Use scenarios: mobile 3D television and video

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ABSTRACT

The focus of 3D television and video has been in technical development while hardly any attention has been paid on user expectations and needs of related applications. The object of the study is to examine user requirements for mobile 3D television and video in depth. We conducted two qualitative studies, focus groups and probe studies, to improve the understanding of user approach. Eight focus groups were carried out with altogether 46 participants focusing on use scenario development. The data-collection of the probe study was done over the period of 4 weeks in the field with nine participants to reveal intrinsic user needs and expectations. Both studies were conducted and analyzed independently so that they did not influence each other. The results of both studies provide novel aspects of users, system and content, and context of use. In the paper, we present personas as first archetype users of mobile 3D television and video. Putting these personas into contexts, we summarize the results of our studies and previous related work in the form of use scenarios to guide the user-centered development of 3D television and video.

Keywords: Personas, Use Scenarios, User-Centered Design, User Requirements, Mobile 3DTV

1. INTRODUCTION

Designing for positive, seamless and attractive user experiences starts from knowing the users. The user is in the focus of user-centered design (UCD) and its processes are based on information gathered from (potential) user's of the product [41]. The benefits of UCD are announced for example in the terms of better user satisfaction and improved quality of system and development process [9][26][31][32]. The end-product is a combination of effort of many players in the field. For example, mobile value chain can be content owner, producer, service provider and device manufacturer. UCD is a cyclic process containing an active user involvement in the whole development activities from planning to design and development, iterative design process as well as multidisciplinary approach [20][41]. The most important user involvement takes place in the early phase of product development [27]. It starts by specifying user needs, expectations and context of use and is followed by construction of potential use scenarios [20]. In the current stage of 3D systems, the focus has been on the technical development, not on the users.

There are only few previous user studies published about mobile 3D television and video and none about related use scenarios representing the next steps of user-centered design. Jumisko-Pyykkö et al. [23] and Strohmeier et al. [38] are the only ones who have published the work about user needs and expectations for mobile 3D television and video. Their work is summarized as initial design guidelines for designing for user experience in this application field. Other past work has either targeted on use of mobile (2D) television and video or 3D video has mainly studied for static environment, like cinema or home with strong emphasis on visual discomfort (overview in [23]). However, the published user needs and expectations are initial and incomplete and they need to be specified in more detail. User requirement elicitation is only the first step in the iterative user-centered design process. It is followed by development of use scenarios which describe how personas, archetypical users "representing the needs, behaviors, and goals of a particular group of users" [5], interact with the system in given contexts [7][10].

The aim of this paper is a two-fold. Firstly, it deepens the understanding of user needs and expectations for mobile stereo video and television. We present the results of two different types of qualitative studies, focus groups and probe study, which were conducted independently. Secondly, the aim of this paper is to describe three primary personas with non-overlapping motivations and social backgrounds which were created based on current and previous studies of user needs and expectations. Our study benefits both academia and industry 1) to form their ideas of portable 3D television and video system based on users' needs 2) to make the certain steps of user-centered design process invisible and applicable in future work.

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The paper is organized as follows. In section 2, we define key concepts of user-experience, user-centered design and its processes including requirement elicitation and use scenario development.. Section 3 presents the results of user needs and expectations for mobile TV and video. Section 4 describes the three primary personas which were created based on requirement elicitation. Finally, section 5 presents the discussion and concludes the paper.

2. FROM USER EXPERIENCE TO USER-CENTERED DESIGN

2.1 User experience

User experience (UX) is a holistic concept and there are numerous meanings as well as points of view associated to it [12]. However, many definitions of UX approach it as being something more than usability. Discussion around the concept of UX also reflects the current shift in paradigm in the field of human computer interaction. It extends the focus from a highly cognitive and task-centered concept of usability [20] to the direction of emotional and hedonistic aspects, and shifts from negative to positive experiences [17][18] [21][40]. Hassenzahl and Tractinsky [18] define UX as follows: *"UX is about technology that fulfils more than just instrumental needs in a way that acknowledges its use as a subjective, situated, complex and dynamic encounter. UX is a consequence of a user's internal state [...], characteristics of designed system [...] and the context [...] within the interaction occurs"*

As this definition describes, there are three building blocks of UX: User, system and context on use. User is defined as a person controlling or manipulating the system and she/he can be described as having the characteristics of needs, motivations, experiences, expectations, mental state and resources [35]. System is defined as the system required for the product under examination to work or to be useful [35]. It contains components such as a device, browser or player, connection and site or content (e.g. any type of moving image or video) as well as service related factors (e.g. commercial and a service model) [23][35]. Finally, the context of use, describes the circumstances under which the activity takes place and it is constructed from components of physical, temporal, social and task context [3][35]. In mobile contexts, transitions between contextual components are common, e.g. physical and social environments are heterogeneous and may change during a usage session [39]. For examination of these building blocks in the product development user-centered design approach is used.

