How to connect user Research and not so Forthcoming Technology Scenarios – The Extended Home Environment Case Study

E. Guercio, A. Marcengo, and A. Rapp

Abstract—This paper draws a methodological framework adopted within an internal Telecomitalia project aimed to identify, on a user centred base, the potential interest towards a technological scenario aimed to extend on a personal bubble the typical communication and media fruition home environment. The problem is that involving user in the early stage of the development of such disruptive technology scenario asking users opinions on something that users actually do not manage even in a rough manner could lead to wrong or distorted results. For that reason we chose an approach that indirectly aim to understand users hidden needs in order to obtain a meaningful picture of the possible interest for a technological proposition non yet easily understandable.

I. INTRODUCTION

THE traditional way of communicating is changing on one hand by the new telecommunication and ict technologies incoming, on the other hand by the attempt to satisfy better both practical and emotional needs. Next step will be their deep introduction in the daily life context: it's growing the "Extended Home Environment" concept that means people will interact among themselves and with a digital environment in a simpler seamless way. In particular they will not configure or switch on/off their devices while moving indoor (at home, for example) or outdoor (i.e. from own home to car) if they want to continue their media or communication sessions. This work paper wants to describe context, method and aims collected in a Telecom Italia project that develops tools and services to make telecommunications seamless and integrated in the daily life context, in a suitable way for potential end users. In particular the main project purpose is to develop some specific services for the end user, by taking in account both the ergonomic users features and their direct and

emotional needs but also the technology capacities and opportunities, i.e. multi-network seamless access, multimodal interfaces, sensor networks and so on.

The question is: "how can we satisfy different users requests to make them communicate and interact in a simpler way with all device they have at home, but also in their car and in their office?" To answer this question we decided to adopt "Personas" methodology, originally proposed by Alan Cooper [8]. Specific people's aims don't change a lot in the course of time, while tasks are strongly related to the concurrent technology landscape. Personas are real users archetypes, with their specific identity representing needs and aims that are long lasting, regardless of the technology boundaries. So they make possible to design services based on not so forthcoming scenarios. We defined 9 "personas": everyone with specific social-demographic characteristics, aims and needs. For every persona was "built" the daily life scenario from the morning to the evening, describing the different environments (home, car, office, university, pub…..) the persona pass through. So that it was possible to deline also a set of communication needs to satisfy that constituted the first step for working out new service concepts. At the end of the personas' modeling process some focus group were carried out to evaluate the acceptability of them. During each focus group several stimulus were used like short videos, low fidelity prototypes, similar solution of other vendors and so on.

II. THE EXTENDED HOME ENVIRONMENT: DEFINITION AND CHARACTERISTICS

Nowadays, the home network environment is characterised by a lack of flexibility and by a raising complexity especially in terms of configuration scalability and management. In this context is quite common that audio-video contents distribution, communication person-to-person and access to information and services use different networks. In the near future technological development, business changes and standardization process in telco area could take the market towards integrated solutions to access contents, services and tools in a seamless way both on production and consumption side. On one hand there're more available contents (professionals or user generated), on the other one it's possible to find more intelligent devices that can enter in the environment, integrate themselves and communicate between them. Their capability to support a lot of applications added to their pervasivity run towards an intelligent net that allow the

user to have more personalized services and tools. Consequently it's possible to have a sort of lack of distinctivity between inside and outside because people could have what they want always, everywhere. So that communication and interaction would be completely seamless towards an homogeneus home environment built above heterogeneous devices and phisical infrastructures. The federation of all the "home environments" in a virtual "extended home environment", which would "distribute" the resources over several physically separated domains, allow the user to have similar application experiences as if he was accessing services in his primary home. This kind of virtual environment can be thought as a whole made with a lot of different layers.

A scouting was done to highlight principal evolution technology trends and to choose which technology pattern investigate with potential end users.

We adopted a four layer model in order to conceptualize the scope of our research domain (see Fig. 1).

