



LINKEDTV



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(Version 2)

Lilia Perez Romero, Lynda Hardman, Michiel Hildebrand

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<i>Author(s)</i>	<i>Lilia Perez Romero, Lynda Hardman, Michiel Hildebrand (CWI)</i>
<i>Reviewer</i>	<i>Veselina Milanova (Universitat St Gallen)</i>
<i>EC Project Officer</i>	<i>Thomas Küpper</i>
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<i>Abstract (for dissemination)</i>	<i>This report describes the process of design and evaluation of LinkedTV News, a second screen companion for interacting with hyperlinked television in the domain of newscasts. Our primary goal was to obtain knowledge about potential users of LinkedTV's technology regarding their information needs and an indication of how they perceive the technology. We performed two initial studies: a focus group and a series of interviews. These allowed us to identify our target group, the context of use, and the requirements with which we created the concept of the application. The design of the application was refined through a series of design iterations and a high fidelity prototype was produced. After creating the LinkedTV News prototype, we evaluated it with a task-based study performed with a selection of participants of the initial studies that closely matched the target profile.</i>

¹ • PU = Public

- PP = Restricted to other programme participants (including the Commission Services)
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1 Introduction

This report describes the process of design and evaluation of *LinkedTV News*, a second screen companion designed for interacting with hyperlinked television in the domain of television newscasts.

The motivation of the study is two-fold: to analyze user's information needs in relation to hyperlinked broadcast video in news context; and to investigate the role that a second screen could have in dealing with some of the challenges that emerge from the interaction with hyperlinked broadcast video.

Desired outcomes of the study are to:

- obtain knowledge about potential users of LinkedTV's technology regarding their information needs and an indication of how they perceive the technology;
- extract initial design guidelines for future work within LinkedTV and in the field of second screen interfaces for web-enriched television newscasts;
- create a high-fidelity prototype to facilitate communicating a future vision of hyperlinked broadcast news.

1.1 Role of the study within LinkedTV

An objective of the LinkedTV project in its second year was to understand the requirements of potential users of Linked TV's technology, which up until this point had been mainly driven by technology concerns. The Linked TV News application was created with this in mind not as a final product, but as a dialogue initiator between the LinkedTV technologies and users, and as a tool for research. It was guided and constrained by the LinkedTV project goals, but not limited by the current development of its technology. We purposely did not start with the presentation engine and the generic second screen application that is built on top of it for the LinkedTV scenario demonstrators (D6.2). To support our iterative design process we needed a flexible environment, and at the time of the development of the LinkedTV News prototype the presentation engine was not yet suited for quick prototyping. Therefore, we opted for the development of a separate lightweight second screen prototype.

By now the presentation engine in the form of the multi screen toolkit has matured (D3.6), and aims to support rapid prototyping. In year three of the project we plan to transfer the LinkedTV News application to the multi screen toolkit. This will provide a more solid infrastructure than is currently provided in the LinkedTV News prototype, for example for the synchronization between screens. It needs further investigation to determine how the user interface components of the generic second screen application can be reused for LinkedTV News.

In year 3 we plan to continue the study into the "antiques iterative" scenario that was started at Sound and Vision, as reported in D6.2. This work should result in a second screen application that is tailored for this scenario. This work will also provide a test case for the prototyping facilities of the multi screen toolkit.

By reflecting on the studies in these two domains we want to collect first insights into the reusability of interface components and functionalities for second screen applications. At the end of the project we should have a better understanding on what is needed to effectively tailor second screen applications for different domains.

The LinkedTV news prototype does not use the LinkedTV pipeline to generate annotations and related content. For the user testing we wanted complete control of the content shown in the application, as we did not want the quality of the content affect the users perception of the application. An important goal for the LinkedTV project in year 3 is to investigate how the automatic annotation and hyperlinking algorithms developed in WP2 (D2.4) can generate

content suited for the LinkedTV News application. In year 3 we plan to work closely together with partners in WP2 to improve and evaluate the annotation and hyperlinking algorithms. This starts with a PhD student from Eurecom visiting CWI for two weeks in November. Studying the process of automatic content generation for the LinkedTV News application will also lead to a better understanding of what is required from a curator using the editor tool (D1.3). We want to use this knowledge to investigate, in cooperation with Sound&Vision, how to improve the editor tool.

1.2 Challenges of Web-enriched broadcast video and the role of a second screen

Hyperlinked broadcast video implies combining content intended for a lean-forward medium (the Web) with a lean-back one (TV). It offers the advantage of providing smooth access to additional information associated with objects depicted or mentioned in the video. However, it also poses new challenges and motivates new requirements from the point of view of user system interaction.

Two challenges for supporting hypermedia are [1]:

- Tension between lean-forward content and lean-back consumption.
- Tension between multiple and single users.

We design *LinkedTV News* as a second screen interface, e.g. for a smart phone or a tablet, that is to be used together with a main TV screen to investigate whether a second screen is useful for dealing with these challenges.

1.3 Method and structure of the report

Due to the user-focused nature of the proposed research, we addressed the design of the intended interface, *LinkedTV News*, using a commonly employed user-centered and iterative design model, namely the one described in the international standard ISO 9241-210.

After an initial planning stage, iterative processes usually start by researching the context of use of the product that is being designed product. From the results of this context research, requirements are extracted and design solutions are produced, see Figure 1. Prototypes of diverse degrees of fidelity are created to illustrate these solutions and evaluated until the user requirements are met.

We follow this iterative design process structure. After a brief view of related work (Section 7), we describe the method, process, and results of the two (Section 3). Next, we define our target group, context of use, and information needs (Section 4). We propose a design concept to satisfy a subset of these requirements (Section 5). The interaction design and the process of improvement of the concept through prototyping are then explained (Section 5.3). Section 6 describes the user evaluation of the high-fidelity prototype and concludes by proposing a direction for future improvements. In the conclusion, the obtained results are briefly analyzed and guidelines for future work are proposed (Section 7).

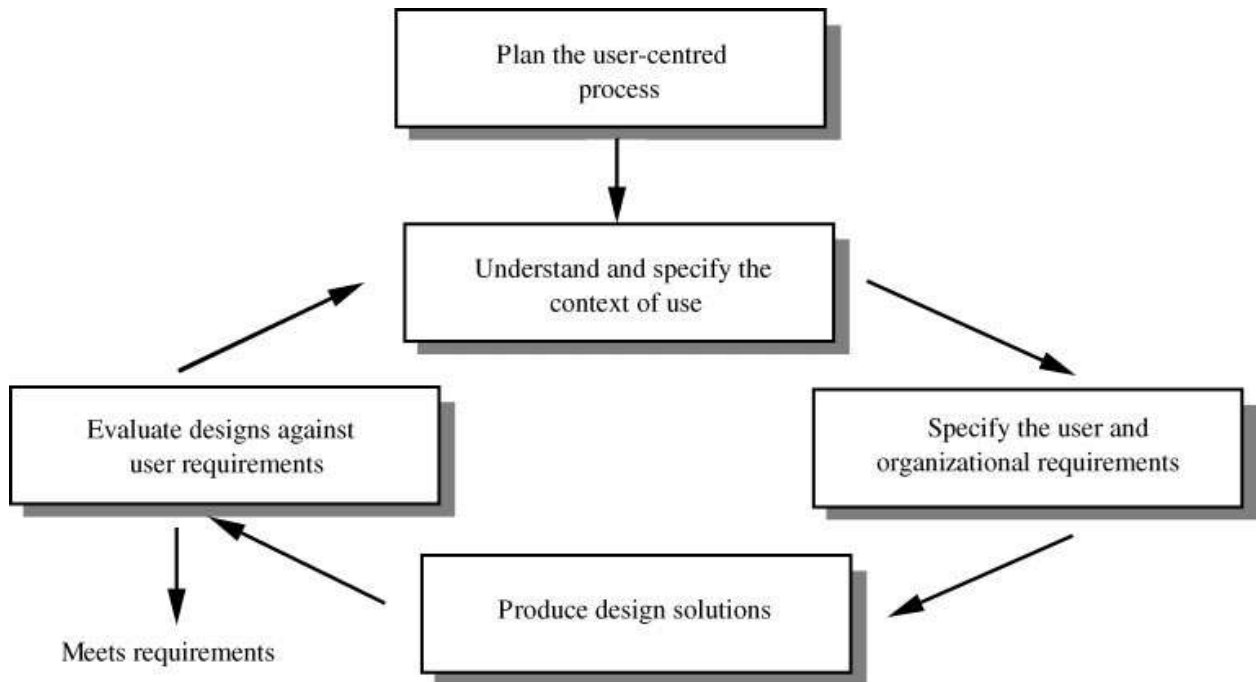


Figure 1 User-centred Design Cycle [19]

2 Overview of related work

2.1 Enhanced interactive news

Interactive news is a subject that has been researched as a use case in various studies concerned with hypermedia and information retrieval. In 1997, Hauptmann and Witbrock [2] presented News-on-Demand, an application that monitors news from TV, radio and text sources and allows the user to retrieve stories of interest. News-on-Demand employed speech and image recognition techniques for scene segmentation and automatic tagging of archival data. The interface was also based on speech recognition and the accuracy of this technology constituted the focus of the study's user evaluations. News-on-Demand can be seen as an early example of hypermedia and automatic linking to the topic of the news.