2.2 User-centered design

According to Keinonen [24] *"UCD* (User-Centered Design) *is a broad umbrella covering approaches such as traditional human factors and ergonomics, participatory design, human-centered design, usability measurements and inspections, and design for user experience"*. UCD bases on design process on information gathered from people who will use the product [41]. UCD has its benefits not only in the terms of better user and customer satisfaction, but also in a) better understanding of users, b) improved quality of the system arising from more accurate system requirements, c) improved quality of system, d) improved developed efficiency (e.g. avoidance of implementation of non-needed system features, avoidance of expensive changes in late phase of development), e) improved level of acceptance of system, f) better understanding of system resulting more effective usage of it, g) increased participation in decision making processes within the organisation, h) safety [9][26][31][32]. UCD, referred also as human-centered design, is a cyclic process [20]. It contains an active user involvement in the whole development activities from planning to design and development, iterative design process as well as multidisciplinary approach [20][41].

In UDC, the most significant user involvement takes place in the early phase of product development [27]. It starts by specifying user needs, expectations and context of use, and leads to specification of user requirements [20]. Broadly speaking users' needs and expectations reflect aspects of their desires and concerns about the system. These can be problems that hinder users in achieving their goals or opportunities to help users to achieve their goals in a particular context [26]. However, the examination of expectations and needs should not be restricted only to these goal-related issues reflecting pragmatic factors of system, but it should be expanded also to hedonic factors of system to reflect UX as a whole. User requirements include any externally visible function, non-functional property or constraint that is required in order to satisfy user needs [26]. In the early phases of product development this means elicitation of requirements more broadly including hedonic and pragmatic factors that might be expressed as explicit or implicit user needs. In the later phases of UCD process, design solutions are produced based on these requirements and they are evaluated [20].

Figure 1 gives an overview of the UCD process, according to Bias and Mayhew [2], by relating it to human-centered design process according to ISO 13407 [20], lifecycle of software project and usability methods. In the early phase of development, within feasibility study and requirement analysis, definition of needs and context of use as well as

requirement analysis are located. In these phases, user needs and expectations are studied, use scenarios are created, and possible interests groups are met. Later, current existing systems are analyzed and usability requirements are set for the product in requirement analysis. User needs and expectations and use scenarios are in the focus of this paper.

ISO 13407 Processes				
Plan process	Specify Context of use	Specify Requirements	Design Solutions	Evaluate against Requirements
System lifecycle				
Feasibility		Requirements	Design	Implement	Release
Usability methods				
1. Stake-holder meeting	2. Context of use 3. Scenarios	4. Evaluate existing systems 5. Usability requirements	6. Prototyping 7. Style guideline	8. Evaluation 9. Usability testing 10. Collect feedback

Figure 1 The process of user-centered design according to Bias and Mayhew [2]

2.3 User requirement elicitation and use scenarios

2.3.1 User requirement elicitation methods

There are numerous possible methods suitable for data-collection of user needs. According to Hannington [16] the methods can be classified into three groups: 1) traditional, 2) adaptive and 3) innovative. The traditional methods includes in market research, focus groups, surveys, questionnaires and interviews. These methods gather the opinions of large numbers of people, but their value is in confirming or disproving already known ideas rather than providing new design ideas or perspectives. Adaptive methods include observational and ethnographical methods [16]. The third group, innovative methods, uses creative or participatory tools such as collages, card sorting, diaries, drama or probes. The aim of these methods is to identify new product ideas by focusing on the implicit needs and desires of users [16]. Triangulation of different methods, from traditional to innovative, is needed to identify the requirements for the different aspects of UX and to gather ideas for the earliest phase of a development project. Our past work has used survey, focus groups and probe study for identifying user needs and expectations for mobile 3D television and video [23][38] and in this article we present the results of the latter two in greater detail compared to previous work.

2.3.2 Use scenarios: personas and scenarios

Personas – A persona is an archetypical user "representing the needs, behaviors, and goals of a particular group of users" [5]. To communicate user requirements within a development team it is important to visualize these on a comprehensible basis. The goal of user profiles and use scenarios is to model specific archetypes and exemplary usage stories out of general user requirements data [28]. One method to present your user profiles are personas, introduced by Cooper [5]. A persona is a "precise description of our user and what he wishes to accomplish. [5]". In more detail "user models, or personas, are fictional, detailed archetypical characters that represent distinct groupings of behaviors, goals and motivations observed and identified during the research phase." [4]. Personas are not real people; they are models which have names and stories of individuals, but they are representative of a whole user group. Personas are derived from user profiles and these users' requirements collected at the beginning of the UCD process [5][6].

The benefits of using personas are "Determining" the functionality of your product to direct the design effort and "Communicating" in a common language with all parties of the development process. [6] Personas can form a commonly understandable basis for different stages and partners in a technological development process. Personas as models of real users are more explicit than data or flowcharts. Personas so are able to visualize user requirements and can help to focus the user-centered development process towards the key factors of users' needs and expectations [6].

Scenarios – Scenarios describe how personas interact with a product in the personas' daily life [10]. These early stage scenarios (context scenarios) illustrate the context of use of the end product and an ideal user experience. So, scenarios focus on the usage goals that will be fulfilled at the end of the whole development process and present users' critical

tasks with the system. Scenarios will grow in parallel to the product development adapting to new user requirements, but also to constraints or exceptions [6].