Fig. 1 Four layers of the project

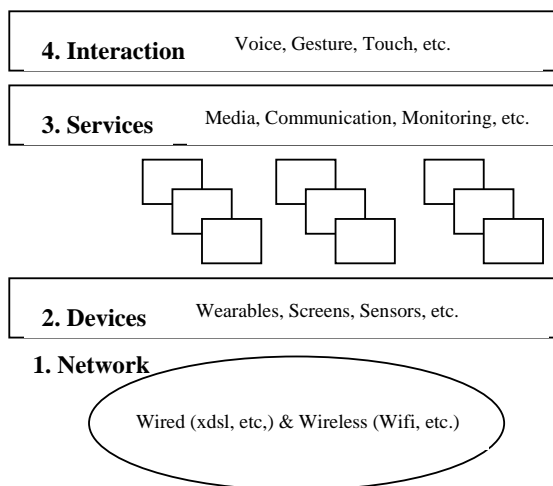**Layer 1→ Networks**

Nowadays in the home domain many different networks are available and they are usually partially inter-connected. So that usually services are "islands" separated between them because they use different communication protocols. Multimedia networks typically use IP or IEEE 1394 protocols, while home automation networks rely on proprietary, non-IP, protocols such as LON, EIB, and Zigbee. The Home Extended Environment would integrate all these technologies in a "transparent" and modular way to point new standard and to improve semplicity and auto-configuration. An example could be the IP Multimedia Subsystem (IMS): it can allow the convergence of Home networks and mobile networks, enabling any IMS capable service to run in all possible user environments and terminals. Then in the future other types of wireless communication could spread, for istance PAN that are Personal Area Network to allow communication process between the usual personal devices (mobile phone, electronic

agenda, etc.) and BAN (Body Area Networks) that can transfer information through different systems we put on our body.

Layer 2→ Devices

There are already multiple displays at home (e.g. High Definition TVs, digital picture frames, Internet tablets) used as visual output devices, but everyone used in a specific and independent way. Moreover, some of the existing home devices, like TVs, have been the same for many years, just pushing content to the users, without any interaction. But in the near future the high definition maxi screen availability allow us to interact more with everything we're watching in the same way of interacting with surrounding environment. Furthermore the significant decrease of thin screen prices will allow people to have them everywhere in their home on every kind of domestic objects like fridge but also on walls and mirrors. The proliferation of personal screens mixed reality systems could allow everyone to have personalized information in every kind of environment he/she's going to access. At the end diffusion of intelligent integrated devices in daily use objects (wearable computers) would help the increasing of digital contents seamless fruition .

Layer 3→Services

In the next near future available services for end users will be always built on his specific antropomorphic characteristics needs and habits. In particular they will cover a service set from co-presence to central mangement of all household appliances. Videoconference could be transformed into a "tele-presence" system, also exploiting High Definition (HD) and allowing far people to share the same event or to communicate among themselves as they're in the same room. Mobile devices will become "full-citizens" in the home domain, as special middleware will be created for the transparent integration of them in the extended home. Another typical scenario could be a sort of system of control positioned in own domestic context that allows every family member to manage and control the household appliances but also their appointments, meeting and in general familiar commitments (shopping, birthdays' date, etc…) not only in a direct way but also remotely.

Layer 4→ Interaction

Spoken dialogue systems have become an important tool for developing attractive applications in the field of human-computer interaction. The technologies involved in speech recognition, dialogue design, etc. are mature enough to allow the creation of trustworthy applications. An other kind of natural interaction is emerging: using hand or eye movements to interact with applications without touching monitors or screens. That will enable users to use their systems and devices in an easy and seamless way, through voice commands, gestures, touch, etc.

III. METHODOLOGY

Involving user in the early stage of the development of such disruptive technology scenario asking users opinions on something that users actually do not manage even in a rough manner could lead to wrong or distorted results. For that reason we chose an approach that indirectly aim to understand users hidden needs in order to obtain a meaningful picture of the possible interest for a technological proposition not yet easily understandable.

