

IST Amigo Project

Deliverable D1.2

**Report on User Requirements  
Quantitative and Qualitative Research  
Scenario Driven  
Volume III**

Public

<b>Project Number</b>	:	IST-004182
<b>Project Title</b>	:	Amigo
<b>Deliverable Type</b>	:	Public

<b>Deliverable Number</b>	:	D1.2
<b>Title of Deliverable</b>	:	Report on User Requirements: Quantitative and Qualitative Research Scenario Driven, Volume III.
<b>Nature of Deliverable</b>	:	Report
<b>Internal Document Number</b>	:	Deliverable_D1.2_VolIII Qualitative research_v10_final.doc
<b>Contractual Delivery Date</b>	:	28 February 2005
<b>Actual Delivery Date</b>	:	11 April 2005
<b>Contributing WPs</b>	:	WP 1
<b>Author(s)</b>	:	Maddy Janse (Philips), Norbert Streitz, Carsten Magenkurth, Carsten Roecker, Thorsten Prante (IPSI), Nathalie Portolan (France Telecom), Mirko Barone, Sergio di Marca (Italdesign – Guigiaro), Arantxa Larrañaga, Imanol Lucas (Fagor), Eva Madrazo, Javier Arribas, Sara Carro-Martínez (Telefónica I+D).

## Abstract

Quantitative and qualitative methods were used to elicit the feedback from the target user population on the concepts that are proposed in the Amigo project scenario. The Amigo scenario consists of four scenes, which provide a view on a day in the life of a fictional family. The scenes comprise examples of the Intelligent User Services and the Application Domains that are proposed in the Amigo project. The quantitative research, Gallery, consisted of a preference ranking of elements in the scenarios, which were exemplars of Intelligent User Services. The first qualitative research method, MyPlace, consisted of a structured focus group session addressing the Amigo Application Domains. The second qualitative research method, IdealHome, consisted of an open-ended discussion on people's expectations of ambient intelligence technologies in their home and life. Using these three complimentary methods resulted in confirming evidence with regard to perceived user goals and needs and the match or mismatch of the proposed Amigo solutions. Elements referring to Intelligent User Services were abstracted from the scenes of the Amigo scenario and people were asked to give a judgment with regard to their perceived usefulness. The results from this Gallery evaluation could be summarized and prioritized in user requirements that are generic for multiple Intelligent User Services. The participants at the scenario evaluation sessions generated a wealth of suggestions and ideas for usage and services. They also were very determined about the ideas that they at face value did not appreciate at all. Most pertinent for people are the requirements, which we might call 'hygienic', such as, easy to use, nice looking, and no programming, no extra effort, affordable, functional. Participants were unanimous in their desire to protect their privacy, their mistrust of a system invading their personal life, and their dislike of being too dependent on an ambient system for social communication

## Keyword list

Networked home, user services, user research, qualitative evaluation, quantitative evaluation, usage scenarios, home information and entertainment applications, home care and safety applications, extended home environment, evaluation methodology, focus groups

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# 1 Goals

The major objectives for conducting the qualitative and quantitative research of the Amigo scenarios are:

- To obtain feedback from users on the Amigo scenarios with regard to usefulness and appropriateness in relation to predicted and perceived user needs.
- To generate user requirements for the Amigo intelligent user services and applications.

The Amigo scenarios describe different possible situations and events that could occur in the environment and homes of people who have an operational 'Amigo' system. These scenarios are futuristic and don't necessarily match people's current experiences and expectations. To explain and visualize these scenarios in such a way that they can be used to elicit feedback from people in a systematic and reliable way and be amenable to the generation of user requirements is a challenge. In addition, the goals and constraints of the project have to be incorporated, structured and made operational for research sessions with target users. These sessions have to be conducted at different locations at different partner sites. The next section describes the variables that were accounted for in the methodology.

## *1.1 Independent Variables:*

The Amigo scenarios are derived from a set of Intelligent User Services (see Amigo DOW WP4) and Application Domains that were predetermined by the Amigo project contract. These Intelligent User Services and Application Domains can be considered as independent variables. The Intelligent User Services are partly nested within the Application Domains.

The following Intelligent User Services (IUS) are proposed in the Amigo scenarios (the codes S1 – S6 corresponds to the codes used in Volume II, State of the Art Analysis):

### S1: Context Collection, Aggregation, and Prediction

This service facilitates the composition of relevant sources (e.g., sensor data) to construct higher-level context information and proposes appropriate actions upon user context detection.

### S2: User Modeling and Profiling

This service deals with interaction and location histories as well as with more explicit user models, profile and preference information.

### S3: Awareness and Notification

This service provides a mechanism that exploits information provided by different sources either in the form of basic data coming from sensors and user interaction or already aggregated at a higher level.

### S4: Content Provision, Selection and Retrieval

Entertainment-, information-, and activity- oriented access for different types of content and tailored for context and user profiles and preferences

### S5: User Interface Services

This service handles the devices to present different contents, in different interaction modalities and for explicit and implicit user interactions.

### S6: Security and Privacy

This service deals with the protection of privacy and personal security in an ambient intelligent environment.

The following Application Domains (AP) are proposed in the Amigo scenarios:

### 1: HomeCare & Safety

2: Home Information and Entertainment

3: Extended Home Environment

These two variables, 6 levels of IUS and 2 levels of AP are hidden in the scenario descriptions. The text of the Amigo scenario and the 4 scenes that compose it are shown in Table 1.

**Table 1: Amigo Scenario**

<i>A day in the life of Maria, Jerry and their children: Robert and Pablo</i>	
<p>John's daughter Maria has recently left her hometown to settle with her husband Jerry and their two sons in a faraway city where Maria has found a new job. The father and daughter have a strong emotional bond and wish to stay in close touch, as if they were still living together. But they also want to keep their privacy, as Maria is not keen to have her father interfere in her family life, and John, being divorced, wants to isolate Maria from his relationship with his new girlfriend, Madeleine.</p> <p>They have had an "ambience sharing" system installed in their respective homes. Maria need not <i>focus</i> on any device, nor need she <i>wear</i> any device, she may go about her usual activities, walk back and forth between her living room and her kitchen, unfettered, unencumbered. Communication becomes a background activity. She can specifically choose the communication mode: it can be automatic, but it is also possible to make the system go off-line, into privacy mode or into fully open communication. John is able to know, without intruding, what is going on at his daughter's home, without paying too much attention, but still feeling connected.</p>	
Scene 1	<p>It's Tuesday morning in Maria's home. A soft and lively song is playing in Maria's bedroom, specifically chosen by the system to cheer her up. Maria wakes up and walks towards the bathroom, with the music following her. While she is having a shower, she starts to sing cheerfully, and when the system recognized the song it looked in the media database. It was in the local database, so the system offers to play it instead of the current song. She answers yes and the song is changed automatically. When she gets to the kitchen, her husband Jerry is feeding their son Pablo. The music stops, as this was predefined in the system when Jerry and Maria occupy the same room, starting again if one of them leaves the kitchen. While they are having breakfast, they request to watch the news on the digital-TV set. The system displays a summary of the main news with the preferences of Maria (sport, local and technology) and Jerry (world, finances and weather). Maria decides to download some of the most interesting news to her personal device, to review it while she is going to work. This information is automatically stored in her personal device, which is in the bedroom. While Maria is cleaning her bedroom the system asks her to look at her personal events for the day. She agrees, by speaking with the system. After that, she says goodbye to her husband and goes to her job, taking her personal terminal that has been brought up-to-date with the decisions she had just made.</p>
Scene 2	<p>Robert is Maria's and Jerry's second son and has finished his lessons early this afternoon. His best friend is going to come over in half an hour, but he decides to play some video games before then. He turns on his new console that is wirelessly connected to the whole home system, and the video wall shows the console start-up screen. He asks for the available video games list, which is downloaded from the server and complemented with the games he already has at home. His favorites are shown on top, with statistics on how well he performed recently and his account status. Robert is underage, so those games that may have adult content are displayed in red at the bottom of the page. Unless clear parental permission is given, he cannot play them. The first times he played these weren't shown, but he always liked to see the whole list, so the system changed that. He wants to play one of the games marked as mild-violence, so the system contacts his parents to check if they will allow him. Robert chooses to play his favorite MMORPG (Multi-Media-Online-RPG). The whole home environment contributes to his game experience. The lighting of the room adjusts to reflect the same lighting level of the game and the surround sound also contributes in increasing the realism of the game play. The video wall is the best display to enjoy these kinds of immersive experiences, and he has place enough to also display the lobby chat, where he can see and hear the real faces and voices of the other players he's interacting with. He doesn't use a pad to input his character's movements because the new system is connected to the home cameras that track his arm and leg movements, so his experience is not hampered by awkward keypads. He just moves his arms, crouches and jumps, and enjoys the new game system much more than he did with the old one. He does have a small wireless analog joystick in one of his hands, because the character still has much more freedom of movement; he plays in a closed room, but it is much more realistic than any other game he played before. Finally, his friend arrives. They decide to play together, so Robert asks the system to let his friend join the game. He has brought his own joystick that self-configures to work in Robert's home wireless frequency. His friend's player profile is downloaded, and they contact even more people through the Internet. They cooperate to win at a very difficult level, so they had a memorable game that day.</p>

Scene 3

After work Maria comes home. The front door recognizes her and lets her in without the need for her to grope for keys. A photo frame shows that Robert is home, but Jerry and Pablo not yet. She wants to start cooking quickly as she is a bit late today. Maria is cooking a new recipe downloaded from Internet. Maria continues cooking. She's wondering about her son Robert and asks the home system to interconnect to him. His image playing in the bedroom room appears in the same screen as the recipe. She talks to him and she asks Robert and his friend to go to the kitchen and help set up the dinner table. They agree to do so. In the meantime Jerry has picked up Pablo from the day care center and has come home as well. He praises his son Robert for helping his mum. Soon the whole family is having an enjoyable meal. After dinner Maria puts the dishes into the dishwasher. This appliance detects that it's full (*by weight sensors*) and it starts to run. Meanwhile Jerry has filled and activated the washing machine. After dinner, father and mother are going to have a rest watching a TV film. For the home system prepares the environment conditions. But before the film has started, the home system says "There is a problem in the washing machine. There are colored and white pieces of clothing together". Jerry is slightly irritated but still goes off and finds a red sock in the white wash. He wishes the system could have picked it out by itself, but is grateful that all his white shirts will not become pink.

Scene 4

In a standby mode, John may be presented with various instances of an audio-video ambience of his liking. Whenever Maria, his daughter, is in her own living room, John can share the ambience at her place, much as if Maria were still living with her. He is clued in by the changed ambience that Maria is back in her living room, yet they do not engage at once in direct talk. After the movie, Maria decides she wants to talk to her father. When Maria walks towards one of the screens the image of John in his own house zooms in and the two talk about what they did during the day and their plans for the coming night. This privileged mode of communication between John and Maria is automatically suspended when Madeleine comes in. John has set her preferences to a semi-privacy mode in this situation, and the image presented to his daughter is partially obscured through a virtual Venetian blind. Maria can no longer make out their conversation, but her father's presence is still indicated. She says 'bye, will talk to you later'.

The following table shows how the IUS and the AP are distributed over the scenes in the scenario. The numbers (1-4) in Table 2 refer to the scenes in the scenario descriptions.

**Table 2: Distribution of Intelligent user Services (S1 – S6) and application domains (D1-D3) over the scenes in the Amigo scenario.**

	S1	S2	S3	S4	S5	S6
D1	3		3		1, 2, 3, 4	
D2	1	1, 2	1, 2	1, 2	1, 2, 3, 4	2
D3	4	4	4		1, 2, 3, 4	4

Except for S5, User interface, not all IUS and AP are present in all the scenes of the scenario. Another complicating factor is that the IUS are described in Amigo WP4 from the perspective of a service that is being provided to end-users. The scenarios assume that these services are already available to the user. So, it is their unobtrusive availability, that needs to be evaluated and not the performance against an operational definition. Such an unbalanced distribution of variables is inherent to our domain of system design and development.

*1.2 Dependent Variables*

The scenarios are in first instance not meant to structure independent variables for an evaluation experiment, but to generate feedback with regard to concepts from potential target users. The feedback from target users can be structured and compared for different project sites and variables by obtaining quantitative and qualitative responses.

The following dependent variables were identified as most useful with regard to providing feedback and input to the overall Amigo project and to provide the basis for the generation of initial user requirements:

- Usefulness and appreciation ratings
- List of advantages and disadvantages
- Responses from focus group sessions

## 2 Methodology

The user studies were composed of three parts. One part was dedicated to obtain the quantitative results and two parts were dedicated to obtain the qualitative results. For each part a methodology was designed. The quantitative part - Gallery session – was conducted in exactly the same way at 6 different sites for all scenario scenes and application domains. The qualitative parts – MyPlace and IdealHome sessions- were conducted as focus group sessions at all 6 sites and adapted to the preferred application domains of the partner sites.

### 2.1 Gallery

The goal of the Gallery session is to collect quantitative feedback from participants on the Amigo scenario. Participants were asked to give a score to the elements that compose the scenes in the scenario and to list advantages and disadvantages of these elements. The contents of the scenes were used as stimulus materials. The elements from the scenes were visualized, grouped as theme and shown in an art gallery set-up. Participants visit the exhibition and are asked to rate their appreciation of each theme and its elements.

#### 2.1.1 Gallery setting

Two neighboring rooms are furnished as a reception/meeting room with large table and chairs, refreshments, paper, pencils and as an exhibition room showing representations of the Amigo themes at four different walls (See Figure 1). These themes are: 'Being followed by personalized content' (Amigo scenario scene 1), 'Playing games' (Amigo scenario scene 2), 'Home caring (Amigo scenario scene 3), and 'Sharing ambiance' (Amigo scenario scene 4). In the reception room, during coffee, a general introduction is given to the participants concerning the visualization of the scenes in the exhibition. This is accompanied with a short instruction relating to the tasks they have to perform in the gallery room.

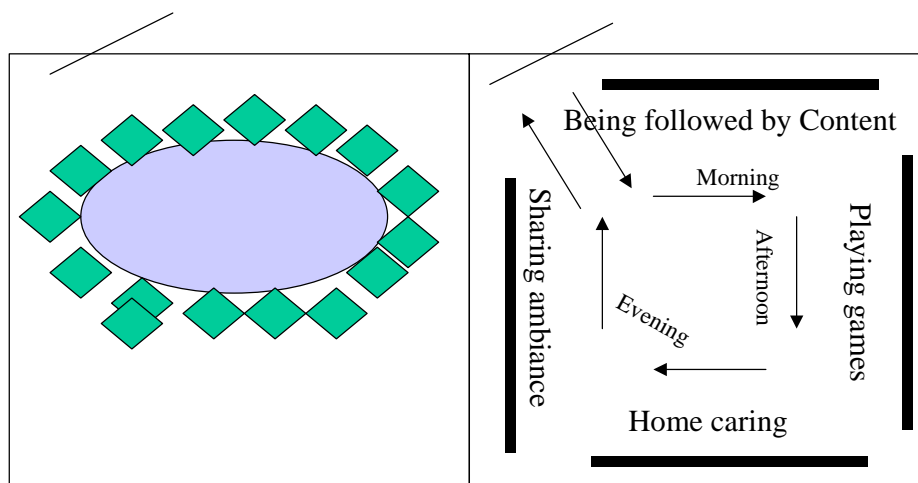


Figure 1: Gallery Set-up: 2 rooms, 1 for reception, 1 for exhibition

#### 2.1.2 Stimulus Material for the “Gallery”

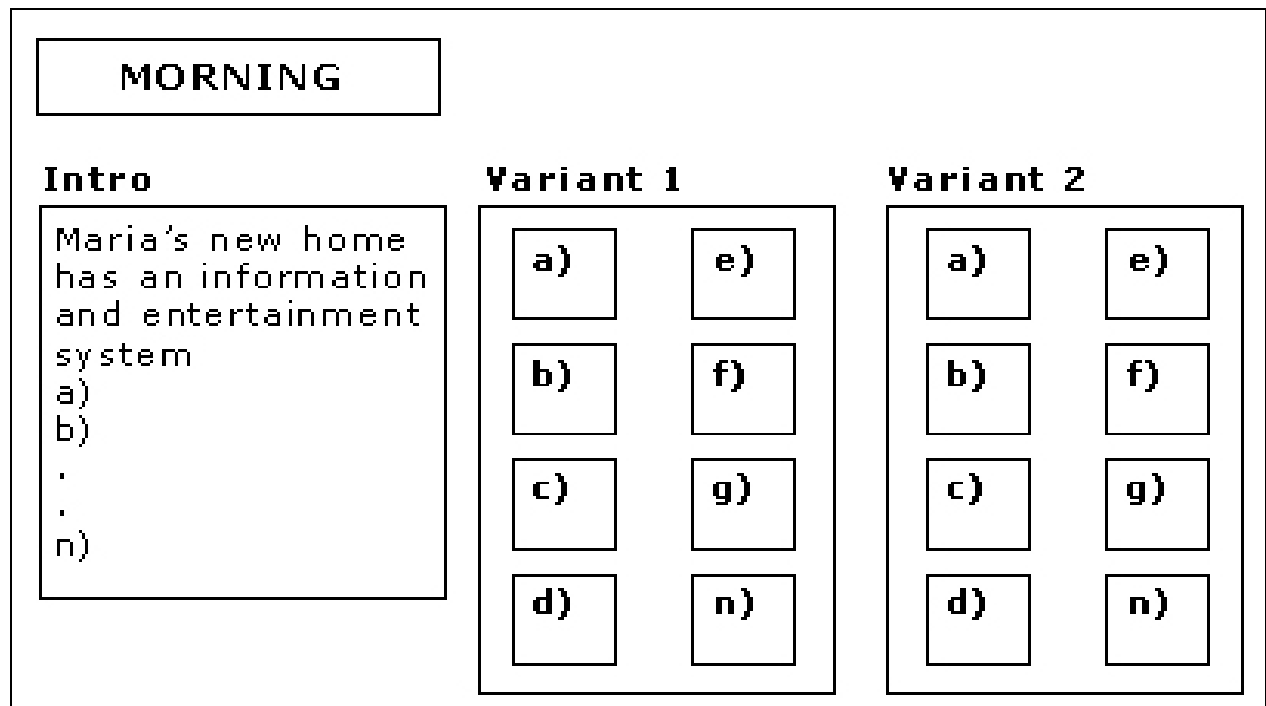
The gallery presents four scenes. Each wall presents one scene (See Figure 2). For each scene there are variants/visualizations in the presentation. These variants correspond to



elements in the scenario. There are two variants for every scenario. The visualizations of each variant were fit on a frame of a different color.