Development process of personas – The development process is described in detail in [6] and [34]. After eliciting user requirements, behavioral patterns are identified for each participant or target group. Comparable patterns are clustered and complemented with demographic data, motivation, expectation and requirements of the relating users and the personas are created step by step. The development process ends with a selection of different types of personas. Within this selection process, "primary personas" is the most important persona type. They are the primary target group of the product whose needs are aimed to be satisfied [6]. The usage motivation and goals which primary personas try to accomplish do not overlap.

3. USER REQUIREMENTS ELICITATION FOR MOBILE 3DTV

UCD starts with an elicitation process of user requirements, needs and expectations about the new product [4]. In user-centered research these user requirements are a first step to define the system under development. The goal is that it will satisfy its final users to become a successful system. These requirements are any externally visible function, property or constrains that must be available within the system to fulfill your users' needs [1]. But user requirements also include tasks which users perform with your product in order to achieve certain goals [42]. Within our research task we decided to use a combination of two research method during the user requirements elicitation process. The goal was to get a broader view on user requirements for mobile 3D television and video.

A focus group study targeted the explicit user needs and expectations for a mobile 3DTV system. Focus groups have been applied in user requirement elicitation of mobile TV and 3DTV [13][25]. An advantage of focus groups compared to interviews is that focus groups benefit from the group synergy processes to bring up ideas and concerns that could easily be forgotten or that no one thought about to ask [7]. But this group effect can lead to an overwhelming of individuals ideas, thoughts and hopes about the product [28]. To close this shortcoming a probe study as a second approach to elicit user requirements was conducted. In contrast to the focus group studies where participants were asked question directly, the probe study was used as a new, innovative way of data-collection targeting the more implicit needs of the users [36]. The results of the probe study complement the knowledge about user requirements with a long-term in-the-field observation of future users targeting especially contextual knowledge about how users will use mobile 3D television. Within this paper we only present the most important results which we used to design our personas and the according scenarios. Both methods and the results are described in detail in [38][23].

3.1 Focus groups

3.1.1 Research question and objectives

The focus groups aimed to a) gather understanding of the service mobile 3DTV and its relation to existing services like mobile TV and 3DTV, b) identification of suitable content and future service scenarios, c) description of future devices and service design regarding e.g. costs or accessibility and d) identification of the context of use.

3.1.2 Participants

We conducted eight focus groups in Germany (six groups) and Finland (two groups) resulting in altogether 48 participants. Participants were recruited through advertisements in forums and online news tickers to match four target groups which were adapted from mobile TV [11]. According to the Domain Specific Innovativeness Scale [15] all participants were classified as "early adopters" or "early mainstream". Each participant received 20 Euros as incentive.

Table 1 Description of the four target groups of the focus group study

Group 1: Pupils (1 group, 7 participants)	Group 2: Non-technical students (2 gr., 12 part.)
Age: 16-19 Education: High school Income: €30-70 per month	Age: 18-30 Education: Non-technical studies at university Income: €100+ surplus per month
Group 3: Technical students (2 gr., 10 part.)	Group 4: Employees (1 gr., 7 part.)
Age: 18-30 Education: Technical studies at university Income: €100+ surplus per month	Age: 25-50 Education: High school or higher degree Income: €1500+ surplus per month

3.1.3 Description of the method

The focus groups were designed as a scenario-based approach to explore prioritized scenarios of future mobile 3DTV systems and services [28]. The focus groups were organized as follows [38]: After an introduction the focus of the group discussion was first set on television viewing habits of the participants and their expectations about a potentially upcoming introduction of 3DTV services. The third part turned the focus towards current mobile devices and the usage habits of the participants to open the participants' mind to the diversity of mobile devices (e.g. functionality, overall size and display size). The fourth part was finally a scenario-based discussion about a system called mobile 3DTV. We asked the participants to imagine to live in a city in which mobile 3DTV is available without any limitations. The participants developed their own usage scenarios and these scenarios were illustrated on a whiteboard. In a last step, these scenarios were discussed according to the participants' expectations in relation to devices and service design.

3.1.4 Method of Analysis

The qualitative analysis was based on Grounded theory developed from Strauss & Gorbin [37]. Grounded theory is applicable when research aims at understanding the meaning or nature of a person's experiences. The focus groups were recorded and transcribed afterwards. The written material was coded openly under the same framework for the two countries as open coded revealed similarities between the groups. The found concepts were organized into groups according to the main factors of user experience: user, system and services, and context (cf. Table 2) [18][35].

Table 2 Categories and their frequencies of the focus groups and probe studies

Categories	Focus groups		Probe study	
	No.	Freq.	No.	Freq.
User	29	179	23	65
System	59	283	29	106
Context	15	64	41	195

3.1.5 Results

3.1.5.1 User

The scenarios showed that users expect to use mobile 3DTV either to be entertained or to be informed according to the context. They wish to access content irrespective of location and time in time gaps or in situations where information is needed instantly. However, users emphasize that mobile 3DTV needs to offer added value compared to existing systems if they are to be motivated to start using it. 3D makes content more impressive and emphasizes the emotional experience compared to 3D. Increased realism and naturalness in 3D contents will help to better identify with the content [23][38].

"Even if it sounds simple, I wish to have three-dimensional content always available when it makes sense that it is three-dimensional."