Another example of content augmentation of news broadcasts is the work of Dowman et al. [3]. Their system identifies individual stories in news broadcasts and annotates them with content from the World Wide Web. Annotations are used to produce summarized texts that can be employed potentially for enrichment of electronic program guides. The focus of Dowman's study is the technology that enables annotation. It presents an interface designed for the postproduction (curating and editing) phase of the enriched hypermedia. This work relates to *LinkedTV News* in its integration of television newscasts with Web content. However it differs in that *LinkedTV News* is concerned with news consumption and not news postproduction.

Ardissono et al. [4] investigated personalization in the context of interactive news broadcasts through tracking and inferring user content interests and media preferences. The authors describe the design and implementation of a broadcast news generator. This system combines automatic video analysis and extraction together with user modeling to provide individualized *personalcasts*. We coincide with this work in that personalization should be an important ingredient in any end-user hyperlinked news interface.

MyNewsMyWay, Lindstedt et al. [5], is a system for nonlinear and interactive news broadcasts with an emphasis on the user needs. With the intention of recreating the television experience that users are most acquainted with, MyNewsMyWay uses the remote control as input device and displays the system interface on a TV screen. A similar remote control, single screen set up was produced and evaluated by Olsen et al. [6] to enable users to access opinions over stories headlines, skip back and forth over stories, and select stories from a playlist.

One of Lindstedt and Olsen's motivations to use the remote control for interacting with news is the users' familiarity with this device [5]. It is reasonable to think that basing new technologies on old habits, such as the use of a remote control along with the TV, will promote a smooth adoption of these technologies. However, we believe that the remote control capabilities are too limited and don't meet the demands of Web-enriched broadcast video in terms of interaction. Moreover, remote controls usually depend on TV screen overlays of hierarchical menus that may disrupt the TV viewing experience. We would like to propose to take advantage of other more recent familiarity and more current habits: the familiarity of users with mobile devices and the recent habit of mobile multitasking. With this motivation, we would like to explore the role of a dual screen set-up (TV plus laptop, tablet or smartphone) in the delivery of Web-enriched broadcast news.

2.2 Second screen

The use of mobile devices by viewers alongside the TV is a typical behavior according to recent studies of user habits. The Razorfish and Yahoo! survey [10], for example, found that mobile multitasking during TV watching is common practice among 80% of the 3000 participants. The idea of replacing these currently disconnected multitasking activities with integrated interaction through the coupling between the second screen and the TV screen has motivated various design-driven research studies.

In [11] a prototype of a second screen web application running on a laptop was distributed to 11 households and evaluated for three weeks. Basapur et al. found that the adoption of second screen systems is facilitated by their resemblance to current behavior patterns inasmuch as they are perceived as natural extensions of these behaviors. The authors reported that users valued the effortless information gathering and felt more connected with their TV shows through experiencing them with a second screen. They also found that the experience promoted engagement with the program even after it was over by inspiring outside activities (e.g. attending a certain movie recommended by the system) and enriching sociality around TV (expanding the circle of friends with whom information is shared).

Prompting and control strategies for secondary devices were explored in [12]. Participants in this study showed a clear preference for a separation between content and control. They agreed that TV content belongs in the primary screen and activities demanding interaction in the secondary device.

The employment of secondary devices for control of TV content was also explored in [12], where four major usages of the secondary screen in interactive television are identified and discussed: control, enrich, share, and transfer television content.

Second screen multitasking is a growing practice that has triggered the interest of industry and stimulated the proliferation of commercial applications for dual device set-ups. One of the best known examples is Yahoo's IntoNow [15]. IntoNow uses audio fingerprinting technology to automatically detect the program that users are watching and deliver related content. Like many of its kind, IntoNow is mainly focused on delivering the experience of "social TV". It detects what friends are watching and connects them so that they can chat about the show. In this study we do not study the social aspects of interconnected TV viewing. We focus on the user information needs with respect to related content.

3 Understanding the context of use

In order to gain understanding of users' current habits and requirements in relation to news broadcasts and news consume in general, we conducted a focus group and a series of semi-structured interviews. This activities relate to the first step "understand and specify context of use" in Figure 1 about user-centered design cycles.

3.1 Focus group

The goal of the focus group is to get a first idea of people's interests and behavior when watching news programs. We used an exploratory approach combined with a feature prioritization approach [16]. The exploratory approach aimed at discerning general attitudes on TV news watching and relation of the users with the news in general, focusing on finding the user's information needs. The feature prioritization approach aimed at determining the features that users would find important to have in the application and the reason for their preferences.

3.1.1 Focus group setting and method

The study took place in an experiment room that recreated an old-fashioned living room environment (Figure 2). The environment consisted of a large television screen, a clock, a center table, a couch and diverse decorative objects. The motivation behind using such a space was to reproduce a setting similar to where participants would most likely watch TV in real life.

Four groups of, in average, three participants were scheduled in four sessions that each lasted 45 minutes. After being welcomed in the living room and given relevant information related to their role in the study, participants were asked to complete a questionnaire on demographics and current news watching habits.



Figure 2 Example of focus group environment

On top of the center table, three stacks of paper were placed with printed mockup frames representing a laptop, a smartphone or a tablet. All the frames had blank space for writing in the center.

Once seated, participants were shown six reports from BBC's One Minute Online World News. The choice of video fragments was made trying to emulate the diversity of news categories included in popular news broadcasts, and was designed after careful observation of the latter. A list of presented news items is given in appendix A.

After each fragment, participants were asked to think whether the news piece had elicited any question or if there was any additional information that they would look up in a similar situation in real life. Then they were asked to choose a paper frame according to the device they would most likely employ to find the answer, if any, and write down the information need they had. Information needs were then discussed with the group and the moderator.

Following the news broadcast exercise participants were asked to freely brainstorm about the functionalities that they imagined would be nice to have in a second screen news companion. Their suggestions were written on a flip-board for the group to see.

Next, each participant was interviewed individually and asked to give his or her vision of how the activity of watching the news would change in the future.

Finally, participants were given a cinema voucher as a "thank you" gift for their help.

The focus group sessions were recorded on video, which along with the mockup frames containing the participant notes and the flip-board pages were kept for later analysis. The main researcher, acting as a technical facilitator, and a second researcher, acting as moderator, conducted the focus groups. A pilot session preceded the four group sessions.

A complete copy of the protocol can be consulted in appendix B.

3.1.2 Focus group participants

We had no requirements for demographic characteristics of the target group, because the product was unprecedented. Therefore we started with a diverse sample hoping that a secondary effect of the study would be to collect information that would be useful to further refine what the target audience should be. However, a necessary condition for participants to be included in the group was that they were regular viewers of news broadcasts.

The recruiting took place at a university and a research center. To ensure a range of participants representative of potential users, participants that were neither students nor researchers were included.

Eleven participants were selected. The mean age of participants was 43 with a standard deviation of 11.5 due to the inclusion of some young students.

According to PEW's 2010 Media Consumption Survey spectators of this age group consume in average more television news than younger audiences [17]. We wanted to investigate if these habitual consumers of television news would also be a good target audience for a news related application.

The population was gender balanced including 6 female and 5 male participants. All participants are residents of the Netherlands. Four of the participants live alone, two live with one other person; one lives with two other people; and the remaining four live with three more.

3.1.3 Findings of the focus group and implications for the design of an interactive news companion

In this section findings obtained from the focus group are presented. The first subsection is dedicated to the questionnaire results (qualitative data), followed by the findings of the focus group discussions and brainstorming. Each finding is followed by possible related implications. To clearly denote the implications, they have been enclosed in frames.

3.1.3.1 Focus group questionnaire results

Devices owned and preferred

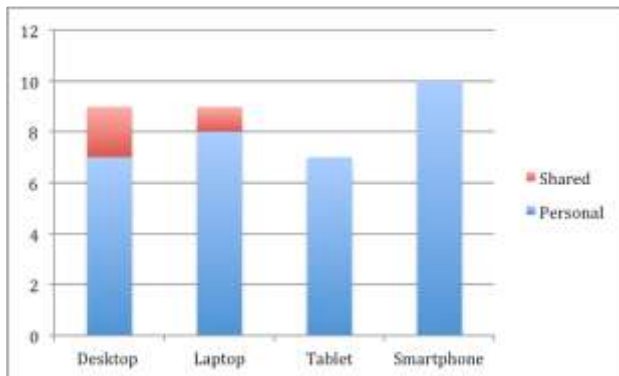


Figure 3 Shared and personal devices used by participant

Although smartphones are the devices that users most frequently own, when it comes to searching for additional information about the news while watching TV, half of the participants preferred laptops and the other half tablets. This corresponds to the findings of *Nielsen Connected Devices Study Q2 2012* [18], which suggest that second screen multitasking with smartphones is a practice of users within the age group of 18-24 while older audiences (as in this study) prefer other devices.