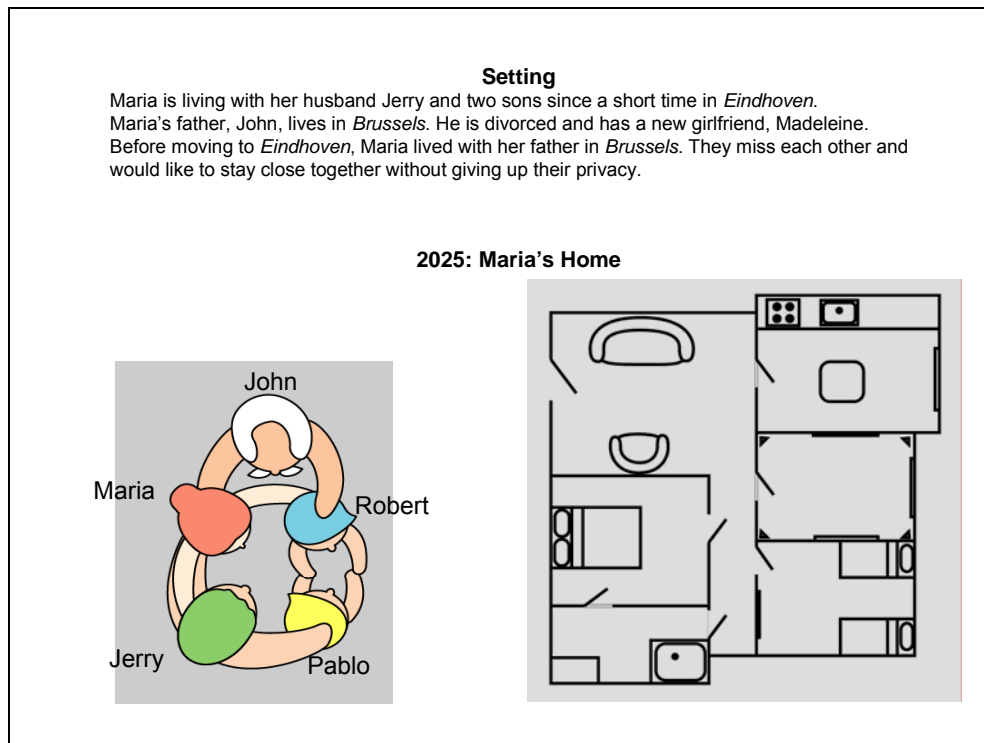
The concepts are visualized and presented on a wall and people can walk around to watch, like they do in an exhibition. The text was minimized and translated for each site (5 different languages).

The visualizations of the Amigo scenarios consisted of materials gathered from the different Amigo partner sites.



**Figure 2: Example of a theme wall in the gallery (Each variant has a colored frame)**

Each scene has an introduction, which constitutes a rewrite of the Amigo scenario in user benefit terms. These user benefit terms correspond to the elements that are visualized as stimuli. Table 3 shows these scenes and their elements. These tables were also used to collect the responses from the participants, i.e., they were asked to rate the elements on a scale from high to low with regard to usefulness and nice to have. Figure 3 shows the introduction to the context of the Gallery.



**Figure 3: Introduction to the Gallery context**

*(Terms in italics were adapted to each participating site)*

**Table 3: Scene from the Amigo scenario and their constituent elements**

<b>Scene1: Being followed by content</b>	<b>Scene 2: Playing games</b>
<b>Elements (n=8)</b>	<b>Elements (n=8)</b>
a) It plays her favorite song when she wakes up in the morning	a) It asks for parental permission
b) The song follows her through the house	b) It downloads and shows game play lists
c) At the same time it shows Jerry's favourite news in another room	c) It adapts the lights and the sounds of the home to the environment of the game
d) If she starts singing her own song, the system starts playing it	d) It displays a video wall to show the game and other players
e) If she goes to Jerry in another room, the system stops playing	e) It lets the game player interact with body movements
f) If Maria or Jerry leave the room, the system starts playing again	f) It recognizes friends at the front door and lets them join in the game
g) The TV shows summaries of their favourite news	g) It recognizes and integrates the game devices of the friend
h) The news is downloaded on a portable device to take along	h) It downloads the profile of the friend
<b>Scene 3: Home caring</b>	<b>Scene 4: Sharing ambiance</b>

Elements (n=7)	Elements (n=4)
a) It has an intelligent door that recognizes family and friends	a) It shows her father at his home and Maria in her home
b) It has a vestibule display showing who is home	b) They see each other and it lets them engage in a chat
c) It downloads recipes in the kitchen	c) It interrupts the chat if other persons enter the room
d) It shows recipes and the whereabouts of the persons in the house	d) It knows the privacy preferences of both Maria and her father
e) It detects faulty items in the washing machine and warns	
f) It starts the dishwasher when it is full	
g) It sets up the living room for film watching, adjusts lights and curtains	

### 2.1.3 Instruction to Participants:

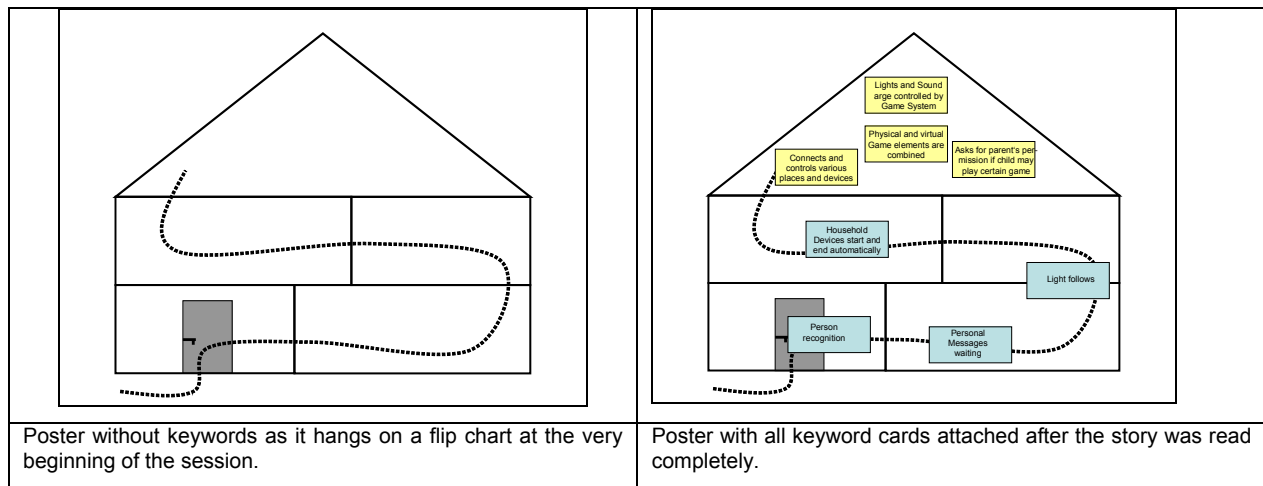
In the reception room, participants are instructed to form small groups (2-4 people). When they enter the gallery, every group is assigned to one theme-wall. Every group is instructed to assess the scene and its elements. After fulfilling these tasks the group can move to the next theme (wall). The participants were requested to follow the natural order of the themes; e.g. morning, afternoon, evening; afternoon, evening, morning; or evening, morning, afternoon. All tasks were performed individually. The participants were asked to rank the elements for each scene according to their perceived usefulness and to list advantages and disadvantages of the elements. They were provided with pen and paper, and a score sheet booklet to use for marking their responses.

## 2.2 MyPlace

The goal of the 'MyPlace' session is to get qualitative feedback on the concepts described in the scenarios and to position this with regard to relevance and match to the needs of users, their family situation and household practices. MyPlace is conducted as a focus group session. The focus group starts with stimulus material in the form of a story, which is read to the participants. The story gives a short introduction into the idea of ambient intelligence and then focus on the topic (e.g. "Home Entertainment" or "Home safety") of "MyPlace". The story should pick up the participants at the status quo of technology and give just some ideas how things may develop. The story may introduce features and services, but the implementation should be left to the participants' imagination. To help the participants remember the key ideas, keywords were presented on a poster. This poster consisted of an abstract visualisation of an environment on which the moderator while reading the story to the participants attached the cards with keywords.

### 2.2.1 Stimulus Material for the "Home Entertainment Scenario"

In the following example the topic of MyPlace is "Home Entertainment" with a focus on games. The story is supported by an abstract drawing of a house and cards with keywords, which will be attached to the poster in the course of the story. In the following story the moments to attach the according keyword are marked.



Today, the number of computer-controlled systems is increasing rapidly. Even at home you have to deal with technical demanding devices like complicated multi media systems, multi functional washing machines or mobiles with a large number of features. Probably all of you already experienced problems in using advanced features of those devices. Often you need time and certain skills to use them efficiently and they are not connected with each other. In the future this will change. Instead of many separate devices there will be an intelligent system connecting people, devices and places. This system is called "Ambient Intelligence", as it should act in an intelligent way from the background.

Let's now have a look into this future. Imagine you come home and you are recognized by your house (card 1). The door opens automatically, personal messages for you are waiting in the entrance area (card 2). When you walk around in the house, the light goes on and off to follow you on your way (card 3). The Dishwasher recognizes when it's full and then starts automatically the cleaning program (card 4). Besides these developments in information management and housekeeping another field, which will profit immensely is entertainment.

Now let's have a closer look at a future entertainment system. Such a system may use various sensors to recognize you and other users as well as in- and output devices. With such a system you could not only watch films with large 3D projections and high quality sound output, but as well enjoy interactive entertainment. Games supported by the system may integrate physical objects into virtual game worlds (card 6). For example you might use sport equipment, game costumes or game boards with game pieces together with large displays or 3D projections anywhere in the house to generate new gaming experiences.

In addition an entertainment system of the future may control light and sound in a room (card 7) to turn it into a game environment and back to a living room. Furthermore thy system may know access rights for certain games. So if a child wants to play a certain game, the system makes sure it only can do so, if it has the parents' permit. If parents did not define access rights for a certain game, the system may consult age restrictions or even contact the parents and ask them (card 8).

## 2.2.2 Questions

The focus group discussion is guided by questions. The first question is a very easy one and each participant is asked to answer it. The function of the first question is to melt the ice and let the group feel comfortable. The next questions introduce the topic of interest and focus more and more on the key issue, which should be investigated in the evaluation. The moderator introduces the question during the discussion. 4-5 questions are used. The moderator regulates the discussion, i.e., encourages shy participants, slow down very dominant participants, and avoids conflict and offence, without influencing participants or revealing a personal opinion. He must only answer questions concerning understanding.

Example questions for the "Home Entertainment Scenario" are:

- 1 Which kinds of entertainment do you and your family use regularly?  
(warm-up question, that should be answered by everyone)
- 2 Games: How can the game experience be improved in the future?

- 3 *Features: Which features would you like for a future game and entertainment system?*
- 4 *Problems: Where do you have doubts about a future game and entertainment system?*
- 5 *How would a future entertainment system have to be so that you would buy it?*

### 2.2.3 Stimulus Material for the “Home Care and Safety Scenario”

#### Introduction

*Today, the number of computer controlled systems is increasing rapidly. Even at home you have to deal with technical demanding devices like complicated multi media systems, multi functional washing machines or mobiles with a large number of features. Probably all of you already experienced problems in using advanced features of those devices. Often you need time and certain skills to use them efficiently and they are not connected with each other. In the future this will change. Instead of many separate devices there will be an intelligent system connecting people, devices and places. This system is called “Ambient Intelligence”, as it should act in an intelligent way from the background.*

*Let’s now have a look into this future. Imagine you come home and you are recognized by your house (card 1). The door opens automatically, personal messages for you are waiting in the entrance area (card 2). When you walk around in the house, the light goes on and off to follow you on your way (card 3). The entertainment system downloads your favourite games and you can play them without any special device just with physical movements (card 4).*

*Now let’s have a closer look at a future house keeping system. All the household appliances will be connected. The dishwasher will recognize when it’s full and then start automatically (card 5). The washing machine will automatically choose the most efficient and economic cleaning program because it can recognize the clothes that are in and it will inform about incidences as coloured and white pieces of clothing together (card 6). You can download all the recipes and ask if all the ingredients are available at home or vice versa ask for recipes, which are cookable with the ingredients you have at home (card 7).*

*Your home will detect and act in consequence when an incident happens: if an intruder is near home, the video surveillance cameras will detect him and avoid his entrance. If any gas or water leak occurs, they will be detected automatically.*

*The home care and safety it’s not limited to household appliances, you can also watch in the kitchen’s display all the members of the family that are at home and interact with them (card 8). When you want to have a rest watching a film you will just have to sit down on the sofa and the living room will be prepared with the favourite lighting conditions, the best position of the blinds according to the sunlight, and the room temperature (card 9).*

*Your home will provide with services that will help you getting a better quality of life such as comfort, beauty or health. You could have a personal trainer that will adapt your training depending on your improvements. You could also make remote diagnostics in case you feel ill and keep connected with your doctor (card 10). The system could also help to the children doing the homework (card 11).*

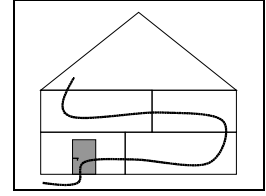
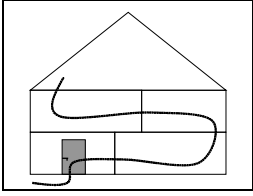
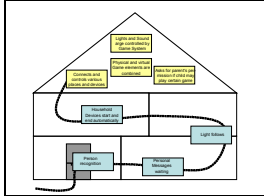
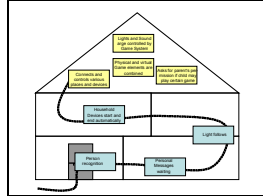
The keywords for the Home care and safety scenario were: 1) Person recognition; 2) Personal message waiting; 3) Light follows; 4) Download and play with body; 5) Dishwasher starts automatically; 6) Washing machine detects incidents; 7) Download recipes; 8) Connect members at home; 9) Adapting environment; 10) Remote medical diagnostics; 11) Homework help.

The questions for the “Home Care and Safety Scenario” were:

- 1 *Which appliances do you use at home?*
- 2 *How can these appliances be improved in the future?*
- 3 *What about remote connections and remote control of the appliances?*
- 4 *Which are the interfaces (voice, screens, movements...) you would like to use with the appliances?*
- 5 *What about security and surveillance systems?*
- 6 *Do you have doubts/worries about such a system?*

## 2.2.4 Stimulus Material for the “Extended Home Environment Scenario”

The MyPlace session for the Extended Home Environment application scenario used the same procedure as described above. The stimulus materials, however, were adapted to this scenario.

			
<p>Poster without keywords as it hangs on a flip chart at the very beginning of the session.</p>		<p>Poster with all keyword cards attached after the story was read completely. The following keywords were used:</p> <p>1) Person recognition; 2) Personal message waiting; 3) Light follows; 4) Household devices start and end automatically; 5) Connects and controls various places and devices; 6) Meet-up with far away friends in your home</p>	

The introduction text was adapted (last paragraph) with the following text:

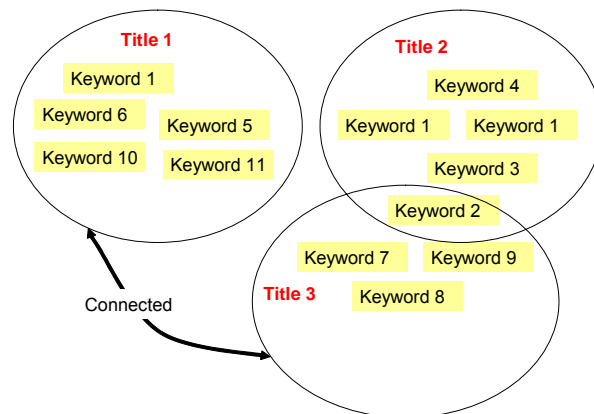
*Now let's have a closer look at a future entertainment system. Such a system may use various sensors to recognize you and other users as well as in- and output devices. With such a system you could not only watch films but also have video communication with your friends and relatives (card 6). For example you might use the system to meet with your parents or children who are living far away or stay in touch with your friends.*

The questions for the “Extended Home Environment Scenario” were:

- 1 *Which equipment and methods do you and your family use regularly to communicate and meet with each other?*
- 2 *How can these meetings be improved in the future?*
- 3 *Should there be a difference for your friends and relatives (kids, parents, acquaintances)?*
- 4 *Do you have doubts about advanced communication and meeting systems?*
- 5 *Would you ever want to use or have one?*

## 2.2.5 Clustering and Rating the Keywords

During the discussion, an assistant collects and writes down keywords on cards. These cards are the database for the report, therefore the keywords should be chosen carefully and formulated meaningful. Participants cluster all cards after each discussion. That means, the cards are introduced by the moderator and pinned on the wall. The participants decide which ones belong to the same topic and they are pinned close to each other. Then, they label each cluster by giving it an appropriate title, draw a border around the cluster and write the title inside of it. It is also possible to add relationships by arrows and labels like an arrow between two clusters labeled “is controlled by” or “connected” or “alternatives” or “subsystem” or what else the participants might explain (Figure 4).



**Figure 4: Example for clusters with titles and relationships**

At last, the participants have to rate the importance of each cluster. In order to do that the clusters are counted and this number is divided by two. To the result is added one and this is finally the number of stickers each participant will get. The moderator asks the participants to attach the stickers to clusters to indicate how important the clusters are to them. They may add as many stickers to a single cluster as they want, but they must put all stickers somewhere.

## 2.3 IdealHome

The goal of the IdealHome session is to generate qualitative feedback from people with regard to their expectations and needs for their ideal home. The gallery material is used as the stimulus material for IdealHome, as it covers various aspects of ambient intelligence. The gallery material is visible to the participants during the discussion. The IdealHome focus group is conducted in the same way for all Amigo application domains.

To start the discussion, the moderator gives a short introduction and then goes on with the first question. This is illustrated in the following example:

*Introduction: Now you have seen many examples for an Ambient Intelligence system. As you can see, it may include various areas of your life, like housekeeping, communication, information and entertainment. Now we want to talk about general affordances, limits and requirements for such a system:*

Questions for the “IdealHome” session are:

- 1 *In which areas of your life can you imagine the use of “ambient intelligence” best? (this assumes that the concept was briefly explained before)*
- 2 *Do you see any risks concerning “ambient intelligence”?*
- 3 *What would be your major requirements for an “ambient intelligence” system at your home?*
- 4 *How would an “ambient intelligence” system have to be so that you would use it?*

The results of the IdealHome focus group session are collected and clustered in the same way as the results of the MyPlace focus group.

## 2.4 Participants

The participants were the same for all sessions at each site. Table 4 shows an example of an average target participant sample that was used as a guide for each site to compose their group of participants. A strict condition for the participants was that they were not employed at any of the participating companies

**Table 4: Example of target profile for sampling participants**

Age levels: 20-30; 30-40; 40-60 years
Single and married/living together status
Living at home and living away from home
Living in a single house and living in a flat
Working and not working
Children and no children
Male and female

## 2.5 Schedule

The overall schedule for the quantitative and qualitative evaluation session is shown in the following table. The active working parts are marked in yellow. This schedule was used at all 6 participating Amigo sites (Table 5).

**Table 5: Schedule for conducting the evaluation sessions.**

<b>Duration</b>	<b>Activity</b>
5 min	Arrival, introduction and explanation
10 min	1. Warming up
45 min.	2. MyPlace
10 min	<i>Coffee Break</i>
15 min	3. Clustering and Rating of the "MyPlace" results
45 min	<i>Lunch Break</i>
30 min.	4. Gallery
15 min	5. Questionnaires
10 min	<i>Coffee Break</i>
30 min	6. IdealHome
15 min	7. Clustering and Rating of the "IdealHome" results
10 min	<i>Unwinding; cooling down, debriefing</i>



## 3 Results

### 3.1 Quantitative results: Gallery

The results of the Gallery session provide two categories of data: the ranking of the elements that compose the scenes of the scenarios and the listing of advantages and disadvantages and general feedback. Figures 5 and 6 show the set-up of the room and a group of participants at two different sites, i.e., Philips and TID.