3.1.5.2 System and Services

Content – The expected content relates to two different scenario types according to usage motivations: entertainment and information. Regarding entertainment participants expect to watch television content such as action movies, sports, live

broadcasts, and, surprisingly, advertisements. In the informational situations documentaries and news clips are attractive television content [23].

Interestingly, mobile 3DTV is not expected to be a television or video only system. As participants in the focus group outline that they want to fully benefit from the three-dimensionality, the focus groups showed that people demand for additional services. These special services serve as entertainment and informational purposes and most popular services are tourist guides through cities or museums, navigation, and, for entertainment, 3D gaming like role play games or puzzles [23][38].

However, the focus groups also revealed differences within the content expected from different target groups. Young people connect mobile 3DTV with fun and entertainment. They want to experience thrill and atmosphere in action movies, special tailored documentaries, or live sport events. They want to use mobile 3DTV to watch product presentations, to inform themselves about the latest trends, or to plan their evening activities.

"Well, I think that documentaries or special effects in action movies will become much more interesting. You will have the experience that everything happens near to you and in 3D."

The participants of the student groups focus on the additional services. They also mention television content, but they doubt that mobile screens can offer the experience which they expect to get. Their interest is mainly related to e-gaming as entertainment or tourist guides in the informational sector. The groups of employees finally showed that often practical reasons dominate expectations about mobile 3DTV services. Some of the participants agree that they will get one of these devices for job-related presentation purposes. However, television content is also very interesting here. For this target group, informational content plays a more important role and the participants even mentioned that news clips can benefit a lot from three-dimensionality. Additionally, these participants introduced educational programs as many of them already have children. They also see mobile 3D television and video to be useful for teaching. All target groups agree that user-created content will become very popular in mobile 3DTV services.

Service design – All these services mentioned above are expected to be paid with flat-rate based data transfer models. Costs of data transportation mustn't limit service access. In contrast access to the services will be pay-per-use according to the participants as mainly on-demand services are expected. Some participants also mentioned services which are financed by advertisements.

"I could imagine that there are two payment methods. Either I accept to see advertisements or I say 'I don't want any ads.' Then I must pay, but I would see the same content as the advertisement based service. Depending on my impatience or my financial situation I think I'd either decide for the one or the other solution."

3.1.5.3 Context

Physically, the most important locations for watching mobile 3DTV will be stations and public transports, shops and cafes, museums, and waiting rooms. Mobile 3DTV is seen to be gap filler on so participants tell that they expect to watch short clips. Longer clips are preferred during journeys where the services offer distraction and entertainment to prevent boredom. Participants expect that they will be the only user of the device. Regarding social context, the focus groups showed that mobile 3D television is expected to be mainly private viewing [23][38]. Shared viewing was not seen to be useful and applicable in all three 'employee' groups. However, young people from target groups pupils and students told that shared viewing will happen for entertainment purposes. People either want to share the same experience with their friends or they want to create interaction of the group members.

"There are people who spend their free-time lying on the grass far away from any buildings. They use their device because they want to have media around them. Otherwise they would feel bored. Mobile 3DTV will be what a ghetto blaster was in former times."

3.1.5.4 Concerns

Although participants of the focus groups show very positive attitudes towards the new system, they also have concerns. Participants are worried that mobile 3DTV can disturb the user's environment more than common systems, e.g. in public transport. Participants emphasize that they want to use headphones with the device. Additionally, adults mentioned that they would not watch certain content like horror movies in public environments as they cannot actively control involuntary co-viewing of others.

Interestingly, participants also mentioned that they are afraid of the case that 3D might support loosing the sense of reality. People are concerned that they will be a too strong part of the content so that they forget everything around them.

"When you watch 3D in a train then you do this in order to get stronger emotional experiences. But […] it is very complicated or in contradiction with that you are surrounded by unfamiliar people, so, the ideas are kind of fighting against each others."

3.2 Probe Study

3.2.1 Research question and objectives

According to Hassenzahl and Tractinsky's definition of UX [18], the user's internal state is one key factor of user experience. While focus groups, online survey, and interviews focus on what people say and answer about explicit questions concerning the system, probe studies engage and provoke responses from users without asking them directly. Self-documentary tools and projective tasks allow each individual test participants to express his feelings, emotions and thoughts about the system which might be otherwise inaccessible for researchers [19][33][36]. In addition to the focus groups, we conducted a four week long probe study to investigate user needs, expectations, and usage motivations related to 3D television and video on portable devices [23][38]. We aimed to get users view on future usage scenarios especially through in-the-field observations that should help us to understand contextual requirements of mobile 3DTV. As in the focus groups, we focused on the key factors of UX: user, system, and context [18][35].

3.2.2 Description of the method

Our probe study combined self-documentary tools in form of a diary and a disposable camera and a projective task in form of a collage [23]. We compiled a probe package that all material needed for the collage, diary, and written instructions. Ten participants received this package by mail and they returned it after the study period of four weeks. One week later a phone interview was conducted with each of the participants.