For a user group of middle age tablets and laptops would be the preferred devices to design for when designing a second screen companion for watching the news.

Location and time

Out of 11 participants 9 watch the news in the evening and sit in a living room.

Chances are that users will watch the news sitting on a couch, and therefore in a relaxing environment and that, if a table is present, it will not be at an adequate level to offer typing support. Most likely, users will be holding the device on their lap. This suggests that a tablet is a more suitable device than a laptop.

Social interaction

Out of 11 participants 6 watch the news in the company of other people. From these 6 participants 5 interact with their companions while they watch.

A second screen companion for watching the news should be able to adapt to group as well as to solitary television watching.

Multitasking

Out of 11 participants 4 eat or drink while watching the news.

From the 11 participants 6 perform second screen multitasking (email reading and Internet browsing) while watching the news. 3 participants didn't answer this question.

A second screen companion should allow diverse levels of engagement in order to accommodate some of the tasks that people perform concurrently to watching newscasts. It should ideally have a "hands-free" mode to allow people to continue interacting with the application while eating or performing tasks that are unrelated to the use of the device.

The fact that some users are already employing their mobile devices to browse the Internet or check their email while watching the news indicates that there is an existing behavior that can allow a smoother adoption of second screen applications.

3.1.3.2 Focus group discussions and brainstorming results

Information needs

The following information needs were identified through the coding of the focus group transcriptions. Quotes have been included with the purpose of illustrating each need and the number of the participant who expressed it is indicated with a "P". These information needs are the ones more frequently mentioned. A more comprehensive list of focus group findings is included in appendix C.

- **Need for more in-depth specific information**

(11 comments / 7 participants + 1 brainstorm list)

P6 About the bird flu - *I was wondering just how expensive it is to make all those vaccines, you know? I was just wondering if it is a good idea to even make a lot of it or how hard it is to make.*

- **Overview of related events that occurred in the past**

(5 comments / 3 participants + 1 brainstorm list)

P7 About North Korea's state of war - *my search would be something like "South Korea state of war ramp up" (...) I would like to know what happened two years ago and how they solved it...*

- **Search for different opinions**

(3 comments / 3 participants + 1 brainstorm list)

P7 About North Korea's state of war - *I'd start with Wikipedia, probably, and then I always look at AP and Al Jazeera to get two different opinions...*

- **Information about how a news event ends, updates when important changes occur**

(3 comments / 3 participants + 1 brainstorm list)

P8 About "Human parents for a baby gorilla"- *I would like to know if the story succeeded, if the gorilla was saved ...*

- **Local effect of global news – What is the impact on my life?**

(4 comments / 2 participants + 2 comments in 1 brainstorm list)

P1 About the bird flu – *Yes, then I would look it up, what is the effect in the Netherlands... (of the bird flu virus)*

People have complex information needs that can't always be transparently traced back to a named entity (in LinkedTV the name of a location, person or organization). It is important to identify some of the most usual information needs and try to model the application's functionalities and the semantic linking accordingly.

Actions triggered by information needs

Different kinds of information trigger different actions. For example, the information about the weather may trigger warning a friend about the rain or comparing the weather in two locations while information about the cinema may stimulate users to buy movie tickets. However, in this study the action that participants executed in order to look for the answer to a given doubt or question was in most of the cases to look it up in a search engine.

We recommend looking at the tasks related to searching information in a search engine as some of the tasks that may be integrated and simplified in the second screen interactive news companion.

Sources currently used

Although some sources, such as Wikipedia, seem to be very often consulted, different questions or information types are best answered by different sources. For example, participants mentioned using Buienradar for finding out about the weather or Pathé when

they wanted to look for information about movies currently shown in cinemas. Also, users typically have their set of preferred sources.

It would be advisable to have a certain flexibility or degree of personalization in terms of the sources of information included in the application.

Functionalities mentioned during the brainstorm sessions

Participants seemed to expect a second screen application to include extended remote control functionalities, and one of the most frequently mentioned desires with regard the application was to be able to skip the part of the news that they don't like or go back to what they think is interesting. Web related functionalities like bookmarking, electronic transactions, getting alerts, or sharing information that are possibly inspired by the Internet, were also mentioned, although more sparingly.

In order to comply with user expectations and to simplify television control, a second screen companion should include video control capabilities as one of its basic features. The role of Web-related features should also be studied.

Perceptions about television and newscasts

Some participants were reluctant to adopt a technology that will require them to be active during TV watching, because they considered this activity as mainly relaxing.

Integrating different levels of engagement through the second screen, including some that are almost linear (not interactive), could be a strategy to promote smooth adoption.

At the other hand some participants indicated they miss interaction in traditional TV only settings. TV may be perceived as outdated because it is less flexible than other "newer" media.

Interactive applications for TV may help change the perception of television as outdated.

3.1.4 Study Limitations (focus group)

The focus group provided a first view on people's current habits while watching the video news broadcasts. It also gave an indication about what kind of additional information people would like to have while watching the news. However, some aspects were detected that could have been improved in favor of the flow of the discussion with the participants. The first one is the language. The focus group was held in English, and the news program shown was also in English. Although most Dutch people are fluent speaking it, apparently some members of our group of participants were not completely comfortable watching British television without subtitles. There was also room for improvement regarding the subject of the news. International news, used in the study, is not interesting for all audiences. Some of the members of the focus group had strong preference for national and local newscasts.

3.2 Interviews

Parallel to the focus group, a series of semi-structured interviews were conducted and complemented the study. This technique was chosen in order to gain a more individual in-depth view at users' habits and perceptions. The interviews were especially helpful in trying out a more specific target group with a smaller standard deviation within the ages of participants and a more specific profile in terms of skills and relation to the news.

3.2.1 Method of the interviews

The interviews were semi-structured. The same interviewer, the researcher, conducted all of them. They were loosely organized around a 45-item questionnaire. The questionnaire served as a script, but probes, or follow-up questions were improvised depending on the

respondent's answers in order to promote a more fluid conversation about the relevant topics. The main topics of the interview were:

- a. Second screen and multitasking user habits
- b. Habits and social context regarding news broadcasts
- c. Habits when searching for additional information (frequency, tools, processes)
- d. Opinions, suggestions and desires regarding the application and functionalities

Questions related to items b and c were defined in such a way that they could map to what Maguire [19] calls the five context factors: user goals and characteristics, tasks, technical environment, physical environment and social or organizational environment. In other words, what do people want to achieve (when watching the news or looking for additional information), what do they do to achieve it (steps that they currently take to find information), which tools do they use (which software and which devices), what is the setting where they perform these tasks, and what is their situation in social terms (do they perform these activities alone or in a group).

An emphasis was made in dealing with not only how participants relate to newscasts, but also in dealing with how participants relate with the news in general and thus with other information sources and how these sources relate or differentiate from the TV.

The interviews were conducted in an isolated room within the respondents' workplace. They were all digitally recorded with the interviewer's smart phone. The length of the interviews varied from 24 to 45 minutes.

Before starting the interviews, interviewees were asked to fill out a consent form and a demographics questionnaire. Once the interview was concluded the respondents were given a list of functionalities extracted from literature and previous findings to rate in accordance to their perceived usefulness.

3.2.2 Participants

The number of interviewees was 8 with a gender distribution of 3 females and 5 males. The mean age of the participants was 33 with a standard deviation 5. All participants were university graduates or postgraduates. All participants were digitally skilled and acquainted with online media and digital technologies as well as mobile devices. All participants were regular viewers of newscasts and declared spending on average 30 minutes daily getting information related to the news through different means.

3.2.3 Interview data analysis

After concluding all of the interviewing sessions, the eight interviews were transcribed with time code stamping using the software F5. Transcriptions of the interviews were then summarized. Data that could be translated into quantitative terms was translated to those terms. Qualitative data was extracted and grouped according to affinity of the remarks in the following broad categories: attitudes toward media (TV and newspapers) based on habits, desired functionalities, and personalization. Some individual remarks that could not be clustered were also kept and reported because they are considered relevant to understand current user habits and perceptions regarding news consumption.

3.2.4 Findings of the interviews and implications for the design of an interactive news companion

In this section findings obtained from the interviews are presented. The first subsection is dedicated to the quantitative data results. This subsection is comparable to section 3.1.3.1 about the focus group questionnaire results. It is followed by qualitative findings obtained from the interviews. The latter are divided according to the categories described in section

3.1.3 and used for coding. Each finding is followed by possible related implications. To clearly denote the implications they are displayed in a frame. Finally, the list of functionalities ranked by the users during the last part of the interview is presented.