To reach the aim to plan services suitable for specific target of users that help them in managing better their daily life, we used "personas" methodology, by Alan Cooper [8]. It helped us to look for personalized and contextualized service patterns to answer different daily life needs of different user targets. "Personas" aren't real users: "they are *hypothetical archetypes* of actual Users" [8], well described in an anagraphical (i.e. name, surname, date of birth, familiar data, etc….) and behavioural way (i.e. life styles, interests, values, etc…). They are also defined with their needs, goals and tasks and they are the fulcrum of the whole planning flow. Many assumptions on every specific "personas" are made and they hightlight not conscious elements of his personality overall specific aspects interesting for planning not all [16]. Although that, Personas can be more powerful if used to complement, not replace, a full range of quantitative and qualitative methods [15]. They can be used in a succesfully way if they are supported by other methods like ethnographic research [3], quantitative market segmentation [9] and experimental psychology [17]. Qualitative data come from interviews and direct observation and quantitative data from statistic and market can be the first step for "personas" creation and definition.

Four principal step were followed:

- **First one**: five specific technological scenarios to investigate were defined.

  - Seamless communication: users could transfer in an authomatic way a specific audio and/or video session from a device to another one (es. from TV to mobile) indoor or outdoor to have the best communication "support" in every moment
  - Co-presence: two or more people far, could communicate in a natural way through maxi screen or videowall as if they were in the same room
  - Wearable technologies: they could be a comfortable and ergonomic solution for end users because allow him to communicate without other devices: TLC technology is integrated in a non intrusive way in clothes or other objects like clocks, glasses that are usually used for other aims in daily life.
  - Natural Interaction: allows users to interact with other people and environment just with vocal commands and hand movements through recognition speech systems and movement sensors
  - Familiar control system: it could allow people to control in a centralized way both the technological instruments of the house (domotic control) and persons who live in (es. ancient people monitoring and remote assistance but also agenda managing…)

- **Second one:** In our work personas' creation begins with data from quantitative segmentation and research analysis of bigger italian research centres: CENSIS [7] for media consumption, ISTAT [10] for time consuming, ISTAT [11] for social trends, income and in general for daily life condition. We defined specific personas' identity on the basis of socio-demographic data collected. In particular we modelized nine "personas": everyone corresponding to one specific user to design for (a set of future services). Every "personas" was defined with a name, a face and a specific pattern of socio-demographic features (marital status, number of children, civic address, job, etc…). Then every persona was characterized with specific needs and aims of their average day paying attention to communication tools and technologies. In particular which ones are used, when and to do what to understand if they can "help" persona in doing what at any time of their life

- **Third one**: a well defined daily life scenario were built for every personas so that it was possible to create the context round him and to define precisely needs and tasks: time and type of warming up, breakfast, children preparation, work in office vs university, and so on.

- **Fourth one:** five focus group were managed. In particular we selected 5 of 9 personas that we considered "key target" for the designing of the future services we interested in. In particular they were early technology adopters and available to spend for techology. So that in every focus group 8 people with the same characteristics of interesting person were involved. Focus group allowed us to validate personas in their daily life "movements" but also "needs" and "goals" and overall to understand what's interesting or not for personas among all presented services to better polarize our attention in designing.

IV. PERSONAS MODELING

Starting from collected quantitative data, we defined a detailed card for every personas, with specific socio-anagraphic data (name, age, sex, etc.), personality data (what persona usually does and likes, his-her values…), technological data (early-not early adopter, used devices and media, etc.) and, at the end, also practical and emotional goals (what he-she wants to reach in a conscious or inconscious way). Practical goals help to understand immediate needs that personas meet in his/her daily life while emotional ones allow to understand better his/her long period point of view and his/her plan of personality and interpersonal relationship definition. So that this card can be more than an actual identity card that can help itself to highlight specific life styles and behaviour of personas.

Fig. 2 An example of card: Gianni's card

Nine different personal were created totally.

Gianni: 45 years old, holder of diploma, executive. He's married with Margherita and he has 2 children: Alice and Marco

Margherita: 40 years old, graduated, employee. She's married with Gianni.

Silvano: 51 years old, secondary school degree, free lance. He's divorced without children

Simone: 12 years old, he's attending secondary school. He lives with his parents

Paola: 24 years old, she's attending university. She lives with her parents

Alessio: 23 years old, he's attending university and lives with his parents.