Figure 2 The probe package containing camera, magazines, diary and project information and a task description

Each participant's task was to create a collage to express expectations and emotions regarding the usage of 3D television and video on a portable device. Participants were asked to take pictures of any situations in which they could imagine watching mobile 3DTV. Each image was commented with a short note in the diary that later helped us to interpret the pictures in the analysis. In addition, we asked the participants to write down their thoughts and general feelings about using mobile 3DTV into their diary. We advised them to write it at home as well as while being on-the-go. Through diary and camera the participants were encouraged to write down their thoughts in a variety of situations and contexts. Later, when they created the collages, each participant worked reflectively and expressed his thoughts about these real and imagined situations. Additionally, we were actively in contact with the participants to encourage them during the whole period of study. Therefore, we designed a questionnaire in the form of four e-cards [14] that were regularly sent to the participants [23][38].

3.2.3 Participants

The participants came from different demographic backgrounds and they represented different age, gender and occupational groups (see Table 3). All participants were Germans. Nine of the ten participants finished the study. Each participants received 50 Euros.

Table 3 Description of the participants of the probe study

Age	Gender	Occupation
18	Male	Grammar school pupil
18	Female	Grammar school pupil
19	Male	Student of computer science
21	Female	Trainee as occupational therapist
25	Male	Management assistant in IT-systems
26	Female	Student of biochemistry
26	Female	Graduate social pedagogue
29	Male	Graduate engineer
44	Female	Journalist

3.2.4 Method of Analysis

Grounded theory [37] was applied to all the collected material. After open coding, all codes were checked by two researchers. To supplement the understanding gathered from the material and to avoid possible misinterpretation we additionally conducted a semi-structured phone-interview [23][38]. The total number of categories and frequencies are presented in Table 2.
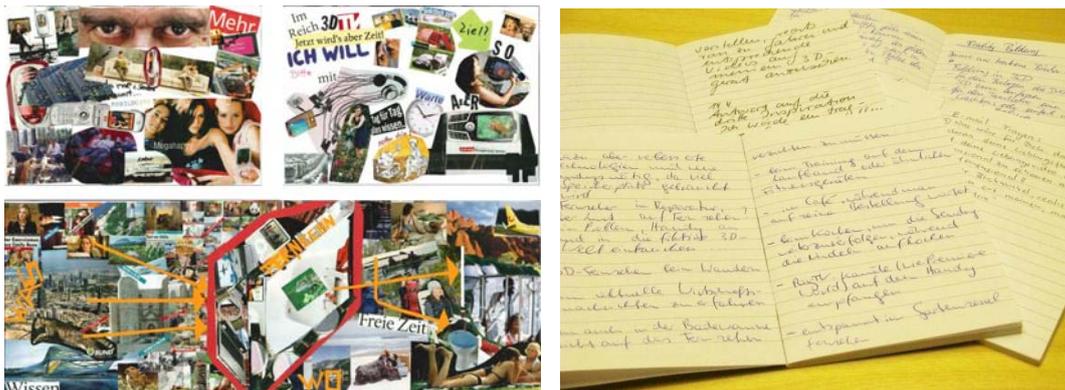

Figure 3 Examples of collages and diaries from the probe study

3.2.5 Results

3.2.5.1 User

Motivation – Relating to usage motivation, the probe study revealed comparable results as earlier presented in the focus groups section. Entertainment, information, and distraction were the main motivations here, too [23]. As expected, the probe study also revealed deeper insight about the emotional relation with the content which is provoked through the 3D experience. Many participants outlined in their diaries that the feeling of being in the content and increased reality and authenticity as a result are key points of 3D experience.

"Three-dimensionality creates more reality and so more suspense, more emotion and more detailed shots of my favorite actor."

What we call added value of 3D was already mentioned in the focus groups, but it seems that a long-term examination increases this demand. This might be a result of active comparison with current TV services. Participants might become aware that 3D can change their experience of TV content. For example, educational programs are expected to be easier

to understand and 3D can evoke a greater fascination. A free selection of the user's point of view can help to experience the content in a new way.

"An increased information content arises through the three-dimensionality that can be very exciting (e.g. for football games) and useful (e.g. for navigation applications)."

Figure 4 Relaxing as important motivation for mobile 3DTV usage

Target groups – As the participants were selected from different backgrounds, one point of the analysis was if they see themselves as potential users of mobile 3DTV. We found that no participant refused to use mobile. Beside teenagers, children, housewives and husbands were seen as primary target groups for mobile 3DTV. This finding supports the assumption that there is a great diversity of target groups for mobile 3DTV.

3.2.5.2 System and Service

Contents - TV content for entertainment, information, and education purposes would be watched in 3D [23][38]. Furthermore, children's programs as well as adult entertainment were described as attractive content.

"Children hate shopping, the better when they can watch "Pumuckel" meanwhile."

Comparable to focus group results, navigation applications, e-games, video phone calls, advertisements, and product presentations are expected to become successful mobile 3DTV services. Especially videophoning would benefit from the added values of 3D making it more realistic or intimate. As users also want to record their own content, user-generated content will be another important genre. Platforms like YouTube are expected for user-generated 3D content to it with friends and family.

Device – Participants compared the future mobile 3DTV device to existing mobile devices. The current trend of control via touch screen and a large display was transferred to the mobile 3DTV device. This shows that mobile 3DTV is seen to be a high-end product for the participants. Design ideas that will be modern when mobile 3DTV systems will be launched must be included in the device to fulfill the users' expectations.

