be aware of the availability of other people and also improves the way how to keep in touch with ones friends and family. We expected to see different acceptance and preference results for different group of people.
- The tangible user interface eases controlling the devices functionality.

4.3.2 Participants

People of different age and preferences to technical devices has been selected to conduct testing. However, as younger people with a strong relation to music are the major target group for the Social Radio, most of the people were selected from this group. Information about the people is shown in the following Figure.

Age range	sex	# people	of special properties	time per person	remarks
11 – 67	43% female	35		25 minutes	

Table 3: People that participate in the tests of the Social Radio

4.3.3 Test apparatus

Each of the two produced Social Radio artefact contains a built-in speaker and lights. The artefacts can be distinguished by the colour of the translucent front (red or blue). Lights inside the artefacts can be switched on and off. This enables to demonstrate the basic concept of social radio and to evaluate the form factor.

In its final version, each artefact has a tangible user interface and can be controlled by its position. The positions of the artefacts and their meaning are pictured in the following.

- Position 1: In this position the artefact is active. Remote music is played when remote person listens to music. The lights are switched off.
- Position 2: In this position the artefact is active. The sound is turned off. The lights are on when the remote person is present.
- Position 3: In this positions and in all other positions not described here, the artefact is inactive. The speakers and lights are switched off.

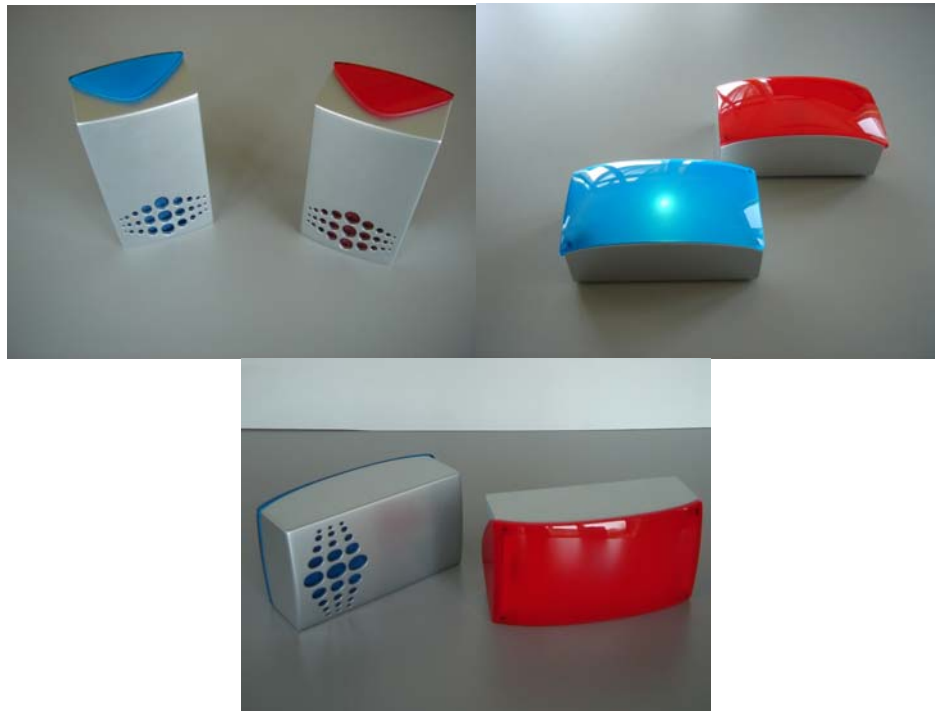


Figure 20: Position that activates the sound (top, left hand side picture), that activates the lights (top, right hand side picture) and deactivates the artefact (bottom picture)

4.3.4 Procedure

The mock-up has been tested quantitatively via a paper questionnaire. The respondents had the opportunity to look at and handle the actual hardware prototype in order to get a feeling for the design and form factor of the Social Radio.

The questionnaire included a mixture of questions as well as explanations about the mock-up's functionality. The goal of the questions was to retrieve demographic information about the test persons as well as current usage of electronic equipment. Further, the questions targeted at the needs of the people with respect to communication and staying in touch with relatives and friends. Finally, questions to gather information about the design and form factor, functionality, user interface and emotional relations to the Social Radio device were presented. The goal was to determine whether the Social Radio fulfils a user's need and whether functionality, design and user interface matches (or surpasses) user expectations.

In short, the procedure can be represented in the following parts:

1. Questions on demographic information.
2. Questions about user experience with other electronic devices and personal preferences.
3. Questions to conduct user needs with respect to be connected with friends and relatives.
4. Introduction Social Radios's functionality. At this stage the user get the opportunity to handle the actual hardware prototype.
5. Questions about the design and form factor of the Social Radio.
6. Questions about the user interface of the device.
7. Questions about the functionality of the Social Radio and whether it actually fulfils the user needs. This also includes finding out whether the user is afraid of any security threads that may arise from installing the device at home.
8. Final questions.

Completing the questionnaire took approximately 25 minutes per person.

4.3.4.1 Questionnaire

See above

4.3.4.2 Measurements

See above

4.3.5 Data analysis

We interpreted the data based on descriptive statistics (e.g. frequencies, percentages).

4.4 Results

First, the overall results of the analysis are presented, then a more detailed presentation is given for different groups of people.

4.4.1 Overall Results

As can be seen from Figure 21, the acceptance of the Social Radio is somewhat limited. That is, only slightly more than 20% of the people think that the device is useful and more than 30% think it is not.

As the above rating has been extracted from all questionnaires with no specific target group in mind, we also analyzed whether the results depend on the attitude of the persons towards music. To this end, we additionally limited our analysis towards people which showed a strong relation to music (which were 20 out of the 35 persons). In Figure 21 the right hand bar shows the corresponding results. Surprisingly, the results are very similar to the rating of all people. That is, the Social Radio does not seem to fulfil user needs appropriately.

One of the remarks we got during the tests is that the functionality is too limited in order to justify a separate device. If more functions would go into the device, its acceptance probably would have been more significant.

Another set of concerns were related to security and privacy. That is, people were afraid of being attacked by hackers if the device is connect to the internet. Further, they feared of loosing their privacy if other people know when they are available. To combat the last issue, mechanisms are required to control when and what kind of information people provide to others.

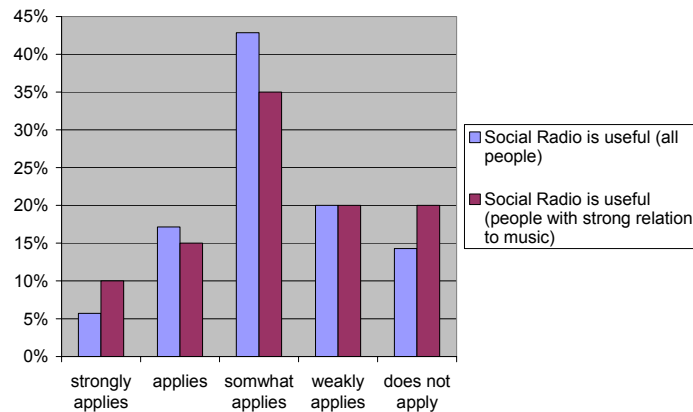


Figure 21: Is the Social Radio is a useful device?

The situation is different if we look to the user interface (see Figure 22). About 65% of the people rated the user interface as “very good” or at least “good” and only 6% gave it the rating “bad”. Hence, people very much liked the idea of controlling the device via changing its orientation.