Figure 5: Gallery room set-up at Philips



Figure 6: Participants at TID

#### 3.1.1 Appreciation of the elements of the Amigo scenario

The participants were asked to rank each element of the themes with regard to perceived usefulness. The highest rank was given to the most useful element.

In the first pilot study with 11 participants, the subjects were asked to rank all elements for each variant of the theme. Furthermore, they were asked to rank the elements according to the qualifications Usefulness and NiceToHave. It was found that the correlation between different variants was high (Spearman's rho (Variant 1 and Variant 2)= .935 ( $p = .01$ ) for both Usefulness and NiceToHave). This implies that the visualization had no effect on the rankings. The correlation between the categories Usefulness and NiceToHave was also high (Spearman's rho = .755). This implies that these two categories are confounded. Therefore, the two categories were merged and the subjects were asked to only rank one instance of the visualization. The agreement among judges was high at all sites (Chi-Square's 76,5 – 95.82,  $df=26$ ,  $p < .001$ ). The data from one site could not be used. Table 6 shows the results of 5 sites for all 4 scenes for a total of 45 participants. The calculations are based on the top 3 rankings for each participant for each site ( $N=45$ , Kendall's  $W(a) = .252$ , Chi-Square= 295.036,  $df=26$ ,  $p < .001$ ).

The preference ranking for the elements in Scene 1 of the Amigo scenario shows that people ranked the possibility of having summaries of the favorite news for different persons at different locations in the house the highest. This was followed by the possibility of having a follow-me functionality and an automatic download to another portable device.

The preference ranking for the elements in Scene 2 of the Amigo scenario shows that people ranked the parental control possibilities very high. This is followed at some distance by the possibility to download game play lists, having a video wall display showing other participants, to interact with the game by means of body movements, and to have the lights and sounds of

the house adapt to the game. The recognition and integration of the game devices of friends and the downloading of their profiles came at the third position in the rank order.

The preference ranking for the elements in Scene 3 of the Amigo scenario shows that a system that assists with household chores scored high, i.e., detecting and warning for faulty items and starting appliances when appropriate. Setting up the environment for film watching, adjusting lights and curtains, and recognition of family and friends by the door scored third.

The preference ranking for the elements in Scene 4 of the Amigo scenario shows that the video communication was ranked higher than the elements that concerned privacy issues, like knowing privacy preferences, being able to see whether somebody is at home, interrupting the video communication when another person enters the room.

**Table 6: Scores for the elements for each scene of the Amigo scenario collapsed over 5 sites (n=45) and ordered from most preferred to least preferred within each scene.**

Description of scene elements	Score
<b>Scene 1: Being followed by content</b> (max. score = 8)	
The TV shows summaries of their favourite news (g)	<b>7</b>
At the same time it shows Jerry's favourite news in another room (c)	<b>6</b>
It plays her favorite song when she wakes up in the morning (a) The song follows her through the house (b) The news is downloaded on a portable device to take along (h)	<b>5</b>
<b>Scene 2: Playing games</b> (max. score = 8)	
It asks for parental permission (a)	<b>8</b>
It downloads and shows game play lists (b) It adapts the lights and the sounds of the home to the environment of the game (c) It displays a video wall to show the game and other players (d) It lets the game player interact with body movements (e)	<b>5</b>
It recognizes and integrates the game devices of the friend (g) It downloads the profile of the friend (h)	<b>4</b>
<b>Scene 3: Home caring</b> (max. score = 7)	
It detects faulty items in the washing machine and warns (e)	<b>6</b>
It starts the dishwasher when it is full (f)	<b>5</b>
It has an intelligent door that recognizes family and friends (a) It downloads recipes in the kitchen (c) It sets up the living room for film watching, adjusts lights and curtains (g)	<b>4</b>
<b>Scene 4: Sharing ambiance</b> (max. score = 4)	
They see each other and it lets them engage in a chat (b)	<b>4</b>
It shows her father at his home and Maria in her home (a) It interrupts the chat if other persons enter the room (c) It knows the privacy preferences of both Maria and her father (d)	<b>2</b>

### 3.1.2 Advantages and disadvantages of the scenes of the Amigo Scenario

In addition to the ranking of the elements in the scenario scenes, the participants also discussed the scenarios and provided their comments as advantages and disadvantages.

This feedback will be discussed for each scene and combines the feedback from all participating sites. In general, the participants liked the way the scenario was visualized and preferred this method to animations. The scenes with photos were self-explanatory.

Rather surprising, but also reflecting the dissonance between user expectations and technological possibilities, most participants did not perceive the Amigo scenario as very innovative. They missed applications such as the possibility to mark something that they heard or saw (i.e., on a radio, while driving a car, or watching TV) and to have the system recover this information for later usage. They also commented on the energy management and power resources and worried about what to do in an “automatic” and totally electric home in case of a power blackout or lack of energy. Another worry expressed by the participants concerned security and the possibility to become isolated ‘because there is no need to go out’.

#### 3.1.2.1 Scene 1: Being followed by content

The appreciation of this feature was rather mixed. Participants who would like music to follow them through the house did this for different reasons, for example, very attractive for an amateur musician, it feels like having company. Keeping control of the system, however, was important. They want to control when the content should follow them and they don’t like it if the system starts or stops playing when someone leaves or enters a room. Most of them would not like the system to start playing a song because or when they are singing. Furthermore, it was perceived as a privacy invasion when the system started or stopped playing music when they came home or were moving around in their house. Most participants, apparently, don’t see much benefit for a system that plays their favourite song in order to wake them up. They can do that with their current systems. They rejected everything that leads to the idea of routine.

The information service was perceived as routine by part of the participants. It induced discussions on current habits, like using newsletters and SMS. People recognized it as services that are currently available, e.g., SMS with personalized information from telecommunication providers to cell phones. Filtering information was appreciated, as well as providing a resume of the information. People only like to receive the information in which they are interested. They don’t like to have too much information as this induces the feeling of having to plough through it for the rest of their day. Translated information from foreign languages into their native language was mentioned as an interesting option. Parental control with regard to access to media services was another topic that people mentioned in the discussion. Although the ranking was very high for this element, the discussion resulted in a more critical and sceptical assessment, depending on the composition of the participating group.

Table 7 lists the keywords given by people with regard to the concepts in scene 1 of the Amigo scenario, i.e., being followed by content.

**Table 7: Advantages and disadvantages listed by participants at two different sites**

Scene 1: Being followed by content	
Advantages	Disadvantages
Nice to have	Control missing (Music ends abrupt)

Less effort	Mood and music have to go together
No interference (conversation, TV)	Too many gadgets; Too many possibilities on settings
Less time consuming	People don't know what they will like to listen to when they wake up
Personalized	Limits people's initiative

**3.1.2.2 Scene 2: Playing games**

Participants who played video games liked this scene, but some participants who did not play video games didn't like it. However, some participants explained that such functionality would be necessary to make him play games with such a future entertainment system.

The adaptation of the lights and sounds of the home to the game environment was very much appreciated by the participants. People, who didn't like video games, would like to have this for other types of entertainment, like watching movies. They also mentioned the possibility for bringing in new games with the different interaction possibilities and the easy to use appliances.

People like the parental control possibility. They like to know and control which video games their children are playing. Some participants also liked the idea that they could play with people that are at another location.

Table 8 lists the keywords given by people with regard to the concepts in scene 2 of the Amigo scenario, i.e., playing games.

**Table 8: Advantages and disadvantages listed by participants at two different sites**

Scene 2: Playing games	
Advantages	Disadvantages
Increases fun	More people, different preferences
Keeps control of kids	Less fantasy and creativity necessary
Workout for kids	
Adaptive (gamer, devices)	
Remote maintenance via Internet	
Voice interface	
User control	
Remote control	
Access control	

**3.1.2.3 Scene 3: Home caring**

Home caring or household automation appealed very much to the expectations of the participants. The examples in the scenario were perceived as gadgets. But still, they liked to be able to download recipes from the Internet to the kitchen and to control the laundry by remote control, including the warnings when inappropriate items are present. This scene is especially appreciated by people living alone.

The intelligent door and the idea of not having to use a key were very much appreciated. But, the system should be robust and secure. Some participants didn't like the intelligent door at all.

Not because of safety and security reasons, but because of social reasons. They want to open the door for friends themselves. They are afraid of losing their basic abilities for taking care of themselves if everything is done automatically.

Privacy was another important point for the participants. They rejected the idea of spying and perceived this as extreme surveillance and an infringement of their personal freedom and privacy. This also includes checking from outside the home for who is at home and checking from inside the home who is where, i.e., the example of the mother who watches from the kitchen what the kids in the playroom are up to.

Table 9 lists the keywords given by people with regard to the concepts in scene 3 of the Amigo scenario, i.e., Home caring.

**Table 9: Advantages and disadvantages listed by participants at two different sites**

Scene 3: Home caring	
Advantages	Disadvantages
Meets user needs	Privacy problem (Big Brother)
Assistance	Too much control (No need for assistance, Overkill)
Handy to have	Stops you thinking; Become lazy: physically and mentally
Preventing mistakes	Complexity of the system
No need for keys; Secure access	Dependency
Secure and easy use of everyday household appliances	Security: House hackers
Setting up the home environment; flexibility	
More free time	
Makes life easier, comfortable, more free time	

#### 3.1.2.4 Scene 4: Sharing ambiance

Participants appreciated the concept of 'staying-in-touch' with voice and video, especially in the case when families are living far apart or to stay in touch with elderly or sick people. Some people compared it to existing video conferencing systems and instant messaging. The always-on connection was, however, perceived as a serious privacy abuse, i.e., nowhere to hide or stay out of reach. They want to be able to connect and disconnect when it suits them. In addition, people expressed their concerns with regard to rudeness and impolite behaviour, i.e., especially in the example where another person is entering the room. People didn't like the idea of being followed by video camera at all. They want to maintain their privacy and only connect to the system when they want to.

Table 10 lists the keywords given by people with regard to the concepts in scene 4 of the Amigo scenario, i.e., Sharing ambiance.

**Table 10: Advantages and disadvantages listed by participants at two different sites**

Scene 4: Sharing ambiance	
Advantages	Disadvantages
Context awareness	Privacy preferences change often (inflexibility)

Privacy	Privacy problem; intrusive (have to communicate)
Presence	Impolite
Spontaneous Conversation	Isolation and loss of real people contact
Closeness with family and friends	Intimacy – video surveillance
Immediacy	Impossible to schedule the intimacy
Take care of children and elderly	Humor, changes of emotional states cannot be programmed
	What happens if people in the house have opposite settings?

### 3.1.3 Conclusions Gallery study

The discussion on advantages and disadvantages of the various elements of the Amigo scenario supports the results from the ranking tasks. People are very outspoken in their desire to maintain control over their environment and to have well defined responsibilities. They are responsible for their children and want to control and protect them from inappropriate entertainment and information. But, they also respect the privacy of their children and parents, i.e., no video monitoring on their whereabouts at home. Reducing interpersonal contact is a very sensitive issue. Participants preferred telling their family if they are leaving a room or the house and so talking to each other more often. The element 'asking for parental permission' (Scene 2) scored very high, while the elements that concerned the starting and stopping of playing a song or presenting content scored low when it was triggered by their behavior or that of other persons (Scene 1). Also, the elements that concerned showing who is at home and what their whereabouts are in Scene 3 and in Scene 4 scored relatively low. The integration of profiles and devices of other people in their systems was observed with reservation. Clearly 'maintaining and respecting control and privacy' are very important and might be the determining factors for the acceptance of Intelligent User Services. The potential loss of direct contact with friends and family was a very serious thread for our participants.

Reducing the information overload and the burden of searching for entertainment and information items is ranked high by people. Providing 'summaries of the favorite news' to each person at the same time was ranked high as well as the follow-me, the down-loading of play lists and the downloading to portable devices.

People were very appreciative with regard to solutions for perceived practical problems with home care, i.e., automation of household chorus, like 'helping with routine household chorus and preventing annoying accidents' (Scene 3), 'adjusting lights and curtains to the desired ambiance' (Scene 2 and Scene 3), and a 'door that recognizes them'.

Some of the elements in the scenes elicited worries with regard to 'becoming too dependent' on the system, 'inducing a lack of physical and mental exercise'. This was also reflected in the preference scores. Except for the possibilities of interaction by means of body movements and gestures for the children's games in Scene 2.

With regard to the elements in Scene 4: Sharing ambiance, people liked the possibility to 'see each other and engage in a chat' very much. They didn't appreciate the other elements because they worried about impolite behaviors, intruding behaviors and in general a lack of privacy. Although there were only 4 elements in Scene 4, the situation induced interesting comments in the advantages and disadvantages listing. People were positive about the possibilities for conducting spontaneous conversations with far-away family and friends, it brings them closer together and creates intimacy. The possibility for taking care of family and friends by means of always-on video communication was an advantage. However, loss of privacy, loss of intimacy, impolite and intrusive behavior were listed as disadvantages. People

also recognized the potential for conflict situations when their requirements for privacy, security and intimacy didn't coincide with those of their family and household friends. They were also concerned about loss of spontaneity in their relations with others.

In general, regarding the current state of the art, it appears that addressing the disadvantages, listed by the focus group participants might be very advantageous for the Intelligent User Services, for example protecting security and privacy of people, addressing the aspects of social communication and polite and expected behavior given the context.

Table 11 summarizes the overall trend in peoples preferences considered over all the scenes and ordered in 6 clusters from most important to least important according to the rankings of the participants. These clusters translate to general user requirements. The related IUS are inserted in this table.

**Table 11: Scenario elements clustered according to ranking preferences.**

<b>Cluster</b>	<b>Scenario elements</b>	<b>IUS</b>
Maintaining control and responsibility	Asking for parental permission re. Entertainment, games and information for kids	S1, S2
Reducing information overload and search burden	Providing information summaries, personalized to different people and concurrently provided at different locations in the home	S1, S2, S3, S4
Preventing household accidents and helping with the chorus	Detecting and warning for faulty objects	S3
Assisting with organizing the personal home environment – individual focus	Selecting favorite songs, inducing follow-me of content, downloading of e.g., music, information, and playlists.	S1, S2, S4
Assisting with organizing the home environment – group focus	Recognizing profiles of family and friends at the entrance door to let them in, downloading profiles of visiting friends to join in the party, downloading recipes to the kitchen, adapting lights and windows to the appropriate activities in a room, conducting a videochat with friends/family at other locations.	S1, S2, S3
Caring for others and staying in touch	Peeking into each other's home, reacting towards events in one of the homes (like another person) and being knowledgeable about privacy preferences while conducting video chats.	S2, S3, S6

### 3.2 Qualitative results: MyPlace focus group

The focus group sessions on MyPlace were conducted before the Gallery session and the IdealHome focus group. All sites followed the same procedure, but the topics were adapted to the different application domains and the interest of the site at which the session took place. The results are reported separately for each participating site. Note that the sessions were also conducted in different countries. The MyPlace focus groups were conducted at the sites of 6 Amigo consortium partners in 5 different countries. The following partners conducted the focus groups:

- Fagor (Spain): 11 participants; 5 ♀, 6 ♂; 22 – 47 years old
- France Telecom (France): 9 participants; 4 ♀, 5 ♂; 27 – 45 years old
- Italdesign-Giugiaro (Italy): 7 participants; 2 ♀, 5 ♂; 21 – 40 years old
- IPSI (Germany): two different groups of 5 participants (15 to 25 and 26 to 45 years old)
- Philips (Netherlands): 11 participants; 5 ♀, 6 ♂; 22 –52 years old
- Telefonica I+D (Spain): 7 participants; 5 ♀, 2 ♂; 25 –58 years old.

The results are reported for each application domain. The partner sites are given to have a check on potential cultural differences and because there is an overlap between the application domains at some sites. Figure 7 shows the set-up at different partner sites.



Figure 7: Setting for MyPlace focus group

#### 3.2.1 Home information and entertainment (Telefonica I+D)

7 people (5 ♀, 2 ♂; 25 –58 years old) participated in the MyPlace focus group. The major objective of the discussion was on the combined application domain of Home information and entertainment. This focus group was conducted at Telefonica I+D.

The first impression given by the participants of the focus group about the Amigo concepts was good. Knowing who is at home when they arrive and recognition of family and friends was liked in the first instance. They didn't see much advantage, however, for a dishwasher that automatically starts when it is full after they have filled it, which they can verify themselves. They were more appreciative about starting a washing machine by remote control. But they worried about the selection of programs and detergent dose. As long as they could stay in control, they liked the home automation options.

It was quite difficult to keep the focus group focussed on information and entertainment. The participants were more interested in household and security aspects. They cared about taking care of their homes and the time they needed for that. They didn't look for entertainment in



their homes. The following table gives the clustered feedback of the participants to the concepts.