3.2.5.3 Context

Physical context – Mobile 3DTV would be viewed when traveling by public transport or in waiting situations resembling the contexts found in the focus group study. Additionally, the home environment was highlighted in the probe study. In this home context mobile 3DTV can be either active usage to relax on the sofa or to watch TV while lying in bed. But it can also be a shared task when doing the homework. Outdoor viewing would be attractive in a park, in the garden, or at the beach.

Figure 5 Photos taken by the participants of the probe study describing the physical context of mobile 3DTV

Social context – Mobile 3DTV is not only private viewing. Especially when people meet in groups during free-time, in cafes, or at work, the participants outline that they do not want to use several devices at a time. Nearly all physical contexts were mentioned to be applicable for shared viewing. Shared viewing is mainly related to entertainment or relaxing whether it is a couple on a park bench or a group of friends at a picnic. Informational purposes seem to be private viewing context.
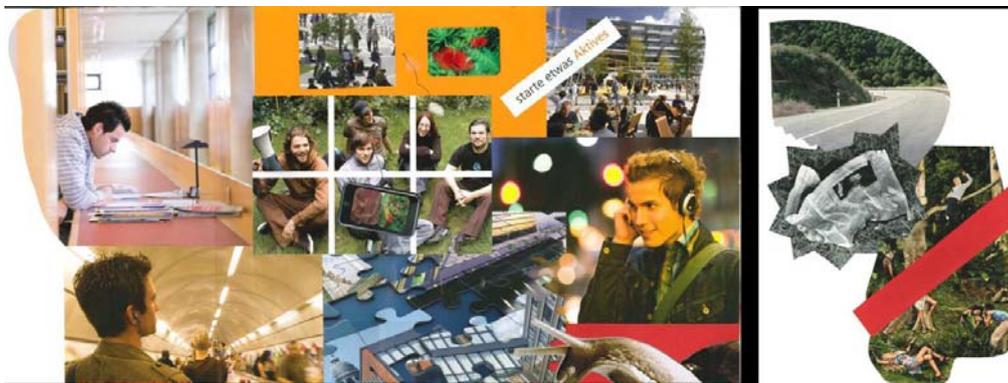

Figure 6 A participant's collage about mobile 3DTV contexts

4. PERSONAS AND SCENARIOS

4.1 Personas in MOBILE3DTV

The goal of persona development is to give user requirements an understandable body. Putting the personas into scenarios finally brings your elicited requirements to life. We presented the results of our first studies into user requirements of mobile 3D television and video above [23][38]. The results show very complex knowledge of usage contexts, preferred contents, and system and service requirements of the users. For us, personas are a suitable tool to now communicate user requirements within the development process, but also to present user archetypes for the public to answer the question, "For whom do you develop mobile 3DTV and how will I use it?"

In a next step we now derive personas and context scenarios from these user requirements [22]. The main focus is thereby set on presenting the different usage motivations relating also to multiple usage contexts and contents of mobile 3D television and video. Following we present three personas as the first user archetypes of the future system and services of Mobile3DTV. According to the results of the qualitative studies, mobile 3DTV will be an interesting for a diversity of user groups. These three personas all represent primary personas [6]. Their demographic background, usage motivations, tasks and goals do not overlap. However, the requirements of all three personas need to be satisfied by mobile 3DTV system and services to guarantee attractive user experience for all main target groups.

4.2 Sanna Virtanen

4.2.1 Introducing Sanna Virtanen

Table 4 Persona description of Sanna Virtanen

Person description	*Age:* 28	
	Status: long-distance relationship since 4 month with Rául Gomez, living in Madrid, Spain *Location:* Tampere, Finland; Owns a 2-room apartment *Profession:* Managing Consultant at WeCan OY – a medium sized software company – in her 2nd year. *Income:* 50'000 €/year	
Psychographic data	*Social network:* Some few old friends, spread all over the world, otherwise loose social contacts *Personality:* Very self-confident, influencer, active, *Beliefs:* Projects her own demands onto others; Only the best is good enough	*Attitude:* Behave according to your status Expect the best from yourself—and others – and products *Lifestyle motivations:* Goal-oriented; early adopter *Hobbies/Interests:* Pilates, Shopping, Design, Gossip
Usage motivation for mobile 3DTV	Sanna is a highflyer in her job. She loves the job, although it is very exhausting and she's always busy at work. But in the same manner in which she loves her job, she lives her life after work. She is a lifestyle woman, always up-to-date and trendy. She bought her mobile 3D phone 5 months ago. Her last phone contract was ending and as she had the possibility to choose a new phone, she decided for mobile 3D. The advertisement and the latest reports in the lifestyle magazines convinced her that this phone fulfills all her demands on functionality and quality.	

4.2.2 Mobile3DTV as lifestyle – benefit from morning until evening

Sanna sits in her favorite coffee shop. It's 5:30 pm and her Pilates workout will start at 8pm. Before she left from work, while synchronizing her calendar with the online backup, she checked the available downloads of the latest "Sex in the city" 3D episode which she had missed yesterday. "I enjoy sitting in the cafe and watch the latest lifestyle magazines or all these cute shows on TV like this 'Finland's next supermodel'. 3D makes everything so realistic and I enjoy diving into the content so that I can forget the day for a short time." Having a cup of Iced Mocha she chills on the sofa and watches the series. As the clips ends and the some of her friends are about to arrive in 10 minutes, she checks the best-of clips of the brand new talent show online as the café offers free high-speed WiFi access. Meeting friends means to be informed about the latest gossip, of course.