3.2.4.1 Quantitative findings of the interviews related to users' current habits

Devices used by participants, Figure 4.

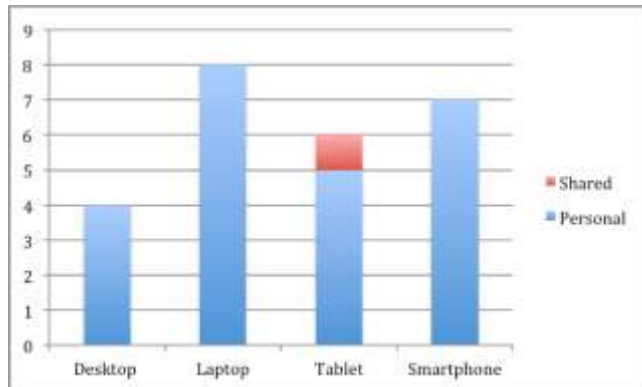


Figure 4 Personal and shared devices used by participants

Location

Out of 8 participants 6 watch the news in a living room occasionally from the dining table. The remaining 2 watch the news in an office environment and a bedroom.

Social interaction

Out of 8 participants 5 watch the news accompanied. All of these 5 participants interact with their companions while they watch.

Multitasking

All participants perform second screen multitasking (email reading and Internet browsing) while watching the news.

The interview's quantitative data findings about user's habits when watching the news are comparable to the findings obtained in the focus group (section 3.1.3.1) and therefore, the same implications apply.

3.2.4.2 Qualitative data obtained from the interviews

The following user perceptions, habits, and preferences were identified through the coding of the interview transcriptions. One quote has been included at the end of each group of statements to serve as example. The number of the participant who expressed each quote is indicated with a "P". This is a selection of the ideas that were more frequently expressed or seemed more relevant to our work. A more comprehensive list of qualitative interview findings and quotes is included in appendix D.

Attitudes toward media (TV and newspapers)

While reading online newspapers and watching TV broadcasts are different ways of consuming the news, these activities are not mutually exclusive. Our contextual research showed that users frequently perform both because they believe that each one of them offers different advantages, for example some users believe that:

- broadcasts are useful in getting an overview of the news, and online newspapers are good for searching in-depth information about specific news.
- it is possible to be more selective and control time better when you are reading (P3, P4, P8).
- watching video news is a social act while newspaper reading is a solitary act (P2).

P2 - *So having the video footage, that you have more in the television news, I think it adds value there, and maybe also the fact that you can watch it together, adds value, so when you read the newspaper I think that you really read alone.*

Desired Functionalities regarding information

Users asserted that they believe that most media are biased and emphasized the importance of getting a complete factual view on a news topic as opposed to partial or predisposed ones. The strategy that some of them currently use to compensate for bias and to get a comprehensive view of the news is to contrast the news headlines or topics of their interest within different information sources and from the point of view of different people. In this sense, when asked about important functionalities for a second screen news companion, users stated that they would like to:

- be able to compare different opinions about a subject, different scenarios, and different sources. (P8, P7)
- access and compare the international view on local news. (P2)
- access opinions of locals, regular people, preferably friends that are where the news take place. (P8)

P8 - *I think that the German news are still kind of OK, but still, I mean everybody is biased in their opinion, so no matter which news you read you always have some bias. It is good to have different and diverse opinions and first-hand information.*

In order to facilitate this contrasting of information within different sources, and in order to fill in general information gaps some users proposed the integration of the television with other sources such as Wikipedia or online newspapers (P1, P2, P6).

P5 - *I think, I would expect that you would include like the main links to what they're talking about like if it was about Hugo Chávez, links to Wikipedia or some articles about him, the country, and stuff like that because I think that's the thing that I would look for myself.*

Personalization

Most interviewees preferred an effortlessly configurable user-controlled personalization that allows adding personal filters to categories or topics and sources. Personalization should not override the importance or diversity of the news. Users don't want to miss important information because of personalization (P1, P2, P8, P3, P7).

P8 - *So, not because in the past I always clicked on a specific news article, I want to have more of these, I would still want to have more diverse angles.*

An integration between media, mainly television newscasts and online newspapers, could be a suitable solution for providing an enriched and hyperlinked news experience because it would incorporate activities that users currently perform and it is potentially simplifying them. Regarding personalization, it should be targeted at preserving user empowerment in making decisions about which media to consult.

Ranking of potential functionalities by interview participants

After the interview had ended, participants were given a list of functionalities and were asked to rank them on the following scale:

1= not useful, 5 = very useful

Table 1 shows the results. The columns labeled with number contain the ratings from each participant. The last column contains the average over all participants. The results closely match the opinions expressed during the open questions part of the interview.

Functionalities	1	2	3	6	4	5	8	7	Average rating
Access different opinions about a topic in the news	4	4	4	4	3	4	5	5	4.1
Follow news about a particular subject throughout sources	3	5	3	4	5	5	5	1	3.8
Follow a news story throughout time	5	4	2	5	5	3	4	2	3.7

Functionalities	1	2	3	6	4	5	8	7	Average rating
Track what a person said in the past about a certain subject	3	2	5	4	3	4	2	5	3.5
Share news with your friends or colleagues	2	2	4	3	3	5	3	4	3.2
Get more information about people in the news	3	4	1	4	4	4	3.5	1	3.0
Follow what an expert thinks about a topic	2	2	3	3	3	1	5	5	3
Look up archived and past news	2	2	2	4	3	4	3.5	3	2.9
Get an information guide about the program's contents	1	2	3	4	2	4	3	3	2.7
Follow what your friends think about a topic	1	2	4	3	2	1	4	2	2.3

Table 1 Ranking of potential functionalities by interview participants scale: 1=not useful 5= very useful

3.2.5 Reflections about the interviews

The interviews allowed us to communicate with participants in a one to one basis, which lent itself to personalized explorations into specific habits and beliefs. Interviews were based on people's memories as opposed to the focus group where participants were asked to react on given contents. Therefore, people could more easily relate to the information needs they were expressing in the interview. However, participants may value information differently when confronted with real needs than they do when reflecting upon past needs. Therefore, in the evaluation we complement the interviews with a task-based study and compare the participant's reflections with their actions.

Only one researcher coded the interviews. In the future, it would be advisable to include more coders to avoid bias.

4 Conclusions about Context

4.1 Target group

One of the objectives of conducting the preliminary studies was to define the target group for *LinkedTV News*, which was not known in advance due to the novelty of the application. After comparing the results of both context studies, the main target user group was defined as follows:

LinkedTV News is targeted at users between 25 and 45 years of age; highly-educated; who like to be up to date about the international news, watch news broadcasts regularly; and own a tablet computer or share it with someone in their household.

These conditions were defined on the following basis:

Education

According to PEW 2010 Media Survey, highly educated people spend more time with the news: in 2010 in USA an average of 81 minutes daily [17]. In addition, according to their 2013 Tablet ownership report [20], they constitute the group most likely to own a tablet computer compared to adults with lower levels of education.

Age

The age of 25 to 45 years corresponds to the age when users are "technology savvy" but also are most likely to have the financial means to buy the kind of technology in which our application would run (a tablet computer). According to the previously mentioned Tablet ownership report [20], 37% of adults 25-34 and 49% of adults 35-44 own a tablet. This percentage is higher than older and younger audiences.

Interest for news

LinkedTV News is a tool intended to assess users' information needs regarding the news. It is meant for people who want in-depth information and it is a TV companion. Thus, our target group should be avid news consumers and regular newscasts spectators.

4.2 Choice of device

The preliminary studies (focus group and interview) indicated that for a user group of middle age the preferred devices for second screen multitasking are laptops and tablets (see 3.1.4 and 3.2.4). It was also shown that the setting where people watch the newscasts is mostly in the living room. Although from a distribution point of view, designing for a laptop could seem like the best option (more people own laptops than tablets), from the ergonomic point of view (users are sitting on a couch with the device on their lap) tablets seem to be a better choice. Furthermore, according to PEW's 2013 Tablet ownership report [20], tablet ownership has doubled within the past year and is on the rise. Therefore, developing for this kind of device seems to be a good investment. Finally, we consider that a touch screen based kind of interaction is better suited for second screen multitasking because it requires less focused attention than the mouse and pointer based one. These considerations led us to choose for a tablet as a target device to design *LinkedTV News*.

4.3 Context of use

According to sections 3.1.3 and 3.2.4 and the results of the qualitative interviews, the environment where users consume television broadcasts and, therefore where they will use *LinkedTV News*, is the following:

Physical Environment

A living room (home environment) with a couch where users lay or sit possibly in the company of another person (most likely partner) or a pet. Often users are eating or drinking. Occasionally, users sit in front of a dining table. Users also sometimes watch the news in a desktop environment (office or hotel).