Ilaria: 34 years oldi, graduated, she has a precarious job. She lives on her own and she's engaged with Giacomo

Giacomo 33 years old, graduated, he works in an IT society. He lives on her own and he's engaged with Ilaria

Riccardo 65 years old, holder of diploma, pensioner. He lives on his own. He's widower.

These persons constitute the user prototypes to design for.

V. DAILY LIFE SCENARIO CONSTRUCTION

At their core, scenarios are stories about people and their activities [6]. They have a setting and actors who have specific goals. A scenario is like a story: there is a plot that is a sequence of actions and events. John Carroll, one of the founders of the scenario design method, argues that scenarios can encourage reflection during design. They are concrete and flexible, and they can be reviewed and exploited in a simple way [5]. Nielsen [13] thinks Carroll's scenarios are too focused on personas' action meanwhile needs and wishes are less important and evident. To understand goals and motivations of potential users, scenario should be built round a character with peculiar needs and goals, interpersonal desires and professional ambitions [13]. So that personas can be "used" like actual rounded characters defined on basis of preliminary needs and goals [14]. Personas and scenarios in combinations with each other are useful in designing future services or IT systems when you don't have a priori a specific target to design for. In literature personas were used in different contexts, for example to capture unknown user requirements for embedded software meant to be used in telephones [2], to identified future and unknown use of electronic records [4] and to reduce the problems with identifying unknown users in database modeling [1].

For everyone of 9 personas we defined, a scenario was built: every daily action and its submitted motivation was described. Figuratively the scenario is a table orizzontally shared in some time slots. In the first column all personas' actions were described taking into account the time (i.e. 8 o'clock in the morning, Gianni has breakfast….) like in an actual story. The second column represent the specific environments that persona passes through during the day (i.e. kitchen), one after another one. The third one itemizes all the practical and emotional goals of the persona that're related to specific needs' satisfaction. At the end, in the latest two columns we added two optional elements: devices or services used today to do something (i.e. alarm clock to wake up) and possible devices or services that will be available in the future (i.e. 2010-2015) to try to create a link between actual needs and future solutions to outline and then test with real people.

Fig. 3 An excrpts of Margherita's scenario

VI. FOCUS GROUPS

Five focus group were managed: a) to validate personas' scenario and b) to evaluate the acceptability of technological solutions we outlined.

Every focus group was centred on a specific persona: Margherita, Gianni, Giacomo, Paola and Simone that had a medium-high technology profile with an early adopter tendency and direct (by himself-herself) or indirect (through parents) capacity of expenditure. In every focus group all the participants were recruited on the basis of homogeneus characteristics, "representing" one single persona. Every focus group was managed with 7-9 people and it lasted about 2 hours. Different stimulus were used to animate group discussion, in particular short film segments of persona's life were used to start discussion and comparison among participants. The storyboard itself was used to create the scenes of the film. In every scene the personas was filmed in doing a specific activity (having breakfast, going to work) that is typical of a specific moment of the day. Five not professional actors were involved to give their face to our personas, so that we have photographed them and then we assembled them in a flash movie to represent storyboard of every personas.

So that first part of focus group was oriented to "test" and "define" the validity of personas. The participants were requested to think their daily life and to pay attention their actual and specific needs: the first input was the presentation of the short film that retraced all moments of their reference "personas" (i.e. Margherita for the participants that were women, with a job, with one or more children, etc…; Simone for the participants that were boys between 12 and 15 years old and so on). In every group the participants had to describe their daily life since inputs of the short film. Particular attention was paid to any differences between "model" (personas) and "real life"of the participants. The principal result of this approach was the characterization of the people's solutions and strategies to organize their life and also lack of something to coordinate better family and work and social networks. The differences between real life and persona's life allows us to "debug" the scenarios. The characterization of what it's more peculiar and/or deficient (coordination, time, technology, etc…) in personas' daily life helped us to focus on what could be interesting "develop" to satisfy personas.