Sanna's day ends after her Pilates class at 10pm. It was nice to meet the girls again and to check the latest trends of clothes and gimmicks online in 3D. But now, it's time to call Rául. Secretly, the 3D videophony was the final reason to decide for mobile3DTV. "You know, it is just this intimacy that I experience when Rául appears in front of me three-dimensionally. For a short time I even forget the annoying distance between us", Sanna says with a smile on her face.

4.3 Marcel Jung

4.3.1 Introducing Marcel Jung

Table 5 Persona description of Marcel Jung

Person description	*Age:* 17 *Status:* Single *Location:* Lives in a suburb of Nuremberg (pop. approx 500'000), Germany, still with his parents *Profession:* 1st year cook apprentice at Koch&Bring", a mid-class catering service *Income:* 550 EUR/month	
Psychographic data	*Social network:* Got new friends (circle of friends) through his apprenticeship; sparse relation to his family *Personality:* Healthy self-confidence, influenceable, calm *Beliefs:* Possession can determine the social role in a group; Advertisements show modern way of living; Gaining independence is an important value from child to adult	*Attitude:* Spend the money you earn; show your financial independency; show your status *Ideology:* Work to get money to buy entertainment *Lifestyle motivations:* Status-oriented and action-oriented; early adopter (in his financial opportunities) *Hobbies/Interests:* Cars, meeting friends (his clique), motor sports, basketball
Usage motivation for mobile 3DTV	Marcel bought his mobile 3DTV device from his first money that he owned in his apprenticeship. It was an important step for him as it was the first time that his parents couldn't bar him from doing so. A first step into independence. Since Marcel owns his mobile 3DTV device he is the star in his clique, of course. Marcel cannot imagine living without mobile 3DTV again. At the beginning, he was afraid that the new experience can damage his eyes or can cause headache. But the joy and the 3D experience are just to amazing and Marcel always says that "you get used to 3D and when you learned to use and enjoy it, you don't want to give it away again."	

4.3.2 Teenager's Mobile3DTV: status symbol and entertainment

It's Wednesday, at 3.30pm. Marcel Jung is on his way home from work. On the walk to the bus stop he receives a call from a colleague on his mobile phone which is not his mobile3DTV device. The colleague invites him to meet at 5pm at the Jakobsplatz, the place where he and his friends usually meet. Marcel happily agrees. At home he prepares his mobile3DTV device while eating some snacks. For him, it is important to be able to impress his friends. As some kind of ritual, he checks the 3D video platforms from the internet to have the latest 3D clips on his phone so that he can show them around later.

As he leaves the house, he turns on the music player option of his mobile 3DTV device as he needs to hurry to catch the bus. On the bus, he switches the display on to watch the corresponding music videos. Although he really likes the song, the clip bores him. So he decides to rather play some three-dimensional RISTET, a very popular game since mobile 3DTV services have been launched. Arriving at the Jakobsplatz his friends are, of course, eager to watch the 3D clips

which Marcel downloaded. He is the first one in his clique who owns a mobile3DTV device. Marcel enjoys the prestige that he gains through his device. One of Marcel's friends, who already turned 18 and dreams of buying his own car soon, remembers that there is a three-dimensional presentation of the new Terault Lico, the car he favors most, available on the manufacturer's website. Marcel lends him his device, of course, and his friend watches the presentation to have a close look at a 360°-model of the car. Everyone agrees that the 3D presentation gives much better experience than the photos of the car in the magazines.

Back home, Marcel manages to avoid his parents and goes to bed early, as his working day will start early tomorrow. While lying in bed, he reviews the car presentation and fascinated of presentation he wonders, what car he is going to buy when he will be 18.

4.4 Stefan Weber

4.4.1 Introducing Stefan Weber

Table 6 Persona description of Stefan Weber

Person description	*Age:* 36		
	Status: Married to Nicole Weber, 31 (bookseller), 1 child (Maximilian, 6) *Location:* Lives in Overath near Cologne (pop. approx. 27'000), Germany in a semidetached house *Profession:* Sales representative at "Hofmann & Söhne", a manufacturer of ceramic tableware *Income:* 38'000 €/year		
Psychographic data	*Social network:* Nice neighborhood with other young families, close relation to other parents, sports club *Personality:* Calm , warm and friendly, eloquent *Beliefs:* Values family; Safety thinking and future planning is very important		*Attitude:* Care for family and child; Travels a lot with family *Ideology:* Work to get money to buy entertainment *Lifestyle motivations:* Outdoor activities; late mainstream *Hobbies/Interests:* Hiking, Culture (mainly Museums), Football, Reading
Usage motivation for mobile 3DTV	Stefan got his mobile 3D device from his company. The sales department decided to take advantage of three-dimensional product presentations and changed from printed catalogues to virtual 3D presentations. Stefan has been equipped with his mobile 3D video device since 6 months. As he has been very impressed from the 3D presentations and the features that the device offers additionally, he asked the sales department for private usage which was accepted. He introduced the device to his family and Maximilian immediately liked the short videos that his father showed. In contrast, Nicole has been rather skeptical. But the more she has used the different applications and services the more she likes the device. Especially the information guides for cities and locations appeal to her.		