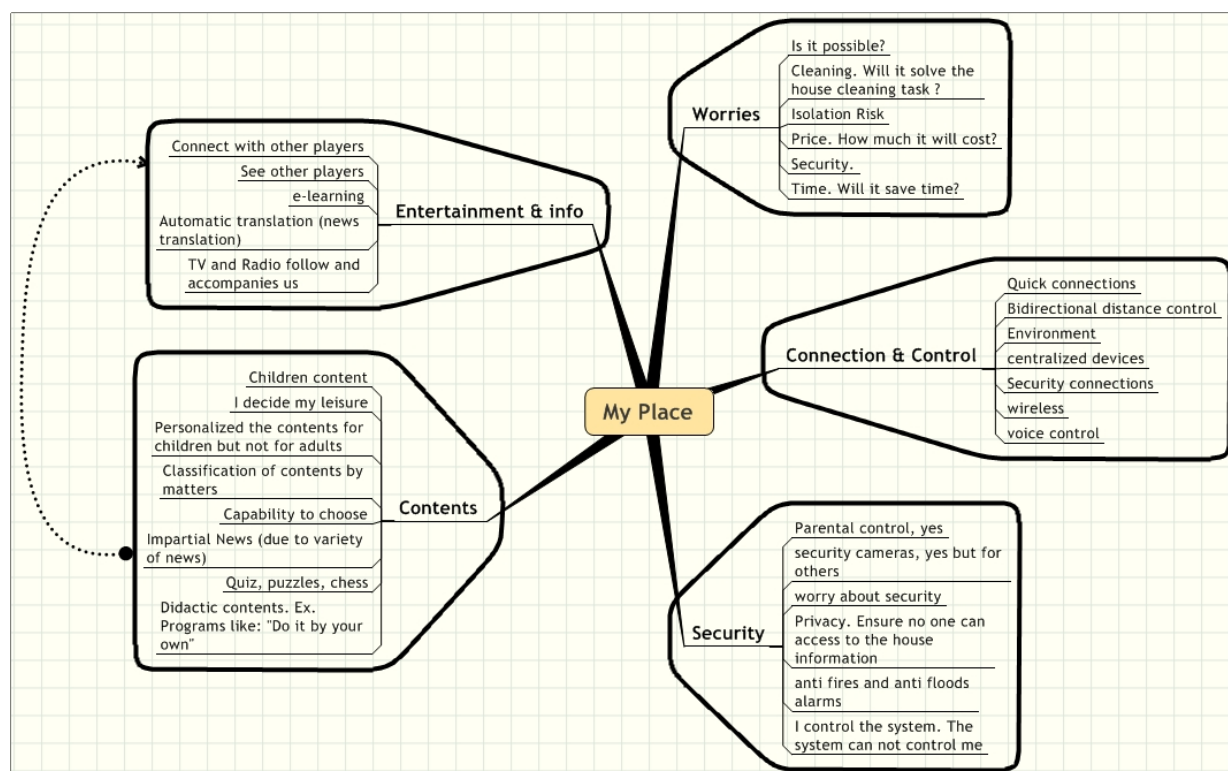
**Table 12 Clustered feedback of the participants to the concepts**

Worries	
Time saving	<ul style="list-style-type: none"> <li>Complex and inflexible system forces people to spend time on stupid and unpleasant tasks</li> </ul>
Costs	<ul style="list-style-type: none"> <li>To be really attractive, the system was expected to be too costly to afford</li> </ul>
Development feasibility	<ul style="list-style-type: none"> <li>Is it possible within my life time</li> </ul>
Security	<ul style="list-style-type: none"> <li>Conflict between having access to all information and not wanting to have this available for others</li> </ul>
Isolation	<ul style="list-style-type: none"> <li>No need to leave home to see friends or family</li> </ul>
Connection & Control	
Quick and secure connections	<ul style="list-style-type: none"> <li>They want to save time</li> </ul>
Bi-directional control	<ul style="list-style-type: none"> <li>Advantage of having bi-directional control for household appliances</li> </ul>
Security and privacy	<ul style="list-style-type: none"> <li>Recognition at the door is fine, but what if it fails and burglars use it to their advantage</li> </ul>
Control	<ul style="list-style-type: none"> <li>More information implies more control, but participants want to control the control</li> </ul>
Adaptation of the environment	<ul style="list-style-type: none"> <li>Don't limit this to just the game environment</li> </ul>
Security	
Robust	<ul style="list-style-type: none"> <li>Disadvantage for centralized system: if it fails, everything else fails</li> </ul>
Privacy	<ul style="list-style-type: none"> <li>No video cameras watching every step</li> </ul>
Home safety	<ul style="list-style-type: none"> <li>Control over people and the operation of their machines</li> </ul>
Parental control	<ul style="list-style-type: none"> <li>Shield children from undesired information</li> </ul>
Content	
Personalised content	<ul style="list-style-type: none"> <li>Especially for children. They don't want to expose children to undesired information and entertainment</li> <li>For adults, they prefer selection criteria and menu choices to create flexibility and allow for changes in mind and mood</li> </ul>
Entertainment and Information	
Access	<ul style="list-style-type: none"> <li>Access to the system should be easy</li> </ul>
Follow-me of content	<ul style="list-style-type: none"> <li>Preference for follow-me by radio or TV sound</li> <li>They decide when and what content must follow</li> </ul>
Multiple players	<ul style="list-style-type: none"> <li>Seeing other players as if they are in the same room</li> </ul>
Automatic translation	<ul style="list-style-type: none"> <li>To access information from other countries</li> </ul>

Table 13 shows how the focus group participants assessed the importance of the topics that they generated. Figure 8 shows the mindmap of these topics.

**Table 13:** Topics according to importance ratings generated by the focus group participants at Telefonica I+D.

Topic	Importance	Rating
Security		8/21
Connection and Control		5/21
Contents		3/21
Worries		3/21
Entertainment and Info		2/21



**Figure 8:** Mindmap of the MyPlace focus group topics at Telefonica I+D.

### 3.2.2 Home entertainment (IPSI)

The MyPlace focus group session was conducted at IPSI with two groups of 5 participants each who differed in age level, 15 to 25 and 26 to 45 years old, respectively, and at TID (for participants see 3.2.1). The results are combined.

The following topics were generated and discussed in depth by the participants.

### **3.2.2.1 Needs and Requirements**

Both IPSI groups were skeptical concerning the need for new entertainment systems. The participants felt satisfied with existing entertainment devices (especially traditional board games) and remarked that it would be hard to convince them of the benefits of a new entertainment system. Especially the group of older participants mentioned, that such a system has to be really innovative to be of any interest. A simple improvement of existing features would not be enough to convince them. The younger group was more open for inventions, but noted that existing systems cover all their needs at the moment. The acceptance of a future entertainment system will strongly depend on its functional quality. The older participants remarked that such a system is likely to be interesting in the first moment, but that afterwards classical games might be favored.

### **3.2.2.2 Basic Qualities**

The participants cared most about the compatibility, extensibility and usefulness of the system. They clearly want a flexible system with upgrade options and both IPSI groups remarked that it has to be possible to take the system with them if they move into another house. They would only buy a new system if it offers various functions and a possibility to extend it, so that they will be able to use it for a long time. In the rating part, both IPSI groups generated a cluster labeled "extensibility" which claimed options to add new functionality or integrate further game parts later as well as updates of the operating system.

Both IPSI groups found, that such an entertainment system must combine various functions. Like modern game consoles offer possibilities to watch DVDs, to communicate and to listen to music, a new entertainment system must also combine various functions related to entertainment. The group with the older participants also remarked, that the system must save power. They asked for low power consumption in general and that the system shall turn off automatically if it is not used for a certain period of time.

All groups noted that such a system must not be too expensive. One group regarded a price comparable to the price of today's games consoles as appropriate.

### **3.2.2.3 Design Goals**

#### **System**

The most important requirement named by all groups is, that all effects and additional features, like for example the adaptation of the environment to games or movies, must be controllable by the user. All agreed that there has to be a simple way to disable them completely. Generally, it was very important for all participants that the user is always in control of the system and never the other way round.

Most participants emphasized that the interaction must be easy, quick and intuitive. Some suggested an interface with speech in- and output. This refers to the setup, the configuration and the daily interaction. The system shall save time by supporting activities the user would do anyway. Another requirement was to have service persons to deliver and install the system, to give some basic training on how to configure and use each feature, and to be available afterwards to help if problems occur. Furthermore, the system shall not require any maintenance after being installed.

Both IPSI groups used traditional tabletop games as a benchmark to judge new entertainment systems. Participants in both groups noted that the game board should remain as a physical object. This requirement was explained with the rich social situation while using tabletop games. The participants claimed that they want to play together with their friends, although the system shall offer the opportunity to work as an additional player. One participant explained

that real game pieces and game boards enabled a haptic experience and generated an atmosphere on their own, which he appreciated very much. Another participant suggested that the system could add sound or special effects to traditional board games or represent the board in form of a projection.

Another topic, which many participants addressed, was security and safety. They were concerned about (software) attacks from outside as well as about potential accidents caused by malfunctioning of the system.

Especially one participant liked the idea of encapsulating himself in a (virtual) game world, which is totally isolated from reality and which helps him to temporarily escape from the real world. At the moment he does not play video games, but he said that if this would be possible, he most probably would buy such a system.

### **Content**

As mentioned above, both IPSI groups emphasized the social aspects of playing games. Generally, the system should help to foster a sense of community between users. This must be considered for each application, no matter if it is a game, a communication system or a movie. Games must offer a single player mode as well as a multiplayer mode for a various number of players. The system must be able to replace missing human players as well as control non-player characters.

All participants expect from a future entertainment system, that it provides better graphics and a more realistic game world. Although this was mentioned as a clear requirement, one participant remarked the ambivalence. On the one hand the participants would appreciate an immersive game world, but on the other they fear that this may cause losing contact to reality.

#### **3.2.2.4 Features**

Generally, the participants want a useful combination of features realized in independent components. The users shall be able to decide which features they need and then integrate them into the system. But the system shall only focus on entertainment. Completely different features, like housekeeping, shall not be integrated in the system. It shall control the physical environment (for example light, curtains, displays and sound) to adopt the room to the current game or movie. They also liked the idea of following content.

The system shall include new technologies, like 3D projections and a speech interface. Furthermore, it shall improve board games with additional feedback (acoustical and visual effects) and the option to simulate additional players. It shall show players who play from a different location like they were in the same room. An automatic translation system could help to access information from other countries.

#### **3.2.2.5 Fears and Doubts**

Overall, the groups were rather critical. The most important requirement was that the user must always remain in control and that the system must not patronize the user. The system shall stay in the background if not needed and rather give recommendations than act autonomously. Furthermore, the system must avoid too much automation. If the household is completely automated, a loss of communication might be the consequence and interpersonal relations will suffer. Even emotions might be reduced, if everything works automatically. One participant preferred to be furious at fellow occupants because of neglected household tasks, rather than to live in a completely automated world. In addition, the consequence of such a system might be that people stay more and more at home and get isolated. Some of the younger participants even worried about children losing existential abilities to care for themselves if they grew up in such an automated world.

The participants do not want any features, which are not reasonable. The IPSI group with the younger participants stated that the system shall not support laziness and that it shall not take over duties which shall remain within the family, like deciding which films a child may watch or abusing the system as a babysitter. They also feared surveillance and being controlled if the system uses cameras to monitor certain areas in the home and mediates communication autonomously. Furthermore, the group with the older participants feared a stimulus satiation. Coming home from work they want a calm environment to recover from the hectic work life.

All participants agreed that an entertainment system could never be a substitute for the real world. Being outside the home will always be a richer experience than any artificial game world could provide. Especially sport games can never replace outdoor sports, even if real equipment, like bikes or rackets, can be used.

### **3.2.2.6 Conclusions**

The focus groups showed that an entertainment system must be designed with care to convince people of all ages. The most important design guideline is that the users must always remain in control of the system and never the other way round. The system must be secure, safe and protect the privacy of all users. Furthermore, all features must be useful and the system must provide an added value to existing entertainment systems. Mediating personal communication and connecting people is regarded as a very sensitive topic. A feature to connect distributed people is only appreciated if the contact would be less intensive or non-existing without the system. But if a direct interaction between people is possible, the system must never replace that.

The major goal of an entertainment system is to support a rich social situation with as much direct interaction between users as possible. Additionally, the system should provide a more realistic entertainment experience for games as well as for movies or other content.

Tables 14 and 15 give an overview of rated topics that were generated by the participants of the MyPlace focus group at IPSI for the two different age groups. Figure 14 shows the aggregated MindMap.

**Table 14: Overview of IPSI focus group (age 15-25)**

Topic	Importance	Rating
Assumption Upgrade option (1) Extensibility (1) Compatible to existing systems (2) Additional functionality (1)		7/20
Doubts Abandoning of Duties (1) Loss of interpersonal communication (1) Support of Laziness (1)		4/20
Price Affordable (4)		4/20
Current Feelings "Real" innovation necessary (1)		2/20
Wishes Insular game worlds (1)		2/20
Community		1/20

**Table 15: Overview of IPSI focus group (age 26-45)**

Topic	Importance	Rating
Contra No need for additional entertainment (1)		4/20
Critical Aspects		4/20
Usability Additional Player (1) In- and Output in speech (1)		4/20
Economy Affordable (1)		3/20
Attributes Extensibility (1) Reasonable combination of features (1) No pure "entertainment" system (1)		3/20
Simplicity Security and Safety on the system (1)		2/20

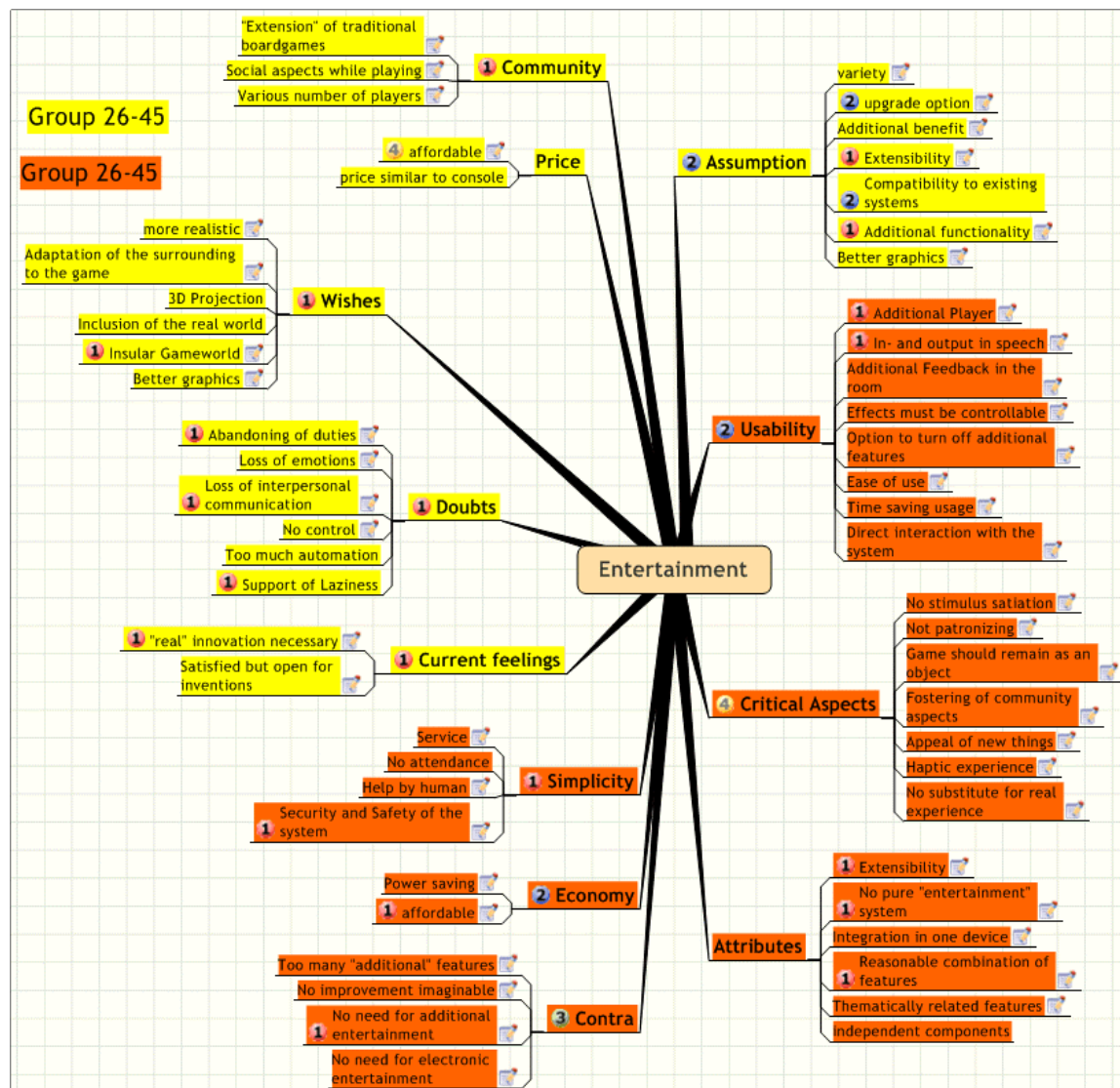


Figure 9: Aggregated MindMap of both Fraunhofer IPSI focus groups (numbers indicate the level of importance)

### 3.2.3 Home care and safety (Fagor)

Eleven people (5 ♀, 6 ♂; 22 – 47 years old) participated in the MyPlace focus group at Fagor. The major focus of the discussion was on the Home care and safety application domain.

The most important desire of the participants was that all the home chores, especially those related with the cleaning, are automatically done. As examples of these, automatic cleaning of the house and the household appliances and automatic ironing were mentioned. This would give everybody more leisure time to do other activities, such as sports, social activities, and family socials. Furthermore, people also wanted to integrate and combine the functionality of the appliances. For example, an oven with fridge functionality -to put the fish inside in the morning and have it cooked just when you arrive home for lunch- or the washing machine with drier and auto- ironing system incorporated. The participants also believed that these ideas seem to be wishes more than things that can be implemented in the near or mid term future.

The following paragraphs list the topics that were generated by the participants of the MyPlace focus group session.

### **3.2.3.1 Management of devices**

People want to get an easier management of the house hold chores. This could be obtained with the help of more intelligent appliances as:

- The washing machine, that is able to detect the different characteristics of the clothes that are inside it and is also capable of choosing the necessary dosage of detergent and softener and select the most effective and economic program. In one word, the user should only put the clothes inside, and forget.
- The fridge, that is able to control what's in it and the products that are going to be out of date. This could be extensible to the cupboards and pantry, managing all the food of the house. This way people could know if all the ingredients for a concrete recipe are available, manage the shopping list, order the basic shopping via Internet (always with the approval of the user).
- The oven that communicates with the fridge and the Internet could download new recipes for the available ingredients.

More improvements that are possible in other appliances such as the toaster and coffee machine were mentioned.

Another service that the participants mentioned related to automation was the autonomous management of the house atmosphere, i.e., a system that would maintain the house environment with regard to, for example, temperature, CO2 levels, and humidity, at the best setting for each moment, improving services of the boiler.

The environment adaptation was also an interesting subject, but it was understood in two ways, i.e., as settings for lights, blinds and shutters to create cool environments and as the possibility to create multi functional spaces.

### **3.2.3.2 Connecting the indoors with the external world**

- The refrigerator that is able to control all the products and their quality could suggest a shopping list and if the user approves it, do the shopping automatically.
- Remote diagnosis and repair of failures and a faster and easier maintenance of the appliances.

### **3.2.3.3 Multiple service system: ease of use requirements**

- People don't want a boss at home. They want to be the ones who make the decisions.
- The system must be easy to learn, to use and to configure. It also should learn from people's behavior and continuous repetitive actions.
- Simplicity and naturalness are well rated characteristics. Speech command systems, body movement's interpretation, touch screens and distributed displays are mentioned as the most preferred interfaces.

### **3.2.3.4 Participants main concerns and worries**

- One of the worries is the power supply of those "intelligent houses". What would happen if the power supply goes down? To avoid this problem houses with solar roofs, or any other possibility to be self-supporting are seen as an important point.
- Participants were mainly concerned about security. The system needs to know the profiles of each person who lives at home, for example, the children must not be able to turn on



the oven, have access to undesired information. Anti intrusion systems must avoid both physical intrusion and hackers actions. The system must also avoid incidences at home, for example, if a water or gas leak is detected, it should close the valves to avoid bigger incidences and alarm the user or the technical assistance.

- Also privacy. Although the video surveillance could help in some situations, as taking care of elderly or disabled people, it's seen as loss of privacy ("Big Brother"). Each person, including children and elderly, need their intimacy.
- Another concerning point was the loss of human relationship. Life with this system could become too programmed and isolated.

Table 16 gives an overview of rated topics that were generated by the participants of the MyPlace focus group at Fagor. Figure 17 shows the aggregated MindMap.