Social or organizational environment

Users who live with others will most likely be in their company while they watch TV. Users will likely discuss the topics of the news program with the people they're watching with. Accompanied users tend not to pause or rewind the program even if the technology they use allows them to as opposed to users watching alone.

Users will often multitask while watching TV either alone or in company of others although the latter are more reluctant to multitask.

Technical environment

The preferred device for watching newscasts is television, although, occasionally, PCs, mainly laptops with or without external monitors are also used.

4.4 Personas

Based on the ethnographical data obtained during the studies, and in our defined target group, two personas, Gina and Alonso were created as a communication strategy and in order to give a name and a face to our users. Gina was adapted from LinkedTV's deliverable D3.1 [21] while Alonso is a completely new creation. See appendix E for a description of these personas.

4.5 Scenarios

Two Scenarios were modeled after the context of use described above. They were written taking into account the characteristics, behaviors and preferences of the users and, therefore, the personas. Their intention was to envision the role of *LinkedTV News* in the persona's environment (current user environment) in order to extract requirements. See appendix F for a description of these scenarios.

4.6 User requirements

The second phase of the user-centered design methodology, after the analysis and definition of the context of use, is the specification of system requirements (Figure 1). This specification is a product of the observation that took place during the first phase and will guide the next phase, the production of design solutions.

Information about users' potential requirements was gathered from the initial exploratory studies (sections 2.1.4 and 3.1.4). Some of them were directly expressed by participants and some of them were deduced as implications of their current practices. Requirements related to information needs were given priority while requirements about social networking or commercial transaction were not always taken into account because they are not within the scope of this study. The following list of requirements summarizes the findings that serve as constraints and guides for the design of *LinkedTV News*. This list of requirements with an indication of the findings that originated them can be found in appendix G.

Requirements about information needs

1. Give in-depth information about the news on TV
2. Give an overview of past-related news
3. Illustrate a multiplicity of opinions about the news
4. Allow users to consult news from diverse sources
5. Build a link between the TV and user's habitual newspapers
6. Update users about important changes in news
7. Give contextual information about the news setting
8. Give information about people and organizations mentioned in the news
9. Allow to access opinions of locals

General requirements

10. Programmed and designed for running on a tablet PC
11. Automatically synchronized to user's program choice
12. Allow for group or single television watching
13. Enable synchronous and asynchronous modes of interaction (bookmarking)
14. Allow some hands free mode of viewing or interacting
15. VCR capabilities pause, replay, skip
16. Portable
17. Share information through the application
18. Notifications turned on/off on demand

Requirements about personalization

19. User-controlled personalization
20. Easy configurable with a couple of clicks

21.	Selection of preferred sources or influence the ranking of sources
22.	Selection of preferred categories
23.	Personalization does not override the importance of the news

In the next section we will indicate the requirement that motivated each design decision with an “R” enclosed within parenthesis.

5 Design solutions

After the requirements are gathered, and the context of use is defined, the next step in the user-centered design cycle is to propose design solutions for the intended application (as depicted in Figure 1). This section describes the design of *Linked TV News*, its concept (Section 5.1), the process of refinement of its interface (Section 5.2) the look and feel of its UI (Section 5.3), and the distribution of its contents (Section 5.4).

5.1 *LinkedTV News*, the design concept

LinkedTV News is a second screen application for tablets that acts as a companion to viewers when watching the news broadcasts (R10, R16). Its main goal is to enrich television newscasts by integrating them with other media thus, integrating and concentrating the different activities related to getting informed about the news in one interactive multiple screen, and potentially mobile experience (R5). It is designed to accommodate two viewing modes in terms of interaction: a lean-back mode and a lean-forward mode.

The lean-back mode

In this mode, the application presents the user with summarized additional information about elements of the news, for example, basic information about the location or people involved (R7, R8). This happens in the form of a slideshow with short texts and images that acts as a sort of news ticker to the broadcast appearing in the main screen. It automatically synchronizes with the TV (R11), and requires no action from the user, but allows the user to browse slides, save them or bookmark news for later exploration (R13). This lean-back mode of the application intends to be as close as possible to a hands free and passive experience (R14). The slides are presented without need for user interaction, so the user can relax, share with her company and pay attention only to what really calls her interest while easily bookmarking her favorite news for later reading (R12). This favors an asynchronous mode of interaction that respects passive TV watching and allows for postponing activities that demand more attention by using the TV program as an index for deciding what to explore in a more suitable time.

The lean-forward mode

The lean-forward mode of the application acts as a hub where the user can access different news sources at different levels of information depth and communicated through different media formats (video, text, audio). This mode offers the following browsing alternatives:

- Follow a news story throughout time (R2).
- Follow news throughout sources (R4).
- Access different opinions about a topic in the news (R3).
- Geo-localized information (common people’s remarks, tweets, according to their country of origin) (R9).
- In-depth curated information about a subject (R1).

Some simple manual configuration of preferences (personalization) is possible, and the user can choose her favorite news categories and her preferred authors or news sources (R19, R20, R21, R22). The application counts with an alert about important updates in users' bookmarked news and about other relevant events (R6). Alerts can be turned on and off at user's will (R18). The application is loosely linked with social media through geo-localized Twitter comments in the "global to local" section, and the possibility to share slides or articles through diverse channels like email, Facebook or Twitter (R17, R9).

The application *LinkedTV News* synchronizes its content automatically with the television without any action required from the users (R11). It has television remote control functionalities (R15), so it is possible to use it for pausing or browsing the television program as well as for skipping news sections or news stories.

LinkedTV News is different from news aggregators because it is structured around news headlines other than a news category, a source, or trends in the news. Every headline can be explored from different levels, in the lean-back mode by dissecting the headline in its actors and settings, and in the lean-forward mode by showing it from different viewpoints.

Main Assumptions (obtained through the studies conducted)

- TV viewers value the possibility to decide whether to multitask while they watch TV or simply sit and relax.
- TV newscasts viewing is regarded as a potentially social activity, while online newspaper reading is an act best performed individually.
- The television newscasts are useful for the users in that they present a panoramic view about the most important recent happenings, while online newspapers are better suited for in-depth information searching.

How LinkedTV News addresses the challenges inherent to supporting hyperlinked media

In the introduction section 1.2 three challenges of web-enriched broadcast video are mentioned. *LinkedTV News* addresses the first two of these challenges through the use of a second screen as follows:

- *Tension between lean-forward content and lean-back consumption.* By allowing synchronous as well as asynchronous interaction through the use of bookmarks and by including two interaction modes, *LinkedTV News* gives its users freedom to decide about how to distribute their attentive resources and which level of engagement they want to have towards the enrichments of the TV contents. This facilitates a smooth transition that will ease the tension between contents and the habits related to the context and medium where the content are consumed (Web contents in a living room – television environment).
- *Tension between multiple and single users.* By presenting enrichments in a second screen, *LinkedTV* leaves the main screen free from overlays, thus keeping the experience of multiple viewers undisrupted. It delivers a personalized version of the TV contents and a personalized experience without directly affecting the shared one. Through the use of bookmarks, users can choose to delay online newspaper reading related to the broadcasted news, for a later moment and meanwhile enjoy the social experience.

5.2 Prototyping

As part of the iterative design phase of the process, prototypes are created for communication purposes with the team and stakeholders as well as for initial user testing.

5.2.1 Wireframes

Wireframes were created using a mockup tool, Balsamiq. The wireframes were discussed with several project partners. Figure 5 below shows one of the Balsamiq wireframes that

were created. Using the feedback on the wireframes the concept and browsing routes were approved.

5.2.2 User testing with screenshots and Paper prototyping

The updated wireframes served as the base for the design of static mockups with a polished design that was specifically created for tablet browsing. These mockups were printed to create paper prototype. These prototypes were informally tested with 4 users who were asked to perform simple tasks: select a slide, swipe a slide, bookmark the current news, share a slide, play, pause, and browse the video, and browse the in-depth information.

Although small changes were made after this iteration, the basic navigation metaphors were well understood. However, it was hard to reproduce the conditions that happen simultaneously when interacting with moving images and multitasking. These aspects would be much better experienced for evaluation in the functional high-fidelity prototype.