4.4.2 Mobile3DTV in families – Dad's phone in daily use

It's Saturday and sunny weather is expected for the whole weekend. Stefan and his wife Nicole decide to go to the zoo in Cologne as Maximilian likes to the wild animals. For Stefan, it is important to spend the weekend with his family. Before they leave, Nicole reminds Stefan to check if there is a visitors' guide for the zoo available in the 3D tourist application. Zoo Cologne indeed advertises their service '3D safari' – a three-dimensional guidance through the zoo which allows mobile 3DTV users to watch short documentary clips about different animals. The service will be included in the entrance fee for the family pass.

While driving to the zoo, Maximilian is allowed to watch 'Experiment', a teaching program for children and Maximilian's favorite TV show, "because it is in 3D." Usually, he is not allowed to use Stefan's mobile 3D device andthis program is the only exception. Arriving at the zoo, Stefan buys the tickets and he asks for '3D safari'. He gets an access code for the service so that he can download the application at the entrance info terminal. Well equipped, they enter the zoo and '3D safari' guides them via the GPS module of the device. Signs in front of different animal areas show that three-dimensional information is available. "It's amazing that Maximilian can watch these small documentaries to inform himself about the animals in the wild life. He has always loved the 3D experience. Look how fascinated he is of this lion video."

Stefan wants to keep these nice family moments for his parents. Luckily his mobile 3D device includes a stereo video camera. He has used the video camera of his device for a long time to record short clips of the family which he presents to his parents whenever they meet. For Stefan, the 3D videos are more realistic and he was proud when his mother said that it is almost as being part of the family activities.

5. CONCLUSION AND DISCUSSION

This paper presented two steps of user-centered design process for mobile 3D television system or service. Firstly, we presented the results of two qualitative studies, focus groups and probe study to deepen the understanding of user needs and expectations for system. Secondly, we took further steps in design process, by describing use scenarios including three primary personas based on current and previous studies of user needs and expectations.

The combination of two qualitative studies allowed us to collect a broad view on user requirements for mobile 3D television and video. The results have deepened the understanding of user requirements according to the three building blocks of user experience: user, system and service, and context of use. For the users, the added values of three-dimensional content experience are one key motivator to use mobile 3DTV. The main usage motivation, entertainment and information, remains the same as the usage motivations of mobile TV [8][29]. However, new genres like movies or additional services (navigation, e-games) seem to become important beside common mobile TV contents offering a great experience of 3D through increased thrill, presence, or reality.

In our results there is a good consensus about the user requirements among different target groups in the studies, we also identified differences between these groups. While young people mainly see mobile 3DTV suitable for entertainment purposes, employees also emphasize informational or job-related use of the system and services. This fact shows that mobile 3DTV is an applicable system for different target groups each having its own motivation and requirements to use the system. Further studies are needed to identify and better understand these patterns to be able to design target group specific services. The two studies allowed targeting both explicit and implicit user requirements for mobile 3DTV according to the definition of user experience. These results can be used as an input in defining functional, non-functional and constrain requirements for the end-system. Nevertheless, it is also worth noticing constrains of the studies. Both studies relied only on the imagination of the study participants which can be a hard task for participants resulting in inaccuracy [30]. The results need to be verified in further studies and early prototyping according to the cyclic process of UCD [20][41]. These further studies also need to include dependencies of the requirements from different user groups.

In a second step we derived personas and use scenarios from the user requirements. The strength of persona design is that they communicate user requirements in an understandable form. The most significant user involvement in UCD is in the early development phase [27]. Personas and scenarios make user requirements comprehensible and communicate both goal-related issues and hedonic factors of mobile 3DTV to reflect UX as a whole for all partners involved in the development process. Our three primary personas follow the findings of the qualitative studies and represent three non-overlapping characters and their interaction with mobile3DTV in daily life. The entertainment and are represented my Marcel Jung. While for him mobile 3DTV is fun which he shares with his friends, Stefan Weber represents the business

man whose main usage purpose is information and, because of his son, education-related. Sanna Virtanen finally is the lifestyle user and mobile 3DTV is fully integrated in her daily life. The presence of the personas in UCD sets the focus of research and development on specified user needs, expectations and contexts of mobile 3DTV. All partners of the value chain benefit from the form of visualization as user requirements become understandable for all. However, our personas are still incomplete and revision according to user requirements verification is part of the cyclic process of UCD [41].

To conclude, this paper presented the results of two qualitative studies into user requirements for mobile 3DTVo. The results deepen the understanding of user's needs and expectations emphasizing the assumption that mobile 3DTV will be an applicable system for a diversity of target groups. The user requirements are visualized through personas and brought to life in use scenarios to communicate and to present critical tasks targeting seamless and attractive user experience. Further work is needed to verify UX factors in detail in iterative process and early prototyping according to UCD.

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