The second part of the focus group allowed us to test acceptability of some service concept we called "application gallery". They were presented to the users with photos, short film and also low fidelity prototypes if availble. We were interested in participants' feeling but also il the actual potential use of these technology of every "personas". Application gallery is specified in the following with the same examples we used for focus group participants:

- Seamless communication: the focus group participants had to evaluate the possibility to transfer in an authumatic way a video music streaming from TV to mobile phone getting out of home to get in car
- Co-presence: the focus group participants could see a man who was in USA and her wife in Italy that can communicate through through their videowall in the living room as if they're vis à vis in the same room. The reciprocal image's showed like a full sized image and the audio was 3D. Another scenario was presented with a grandfather who communicated with his grandchild.

- Wearable technologies: a lot of wearable solution were presented to demonstrate to the participants various possibilities and involvments of wearable. A wristwatch that's also phone and electronic agenda; a personal token like a chain, a pair of glasses with camera, a jacket with keyboard, a t-shirt with screen, etc. for every object at least an use case was associated to make clear their use
- Natural Interaction: the management of a pc interface with vocal commands and the information requests in a cothing store through hand movements were presented
- Familiar control system: a fridge with screen on was the assumed centre of control. On the screen a lot of input and information could be given and read. Some of them were commands to control heating system or alarm of one's home or his parents'/friends'. Others were electronic post it to remember something to someone directly on their mobile phones.

VII. RESULTS

The first result is a very good overlap of personas and the corresponded real people interviewed in focus group in life description, needs to satisfy and strategies to adopt. Where the differences were significant, personas scenarios were changed. So that personas could be used in a reliable way also in future service design when they'll be the target.
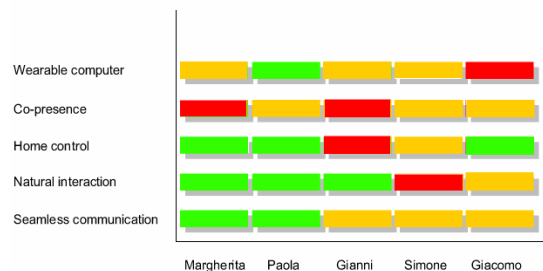

Fig. 4 Graphic of personas' preferences for every application. Green = it's interesting; Yellow = it's interesting but with hesitation; Red = it's not interesting

Results on acceptance of different layers involved in the research can be disclosed just at a very general level and for explanation purpose only as in fig.4 where are summarized on a graphical presentation the interest level for the service/device concepts presented during focus group for every personas. Green bar is used for interesting categories yellow one for categories that are interesting on average but people hesitated to accept them because of their implications and red bar for categories not interesting at all.

Paola is open to all the concepts we showed her and Gianni is the most critic. Giacomo who is the par excellence early adopter, is sceptic: he can't leave out some specific technological bonds he see in new form of communication for example vocal commands.

On the other hand wearable computers were not accepted a lot because of they're no so compact to justify the complete substitution of traditional technological objects. Co-presence was seen like an attempt to substitute the human relationships and not so ethical. In general the possibility to communicate in an extended environment in a seamless way was the preferred concept: none personas rejected it.

This methodology permits to develop technology scenario on a user centred perspective focusing on the more acceptable categories even for really disruptive projects. It is so possible to avoid the bias due to lack of understanding and resistance often associated with user involvement in projects dealing with not so forthcoming technologies.

REFERENCES

[1] Axelsson, L.-E., "Identify user profiles in information systems with unknown users," International Journal of Public Information Systems, 2006(2), 19-32.

[2] Aoyama, M., "Persona-and-scenario based requirements engineering for software embedded in digital consumer products," in Proc. at the 13th IEEE International Conference in Requirements Engineering RE'05, 2005.

[3] Blomquist, Å., Arvola, M., "Personas in action: Ethnography in an interaction design team," in Proc. NordiCHI 2002.

[4] Borglund, E., Öberg, L.-M., "Scenario planning and personas as aid to reduce uncertainty of future users," in Proc. 30th Information Systems Research Seminar in Scandinavia IRIS 2007.

[5] Carroll, J. M., "Five reasons for scenario-based design," Interacting with Computers, 13(1), 43-60, 1999.

[6] Carroll, J. M., Making use: Scenario-based design of human-computer interactions. Cambridge, Mass.: MIT Press, 2000.