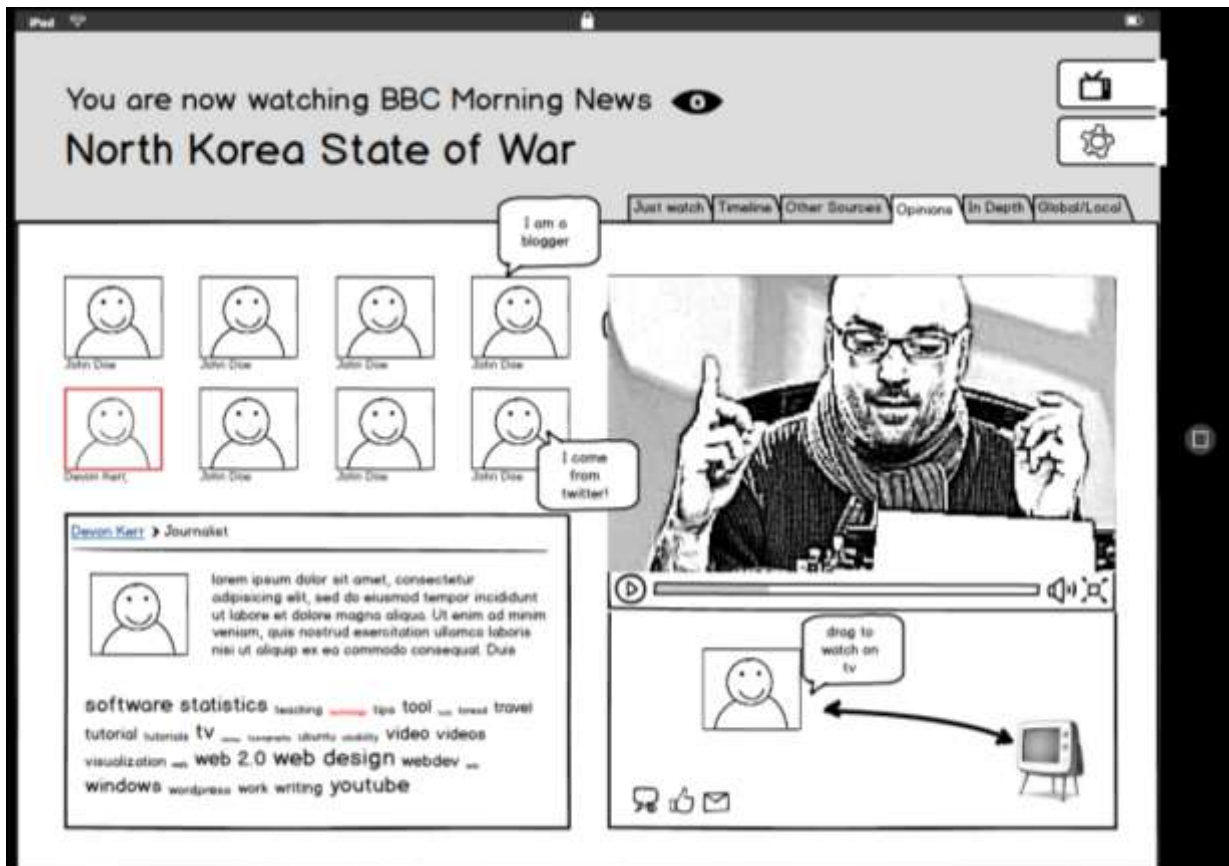


Figure 5 Example of Balsamiq wireframes for *LinkedTV News*

5.3 LinkedTV News UI design

This section contains detailed descriptions of the UI and interaction design of *LinkedTV News*.

Lean-back mode (slideshow screen)

When a user launches *LinkedTV News* and once the application has automatically synced to the chosen program, the first thing that she sees is the lean-back screen, Figure 6.

The lean-back mode presents bits of information about key elements of the news item in the form of slides, in a similar way to a photo carousel. The elements of this screen are distributed in 4 main areas: the menu area (A), the slide navigation or thumbnail strip area (B), the main slide or information area (C), and the television area (D).

At the bottom of the screen, in the television area (D) can be found information about the show, for example, the name of the program (1), and the news heading or story currently being told (2). The TV control (3) is also in that TV area. Moving the slider control or tapping at any point in the line can advance the program back or forth. The TV can also be paused with the play/pause button. The bookmark button (4) is placed inside the TV area to the right of the news heading to indicate that when it is pushed, the whole news heading or episode is bookmarked (Figure 7). The bookmark icon was placed in this corner of the screen in order to facilitate bookmarking with the thumb while holding the tablet with the hands. Thus making it possible users to bookmark without need of looking at the app's screen.



Figure 6 The five areas of the LinkedTV News lean back mode screen: the menu area (A), the slide navigation or thumb strip area (B), the main slide or information area (C) and the television area (D)



Figure 7 Bookmarking a news story with the thumb

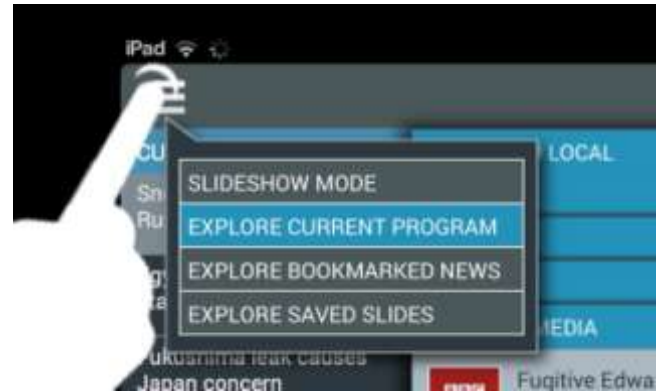


Figure 8 LinkedTV News contextual menu

The information shown in the main slide is mainly taken from Wikipedia and it corresponds to the first lines (short summary) that are standard in most Wikipedia pages and to the facts that appear in the main fact rectangle at the right of the Wikipedia entries. The image frame is intended for displaying an illustration representative of the entity.

The slides in the carrousel change automatically. The transition between one slide and the next is a horizontal push transition where the new slide “pushes” the old one from right to left and takes its place. It is also possible to browse through the slides manually and this is done either swiping the slides or selecting slides in the thumbnails strip.

The pace at which the slides change depends on the number of slides available and the duration of the news item, and it varies between 12 and 16 seconds. When users select a slide, the slideshow pauses for 15 seconds, and then, if the system senses no activity from the user, the carrousel advances to the slide coinciding with the current moment in the video.

The main slide area contains its own controls at the bottom right of the slide (8). These controls are from left to right: the timer that shows how much time a slide will be shown in the automatic mode of the slideshow, the pause/play button which can be activated to stop the movements of the slides, the share button used to access the options for sending an email, posting on Facebook or tweeting, and the save icon used for saving the slides within the application.

The thumbnail strip area (B) consists of a series of thumbnails that correspond to all the available entities in the news story or chapter (9). A triangle marker (10) indicates the start of a news story, and therewith indicates which slides correspond to a news story. The thumbnail strip acts as navigation and selection device, selecting a slide’s thumbnail advances the carrousel to the point where the corresponding slide is shown. The selected slide is indicated with a blue rectangle (11). The thumbnail strip shows one news story at a time and thumbnails are loaded into it only when the beginning of the story is playing on TV. When a news story has ended, the thumbnails of the next story substitute the existing thumbnails. The thumbnails and slides remain in the left section of the thumbnail strip and can be browsed through. In other words, it is possible to see slides from past news stories but not future news stories. The navigation and selection in the thumbnail strip happens through swipe and tap motions.

The menu area (A) is a bar on the top of the screen. It contains the menu icon (12), the application’s name (13), the date (14), and the settings icon (15).

When tapped, the menu item (Figure 8) displays a contextual menu. This menu enables the user to change screens from the lean-back mode to the lean-forward mode (“slideshow mode” to “explore current program”) and gives access to the bookmarked news and to the saved slides.

Lean-forward mode (in-depth browsing routes)

Figure 9 shows the lean-forward mode. Once the user has chosen the option in the menu to browse more in-depth information (by selecting “explore current program”) she switches to the lean-forward screen from where she can access all of the program news through five different browsing routes or in five different sections. The lean-forward screen has a standard design through the sections. Only the section for “global to local” has an alternative design.



Figure 9 LinkedTV News lean-forward screen: the news item column A, the article selection column B, the contents column

The structure of the lean-forward screens is based in a three-column design as shown in Figure 9. The left column (D) presents a list of the news headings. When exploring the current program, these headings correspond to the program now playing. When exploring bookmarked news, those headings correspond to the bookmarked news. To select an item of this column the user taps on it. Selected items are highlighted (1). The column contents scroll vertically when needed with a tap and drag gesture.

The center column (E) is formed by two main sub-sections: the menu tabs (2) and the article selection list (3). The menu tabs present the 5 browsing routes. When the user taps on one of the sections, the menu tabs below that section slide down to the bottom of the page to uncover the selected section’s article list as shown in Figure 10. When the user taps a menu tab that is already at the bottom of the page, the menu tab slides up to show its contents.