**Table 16: Topics generated by the participants of the MyPlace focus group at Fagor**

Topic	Importance					Rating
Security and privacy						11 / 44
Management						10 / 44
Interfaces						9 / 44
Easiness and profiles						6 / 44
Remote						5 / 44
Wishes						4 / 44

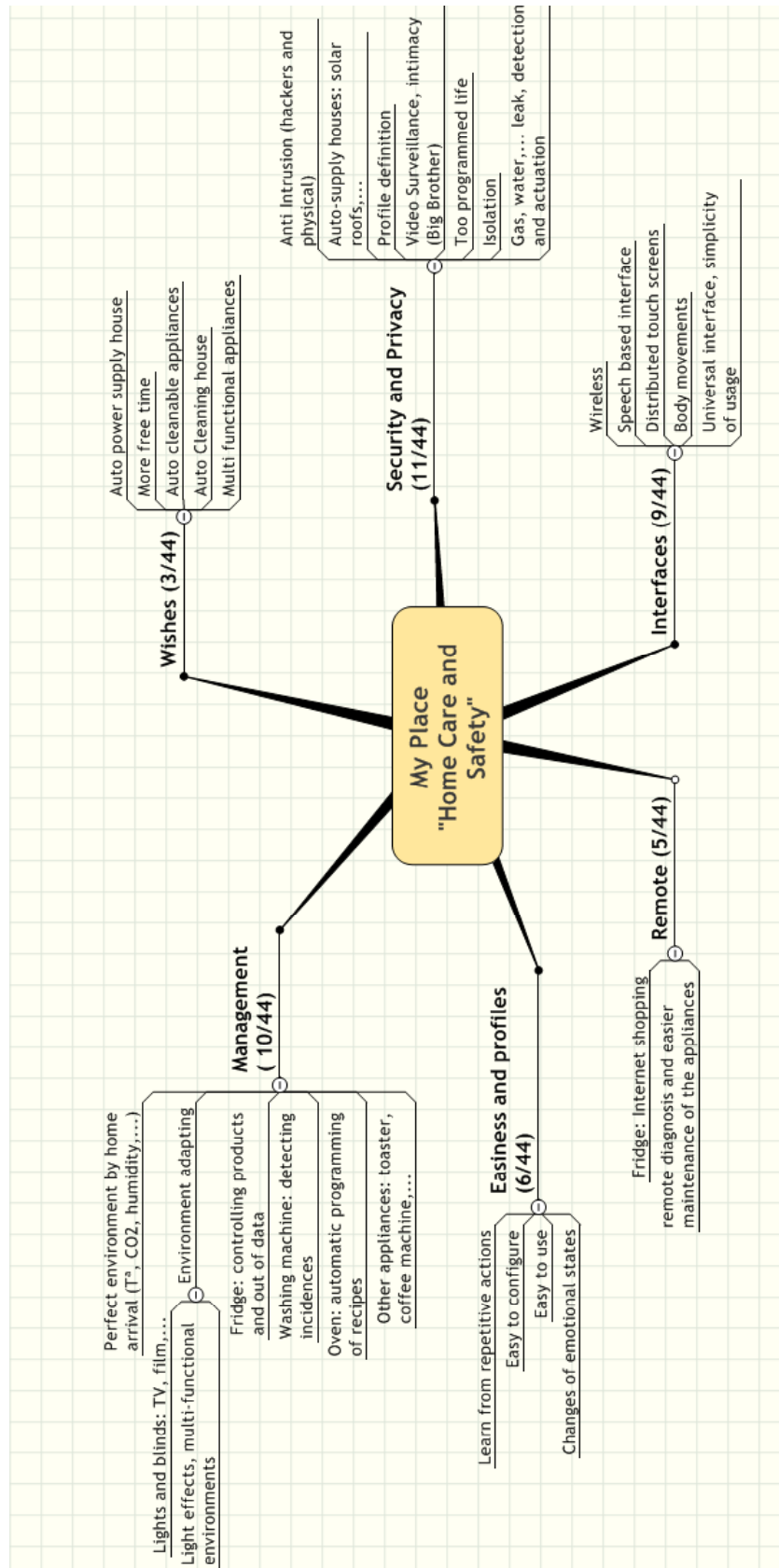


Figure 10: Aggregated MindMap of the MyPlace focus group at Fagor (numbers indicate the level of importance)

### 3.2.4 Extended home environment (France Telecom, Italdesign-Giugiaro, and Philips)

This paragraph refers to the MyPlace Focus Group session held by the partners who belong to the Extend Home Environment field, i.e., France Telecom, Italdesign-Giugiaro and Philips.

A possible application of this kind of concept is proposed in Scene 4 of the Amigo project DOW. This scene refers to people who are living in different locations and can communicate with each other by sharing the ambiance of their homes.

The extended Home environment focuses on a new way of communication with someone outside the home. It can be seen as an extension of our current communication means.

Partners interpreted this concept according to their concept of the Extended Home, so the obtained feedback could differ a little bit.

The data has been collected with the method described in chapter 2.2. The data has been put in a tabular format. The keywords belonging to each cluster were collected and for each keyword a sentence explaining the related discussion was selected.

#### 3.2.4.1 France Telecom

9 People participated in the focus group (4♀, 5♂). Their age was between 27-45 years old. At first, they didn't perceive the concept as highly innovative or spectacular. For them it resembled instant messaging. It induced worries with regard to videoconferencing, intruding into peoples' private lives and loss of privacy. However, they also expected that these reservations would disappear when videoconferencing would become a more regular practice. One of the participants, for example, used an instant messaging service with a web cam on an almost daily basis. Nevertheless, the concept of having an always-on connection was perceived as excessive. The participants emphasized the need for a mutual agreement to begin a discussion, i.e., like the instant messaging services:

*".. this does not mean you stay connected all the time, at any given point .. there is a reciprocal agreement .."*

They also emphasized that such a service should be almost exclusively used with close family who are geographically far away.

*".. I am happy to have some time without my girlfriend calling me .."*

*"My husband has 2 months summer holiday but I only have 3 weeks off .. I could stay in contact with him and the children ... the system would be in place between these two houses for these 2 months..."*

This type of communication service could possibly be considered for separated families, families who are geographically far apart or to keep in contact with old people, sick people or people living in isolated locations. One of the disadvantages, however, could be that such a system reduces the feeling of being responsible and direct contact might become less frequent. The "Follow Me" concept was perceived as beneficial compared to using instant messaging and a web cam, because discussions could be more natural.

The following table gives the clustered feedback of the participants to the concepts.

**Table 17: Clustered feedback of the participants to the concepts**

Use context	
Specific target	<ul style="list-style-type: none"> <li>• For separated families: geographically or parent/children in case of divorce</li> <li>• Family who wants to keep contact with elderly people</li> </ul>

Other target	<ul style="list-style-type: none"> <li>To use for "video conferencing", with friends, provided that it is not always on or automatic</li> </ul>
Specific situation	<ul style="list-style-type: none"> <li>To keep contact with sick (in hospitals) or isolated people</li> <li>To keep contact for a short time period, e.g., during the holidays</li> <li>To share specific life moments, e.g., birth, birthday, with distant family</li> </ul>
<b>Controlling the system</b>	
Privacy	<ul style="list-style-type: none"> <li>No intrusion into people's private life</li> <li>Mutual agreement to begin a discussion</li> </ul>
Continuity of connection	<ul style="list-style-type: none"> <li>Always on but not always available. It should work more like "instant messaging"</li> </ul>
Keep Control	<ul style="list-style-type: none"> <li>Users stay in control; they connect and disconnect</li> <li>They decide when and with whom they will be connected</li> </ul>
Security	<ul style="list-style-type: none"> <li>The system should be protected against intrusions</li> <li>Protection against pirating</li> </ul>
<b>User interface</b>	
Means of communication	<ul style="list-style-type: none"> <li>Always-on videoconferencing should not be too intrusive.</li> <li>Should have a display that shows a larger picture (larger than the web cam today) and background is proposed.</li> </ul>
Follow me	<ul style="list-style-type: none"> <li>Multiplies the places for having a conversation and makes it more convivial and more natural (no need to be right in front of the screen).</li> <li>Allows sharing and showing your interior, your home.</li> <li>Brings freedom in the communication.</li> </ul>
Politeness rules	<ul style="list-style-type: none"> <li>The usual conversational rules must be preserved.</li> <li>No automatic cut of the conversation by the system (prevent people from getting paranoia or generating conflict situations).</li> </ul>
<b>Impact on relation</b>	
Social responsibility	<ul style="list-style-type: none"> <li>Should not induce a diminishing of responsibility in caring relations.</li> </ul>
Depersonalisation	<ul style="list-style-type: none"> <li>Should increase security and protection (e.g., caring for elderly), without reducing the human-human interaction</li> </ul>
<b>Technical points</b>	
Simplicity	<ul style="list-style-type: none"> <li>Simplicity of use: communication must be initiated with little actions</li> <li>Simplicity of installation process</li> </ul>
Compatibility	<ul style="list-style-type: none"> <li>Be compatible with existing equipment</li> </ul>
Equipment	<ul style="list-style-type: none"> <li>No clutter of equipment through the home</li> </ul>

### 3.2.4.2 Italdesign – Giugiaro

Two women and five men aged between 21 and 40 years participated in the focus group. The concept of the Ambient Intelligence and of the Amigo project scope was explained to the people taking part in our Focus Group. The next step was to spotlight the participant's knowledge and familiarity toward Ambient Intelligence and understand where this awareness comes from (for example if they heard something about this topic on TV or in the newspapers, etc.). Some of the participants have already heard something about it through the Media but mainly regarding the white goods of the future. Then we asked them what kind of future they would like to have in the future, both in their home life and in their professional life.

Our questions and remarks mainly concerned security and safe information exchange: in a company like Italdesign - Giugiaro this is a typical matter of discussion and it usually requires a strong grade of "privacy". Some comments were made by the participants about the safety in

case of a black out or energy shortage problems in the house/place of work: in this case, people feel a little bit precarious to be so dependent on a full “automatic” (and electric) system.

The following questions were asked:

- Which kind of tools do you regularly use in your office/home?
- Job: How can the job experience be improved in the future?
- Features: Which features would you like for a future home/job system?
- Problems: Where do you have doubts about a future home/job system?
- What would a future professional/home system have to be like so that you would buy it?

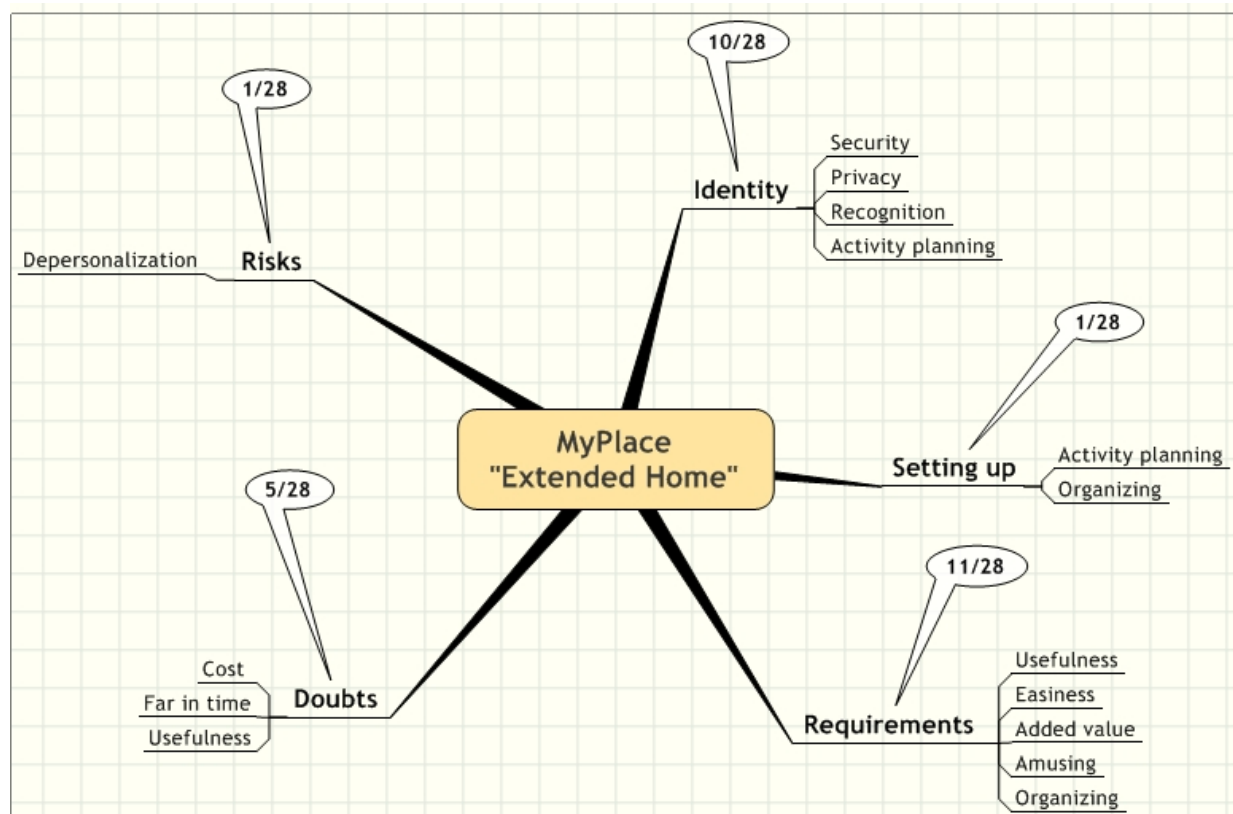
**Table 18: Clustered feedback of the participants**

Identity	
Security	<ul style="list-style-type: none"> <li>• The system has to assure a very strong data security.</li> </ul>
Privacy	<ul style="list-style-type: none"> <li>• People are concerned about their privacy with such kind of system that could know all about them.</li> </ul>
Recognition	<ul style="list-style-type: none"> <li>• The system should provide a very reliable recognition system that is able to avoid third parties intrusion</li> </ul>
Activity planning	<ul style="list-style-type: none"> <li>• The system is considered as very powerful in terms of help for activity planning.</li> </ul>
Setting up	
Organizing	<ul style="list-style-type: none"> <li>• The system could be useful to appropriately arrange the data.</li> </ul>
Activity planning	<ul style="list-style-type: none"> <li>• The system contains a very large amount of data, so they need to be properly put together in order to organize and plan activities</li> </ul>
Requirements	
Usefulness	<ul style="list-style-type: none"> <li>• The people are not so sure about the usefulness of this kind of technology.</li> </ul>
Easiness	<ul style="list-style-type: none"> <li>• The system should be easy to use. No need of any kind of training.</li> </ul>
Added value	<ul style="list-style-type: none"> <li>• The system, if properly developed, could provide an added value to the user's life.</li> </ul>
Amusing	<ul style="list-style-type: none"> <li>• The system should be “amusing” as soon as possible: it should overcome the current bad feeling that a lot of people have when they deal with technology.</li> </ul>
Organizing	<ul style="list-style-type: none"> <li>• The system could be useful to properly arrange the data.</li> </ul>
Doubts	
Costs	<ul style="list-style-type: none"> <li>• The participants suppose that such kind of system will be very expensive. Instead they will accept (buy) it only if it will have a reasonable price.</li> </ul>
Far in time	<ul style="list-style-type: none"> <li>• The participants consider the described system as something that could be developed but not in a short time.</li> </ul>
Usefulness	<ul style="list-style-type: none"> <li>• People are not sure they will use this kind of technology a lot.</li> </ul>
Risks	
Depersonalisation	<ul style="list-style-type: none"> <li>• Some participants (particularly the oldest) think that the system could produce user's depersonalisation.</li> <li>• “A machine could never be like a man”</li> </ul>

The clusters were prioritised with regard to importance. The results are presented in the following table (Table 19). The metaplan is presented in Figure 11.

**Table 19:** Topics according to importance ratings generated by the focus group participants at Italdesign - Giugiaro during in the MyPlace session.

Topic	Importance					Rating
Requirements						11 / 28
Identity						10 / 28
Doubts						5 / 28
Setting up						1 / 28
Risks						1 / 28



**Figure 11:** Metaplan of the topics generated in the MyPlace session at Italdesign - Giugiaro

### 3.2.4.3 Philips

11 People participated in the focus group, 5 ♀ and 6 ♂, the age varied between 25 and 52 years. After a short introduction (see section 2.2) the participants were asked to address the following questions:

- Which equipment and methods do you and your family use regularly to communicate and meet with each other?
- How can these meetings be improved in the future?
- Should there be a difference for your friends and relatives (kids, parents, acquaintances)?
- Do you have doubts about advanced communication and meeting systems?

- *Would you ever want to use or have one?*

The topics generated in the discussion are listed in the following table.

**Table 20: Topics generation in the discussion**

Emotional	
Telepresence	<ul style="list-style-type: none"> <li>• The participants liked the idea to talk to somebody who lives far away and still it "feels" like he shares the same space.</li> </ul>
More spontaneous communication	<ul style="list-style-type: none"> <li>• They thought that communication could be much more spontaneous in the future</li> </ul>
Context awareness	<ul style="list-style-type: none"> <li>• For them a system could be improved by being context aware, so no interruption or interferences</li> </ul>
Transparency	<ul style="list-style-type: none"> <li>• Setting up the communication should be intuitive and natural</li> </ul>
Communicate emotions	<ul style="list-style-type: none"> <li>• With the new ways of communication, emotions are a clearer part of it. The communication will be more truthful.</li> </ul>
Not forced	<ul style="list-style-type: none"> <li>• It was important for the participants that communication should never be forced</li> </ul>
Challenges	
Privacy issues	<ul style="list-style-type: none"> <li>• A big issue for our participants was the privacy which should be strengthened in future technologies</li> </ul>
Do I want this? Unreal communication?	<ul style="list-style-type: none"> <li>• Increase in complexity</li> <li>• Time zone solutions</li> <li>• Afraid to loose control</li> <li>• What if it doesn't work</li> <li>• Free internet</li> <li>• Be able to make distinctions</li> </ul>
Old technology should still be used	<ul style="list-style-type: none"> <li>• The participants weren't happy about the idea to learn new technologies</li> </ul>
People expect that you are always available	<ul style="list-style-type: none"> <li>• Today mobile phones make people think that you have to use it and answer it wherever you are. Will it be even worth in the future?</li> </ul>
Unreliable (manipulate information)	<ul style="list-style-type: none"> <li>• A big challenge will be in the eyes of the participants to make a advanced communication system reliable</li> </ul>
Accessibility	<ul style="list-style-type: none"> <li>• The participants were doubting that accessibility everywhere and every time could be accomplished in the near future</li> </ul>
Price	<ul style="list-style-type: none"> <li>•</li> </ul>
Technical	
Media integration	<ul style="list-style-type: none"> <li>• Everything should be integrated in one, not several remote controls for example</li> <li>• Compatibility</li> <li>• Modularity</li> </ul>
Multiple devices Multiple users	<ul style="list-style-type: none"> <li>• Communicate with more than one person at a time</li> <li>• Personalized default settings</li> <li>• Asynchronous communication</li> <li>• Adaptive to the situation</li> <li>• Select availability</li> <li>• Ability to overrule</li> </ul>
Preference	<ul style="list-style-type: none"> <li>• Decline options</li> <li>• Less obtrusive</li> </ul>
Emoticons to change device behavior	<ul style="list-style-type: none"> <li>• Mood prediction</li> </ul>
Fool proof	<ul style="list-style-type: none"> <li>• Easy to use was an often-mentioned feature. Reliable. Control over devices (on/off).</li> <li>• No need for programming</li> </ul>
Simple/advanced modes	<ul style="list-style-type: none"> <li>• The system should differentiate in e.g. elderly who have more problems with technology and younger more technical experiences persons</li> </ul>

User challenges	•
<b>Existing means</b>	
Postcards	• “Old fashioned” ways of communicating are not forgotten and especially in certain situations preferred to use e.g. postcards on vacations
E-cards	• But also the modern technologies are used
Sms	•
Web cam	• Even elderly members of the families were equipped with web cams to make communication more real
msn	•
Physical contact	•
Sharing pictures	•
Voice over IP	•
Non verbal (body language)	• The participants said that they miss non-verbal communication
Going out	• What about communicating with people in public e.g. when going out?

The clusters were prioritised with regard to importance. The results are presented in Table 21.

**Table 21: Topics according to importance rating generated by the focus group participants at Philips**

Topic	Importance					Rating	
Emotional						14/34	5
Challenges						9.5/34	3,39
Technical						9/34	3,21
Existing means						1.5/34	0,54

### 3.2.5 Conclusions MyPlace

The purpose of the MyPlace focus group session was to explore and generate feedback from people about the concepts that are proposed by the Amigo scenario. Although different aspects of home life such as information, automation, entertainment (games) and extended home environments were addressed and the studies were conducted in different countries, no cultural differences were identified and many common topics could be identified from the results.