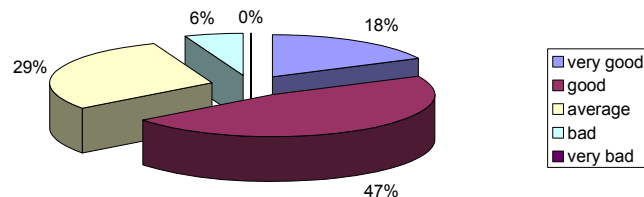


Figure 22: Overall Rating of the user interface

To summarize the results, the following points can be derived from the analysis:

- People do have the need to feel connected with their family or friends but the Social Radio as it currently is does not seem to provide an acceptable solution to most of them. One reason for this might be the limited functionality of the device. Hence, acceptance may increase if more functions (like built-in instant messenger) are added.
- People had some concerns about losing their privacy. However, providing information to friends or relatives is acceptable if people stay in control of what kind of information is shared with whom. They typically do not want that privacy-related information is automatically distributed. Further, people were also afraid of being attacked by hackers over the internet via potential security holes within the Social Radio.

- The user interface has been rated quite positive. People like its simplicity. The only concerns were about associating the devices orientations with the appropriate functions.

4.4.2 Detailed analysis

In order to find out whether the Social Radio actually addresses a real need, the need of feeling connected with friends and/or relatives were analysed. The results is shown in Figure 23. As can be seen form the data the need to feel connected is very strong. As a result, the Social Radio obviously addresses a need that is very valid for most of the people.

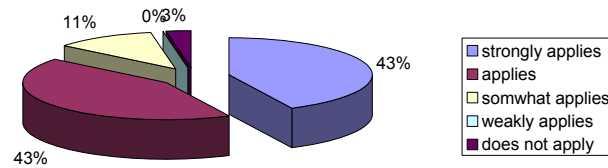


Figure 23: The need to feel connected (all people)

4.4.2.1 Needs with respect to be “connected with friends”

When people were asked whether it is important to them that friends and relatives know how they feel, most of the people replied positive as is shown in Figure 24. This is as expected as connectedness typically covers sharing information about other people in a bi-directional fashion.

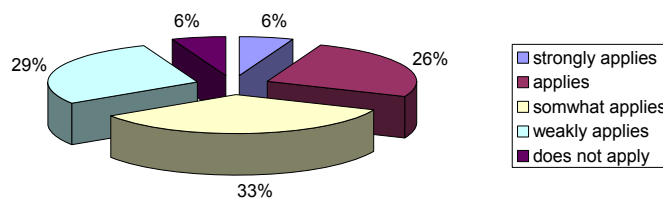


Figure 24: The need that friends and relatives know how I am (all people)

The results are similar if people were asked whether they are interested in knowing who is at home (see Figure 25). 68% of the test persons stated that they are not or moderately interested in this information.

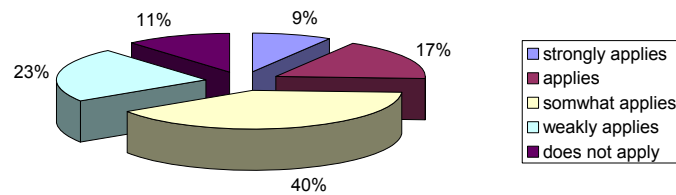


Figure 25: The need to know whether friends and/or relatives are at home (all people)

Given the results that most of the people are interested in known when their friends are available, it is interesting to note that people are less willing to provide this information to other people (see Figure 26). Obviously, there are some significant concerns about sharing this kind of information even with friends or relatives. That is, people want to be in control of the information they share with others. They typically do not want that privacy related information is automatically distributed to others, not even to friends or relatives.

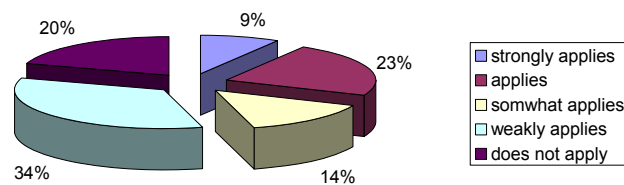


Figure 26: The need to give information about one's availability to friends or relatives (all people)

4.4.2.2 Design of the Social Radio

Further, it was investigated how the people liked the design of the Social Radio prototype. To this end, they were asked about colours, size and form of the mock-up as well how they liked the overall design. Figure 27 shows the result: More than 50% of the people liked or very much liked the overall design. Hence, the mock-up was well accepted. The individual results about colour, size, and shape were similar, so only the overall rating is presented here.

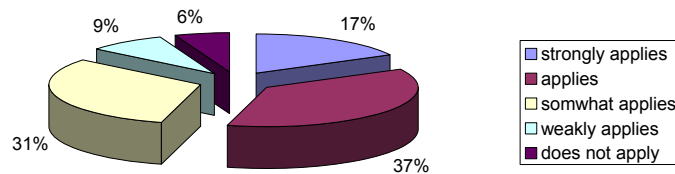


Figure 27: How did people agree to the statement "I like the overall design" (all people)?

4.4.2.3 User Interface

Another interesting aspect of the Social Radio is its user interface. As described before, the functions of the device can be controlled by its orientation. To assess the acceptance level of this special feature, people were asked about the user interface. In detail, they were asked about their opinion to control operation modes via changing the orientation of the device and also whether it is intuitive to associate a special function with a specific orientation. Further, they were asked about the feature to inform the user about the presence of a friend via a light.

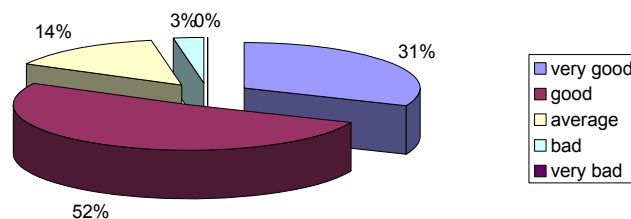


Figure 28: How do people like controlling the function via its orientation (all people)?

As shown in Figure 28, this special controlling feature is very well accepted. That is, 83% of the test persons liked the approach. So, the next interesting question is to analyse who easily people could associate a specific function with its associated device orientation. For this question, 64% of the persons do not have any problems to mind the association which is 19% less people than those who liked the approach (see Figure 29).

Hence, people like the approach but there is some concern about associating the function with the corresponding orientation.

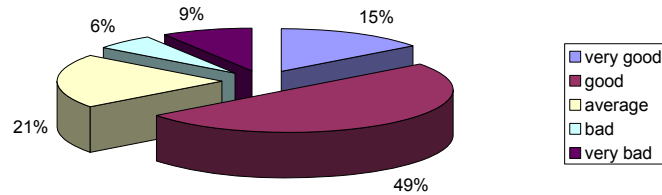


Figure 29: Associating a specific function with the appropriate device orientation (all people)?

Furthermore, people liked the simple approach to show availability of friends via a simple light. In detail, for 76% of the test persons this signalling mechanisms were attractive. As a summary, people liked the simple and intuitive user interface very much. The only major concern was with associating the specific function with the appropriate orientation of the device.

4.4.2.4 Function of the Social Radio

In order to assess the actual functionality of the Social Radio idea, it was first checked whether music is actually a appropriate indicator to derive to the mood people are currently in. To this end, they were asked whether the music they are listening to represents their mood. Further, they were also asked about the connection between music and mood for their friends or relatives. The results for both questions are shown in Figure 30.