Figure 10 Menu tabs sliding down upon selection through tapping

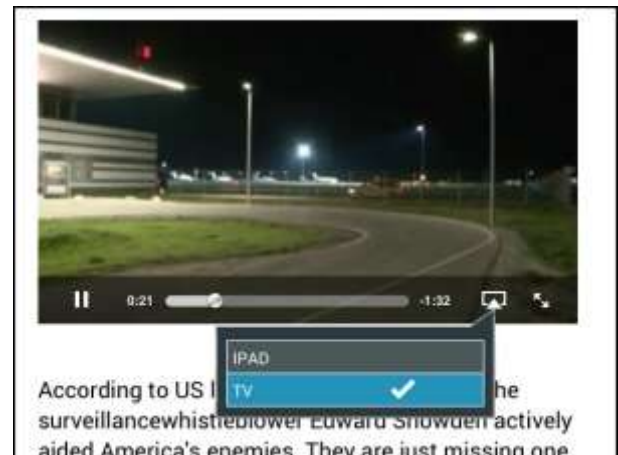


Figure 11 Example of airplay and video controls

The contents of the articles list vary depending on the selected section and the selected news. However, all article cells (4), have a similar basic structure. This structure is composed of a square thumbnail icon representing a person or the logo of a media source (5), a short text (6) (usually containing the name of the article and the author or author's details), date (7), and a video or audio icon when the contents of the article are available in one of those media formats (8). Identical to the news item column, to select an item of this column the user taps on it. Selected items are highlighted. The column contents scroll vertically when needed with a tap and drag gesture.

The third column of the lean-forward mode (F) presents the articles and media content. This column has a title area (9) for the name of the article, the date and author of the article (10) and a link to the article in its original source (11). When clicking on this link, the external source is opened within the application. The app menu remains visible and a "close" button appears to go back to the lean-forward screen.

The article and media content column also contains an area where video/audio representations, or images illustrating the contents appear (12). This media frame or container has a space for caption text when the caption is available.

When video or audio material is presented in this media container, playing controls appear including an "airplay" button, Figure 11. When the "airplay" button is tapped, a contextual menu offers the option of showing the media content on the main TV screen. Selecting this option (by tapping the TV icon) interrupts the program being shown on the TV and replaces it with the content of the tablet's media frame. Tapping the button again and selecting the tablet icon returns the media content to the application's media frame and the TV returns to the point of the video where it left.

The last area of the right column (F) is where the body or main text of the article is presented (13). This area extends beyond the bottom of the screen as much as needed to adjust to the length of the article and the user can scroll vertically to access the hidden parts of the text.

The whole article column can also be swiped horizontally. Swiping horizontally to the right will show the next article on the list and to the left the previous one.

5.4 Explanation of the five browsing routes by contents

In other Media

The "in other media" section of the interface is dedicated to showing the selected news as they are reported in other newspapers, radio, or TV programs (Figure 12). This section should be devoted to the narration of facts rather than the presentation of opinions. The

system should, for this reason, look for close semantic match between all the terms in the news headline itself and the articles to be included here.

In the implementation of the application, users should be able to decide which sources they want to include or influence their ranking in case that the broadcaster uses a predefined list of sources. This section is different from the “opinions” section in that it doesn’t emphasize the author of the news, but its source.



Figure 12 In other media

Opinions

This section shows opinions from different authors about the selected news, see Figure 13. In this section the most relevant element is the author. In the implementation of the application, users should be able to decide which authors they want to include or influence their ranking in case that the broadcaster uses a predefined list of authors. It should be possible to include public figures like politicians as well as bloggers. This section corresponds to the “opinion articles” section included in many newspapers.

The screenshot shows the NewSync application interface on an iPad. The top status bar displays 'iPad', signal strength, '19:58', and '100%' battery. The app header includes the 'NewSync' logo and the date '29 July 2013' with a settings gear icon. The left sidebar contains a 'CURRENT PROGRAM' section with items like 'Snowden applies for Russia asylum', 'Egypt's Morsi vows to stay in office', 'Fukushima leak causes Japan concern', 'Rallies in US over Zimmerman verdict', and 'Royal baby prince named George'. Below this is a 'GLOBAL TO LOCAL' section with 'TIMELINE', 'IN DEPTH', and 'OPINION' options. The 'OPINION' section lists three articles: one by Sandra Hernandez (08/06/13), one by Spencer Ackerman (05/08/13), and one by Dean Obeidallah (07/06/13). The main content area features the article 'EDWARD SNOWDEN IS A WHISTLEBLOWER, NOT A SPY - BUT DO OUR LEADERS CARE?' by Spencer Ackerman, dated June 5, 2013, labeled as an 'original article'. It includes a video player showing a night scene at an airport with a play button overlay. The article text begins with: 'According to US legislators and journalists, the surveillancewhistleblower Edward Snowden actively aided America's enemies. They are just missing one essential element for the meme to take flight: evidence. An op-ed by Representative Mike Pompeo (Republican, Kansas) proclaiming Snowden, who provided disclosed widespread surveillance on phone records and internet communications by the National Security Agency, \"not a whistleblower\" is indicative of the emerging narrative. Writing in the'.

Figure 13 Opinions

In-Depth

The “in-depth” information (Figure 15) includes in-depth coverage of articles related to the selected headline that could form part of the lean-back mode “entities”, but offer a more extensive view. It also includes archive articles. In-depth covers the details of the facts: background, actors and their backgrounds, context, and prediction about possible future outcomes. It also includes profiles of the persons involved in shown events.

The screenshot shows the NewSync iPad app interface. The top status bar displays 'iPad', signal strength, '00:32', and '43%' battery. The app header shows 'NewSync' and the date '29 | July | 2013'. The left sidebar contains a 'CURRENT PROGRAM' section with headlines like 'Snowden applies for Russia asylum', 'Egypt's Morsi vows to stay in office', 'Fukushima leak causes Japan concern', 'Rallies in US over Zimmerman verdict', and 'Royal baby prince named George'. Below this are 'GLOBAL TO LOCAL', 'TIMELINE', 'IN DEPTH', 'OPINION', and 'IN OTHER MEDIA' sections. The main content area displays an article titled 'NSA'S PRISM SURVEILLANCE PROGRAM: HOW IT WORKS AND WHAT IT CAN DO' by The Guardian, dated July 8, 2013. The article includes a diagram titled 'FAA702 Operations Two Types of Collection' showing 'Upstream' collection (fiber cables) and 'PRISM' collection (directly from servers of U.S. service providers like Microsoft, Yahoo, Google, Facebook, etc.). A yellow callout bubble says 'You Should Use Both'. The diagram is labeled 'TOP SECRET//SI//ORCON//NOFORN'.

The slide details different methods of data collection under the FISA Amendment Act.

Since [Prism](#) was first revealed by the [Guardian](#) and the [Washington Post](#), there has been [much discussion](#) across the media around exactly what the [NSA's](#) top-secret program is, how it works, and what it covers.

While many of these have provided useful insight

Figure 14 In-depth

Timeline

The timeline section, Figure 15, shows an overview of the events related to the selected news item chronologically. Ideally, the timeline should support different degrees of zooming (years, months, days, or minutes) depending on the type of event. Sources and authors are not relevant for this section. Timelines are often presented in well-known newspapers or posted by lay authors.

The screenshot shows the NewSync application interface on an iPad. The top status bar displays 'iPad', signal strength, '19:50', and '58%' battery. The app header shows 'NewSync' and the date '29 | July | 2013'. The main content area is titled 'JOINED THE NSA AS A CONTRACTOR' with the date 'January 2, 2009'. Below the title is a photo of NSA Director Gen. Keith Alexander. The text below the photo reads: 'NSA Director Gen. Keith Alexander image via Chip Somodevilla/Getty Images' and 'Snowden first worked as a contractor for the National Security Agency in Japan in 2009 per The New York Times. It was from here he said where he watched 'as [President Barack] Obama advanced the very policies that I thought would be reined in.''. On the left side, there is a 'TIMELINE' section with a list of events:

Year	Date	Event
2009	2 JAN	Joined the NSA as a Contractor
2007	1 JAN	Stationed With CIA in Geneva
2004	29 SEP	Security Guard at NSA Facility
2004	28 SEP	Left the Army
2004	7 MAY	Enlisted in the U.S. Army Reserve
1983	21 JUN	Born and Pre-2004

Below the timeline are sections for 'IN DEPTH', 'OPINION', and 'IN OTHER MEDIA'. The left sidebar contains 'CURRENT PROGRAM' and 'GLOBAL TO LOCAL' sections with various news items.

Figure 15 Timeline

Global to local (geo-localized tweets)

This section includes live feeds from Twitter, Figure 16. The tweets included here, however, are filtered by subject and by geo-location. The intention of this section is to show people's opinion in the place where the news happens as well as near the user's current location.

The underlying motivation is to give an overview of the perceived local effect of the international news in the user locality as well as a first-hand opinion of people located where the story takes place.