At first sight, ambient systems at home seem to highlight more fears than benefits. Fears concern: lack of control, lack of security, increasing isolation, favouring of laziness (sometimes even an extreme decrease in responsibility). They are more or less present among the concerned scenarios. For example, the fear of isolation was the advantage expressed for scenarios 2 (entertainment) and 4 (extended home).

Designers may be unsettled by the expression of these fears. Their good understanding must include elements, which relate to the fact that such fears often arise when speaking about a new system. Fears are also often balanced with wishes: for example, people expressed the idea of having all the chores done automatically and, at the same time, expressed their fear of an entirely automatic system that would favour laziness. Even with careful interpretation, these results outline the fact that ambient intelligent systems present risks that people may be afraid



off. Two risks have particularly come to light, all countries and scenarios included: the loss of control by the users and the question of security.

With concepts such as context awareness and implicit actions, ambient intelligence systems really highlight questions about how users can stay in control. A balance has to be found between automatic action and action completely under the control of the users. Some elements have been proposed by users to guide designers:

- First one and this is a rule: users must stay in control of what is happening: from concrete action to will/wishes. Users must never have the impression that things they didn't want are going on.
- Pre-existing social rules: for example when someone enters the room where two people are already chatting, they all know what to do without having a system interfering.
- The system must not replace interaction between people.

Security is also an important concern. Fear of pirating is generally the biggest reservation when a network is mentioned even more so if it has a remote server. A vital factor for the smooth running and for gaining the support of the participants is that the system should be secure:

- System should be as well protected against intrusions as it is against the loss of data.
- Household data must not be accessible from the outside and there must not be any risk of pirating or viruses.
- Security of the system would also include controlled access, particularly for children. Due to the centralisation and sharing of data in the home, users need to be able to place access restrictions on some functions and some content, based on the user profile.

Security is also a global concern that includes physical security at home: prevention from domestic incidents, children's protection etc. This is more related to home automation. The system needs to be able to issue alerts in the event of breakdowns or incorrect functioning of equipment. But this security needs to be extended in order to detect and avoid the risk of domestic accidents and to make the household more secure.

Speaking now about the benefits and the interesting features for the system, we can outline the point that people, not surprisingly have been very much inspired by the idea of "home automation". It is part of a kind of ideal dream: having no more chores to do.

In a more concrete way people have expectation towards "intelligent" devices that would act more like an assistant than as a replacement. The "washing machine that detects the characteristics of the clothes and chooses the appropriate detergent's dosage and the most efficient programme" is a good example of an expected feature. People have also expressed the wish to have links between household devices: such as cupboard and fridge in order to give them ideas for recipes. Domestic environment functions are not restricted to reducing housework. Other functions were envisaged such as household hygiene functions like monitoring the level of dust mites or the ambient atmosphere. These features may be the expression of either a need of well-being and comfort or to a real concern about the environment.

People also have expectations for the entertainment field, especially the games. They are very open to features that would improve their experience: sound, special effects, adaptation of the environment to the game or the movie.

About communication, people wish to share more emotional aspects with distant relatives or friends. So, the idea of sharing the same space is quite seducing, even though the target for such systems has to be very well defined. They also expressed the wish to be in touch with several persons in several different ways.

### 3.3 Qualitative results: IdealHome focus group

The focus group sessions on IdealHome were conducted after the MyPlace focus group and the Gallery session. Although all sites followed the same procedure, the participants were already tuned to certain topics and cued with regard to the particular interest of the site at which the session took place. The results are reported separately for each participating site. Note that the sessions were also conducted in different countries. The IdealHome focus groups were conducted at the sites of 6 Amigo consortium partners in 5 different countries. The following partners conducted the focus groups:

- Fagor (Spain): 11 participants; 5 ♀, 6 ♂; 22 – 47 years old
- France Telecom (France): 9 participants; 4 ♀, 5 ♂; 27 – 45 years old
- IDG (Italy): 7 participants; 2 ♀, 5 ♂; 21 – 40 years old
- IPSI (Germany): two different groups of 5 participants (15 to 25 and 26 to 45 years old)
- Philips (Netherlands): 11 participants; 5 ♀, 6 ♂; 22 – 52 years old
- Telefonica I+D (Spain): 7 participants; 5 ♀, 2 ♂; 25 – 58 years old

#### 3.3.1 IdealHome focus group results: Fagor

11 people (5♀, 6♂; 22-47 years old) participated in the IdealHome focus group. The group discussion induced participants to address topics that concerned more autonomous and “intelligent” household appliances. But as home care and safety is not limited to the appliances, the participants began to think about some services that an “intelligent house” should provide, for example, medical and beauty care, and entertainment services were mentioned. The following paragraphs list the topics that were generated in the discussion.

##### 3.3.1.1 Health services application examples

- First aid: if an accident occurs at home, it should indicate first aids steps in case somebody is injured.
- Pediatrician assistance
- Health monitoring: a continuous medical checking service for people with chronic illness could avoid everyday visits to doctors, with a system that checks him/her state every day and just limit the visits to longer periods or when an anomaly is detected.
- Pharmaceutical services: To complement other medical services.

One of the worries of participants was that such continuous checks could turn people into hypochondriacs. They also emphasized the importance of the personal relationship with their physician.

##### 3.3.1.2 Beauty services

- Personal training and diet adviser: a gym at home where the system advises for training depending on physical condition and for the most appropriate diet.
- Personal dresser: advising on attire, best fit and appropriateness with regard to conditions, for example weather or occasion, and luggage packing.

### **3.3.1.3 Information services**

- Personal information management: managing information, for example, calendar management, looking for additional information, best deals, different travel options, available and preferred performances and shows, etc.
- Banking services: advising on investment suggestions, etc.
- Educational service: a “virtual teacher” that supports parents helping their children.

### 3.3.1.4 Free time

If users could get a system with all the services mentioned in the sections of MyPlace and IdealHome, they feel that they would reach a better quality of life. This system would increase people's leisure time and the possibility of enjoying it. For example, to have a relaxing bath, where people could indicate the temperature of the water, environment as lights, music, images and so on, while the system works for you. The management and access to all those services should be easy, simple, and natural.

### 3.3.1.5 Worries

People are, however, concerned about:

- Their reaction if they receive and have too much information.
- Becoming too dependent on the system.
- Isolation due to too much "computing".
- Protection of face-to-face relationships.

22 shows how the focus group participants assessed the importance of the service ideas that they generated. Figure 19 shows the metaplan of these topics.

**Table 22:** Topics according to importance ratings generated by the focus group participants at Fagor.

Topic	Importance					Rating
Health and Beauty						10 / 33
Free Time						8 / 33
Worries						8 / 33
Information Management						7 / 33

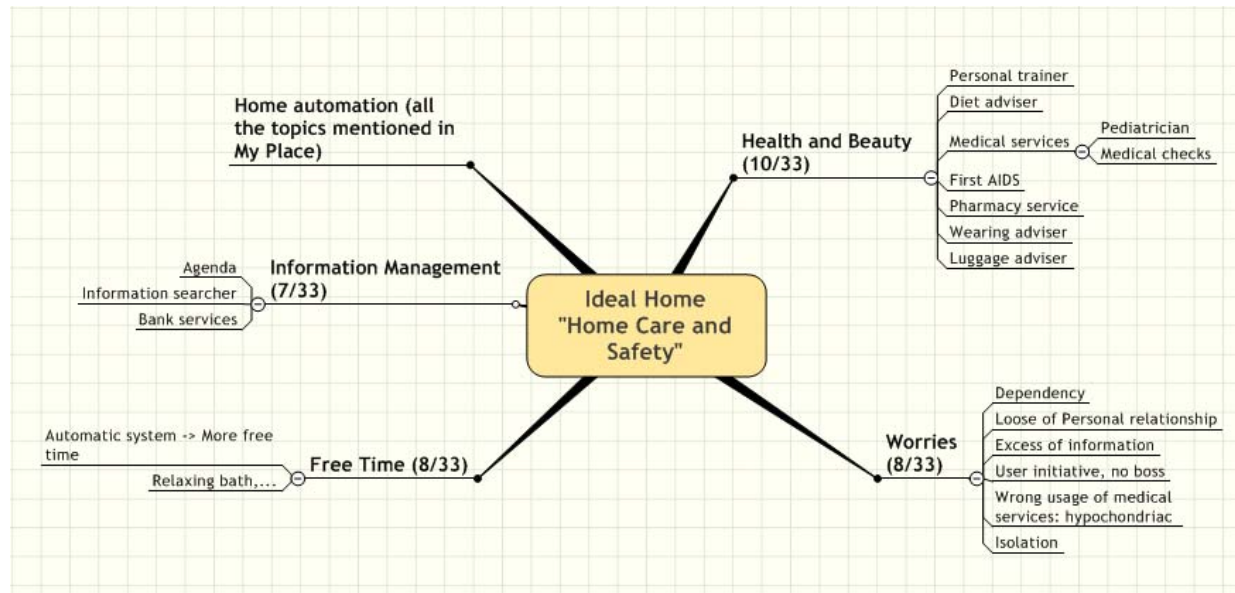


Figure 12: Metaplan of the IdealHome focus group topics at Fagor

### 3.3.2 IdealHome focus group results: France Telecom

9 people (4♀, 5♂; 27-45 years old) participated in the IdealHome session. Simplicity was the core theme for the participants at the start of the session. They all agreed on the need for appliances that are easy and intuitive to install and use and that are compatible with each other. Assistance with the chores of daily life and security were the most looked-forward to services. Security was associated with the protection against intrusion into the domestic network and prevention of domestic accidents of people. The following paragraphs list the topics that were generated in the discussion.

#### 3.3.2.1 Basic functions

- Simplicity with regard to usage, installation and programming is the vital factor for introducing an Ambient Intelligence system. Furthermore, it needs to combine and integrate basic specific features to avoid being considered as a gadget.
- Security is the second important factor. Assuming the centralisation of data requires that the system is reliable and provides protection against intrusions and the loss of data. In addition, a centralized system should allow that the data could be circulated between the various pieces of equipment in the house and the different members of the household.

#### 3.3.2.2 Day-to-day operation

- Home automation, including domestic security and assistance with day-to-day tasks are the most desired functions. Usefulness is important.
- Simplification of day-to-day living by having assistant functions, such as an interactive organiser, memo, going-out guide functions.
- Monitoring and managing the home ambiance with regard to “health-related” problems, such as, air quality or dust mite levels, but also to adapting lights, curtains, shutters and temperature.

The participants, however, reject any form of surveillance, which would interfere with their personal freedom.

*"... respect the privacy of the people who live in my house."*

*"I am disturbed at the thought of disclosing who is at home."*

*"I would hate to be keeping an eye on the children from the kitchen."*

### **3.3.2.3 Leisure**

The participants did not recognize major technical innovations in the scenarios, but they observed improvements in the conditions for carrying out recreational activities. The participants, however, rejected anything that was related to routine in the system.

- Entertainment and communication functions were identified as attractive for specific target groups.
- Playing music according to the user's movements seemed to be highly attractive for music lovers.

*"I don't want to listen to the same piece of music every day ..."*

*"Objectively speaking I listen to music and watch the news every day."*

*"It's a sort of intellectual laziness. you don't even look for something to put on ... everything is programmed".*

*"If you hummed a tune and it just played it, that would be too much."*

*".. the fact that something is forced on you and afterwards you react."*

- Adapting the ambience of a video game was perceived as fitting with the players' habits. Adapting the ambience to other situations then game playing was suggested for other entertainment occasions, like watching a movie with friends. Providing new game opportunities by having plug and play equipment was also mentioned. Participants who don't play video games, however, only considered video games for children. They suggested not only adapting the ambience to the game, but also to the game environment, i.e., reducing noise and light for the non-game players in the house.

*"Total immersion ... it's like being at the cinema."*

*"I am waiting for glasses that can project on to the retina."*

*"The environment could be adjusted to the child."*

### **3.3.2.4 Extended Home**

- Video conferencing for people who are close but don't live close together was perceived as very attractive. People compared this to using an instant messaging system using a Web cam. Sharing and bringing people closer together were the major reasons for people's positive reaction. However, they have strong reservations with regard to the protection of their privacy and impolite behaviour, like automatically cutting off the communication when another person enters the room. The participants couldn't think of matters that were so private that they wouldn't want to share it with other members of the household. They thought that excluding some people from the conversation is contrary to social courtesy conventions. The participants were also concerned about potential conflict situations that might exist or arise between members of a household.

*"It's very excluding: who were you talking to? you could get paranoid. "*

- "An icon is displayed: so-and-so is in the room."
- Privacy protection and having the freedom of choice for being available is crucial. They did not envisage any permanent connection between the two houses but a sort of

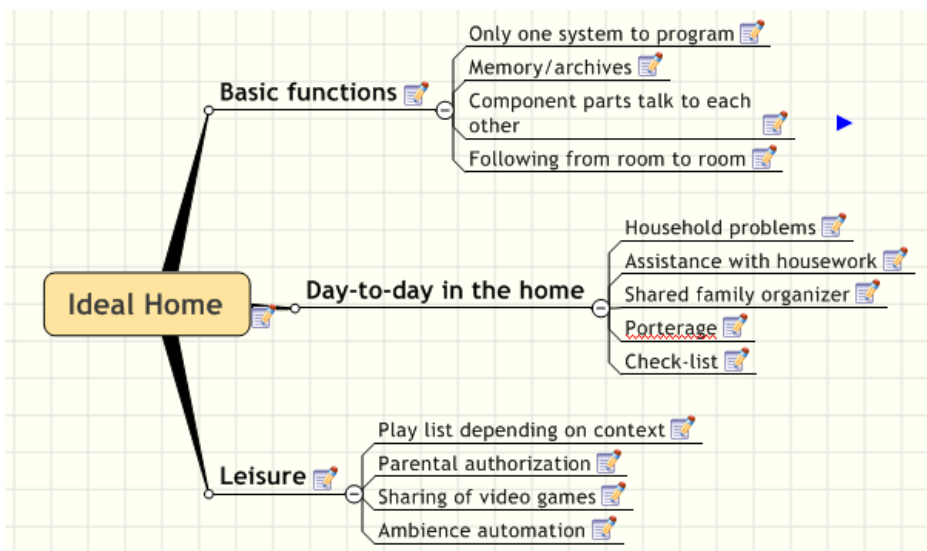
instant messaging system in which people’s presence could be activated and deactivated at will.

“...otherwise it’s like MSN Messenger, apart from the fact that a person is followed around the house...”

Table 23 shows how the focus group participants assessed the importance of the topics that they generated. Figure 20 shows the metaplan of these topics.

**Table 23:** Topics according to importance ratings generated by the focus group participants at France Telecom.

Topic	Importance					Rating
Only one system to program						5/27
Household problem						4/27
Parental authorisation						3/27
Communication						3/27
Sharing of video games						2/27
Music in all rooms						2/27
Ambience automation						2/27
Automation of household tasks						2/27
Porterage						2/27
Shared family organiser						1/27
Component parts talk to each other						1/27



**Figure 13:** Metaplan of the IdealHome focus group topics at France Telecom

### 3.3.3 IdealHome focus group results: Italdesign-Giugiaro

7 people (2♀, 5♂; 21-40 years old) participated in the IdealHome focus group. Starting from the discussion about the Amigo scenarios explained during the Gallery session, the

participants have been stimulated about their impression and ideas regarding the possible uses of ambient intelligent technologies both at home and office.

The following questions were proposed to the participants:

- In which areas of your office/home can you imagine the best use of an “ambient intelligence” system?
- Do you see any risks concerning an “ambient intelligence” system?
- What would be your major requirements for an “ambient intelligence” system at your office/home?
- How should an “ambient intelligence” system be so that you would use it?

Then discussion moved to the requirements and the description about what this technology should be and the main output was that this system should be easy to use and in particular it should give a tangible added value to the user's life.

The main functions that were extracted by the participants from the applications that were shown in the previous sessions concerned the possibility of customizing their environments and avoiding errors. They very much emphasized that all applications should be very easy to use and that they should give tangible added value to everyday life. The participants thought that a feature that let's you know from the outside who is in the house and in which room was particularly useless. The following paragraphs list the topics that were generated in the discussion.

### **3.3.3.1 Potentialities**

- Global information: The system is considered as a very powerful way to obtain “the needed” information in the sense that it will provide to the user only the information that he is interested in, skipping all the others.
- Local information: The system should provide information about the home, and the system itself (diagnostic of the system or of the washing machine for example)
- Control: Allow the control of the home in both terms of access and maintenance
- Classification: The system should help the user with activities planning.

### **3.3.3.2 Risks**

- Indolence: People may become lazy, because they know that there is the system that will manage all the “problems”.
- Unnecessary: People think that there is a strong possibility that a lot of useless applications could be developed. This comment depends on the fact that they considered some of the proposed features as not very useful.
- Some of the participants considered the technologies proposed in the scenario as not feasible in short time: they still consider it a far future challenge.

### **3.3.3.3 Doubts**

- Far in time: People are not so confident about the possibility that such a large number of devices, technologies and so on will be easy to use. They are still conditioned by the current technologies.



#### **3.3.3.4 Functionality**

- **Wireless:** To overcome the limitation of the actual technologies all the system components should be wireless.
- **Access:** The access to the system should be checked and limited in relation to the preferences of the main user.
- One of the main features connected with the proposed scenario system is the possibility to customize the environments according to the user's preferences.

### **3.3.3.5 Requirements**

The features and requirements for the IdealHome were the same topics that they raised in the entire meeting:

- **Easiness:** Simplicity of use, every action taken by the user should be communicated to the system with simple gestures or generally speaking without the need of particular skills.
- **Tangible advantages:** Only applications that provide tangible advantages should be developed.
- **Help in error avoidance:** Is one of the favourite features of such kind of future system. It is considered as one of the system's main tasks.
- **Essential:** The developed applications and generally speaking the system should provide only needed features. Not too many but strong ones and well developed.
- **Practical:** The developed system should be practical, easy to be used and without the need of too much training.