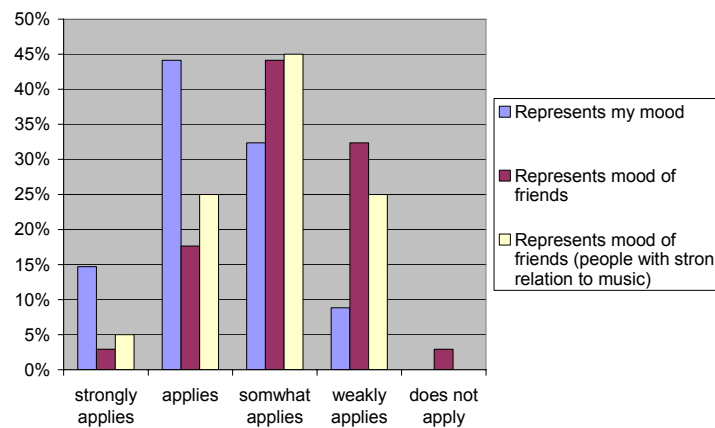


Figure 30: How does music represent your/your friends mood (all people)?

As can be seen from the numbers, people think that music their music is a good indicator for their own mood but are less sure about this for their friends or relatives. In order to find out whether this difference is also true for people that have a strong relation to music, we extracted a subset of the test persons that stated “strongly applies” or “applies” to the statement “music represents my mood” and checked what they think about this for their friends (see third bar in Figure 30). Obviously, the general statement that music does not necessarily represents the mood of friends and relatives is not limited to people that do not have a strong relation to music. The reason might be that people have strong connections to both type of other people: people with and without strong interest in music.

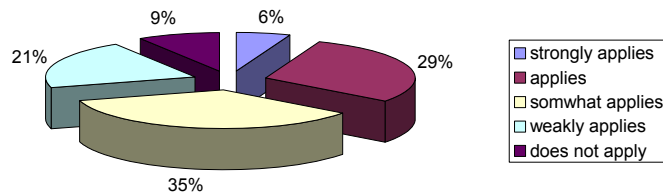


Figure 31: Social Radio helps to feel connected (all people)?

To find out whether a Social Radio fulfils its intended function, people were asked whether the device may help to feel connected with friends and relatives. As can be seen from Figure 31 this statement gets support by only 35% of the people while 30% do not think the Social Radio is useful for that purpose.

To check out whether the Social Radio provides some unique functionality people were asked whether the device is redundant and other devices provide an equal or even better solution to the connectedness need.

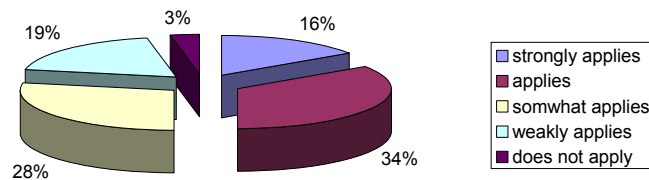


Figure 32: Is the Social Radio a redundant device (all people)?

From Figure 32 we can see that indeed the Social Radio is seen as an somewhat redundant device. Only 22% of the test persons responded that it provides a unique functionality that is not realized by another device available today. Today there are several tools on the internet (e.g., messenger) that help people to feel connected (they show availability of one another, however, they do not share information about the mood of people). As a result, the Social Radio does not have a unique feature that cannot be found somewhere else. However, one of its advantages that have been mentioned by the test people is that it does not need a PC to be up and running.

Another important topic with respect to the functionality of the social Radio are concerns with respect to losing one's privacy and the fear of being attacked by hackers if the device is connected to the internet. As shown in Figure 33, about 30% of the people are concerned about privacy issues. This is actually less than one would expect given the fact that the device distributes information about one's availability. Further, only about 24% of the people are afraid of being attacked by hackers. The reason might be that most of the people already use devices (e.g., routers or PCs) that are already connected to the internet. Hence, adding another device does not appear to introduce a significant risk increment to them.

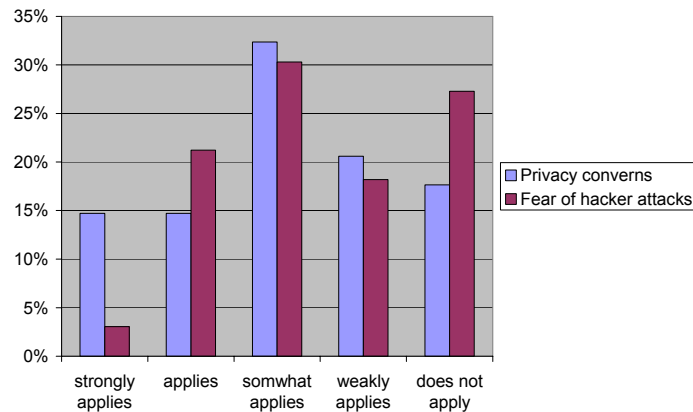


Figure 33: Concerns about privacy and fear of being attacked by hackers (all people)?

As can be seen from Figure 34 people do not want to provide information about their presence in all cases. Instead, they want to be in control of which information is given to the outside world even if this information is sent to friends or relatives only. This explains why only 30% of the people had strong privacy concerns. That is, people are aware of privacy issues but the level of privacy concerns can be obviously lowered if people are in control of the information they share with others.

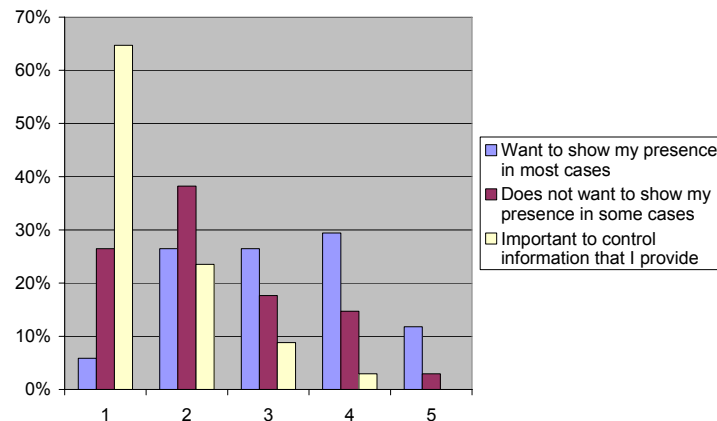


Figure 34: Concerns about providing information (all people)?

Finally, we people also rated the overall usefulness of the Social Radio (see Figure 35). It is interesting to note that only about 23% think that the device is useful. 43% did have an indifferent opinion while 28% did not like it at all. Obviously, the acceptance of the Social Radio concept is low.

While the Social Radio actually addresses a real need, the downsides obviously are considered to be important or the functionality is not sufficient. To see whether this depends on the relation people are having with music, we also looked at the overall rate of this special user group (second bar in Figure 35). As can be seen from the numbers, the acceptance even within this group is very similar compared to the overall group. As a result, the Social Radio does not seem to fulfil user needs very well.

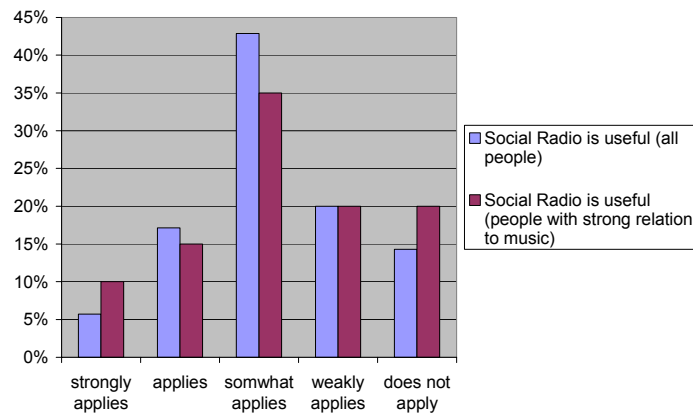


Figure 35: The Social Radio is a useful device (all people)?