[7] Censis: Quinto Rapporto Censis-Ucsi sulla comunicazione in Italia 2005: 2001-2005 cinque anni di evoluzione e rivoluzione nell'uso dei media, Roma 2005.

[8] Cooper A., The Inmates Are Running the Asylum: Why High Tech Products Drive Us Crazy and How To Restore The Sanity. Sams, Indianapolis, Ind., 1999.

[9] Grudin, J., Pruitt, J., Personas, "Participatory design and product development: an infrastructure engagement," In Proc. PDC 2002. CPSR (2002), 144-161.

[10] Istat: L'uso del tempo Indagine multiscopo sulle famiglie "Uso del tempo" - Anni 2002-2003, Roma 2007.

[11] Istat: La vita quotidiana nel 2005: Indagine multiscopo sulle famiglie"Aspetti della vita quotidiana" Anno 2005, Roma 2007.

[12] Istat: Reddito e condizioni di vita: Indagine sulle condizioni di vita - Anno 2004, Roma 2007.

[13] Nielsen, L., "From user to character - an investigation into user-descriptions in scenarios," in Proc. Design of Interactive Systems DIS2002, London 2002.

[14] Nielsen, L., "Engaging personas and narrative scenarios," (Vol. 17, PhD Series). Copenhagen: Samfundslitteratur, 2004.

[15] Pruitt, J., Grudin, J. "Personas: Practice and Theory," in Proc. DUX 2003, ACM Press (2003), 1-15.

[16] Pruitt, J., Adlin, T., The Persona Lifecycle: Keeping People in Mind Throughout Product Design. Morgan Kaufmann, 2006.

[17] Rashmi, S., "Persona development for Information-rich domains," in Proc. CHI2003.

Elena Guercio was born in Turin, Italy, on 9th September 1969. In 1994 she graduated in Padua in Psychology. In 1997 she attended the Corep Master in Ergonomics and now she's one of the 34 certified european ergonomists in Italy (EurErg). From 1994 to 1995 she had a post lauream experience in a consulting office for training on the job. From 1995 to 1998 she worked in Telecom Italia and in Fiat Auto, as a consultant in usability field. In 1998 she was employed in Telecom Italia. For seven years she's worked in the usability group where she has been involved in a lot of telco and ICT projects both internal and european. The projects have concerned: planning and evaluating new services (i.e. VAS for fixed and mobile network), products (i.e. mobile and fixed phones, web sites and portals), systems (i.e. videocall systems) and also processes (communication between mobile office and a control centre: WFM management) from the users' point of view. The applied methodology has been, in particular, the user centred design and all its tools (focus and creative groups, usability test, cognitive walkthrough, questionnairres, etc...). Since 2005 she's been working in the research and trend area in Telecom Italia, where the service design and the user centred planning is focused on blue sky projects and not only on the short term ones.

Alessandro Marcengo. Degree in Work Psychology (with a major in Human Factors / Human Computer Interaction) from the University of Torino, Italy, 1998. In 2001 he received his Master's Degree in Ergonomics from COREP/Turin Polytechnic. Since 1999 he has worked on human factors and service design within Telecomitalia Lab. Over the years he developed an extensive background on designing and testing of advanced user interfaces for mobile services and devices, Internet services and applications, Internet appliances, voice interaction services, etc. Lately he has been conducting in-depth studies on the usage of complex contents on different platforms and devices and the related communication pattern. He teaches several postgraduate courses on user experience and multi-channel design aspects. He has been involved with different roles in several EU projects. At present he leads the Service Design activities within the Continuous Cross Ambient Communication Research Project of Telecomitalia.

Amon Rapp. Degree in Communication Sciences from the University of Turin, Italy, 2006. Since 2006 he's been working in the research and trends area in Telecomitalia Lab. In 2007 he received a research scholarship "Progetto Lagrange – Fondazione C.R.T." He is with Telecomitalia Lab and the department of Computer Science, University of Turin. At present he works in the Service Design activities within the Continuous Cross Ambient Communication Research Project and the Dynamic Tv Research Project of Telecomitalia.