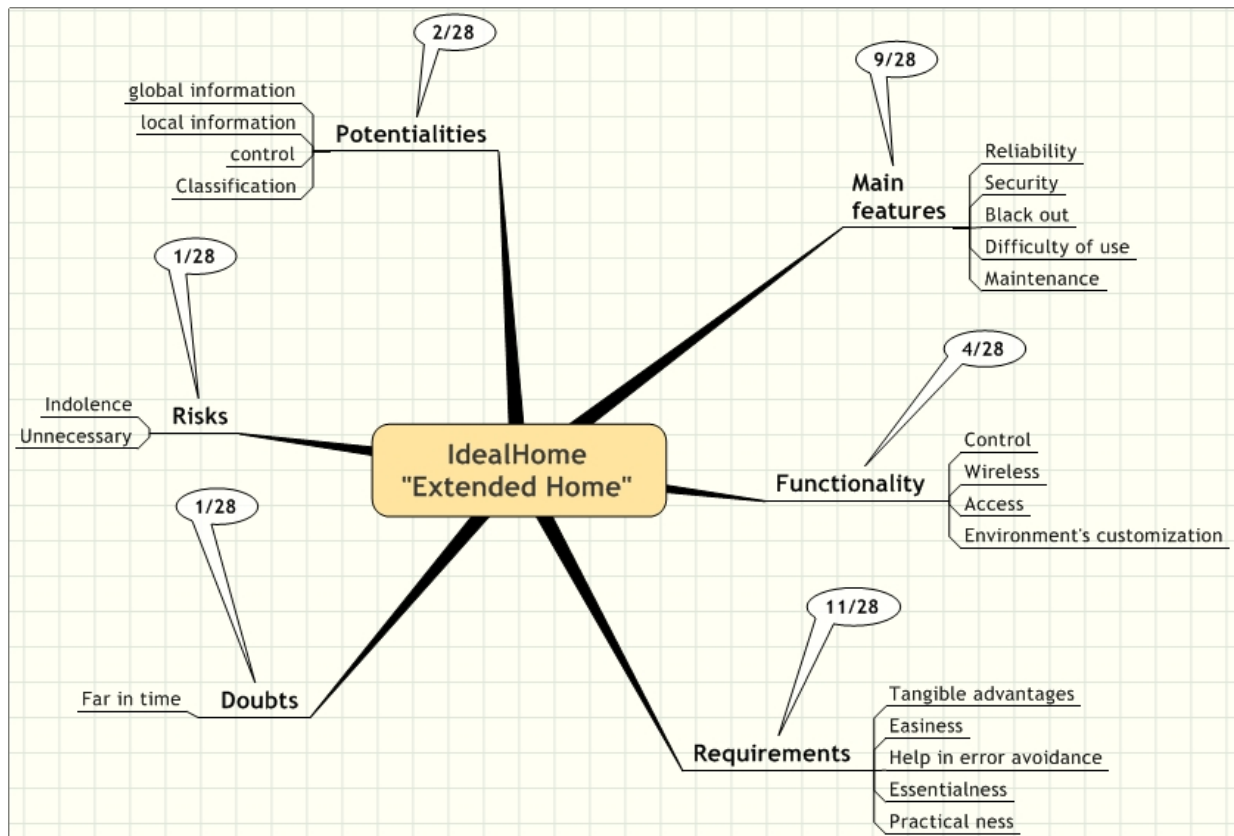
### **3.3.3.6 Main Features**

- **Security:** The system should protect the user's data from "external attack", the system knows all the user preferences so they have to be kept very confidential and they have to be safe.
- **Reliability:** The system should be reliable. The users accept this kind of system only if he is sure that they can count on it.
- **Maintenance:** The system shouldn't require a lot of maintenance.
- **Black out:**
  - What happens in case of black out?
  - The system has to be equipped with a backup structure.
  - Users are scared about the possibility to remain a "prisoner" in their home during a black out (as in a lift)

Table 24 shows how the focus group participants assessed the importance of the topics that they generated. Figure 21 shows the metaplan of these topics.

**Table 24: Topics according to importance ratings generated by the focus group participants at IDG**

Topic	Importance					Rating
Requirements						11 / 28
Main features						9 / 28
Functionality						4 / 28
Potentialities						2 / 28
Risks						1 / 28
Doubts						1 / 28



**Figure 14: Metaplan of the topics generated in the IdealHome session at IDG**

### 3.3.4 IdealHome focus group results: IPSI

Two different groups, each with 5 people (15-25 and 26-45 years old) participated in the IdealHome focus group. The following paragraphs list the topics that were generated in the focus groups.

#### **3.3.4.1 Variety of features**

- Following music: Most participants liked this feature much.
- Household: Generally they liked the idea that the system may help them with the household.
- Different features: The system needs to offer a variety of features; otherwise the participants would not see any value in installing it.
- Helps finding things: The system shall track the whereabouts of special types of things (like keys, bankcards, jewelry or other things which often get lost) and tell the user where he will find them if he is looking for them.
- Autonomous cleaning: All participants liked the idea very much, that the system cleans the house autonomous.

### **3.3.4.2 Security and Safety**

- Security: To work properly the system needs to collect many data, and it controls devices where abuse could have fatal consequences (like doors which open automatically). So it has to be considered carefully which features the system shall include. One has to consider the risks concerning abuse on the one hand and the benefit for the user on the other.
- Protection of personal data: Especially personal preferences need to be protected.
- Service: The system shall offer human service, where the user may get help concerning set up, usage and eventually concerning problems.
- System check: The system shall offer a simple possibility to do a self-check. This shall include the well functioning of all features, trials to access the system from other persons and data protection.
- Uncomplicated usage: The whole system needs to be easy to use. A suggestion for an easy to use interface was a speech-based interface.
- Protection of privacy: Personal data and preferences must be protected not only against intruders, but also against other users. For example shall parents who try to call not see, that their children are at home and just don't want to answer the call.

### **3.3.4.3 Requirements**

- Security and safety: system has to be secure against viruses and attacks from the outside. System should protect the house / inhabitants.
- Modular construction: system should consist of independent parts that could be bought separately. User buys only what he needs (no unnecessary functions/complexity).
- Extensible: easy to upgrade. Parts/modules should be available for a long time.
- Easy to configure: easy and intuitive interface. Programmable without deeper knowledge of the system.
- "Direct" communication: configurable through speech input. Natural interaction with the system.
- System shall remain in the background: system should not be visible. System should stay unnoticed until help/support is needed.
- Mobile: system should not be integrated in the house/apartment. Easy to move to a new house/location.
- Self-learning: not initial configuration should be required. Systems adapts its setting over time by "watching" the user.

### **3.3.4.4 Entertainment**

- Selective news: system should pre select interesting news.
- Following music and radio: music and radio (news etc.) should follow the user through the home.

#### **3.3.4.5 Risks**

- Loss of autonomy: fear that system is too authoritarian. Users should be in control and able to decide on their own.
- Monitored: fear that inhabitants are monitored all the time. Especially video is rated critically. No system, that constantly monitors/shows where every person is.
- Loss of interpersonal relations: critique on the intelligent front door. Also valid for the monitoring system (there wouldn't be a need to personally tell someone what a person is going to do or where he will be in the next time).
- Impersonal: related to the topic above.
- No privacy: especially video surveillance was criticized.
- Lack of control: fear that a system is not acting in one's favor. System should be controllable. Easy to over-rule.
- Option to turn off: easy to switch off or over-rule.

#### **3.3.4.6 Household**

- Recipe suggestions: system should suggest recipes based on the available food in the refrigerator.
- Intelligent refrigerator: refrigerator should order groceries if they are running out. Connected to the Internet.
- Household: Cooking, washing, shopping. An intelligent system would be especially appreciated for all household activities.
- Stock managing: system should keep track of provision (especially groceries).
- Automatic cleaning: system should automatically clean the house.

#### **3.3.4.7 Price**

- No power waste: The system may help saving power if it regulates devices and turns them off if they are not needed or regulates them that they run on low power if possible. But the system may also waste power if everywhere devices are running all the time.
- Low price.

#### **3.3.4.8 Apprehensions**

- No filtering of news: gallery material: If news is filtered, participants fear to miss important news of subjects they are generally not interested in.
- No patronizing: Generally the user must always remain in control. Users want to decide and the system shall only carry out those decisions.
- Automatic door very impersonal: The system shall not interfere with human relationships. It shall support human connections but not reduce them.
- No surveillance: The system shall not collect more data than necessary to support the users and it shall not be present everywhere at every moment.

- Limited trust in the system: Generally the participants were skeptical about the system. They did not trust that it can do all the tasks presented in the gallery properly and they had fears concerning security and safety.
- Own decisions are important: The system shall not make decisions on its own. Either the user shall define settings when to start which feature or the system shall only offer services and let the user make the final decision really to start it.
- Loss of personal communication: The system shall not mediate communication and relation between people when they have the possibility to interact directly. For example it shall not show which person is in which room, but the people may walk along and see for themselves, including the possibility for a small chat.
- Ability to handle all day things gets lost: If the system takes over too many tasks, the users may forget how to do things themselves. Especially children may not learn how to do things themselves and lose ability to handle their everyday life.
- Leads to addiction to system: Too much stimulus input may cause addiction to a "media overflow".
- Losing contact to reality: Too intensive and rich media output may result in such a convincing fictive world, that the contact to reality suffers.

#### **3.3.4.9 Assumptions**

- Individual settings: User may set preferences: Which service for which device at what time etc.
- Easy to configure: It must be easy to change preferences. An example for an easy way to make configurations was a speech interface.
- Usable from everywhere: Remote control, e.g. starting and stopping machines.
- Configurable by user: It must be possible that the user may set preferences himself. He must not need expert knowledge or assistance by a service provider.
- Mobile: If the user moves into a new apartment or house, he must be able to take the system with him.
- Extensible: It must be possible to add new devices and services or to replace old versions by new ones.
- Flexible: It must be possible to adapt the system to different situations, users and places.
- Option to turn off single features: Even features the participants like very much shall have this option, because the user shall remain in control of everything.
- Uncomplicated Usage: The whole system needs to be easy to use. An example for an uncomplicated interface was speech control.

#### **3.3.4.10 Good Design**

- System has to look nice to place it somewhere in the home.
- Users see a good design as one of the most important buying criteria.

Figure 15 shows the metaplan and the importance assessments of the topics generated by the two focus groups at IPSI.

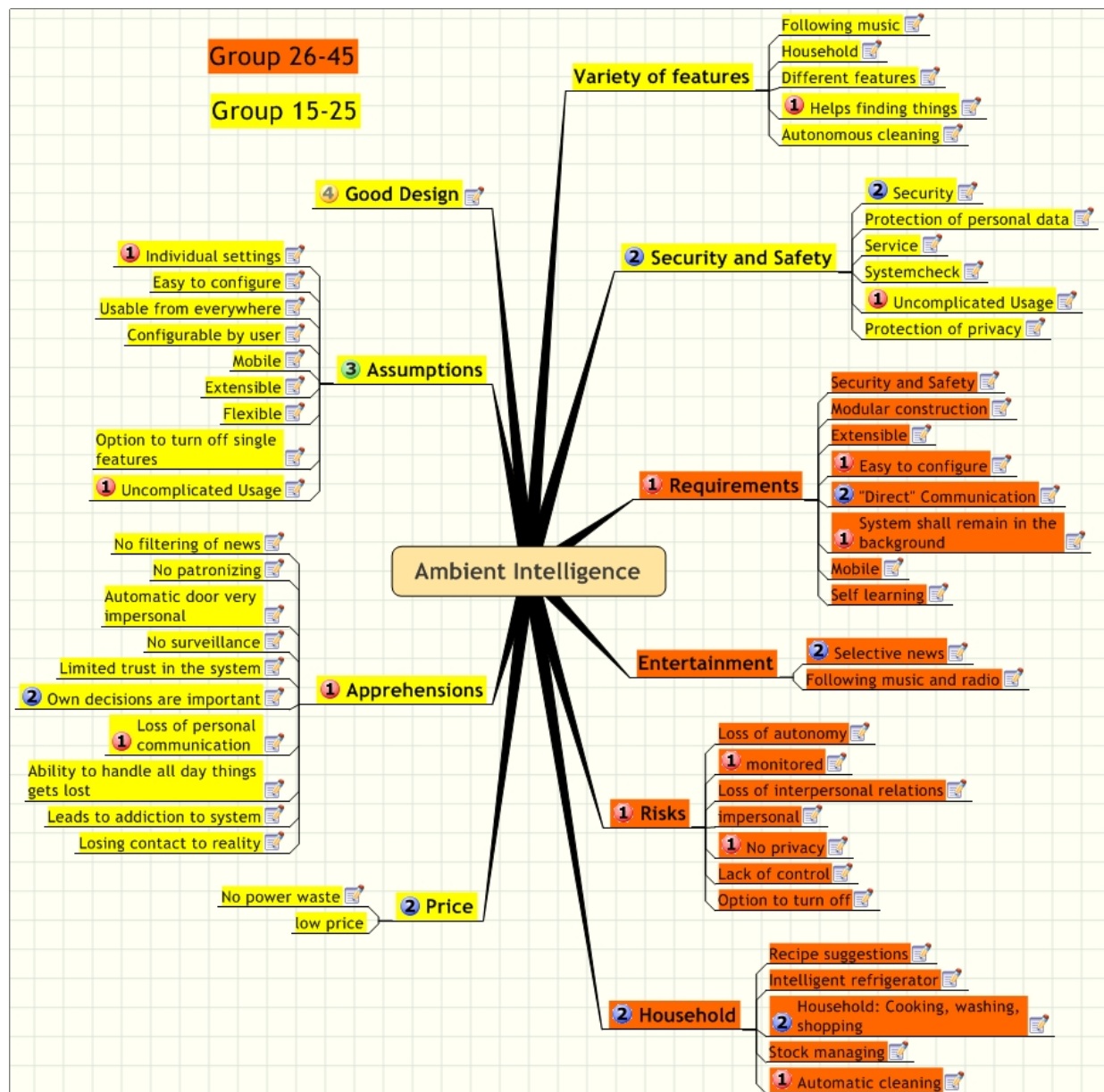


Figure 15: Metaplan and importance assessment of the topics generated by the IdealHome focus group at IPSI.

### 3.3.5 IdealHome focus group results: Philips

11 People participated in the focus group, 5 ♀ and 6 ♂, the age varied between 25 and 52 years. The following paragraphs list the topics that were generated by the participants. These topics are a summary of the topics that were generated by the participants during the MyPlace session and the Gallery session.



### **3.3.5.1 Requirements**

The major requirements listed by the participants were:

- The system should be In-obtrusive, user friendly, fun and easy to use
- The system should not increase the mental load for its users
- The system should be reliability
- The system should be able to handle multitasking
- The system should be efficient for the users
- The system should be less intelligent than the user

### **3.3.5.2 Privacy issues**

The major concerns with regard to privacy issues were, according to the participants:

- Control – users should be able to turn the system off and on
- The ‘big brother’ effect should be prevented
- Protection against ‘house hackers’ is needed
- The system should have a security alarm system

### **3.3.5.3 System challenges**

The major concerns with regard to challenges encountered by an Amigo system were, according to the participants:

- The cost of the system should be appropriate for the functionality it provides
- The maintenance of the system should be efficient, easy and affordable
- The system should be able to cope with multiple users
- The system has to make ‘everybody happy’ – how to convince people of that? Where are the trade-offs?
- Questions as to how far the system can adapt to the user and whether this is desirable

### **3.3.5.4 User challenges**

The major concerns with regard to challenges for the users of an Amigo system were, according to the participants:

- To not grow fat, lazy, and incompetent.

### **3.3.5.5 Applications**

The following application topics/areas were mentioned:

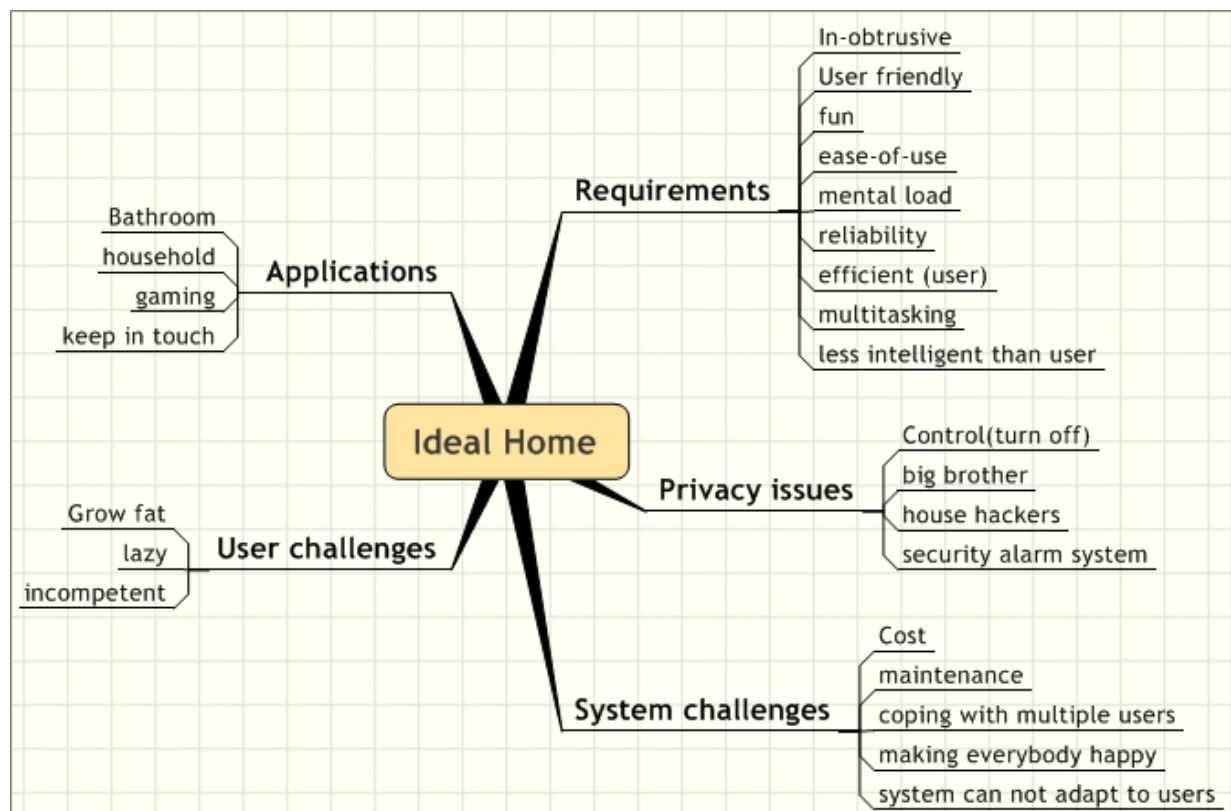
- Bathroom,
- Household,
- Gaming,

- Keep in touch.

Table 25 shows how the focus group participants assessed the importance of the topics that they generated. Figure 23 shows the metaplan of these topics.

**Table 25: Topics according to importance ratings generated by the focus group participants at Philips**

Topic	Importance					Rating
Requirements						15 / 39
Privacy issues						9.5 / 39
System challenges						8.5 / 39
User challenges						4 / 39
Applications						2 / 39



**Figure 16: Metaplan of the topics generated in the IdealHome session at Philips.**

### 3.3.6 IdealHome focus group results: Telefonica I+D

7 people (5♀, 2♂; 25-58 years old) participated in the IdealHome focus group. After seeing the scenarios, the group put more emphasis on the previously treated issues. They were still worried about security issues. Robustness of the system, privacy protection, and failure prevention were their most important concerns. The system should be stable and easy and intuitive to use. The most appreciated functionalities were associated with home care, i.e.,

cleaning, shopping. New applications were proposed, for example, an assistant for image consulting or a secretary for keeping agendas. They also thought, however, that in case of failures the technical assistant should be human. The participants generated the following topics.

#### **3.3.6.1 Risks**

- The group was worried about security and privacy. These topics were also considered as risks because if the system is not robust enough, nor secure, they will not adapt their house to include the system. Hence, the system should be robust and secure.
- The need to be easy to handle and to be useful is also considered as a risk in case this requirement is not fulfilled. Disabled people also should be able to use the system.
- Loss of communication loss (similar to the idea of Internet isolation). If people have all the comfort and all that they need at their homes, they can avoid going out and communicating face-to-face with others.

#### **3.3.6.2 Aspects**

For this point people thought about situations where the system would be useful:

- Help disabled people. Make disabled people life comfortable and easy. For instance, the system could warn a blind person (with sounds) when he is near an object or a wall.
- Could improve the home security not only from intruders but also from fire and flooding.
- Could save time, making household tasks.
- People could keep in touch even if they are far away, so this could improve communication.