4.4.2.5 Emotional and rational level

To assess how the Social Radio addresses the emotional and rational level, people were asked about the device with respect to surprise about its functionality, attractiveness and fun. As shown in Figure 36 the surprising level as well as the attractiveness of the Social Radio are high. However, the fun level seems to be limited. The reason might be the insufficient functionality of the device.

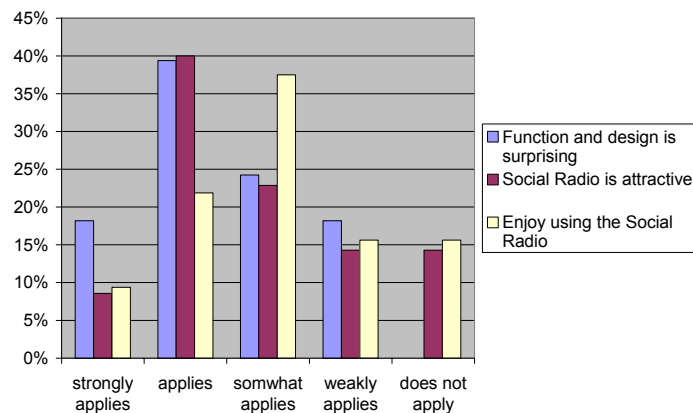


Figure 36: Emotional and rational level of the Social Radio (all people)

4.4.3 Discussion of the Social Radio

With respect to the functionality of the Social Radio the results were not quite positive. The results show that the user needs that were intended to be addressed by the device are actually significant. However, the Social Radio does not seem to be an appropriate answer to this needs. The device is based on the assumption that music is a good indicator for the mood of persons. While this is actually true for people with a strong relation to music it is not valid as a general statement. Moreover, people with a strong relation to music typically also want to be in touch with people that do not have this relation (e.g., children <> parents). Hence, the Social Radio can only help in a limited set of cases.

In order to provide a useful functionality to larger set of people, the device should have more functionality build in. I.e., the functions of the Social Radio were considered to be too limited. For example, it was suggested to embed an instant messenger so that people are not only aware of each other but also have the opportunity to get in touch with each other. To summarize, the devices functionality should be carefully designed so that a wide range of people considers it to be useful.

Interesting results is that people are aware of privacy and security issues. However, if people are in control of what kind of information is provided by them, they are less concerned about privacy issues. That is, people are willing to provide information about themselves if they can control what to share and with whom to share.

Finally, the devices user interface was rated very good. That is, people like the simplicity of the UI. The only (limited) concern was with respect to remembering the association between function and device's orientation. Finally, the design of the Social Radio was also rated quite positively.

4.5 Effects on other work packages / tasks

The overall results of this user test affect the whole Amigo project. Hence, it is required that all participants in WP4 (IUS) read the overall results section of this user test, and mainly those responsible and working for the task Awareness & Notification and Privacy & Security. Further, the test also raised some issues that are of general interest to all application work packages WP5, WP6, and WP7.

5 Graphical User Interface

5.1 Responsible person

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5.2 Description of the mock-up

As part of the Amigo project the mock-up named "GUI" has been developed. The goal of this mock-up is to find out how the menu structure of a graphical user interface shall look like and how people interact with GUIs that follow different navigation strategies.

Within a future home, it is expected that there will be numerous devices and services available which somehow must be controlled by the end user. In many cases there will be a graphical user interface that allows the end user to directly control the service or device using a PC attached to a graphical display, a PDA or even a cellular phone. Note that the Microsoft Media Center Edition (MCE) provides an interesting platform to implement a graphical user interface system. While the MCE is actually focussing on multimedia application and services, its widespread use makes it a good candidate to add an user interface for domotic components/services to it.

However, a GUI where each device or service provides its own interface is of course not a viable solution. Instead, an integrated homogenous interface is needed that hides the heterogeneity of the actual device and service structure from the user. That is, a single solid menu system is needed where each device or services is seamlessly integrated. With the GUI mock-up we want to evaluate how such a menu system shall look like. However, we are not interested in the graphical details of the GUI. Instead, we here focus on the menu structure and the concept how the menus are build.

To this end, we built three mock-ups that all represent a different way how a menu structure is logically generated. Each mock-up represents a menu structure for the same simple home that consists of several rooms (bath room, kitchen, hall, living room, bedroom) with various devices (e.g., cooker, TV set, radio, windows, light). The difference between the mock-ups were that the first two mock-ups share a device oriented view while the last mock-up is function oriented. That is, in the last mock-up the device borders are dissolved bringing functions of different devices onto a single menu page.

In order to find out how user operate with these different kind of menu systems, the mock-up were implemented as Java applications that can be executed on a PC. The test user were assigned a set of tasks they had to execute. The time required by the various users were recorded. Further, the user had to fill out a questionnaire.

5.3 Study Methodology

Our tests aimed at analysing the effectiveness of different menu structure from a use perspective. That is, the outcome of the tests is expected to answer crucial questions regarding user preferences on menu structures. To obtain the results, users were confronted with the mock-ups and asked to perform a set of task. The results of this user test will feed into development of the user interface services.

5.3.1 Hypothesis

One major goal of the test was to find out, how people would like to have their menu structures logically laid out. Especially, we want to check out, whether people prefer a device/room oriented view on the devices or prefer to focus on the functions instead of devices.

Before the tests, we had the following expectations:

- It is expected that users prefer different user interfaces and that the preference is somehow equally distributed among the menu candidates. I.e., we expect that there is no single “one approach fits all” solution
- We expect that user become faster when they become used to the specific way a menu structure is logically build.
- We expect that user will prefer those menu structures which they are able to reach their goal in less time.

5.3.2 Participants

People of different age has been selected to conduct testing. Information about the people is shown in the following Table.

Age range	Sex	# of people	special properties	time per person	remarks
22 – 46	14% female	29		25 minutes	

Table 4: People that participate in the tests of the Social Radio

5.3.3 Test apparatus

There were three mock-ups created for the same virtual apartment. The mock-ups were implemented as Java based applications. Hence, user were able to operate it via a mouse. However, the mock-ups did not actually control any device or services. Further, the mock-ups automatically created tasks for the user during the tests and measured the time needed to fulfil the tasks.

In detail, the menu structure of the different mock-ups were build according to the structures that are explained in the following sub-sections.

5.3.3.1 Mock-up 1

The first mock-up implemented a menu structure where at the first menu level the user had to choose the appropriate room, then a device and finally a function of the device. Depending on the device type, they could then directly select a specific function or had to choose between different sub-menus like “basic function” or “recording”. This menu structure is classified as “device” centric in the following.

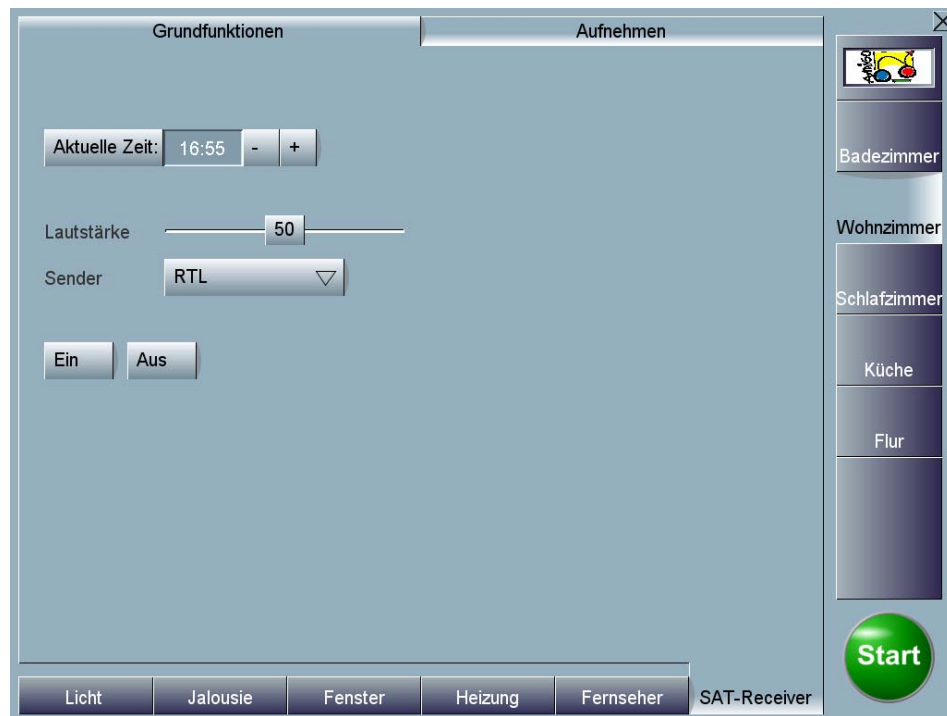


Figure 37: Menu structure of the first mock-up

Figure 37 shows a screen shot of the first mock-up. As can be seen, the first menu level is displayed on the right hand side (room selection). Then, the devices in the appropriate room become available (bottom of window). Finally, the user can select the appropriate function or chose between “basic functions” and “recording functions” (top of window).

5.3.3.2 Mock-up 2

The second mock-up implemented a menu structure that allows the user to choose between ambient functions, comfort function, multimedia and white goods. In the next level, the user selects between different rooms. In case of a complex device, the user selects between “basic function” and “recording”. Finally, the actual device function can be chosen.

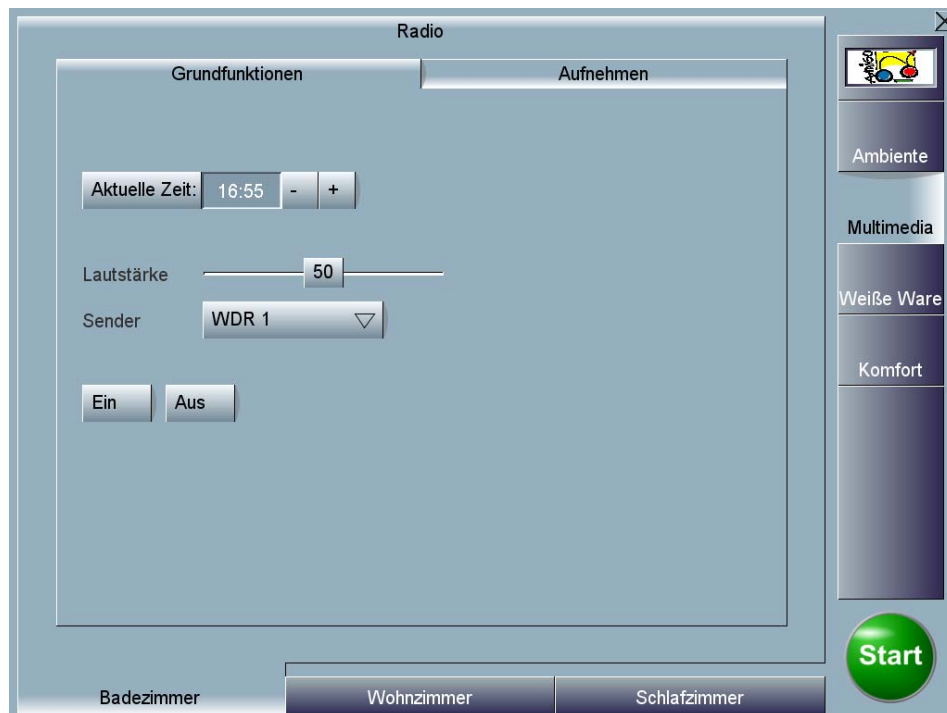


Figure 38: Menu structure of the second mock-up

An sample screen shot of the mock-up is shown in Figure 38. Again, the first (top) menu level can be selected at the right hand side (category of the device). Then, available rooms are selected on the bottom page. Due to the previous selections, the devices available in a room and belonging to the selected category are shown and can be selected via the menu items shown on the top. Finally, additional sub-menus may be selected depending on the complexity of the devices. This menu structure also belongs to the “device-centric” class.

5.3.3.3 Mock-up 3

At the first menu level, the functions are grouped by ambient functions, comfort function, entertainment, wellness etc. Then, rooms can be selected. Afterwards, for complex devices the functions are separated by functions that are related to setup, programming and “life”. “life” functions have a direct effect on the behaviour of the home.



Figure 39: Menu structure of the third mock-up

The third mock-up is shown in Figure 39. Note that in contrast to the other both mock-ups a function centric view is presented. That is, the user first selects a function category (e.g., entertainment or cooking) and then chooses the appropriate room. Next, in top part of the menu screen the user can do further selection on the functions.

An sample screen to show that on the final page there may show up functions of more than a single device is Figure 40. Here the “live” functions for the TV-set as well as for the satellite receiver are presented on a single page.

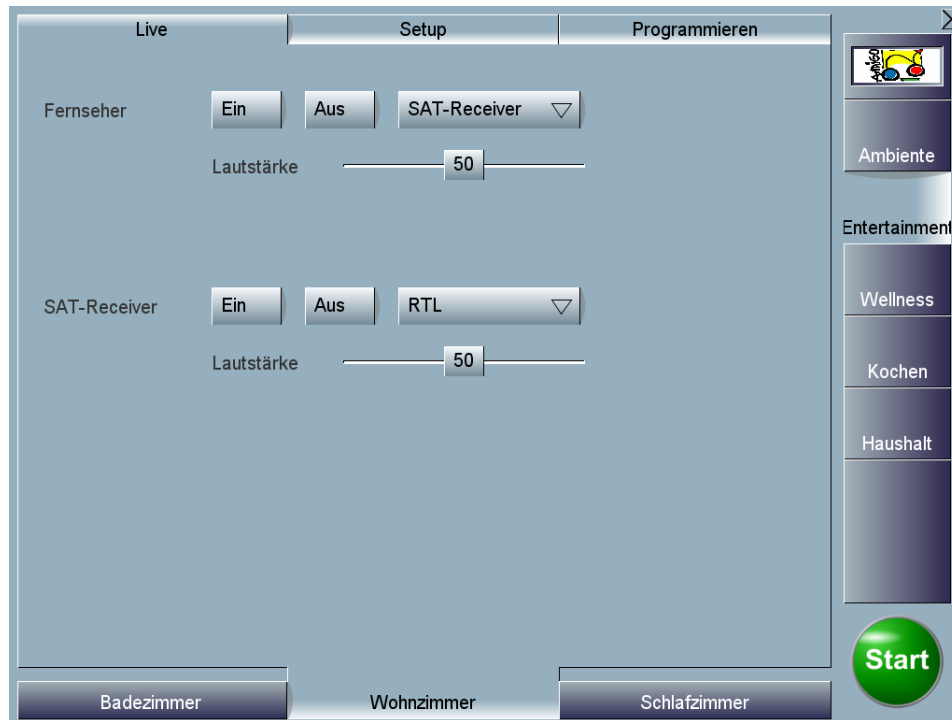


Figure 40: Final menu page with functions of two devices (TV-set and satellite receiver)

5.3.4 Procedure

The mock-up has been tested qualitatively via direct user – mock-up interaction. During the tests, the user were assigned a set of tasks they have to fulfil via the mock-up. The system then recorded the time needed to reach the specific goals. The tasks ranged from simple assignments like “switching on the lights in the hall way” to complex ones like “programming the satellite received to record a specific channel between 5pm and 6pm. For each mock-up the same set of tasks were asked so that we could compare efficiency of the UI for the different logical menu layouts.