#### **3.3.6.3 Functionality**

An ideal home must have de following functionality:

- Must help with household tasks. This was a unanimous request although the most interested people were the housekeepers.
- Could assist with dressing (colors, shapes, ties...) was considered important by the male participants.
- Adaptive environment (temperature, light) is also an advantage.
- The system must be easy to handle. Participants prefer to control the system themselves.

#### **3.3.6.4 Requirements**

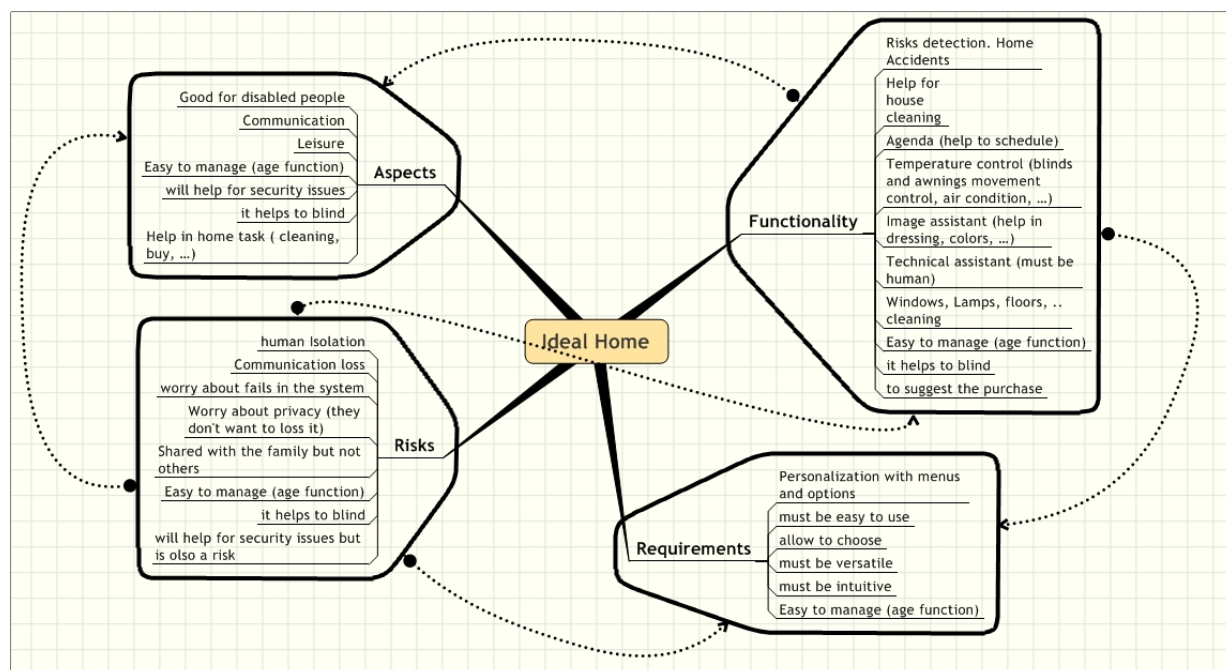
Features and requirements for the Ideal home were the same as the topics that they generated in the entire meeting:

- A secure system, that allows privacy.
- Versatile and intuitive, functionality must be easy to use and to learn.
- They want to control the system and not to be controlled. The system must be customizable.

Table 26 shows how the focus group participants assessed the importance of the topics that they generated. Figure 24 shows the metaplan of these topics.

**Table 26: Topics according to importance ratings generated by the focus group participants at TID.**

Topic	Importance					Rating
Risks						9 / 21
Functionality						7 / 21
Requirements						3 / 21
Aspects						2 / 21



**Figure 17: Metaplan of the topics generated in the IdealHome session at TID**

### 3.3.7 Conclusions IdealHome focus groups

The agreement amongst participants from all Focus groups was large. First of all, all participants agreed that the system must be easy to use and configure, simple and intuitive, customizable to the preferences of each user, and it enable natural interaction.

The strongest worries of people refer to expected security and privacy problems with the system. It reminds them of a 'big brother' type of system; people do not want to be monitored by a system, as they perceive this as threatening their privacy. Hence, the system must not produce awkward situations for people, not interfere when it is not appropriate, and it must respect each user's requested privacy. People also worry about the lack of control of the system. They propose that it should have a *turn off control functionality* because the user must control the system and it shouldn't be the other way around. Furthermore, people worry about the protection of their private data.

The participants worried about the effects that this system could have on humans, i.e., they can become lazy because they do not have to do anything, or incompetent because they forget how things are done and so on, or they get isolated due to loss of direct personal communication. These problems should be avoided; one idea in the IPSI focus group was that the system should not mediate communication and relation between people when they have the possibility to interact directly. For example, the system shall not show which person is in which room, as the people could go there and see them; they could even engage in a chat.

All participants were enthusiastic about home automation functionalities (household tasks, cleaning, recipe suggestions and so on). They all agreed that more autonomous and *intelligent* household appliances could improve the quality of life by increasing people's free time.

Some functions coincided, for example:

- Help people managing their wear (a kind of fashion assistant).
- Organizer or agenda that helps users at planning their activities.
- Adaptive environment (temperature, lighting) that improves health caring.
- System auto check diagnosis.
- Help to save energy.

People also observed that it should be easy to move the system to another home.

Despite all these correspondences, the groups also disagreed on several topics. For example, a news summary service appeared to be attractive for some but undesirable for others (because they think that some important news may be filtered). Therefore the system should be flexible enough so that all these different points of view of the system can exist together by allowing, for example, profiling in these functions.

## 4 Conclusions: Quantitative and Qualitative Research

Quantitative and qualitative methods were used to elicit the feedback from the target user population on the concepts that are proposed in the Amigo project scenario. The Amigo scenario consists of four scenes, which provide a view on a day in the life of a fictional family. The scenes comprise examples of the Intelligent User Services and the Application Domains that are proposed in the Amigo project.

The quantitative research, Gallery, consisted of a preference ranking of elements in the scenarios, which were examples of Intelligent User Services. The first qualitative research method, MyPlace, consisted of a structured focus group session addressing the Amigo Application Domains. The second qualitative research method, IdealHome, consisted of an open-ended discussion on people's expectations of ambient intelligence technologies in their home and life. Table 27 compares these three methods.

Using these three complimentary methods resulted in confirming evidence with regard to perceived user goals and needs and the match or mismatch of the proposed Amigo solutions. Note, that a perceived mismatch can be reformulated as a requirement, condition or constraint for the Amigo system requirements.

**Table 27: Comparison of the methods used to elicit user feedback**

	<b>Gallery</b>	<b>MyPlace</b>	<b>IdealHome</b>
<b>Method</b>	Quantitative	Qualitative	Qualitative
<b>Focus</b>	Intelligent User Services	Application domains	Generic
<b>Task</b>	Preference ranking assignment for individual participants (45)	Structured groups discussion (6-12 persons)	Open groups discussion (6-12 persons)
<b>Data</b>	Agreement among judges collapsed over all participating sites	Topics and value ratings clustered per application domain per site.	Topics and value ratings for each site
<b>Interpretation of results</b>	Results are based on how individual participants interpret the visualizations of the scenario scene's elements	Results are based on 'chemistry' in the focus group and the interpretation of the facilitator	Results are based on 'chemistry' in the focus group and the interpretation of the facilitator

### 4.1.1 Intelligent User Services

Elements referring to Intelligent User Services were abstracted from the scenes of the Amigo scenario and people were asked to give a judgment with regard to their perceived usefulness. The results from the Gallery evaluation could be summarized and prioritized in user requirements that are generic for multiple Intelligent User Services (see also Table 11, 3.1.3.).

First and foremost, maintaining control and responsibility for how they organize and maintain their physical and social household is top priority for people. This is made explicit in S1 and S2 by the elements that show the role of the system in asking for parental permission with

regard to content and games for their children (highest preference judgment over all sites). The qualitative results from MyPlace and IdealHome support this user requirement fully for all Application Domains.

1. The user must always remain in control of the system and never the other way around
2. The system must be secure, safe and protect the privacy of all users
3. The system must provide an added value to existing systems
4. The system should never unnecessarily replace direct interaction between people
5. The home comfort should always be maintained and not be subversive to the system

These requirements are always subsumed in all other requirements.

Second in priority for people is the need to reduce the overload of information and the burden to search. This was made explicit in S1, S2, S3, and S4 by the elements that provided information summaries, personalized to different people, provided at different locations in the home, and dependent on context. The qualitative results from MyPlace and IdealHome did not show this priority since the structured questions didn't address this topic. This requirement in general is supported by the results from the Amigo field studies (D1.1). Although ranked very high, the different elements elicited mixed feedback. Subsuming the user requirements with regard to control of the system, this feedback can be summarized as:

6. The system should provide concurrently the appropriate information to the right persons for the appropriate occasion at different locations, i.e., filter information, provide resumes, according to user preferences (note people refer to existing services that they know)

Third in priority for people is to reduce the load of housekeeping chores and to prevent all kinds of household accidents. This was made explicit in S3 by the elements that detected faulty items in the laundry and automatically started appliances. The qualitative results from MyPlace and IdealHome support this user requirement fully for all Application Domains, but especially for the Home Care and Safety domain. Clearly with regard to home care and safety, people have great expectations.

7. The system should reduce the time needed for household chores and where possible do most of the cleaning jobs
8. The system should integrate and combine functionality of appliances
9. The system should be energy saving
10. The system should be cost saving

The system should maintain the appropriate environmental conditions of the house (temperature, humidity, light, air, dust, mites, etc.)

(N.B. none of the participants referred to the potential life threatening dangers of bacterial and viral infections that have to be prevented when different food substances at different temperatures and at different levels of cooking come into contact via combined appliances and integrated preparation procedures).

Fourth in priority for people is to have assistance with organizing their personal environment at home and between home and the office. This was made explicit in S1, S2 and S4 by the elements that selected favorite songs, induced a follow-me of content and downloaded content and play lists to different devices. The qualitative results from MyPlace and IdealHome support

this user requirement fully for all application domains, but especially for the Home Information and Entertainment domain.

11. The system should support the activity organization and planning for multiple persons at home, between homes and between home and work
12. The system should protect against abuse, intrusions, loss of data, house hackers
13. The system should provide controllable access and respect individual preferences and authorities

Fifth in priority for people is to have assistance with organizing their home environment. This was made explicit in S1, S2 and S3 by the elements that adapted the ambiance, i.e., lights, windows, to the appropriate activities in a family or game room, and the recognition of people at the main entrance. The qualitative results from MyPlace and IdealHome support this user requirement fully for the different application domains.

14. The system should take context/environment conditions into account and be aware at any time of the local situation.

Sixth in priority for people is to be supported with the care for others and to stay in touch with others. This was made explicit in S2, S3 and S6 by the elements that addressed user modelling and profiling, awareness and notification, and security and privacy. To see each other while talking or being involved in joint activities from different locations was the preferred example. The qualitative results from MyPlace and IdealHome support this user requirement fully for the different application domains.

15. The system should take implicit social rules of behaviour into account
16. The system should protect people's privacy at all times

All studies showed confirming evidence with regard to general user requirements including the very obvious, like the system should:

- Be easy to use and to configure – no need for programming by the user
- Not being used for surveillance
- Enable individual settings and preferences
- Configurable by the user or service provider
- Movable, in case of moving house
- Extensible - easy to upgrade
- Flexible
- Turn off individual features
- Modular
- Be maintenance free (i.e., no need for maintenance by the user)

#### **4.1.2 Recommendations for refining the user scenarios**

The participants at the scenario evaluation sessions generated a wealth of suggestions and ideas for usage and services. They also were very determined about the ideas that they at face value did not appreciate at all. Most pertinent for people are the requirements, which we



might call 'hygienic', such as, easy to use, nice looking, and no programming, no extra effort, affordable, functional. Participants were unanimous in their desire to protect their privacy, their mistrust of a system invading their personal life, and their dislike of being too dependent on an ambient system for social communication.

From the user's point of view, the functionality of an Amigo system can be distinguished in four categories:

1. Practical: addressing a recognized need or being quite handy to have
2. Improvements: increasing pleasure by enlarging the possibilities for having access to information, entertainment and games
3. Affecting the emotional balance of the household
4. Arousing fear for intensive use and being cut of from the real world

#### 4.1.2.1 *Practical functions*

These functions are perceived as practical compared to current practices that people are used to. Participants insisted that the system should be useful and functional. In this context, the home automation functions were well received in that they lead to an improvement of daily life and could reduce the tediousness of home care.

The key user benefit concerns everything that:

- Reduces malfunctioning and the time spent on domestic chores.
- Reduces risks for home accidents and calamities, i.e., a safe and healthy home environment.
- Integrates and links different devices
- Improves home management

User suggestions for the system are:

- Manage all the tasks that are time-consuming and annoying - automate domestic tasks such as cleaning or ironing.
- Automate domestic safety
- Assist – not fully automate- tasks that improve comfort, like remote activation of household appliances.

**Table 28:** Implications for the Amigo scenario with regard to the elements in Scene 3: Home caring

	<b>Element reference and description</b>	<b>Implication</b>
c)	It downloads recipes in the kitchen	Keep In spite of varied responses, may be make a link with appliance in the kitchen
e)	It detects faults in the washing machine and gives a warning	Keep Develop safety aspects (safety of the individual and the machines)

f)	It starts the dishwasher when it is full	Keep
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#### 4.1.2.2 Improvement functions

These functions are perceived by people as improvements of their environment and current practices. In this context people refer to the music that follows a person into various rooms or the ambiance that adapts to the environment for playing games or watching a movie. People are interested because they expect that this brings more pleasure to their leisure activities.

The key benefits for the users are:

- New functionalities offered, which provide new possibilities for using existing equipment
- New possibilities for playing games.
- Broadcast that follows around the house
- Making communication easier

User suggestions for the system are:

- Simplify access - controlling the equipment in relation to context and function
- Interconnect the functionalities related to leisure activities, including the user interface.
- Integrate with existing solutions and environments
- Prevent obsession, repetition and routine

**Table 29: Implications for the Amigo scenario with regard to the elements in the scenes:**

	Element reference and description	Implication
<b>Scene 1: Being followed by content</b>		
a)	It plays her favourite song when she wakes up in the morning	Refine Use the notions of settings and play list management.
b)	The song follows her through the house	Keep
c)	At the same time it shows Jerry's favourite news in another room	Keep
d)	If she starts singing her own song, the system starts playing it	Refine Find a more creative solution
g)	The TV shows summaries of their favourite news	Refine Find a balance between fear of missing an information and personalized information; complete/summarized information
h)	The news is downloaded on a portable device to take along	Keep Not perceived as innovative, but as quite appears obvious
<b>Scene 2: Playing games</b>		
b)	It downloads and shows game play lists	Keep the game play list Focus on the downloading modes: local or remote.
c)	It adapts the lights and the sounds of the home to the environment of the game	Keep

	to the environment of the game	
d)	It displays a video wall to show the game and other players	Keep Focus on: The video wall that adapts to the environment of the game conditions. Displaying other players on screen.
e)	It lets the game player interact with body movements	Keep
f)	It recognizes friends at the front door and lets them join in the game	Move to Scene 3 element a) for better fit
g)	It recognizes and integrates the game devices of the friend	Keep
h)	It downloads the profile of the friend	Keep
<b>Scene 3: Home caring</b>		
g)	It sets up the living room for film watching, adjusts lights and curtains	Keep
<b>Scene 4: Sharing ambiance</b>		
b)	They see each other and it lets them engage in a chat	Refine Go towards instant messaging more than an "always there" system

#### **4.1.2.3 Functions that affect the emotional balance of the household**

Some functions that are presented in the Amigo scenario can have an affect on the relationships between the members of a household; for example, functions that require the presence of cameras invoke the feeling of being kept under surveillance. The participants reject these functions. This even concerns child monitoring (inside the house), which can be interpreted as an infringement of personal freedom and affecting the responsibility for and from children. People fear that the relationship between parents and children may become virtual and regulated too much via the system. Participants, on the contrary, appreciate the doorkeeper. Furthermore, participants want the system to obey and maintain social rules and conventions.

The key user benefits are:

- Support for social and family activities, that is context aware and obeys social rules
- Clever doorkeeper and safety control

User suggestions are:

- Don't replace the individuals or make decisions for them regarding direct or indirect social relations
- Consider system usage in relation to the media that are being selected with regard to relational logic, rules and regulations of conversation.
- Don't be a 'Big Brother'

**Table 30: Implications for the Amigo scenario with regard to the elements in the scenes:**

<b>Scene 1: Being followed by content</b>		
e)	If she goes to Jerry in another room, the system stops playing	Throw Control of the system actions must be left to the user's own initiative (social rules)
f)	If Maria or Jerry leave the room, the system starts playing again	Throw Control of the system actions must be left to the user's own initiative
<b>Scene 2: Playing games</b>		
a)	It asks for parental permission.	Keep A function that can be re-programmed by limiting the intrusive aspect and the idea of surveillance
<b>Scene 3: Home caring</b>		
b)	It has a vestibule display showing who is home	Refine Interesting function in spite of varied responses.
d)	It shows recipes and the whereabouts of the persons in the house	Refine Discard surveillance functions
<b>Scene 4: Sharing ambiance</b>		
a)	It shows her father at his home and Maria in her home	Refine The system is "always on" but not "always there" Use also other channels than video
c)	It interrupts the chat if other persons enter the room	Throw or refine Come up with a less brutal privacy management system.
d)	It knows the privacy preferences of both Maria and her father	Refine A privacy system must not be managed by the system

#### **4.1.2.4 Functions that arouse fear for intensive use and being cut of from the real world**

Consumers do not expect everything to be sanitized and automated. They are not looking for so much automation that it results in the disappearance of the slightest effort. Accordingly, participants rejected everything that they associated with laziness.

They fear losing control when confronted with the mechanization of their daily life. They perceive this as a contradiction between the promise of an even more accessible and intelligent house and being forced to suppress their - "tactile" contacts with their environment, i.e., actions that are a way for marking one's territory and asserting oneself at home. Security is another fear, as household data and information is potentially exposed to the risks of intrusion, a virus attack or piracy. Moreover, the use of cameras leads to fears of misuse and intrusion of privacy. The centralization of several functions in a single system raises anxieties about potential malfunctions that might occur due to system malfunctions or simple power cuts.

The key user benefits are:

- Perceived and actual safety
- Protection against undesired intrusions

User suggestions are:

- Partial automation of the household
- Prioritize set-up and personalization possibilities
- Don't go for gadgets
- Avoid abuse and misuse

**Table 31: Implications for the Amigo scenario with regard to the elements in the scenes:**

<b>Scene 1: being followed by content</b>		
a)	It plays her favourite song when she wakes up in the morning	Refine Use settings and play list management.
d)	If she starts singing her own song, the system starts playing it	Refine Focus on user control, emphasise the fun aspect and get rid of constraints.
<b>Scene 3: Home caring</b>		
a)	It has an intelligent door that recognises family and friends	Refine Emphasise the system's safety aspects
b)	It has a vestibule display showing who is home	Refine Mixed responses
d)	It shows recipes and the whereabouts of the persons in the house	Refine Discard surveillance functions
<b>Scene 4: sharing ambiance</b>		
a)	It shows her father at his home and Maria in her home	Refine. Focus on agreements between both parties.