For testing, the each user got an introduction to the virtual home and the test environment. Then, people were asked to run the actual tests where the program assigned tasks to them and measured the time to completion. The time data were stored to a file.

After the practical tests, people were asked to fill up a questionnaire. The questionnaire included a mixture or questions as well as explanations about the mock-up’s functionality. The goal of the questions was to retrieve demographic information about the test persons as well as current experiences with complex menu structures and how people get used to complex devices. Then, they were asked about the mock-ups. In detail, they were asked to rate how the mock-ups compare to each other and whether the menu were structured as expected. Finally, they were also asked to rate the different menu structures.

In short, the procedure can be summarized as follows:

1. Introduction to the virtual home setup (available rooms and devices) and to the test procedure
2. Practical part: mock-up testing
3. Questionnaire

Completing the practical tests and the questionnaire took approximately 25 minutes per person.

5.3.4.1 Questionnaire

See above

5.3.4.2 Measurements

See above

5.3.5 Data analysis

We interpreted the data based on descriptive statistics (e.g. frequencies, percentages).

5.4 Results

First, the overall results of the analysis are presented, then a more detailed presentation is given.

5.4.1 Overall Results

An important question is what people think about menu structures of current devices and how these structures typically relate to each other. Hence, people were asked whether they think that the handling of current devices differ significantly or not. In Figure 41 the results show that the vast majority of people think that varying menu structures are actually an important issue.

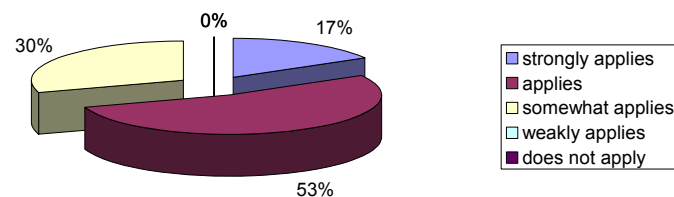


Figure 41: Handling of modern devices differs

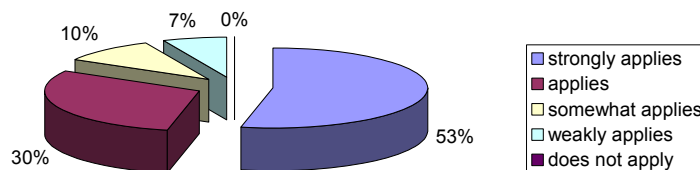


Figure 42: Need for a single user interface

Further, people were asked about the advantage of having a single user interface to their devices (see Figure 42). Obviously, the need for a single homogenous user interface for all (or many) devices in the home is very high. This is not surprising, as struggling with many remote controls is quite a common scenario in today homes.

One of the most important question is of course about the preferred menu structure. As can be seen from Figure 43, the most popular menu structure is the simple “room-> device->function” (device centric) approach. That is, 2/3 of the people prefer to look at the devices from a hierarchical point of view. However, note that still 34% prefer another logical menu layout. The strong bias towards this simple menu structure is somehow surprising. A reason for this might be that people are currently used to look at functions from a device perspective because this is the currently the way functions are organized. As a result, this preference may change if more and more functions are embedded into the environment where no single device can be identified to be the host of a specific function.

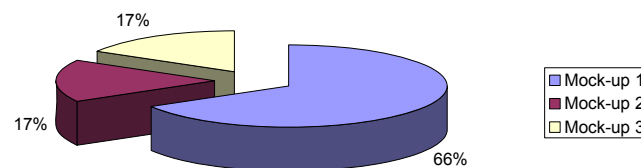


Figure 43: Preferred menu structure

In order to have more insight into the reasons why people prefer the menu structure 1 see Figure 44. Obviously, a big advantage of the simple menu structure is that people can more easily grasp the core idea that has been used to build it.

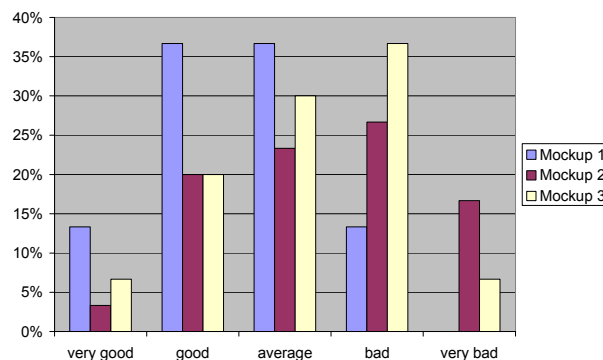


Figure 44: Can the menus be operated in an intuitive way?

Note that efficiency does not play the first role when deciding about the preferred menu system. In the following figure, the efficiency ratings are presented. While the first menu structure is still the winner, the difference especially between the first and the second structure is not as big as the overall preference might indicate.

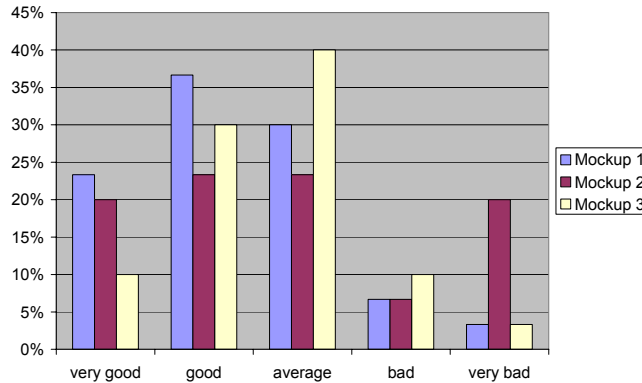


Figure 45: Efficiency of the menu structures

In the figure below, the rating for the conciseness of the mock-ups is shown. Here, menu structure 1 can claim a significant better acceptance than the other approaches. Hence, conciseness seems to be a more important aspect of a GUI than the time needed to fulfil a specific task.

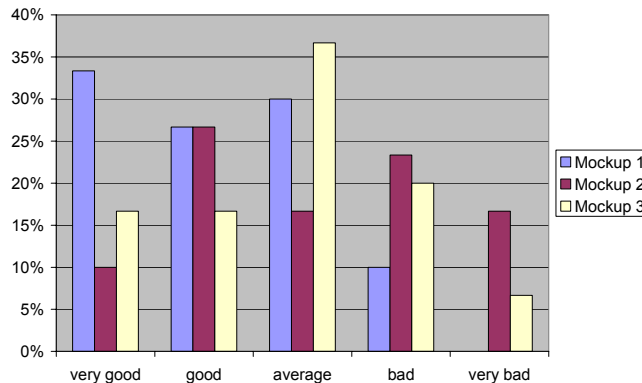


Figure 46: Conciseness of the menu structures

To backup this qualitative results we also done some quantitative experiments where the execution time for the various experiments were measured and compared. In general, the results show that people are getting faster when they become used to a user interface. However, the results also showed that usage speed or efficiency is not the major criteria to rate a specific menu structure.

5.4.2 Detailed analysis

5.4.2.1 Current user interfaces of devices

In order to find out what people think about user interfaces of current (complex) devices they were asked about

- user handling of different devices,
- use of user manuals and
- how intuitively current user interface can be operated.

The results are shown in Figure 47. From these diagrams one can see that people feel that UI differs significantly from device to device. However, people also experience that the UIs are somewhat self describing so that they tend not to read user manuals before starting using a new device. So, UIs differ but people are typically capable to adopt to a new UI. One reason for this is that the people that were involved in the tests were somewhat young and hence were used to operate complex devices frequently. For sure, the

results were different if elderly people would have been asked. However, for this analysis we targeted on people that are used to modern technology.

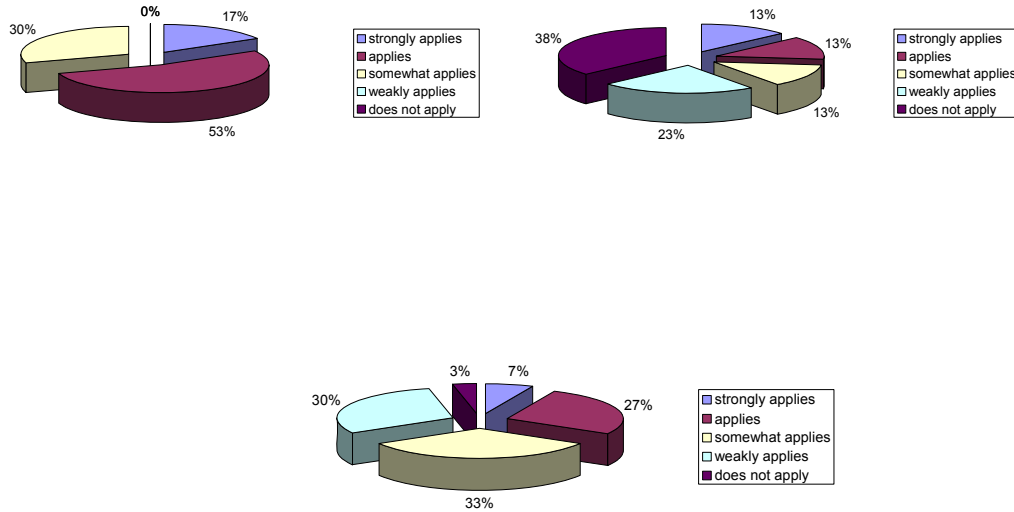


Figure 47: Agreement of people to the statements "handling of devices differs strongly" (top left hand side) and "I am reading the user manual first before starting using it" (top right hand side) and "menu structures of current devices are self describing" (bottom)

5.4.2.2 Need for a integrated user interface

Further, people were also asked whether they regularly use foreign devices and whether there is a desire to have a single central UI for all (or most) devices available within an environment. The results are shown below.

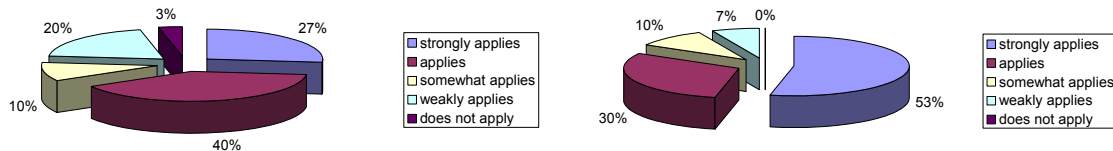


Figure 48: Agreement of people to statements "I am often changing environments where I need to operate devices" and "I think a single integrated UI is useful"

People often change their environment and also see a strong benefit in having a single integrated user interface available. That is, far more than 60% of the people agreed (answer with "strongly applies" or "applies") to both statements. So, despite of the fact that people are capable of handling different UI

reasonably efficient, they see a very strong need and benefit in having a single homogeneous UI. However, the level of desire for a single UI is somehow surprisingly (83% of the people replied that this is desirable or very desirable).

5.4.2.3 Qualitative comparison of the three menu structures

For comparison of the three different menu structures, people were asked about their rating for each structure with respect to efficiency of usage, conciseness, whether it is self describing and whether it can be operated in a intuitive way.

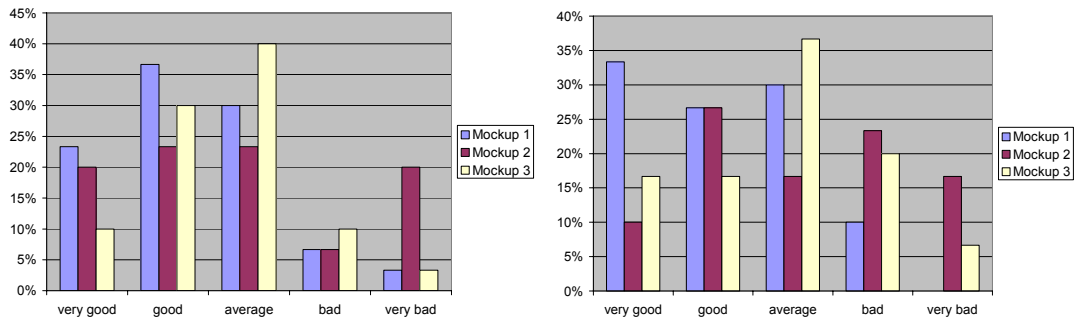


Figure 49: Efficiency of usage (left hand side) and conciseness (right hand side)

The results are shown in Figure 49. People consider menu structure 1 as more efficient and more concise compared to the others. However, while menu 1 is considered as far more concise, its advantage with respect to efficiency is not that big. That means, that conciseness does not necessarily directly translates to efficiency.

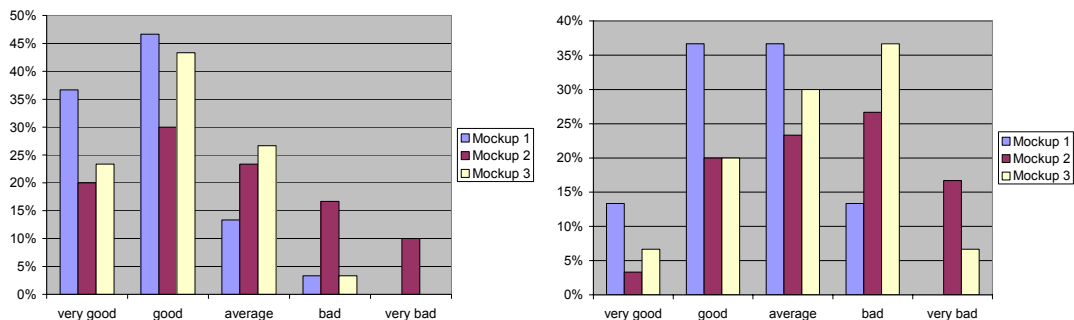


Figure 50: Whether menus are self describing (left hand side) and whether they can be operated in a intuitive way (right hand side)

Next, user opinions about whether the menus are self describing and whether they can be operated in a intuitive way are shown in .Figure 50. Note that for the self description capabilities all menus are somewhat similar (while menu 1 still has an advantage over the other ones). However, with respect to whether they can be operated in an intuitive way, menu 1 has a significant bigger acceptance rate. That is, even though people could actually grasp the main idea of how the menus were structured quite well, menu 1 seems to be the most “natural” way of looking at the home environment. This is also shown in the overall rating (see Figure 51). Here, 66% of the people prefer menu structure 1 and the remainder is split up equally between menu structure 2 and 3.

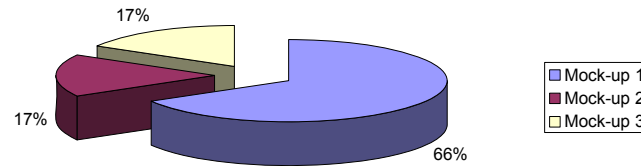


Figure 51: Preferred menu structure

5.4.2.4 Quantitative comparison of the three menu structures

In this section an analysis of the execution time for the various assignments that were given to the users is provided. First, the overall execution time of the three mock-ups are compared in Figure 52. The numbers are related to mock-up 1 (100%). Note that the overall difference is not that big. That is, it is about 7% at maximum (mock-up 1). This is somehow surprising when comparing these numbers with the overall preference of the users. As a result, this figure supports the conclusion, that efficiency (speed of usage) is not necessarily the most important aspect for choosing a preferred menu structure.

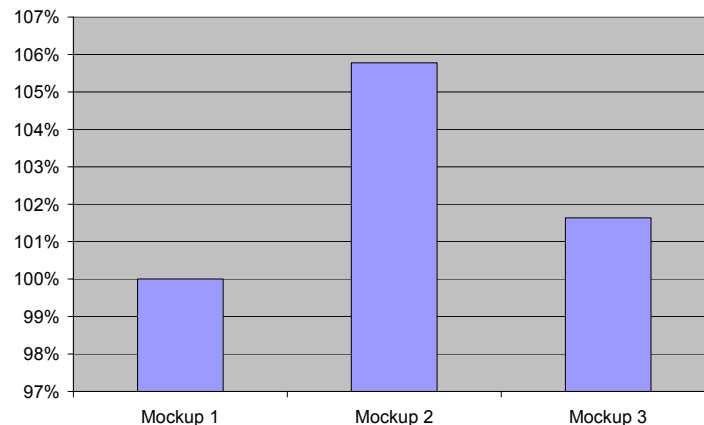


Figure 52: Overall exercise runtime related to mock-up 1

To find out whether user are able to operate a menu structure faster once they get used to it, the runtime of two specific experiments were compared. In detail the runtime for experiment 2 “record the movie on TV channel PRO7 from 5pm to 6pm” were compared to the runtime for experiment 12 “record a radio broadcast on WDR3 from 5pm to 6pm”. The comparison is shown in Figure 53. Note that for mock-up 2 and mock-up 3 the difference is quite high (19% and 27%). Surprisingly, runtime for mock-up 3 does not improve over time. A reason for this might be that people are having difficulties to get used to the menu structure of the last mock-up.

To find out whether improvement rate correlates with the preferred choice, we created three groups of people where each group contained only people that preferred a specific menu structure. Then, the speedup numbers were determined for each group separately. The results are shown in Figure 54. As can be seen from the figure, the general picture still holds. That is, people became faster with menu structure 1 and 2 and slower with menu structure 3. It is interesting to note that people that preferred menu structure 1 got significantly faster over time (about 25%).

Finally, the overall execution times were also correlated to the preferred menu structure choice. It turned out that this choice is not correlated with the fastest execution time. In detail about 50% of the people actually did not choose the menu structure which they could operate faster than the others.

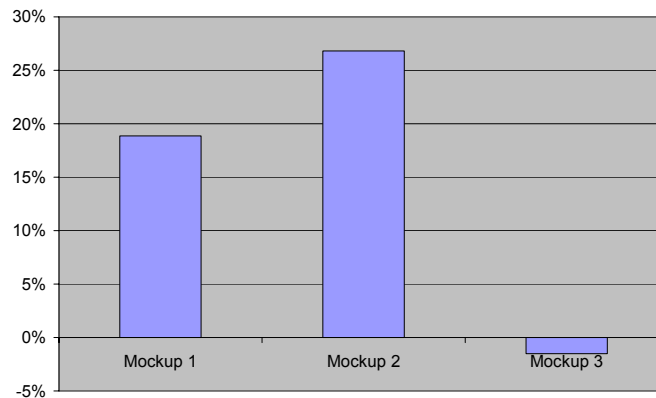


Figure 53: Execution time difference between experiment 2 and experiment 12

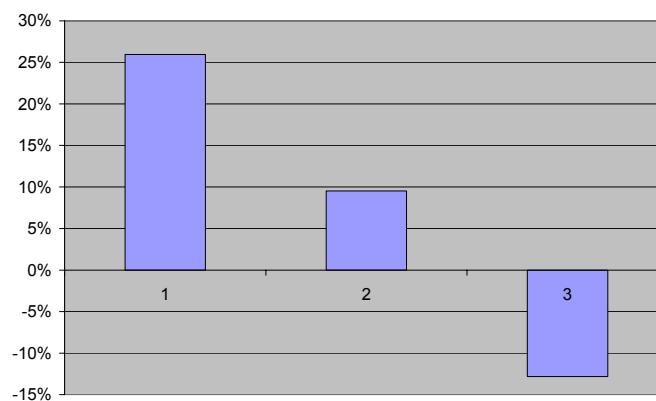


Figure 54: Execution time improvement for experiment 2 and experiment 12 taking preference choice of user into account

5.4.3 Discussion of the user interface mock-ups

As a summary, the following results were obtained.

- Users have a strong preference to a menus which structures the devices in a strongly hierarchical fashion starting with rooms, then devices and finally functions. The reason for this might be that this reflects the current way of operation. That is, people are used to think in terms of devices and not in terms of functions or services. This may change in the future when the borders between devices and function/services become more blurry.
- While there is a strong preference towards a device oriented (room->device->function) structured user interface, a significant amount of people also had other preferences. That is, one third of the people preferred one of the other two approaches. So there is no “one-fits-all” menu structure.
- Users menu operation actually become faster when they get used to a specific menu structure. This does not only hold for menu operations that are just repeated but also for operations that are just similar.

- User do not necessarily choose the menu structure they can operate fastest to be their preferred menu structure.

As a consequence of the results, the default menu structure that is presented to new users (i.e., users the system has no preference information about) should be device oriented (room->device->function).

5.5 Effects on other work packages / tasks

The overall results of this user test affect especially those work packages that are related to user interfaces or need user interfaces. Hence, it is required that participants in WP4 task 4.5 (user interface services) and WP5, WP6 and WP7 read these results.

6 Overall recommendations

While the questions that were tried to be answered by the user tests were specific to the actual mock-up type, there are also some results that may be considered to be of general interest. In the following some more general statements and results are summarized that may be of interest to application and middleware developer:

- Users like to have devices for a special need, however, they clearly look whether a device's functionality is sufficient to justify a separate device.
- People are aware of privacy and security issues. That is, services or devices must be designed with these aspects in mind. This holds even when it comes to sharing private information with friends or relatives. However, once there is a significant benefit and people are in control of the information that is going to be shared with others, they accept these kind of risks to some kind of extent.
- Awareness and notification are significant needs of people. Even if the currently provided solutions are not an accepted answer to this needs, this does not mean that people would not like to have a solution for it.
- People are aware of the problems that arise from using various different devices. While they are typically able to operate them reasonably fast, they see a strong need for integrated homogeneous user interfaces that provide a similar look and feel across various devices and applications.