This section is different from the rest in terms of interaction design because instead of the article, the right column contains a map that can be zoomed and panned. The selection of the information can be made by tapping on the center column or by tapping the Twitter icons. Balloons with the tweets then appear as overlays to the map. Two buttons on the bottom of this section with the legend "near me" and "near the news" serve as shortcuts to navigate the map with one click to the current user location (near me) and read tweets of neighbors about the subject of the news; or to the place where the event in the news occurs (near the news), and read the testimonies and opinions of locals.

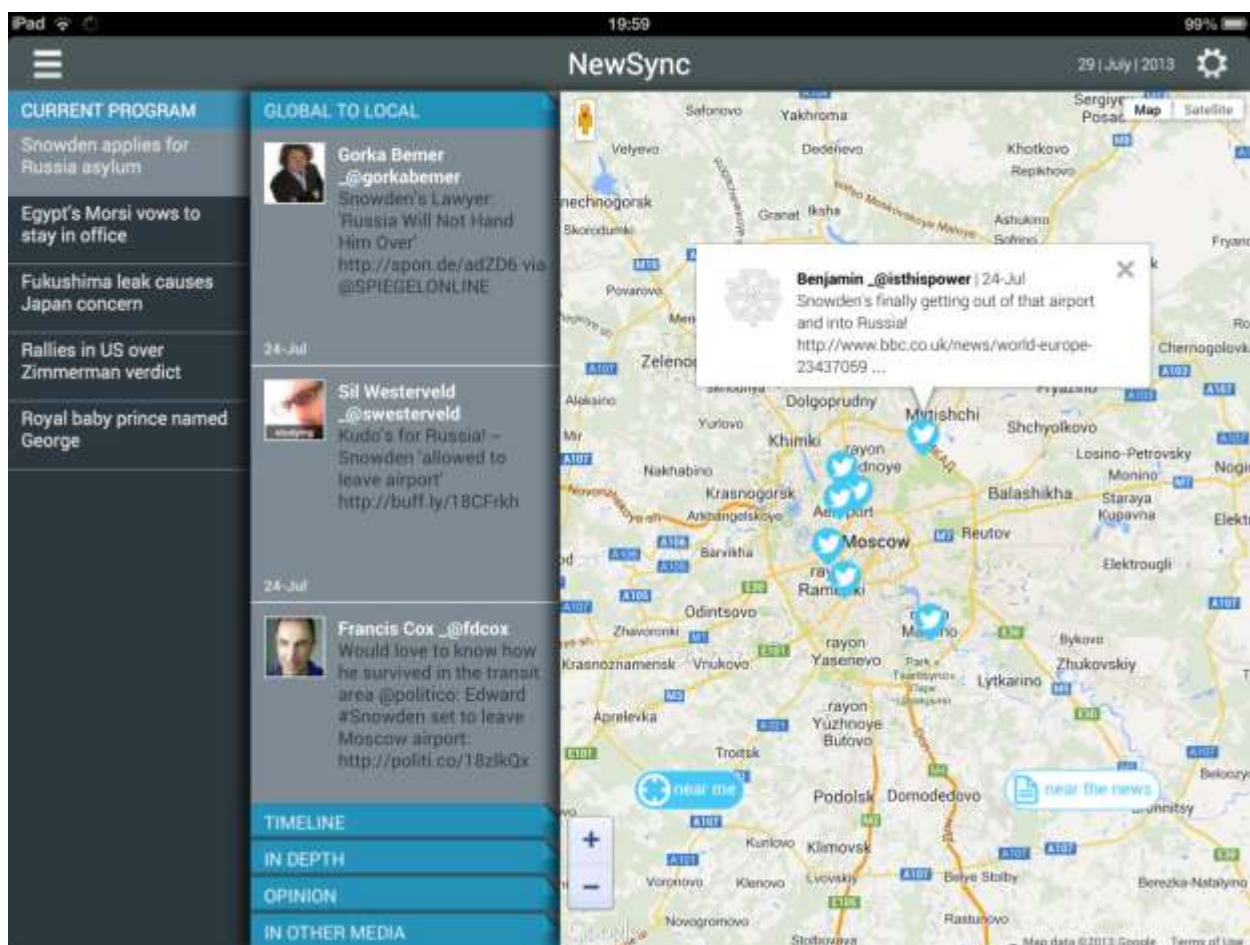


Figure 16 Global to local

6 Evaluation

Evaluating design solutions against user requirements is the last step of the user-centered design cycle before deciding whether to consider the cycle concluded or restart a new iteration as denoted in Figure 1. This section describes a task-based evaluation of the *LinkedTV News* hi-fi prototype conducted with the aim of testing its usability, perceived usefulness, appeal, and most importantly its ability to fulfill user- demands in terms of

information needs. Section 6.1 discusses the implementation of the hi-fi prototype. Section 6.2 the objectives of the evaluation; Section 6.3 its setup; Section 6.4 the method; Section 6.5 its participants; and Section 6.6 the results obtained.



Figure 17 Participant interacting with *LinkedTV News* during the evaluation

6.1 Videos, entities and related content

Five short news videos were selected and edited to form an eight and a half minutes long newscast. An HTML5 functional website was created according to the InDesign screenshots and specifications. This website was adapted so that it could seamlessly pass for a native IOS application seen in full screen. Contents were added manually through json and HTML coding to each of the news stories and each of the browsing routes. This resulted in 84 html pages containing articles, 40 summarized descriptions and 467 image files. The look and feel of the application obtained was very realistic except that the contents are not live and therefore, not updated. The experience of feeding the interface with real contents helped to adjust some of its characteristics such as space in the diverse text fields.

Due to time and technology constrains, not all the functionalities intended for a final application were implemented and the ones implemented worked only for the horizontal screen position. However, core functionalities were all included.

A list of the functionalities implemented in the hi-fi prototype can be found in appendix H.

6.2 Objectives

The objective of the evaluation was to investigate how users experienced the information needs in practice, how these are supported by the prototype. In addition, we evaluated the interaction with the application and the pertinence of the elements of the interface. The following 12 points were used as items of interest to design the study:

Information needs

- How well does the system meet the user's information needs and how can it be improved?
- Is the choice of information elements in the slides adequate?
- Is the information contained in the slides interesting?
- Are the five browsing routes of the lean-forward mode useful and suitable?

Interaction

- How do users perceive the experience of having additional information presented in a second screen while viewing a television newscast?
- Is the pace at which slides are shown adequate for users to decide whether to consume the information that they contain?
- Is the amount of information contained in the slides adequate?
- Do users prefer synchronous or asynchronous interaction with the application?

Interface

- Are the elements of the interface clear to the user?
- Are they adequate for achieving their intended goals?
- Is it easy to learn to navigate the interface?
- Is the application perceived as useful?
- Do users find interacting with the application pleasant and satisfying?

Tasks

In order to investigate the points described above, a task based evaluation format was chosen. Three basic types of tasks were included: exploratory tasks, simulated information needs tasks, and free formulated question tasks. For an overview of the task types and examples see appendix I.

Participants were asked to perform some of the tasks synchronously and some asynchronously in order to assess their experience in both cases. The actual evaluation was preceded by a pilot in which we test the wording of the tasks, the length, and other aspects of the protocol.

6.3 Set up

The evaluation was conducted in the same setting as the focus group, reported in Section 3.1.1, in a living room like experiment room provided with a sofa, a center table, and a large television. The television was used to broadcast the news program and an iPad was given to participants as a second screen. The application was installed and functioning in a full screen mode in the tablet. Two cameras were included in the set-up: one situated on top of the participant pointing at the second screen device and transmitting live feed to the researcher's computer and one on top of the television recording the general setup. The first was intended for direct observation and creation of usability logs by the observer and the second one will be used in future research (out of the scope of this deliverable) to analyze the direction of the gaze while interacting with the application.

6.4 Method

After being greeted, users were given a task book. This task book contained consent forms and demographic questionnaires in its first part and the rest were instructions for completing 6 tasks. Many of the tasks were followed by ASQs (after scenario questionnaires) to assess the ease of fulfilling the task, the pertinence of the time demanded and how realistic the task seemed to the user in terms of resembling real tasks that she would perform outside the studio environment.

Each task and its corresponding instructions were explained in one page and participants were asked not to turn the page until they were done with the task. Tasks were loosely timed, there was no limit as to how soon a task could end, but participants were asked to stop solving a task after having invested five minutes in it. At the end of the task book two questionnaires were added: the SUS (System Usability Scale) [22] and the USE [23] (Questionnaire for User Interface Satisfaction). These assess perceived usefulness and ease of use, learnability and satisfaction. Only a part of the USE was employed (perceived usefulness and satisfaction) in order not to overload users with questions. Furthermore, SUS already measures learnability and ease of use and is a more widely employed and validated tool. After finishing the questionnaires a follow up interview about the experience was conducted by the researcher and recorded for analysis.

At the end of the evaluation, participants were rewarded with cinema vouchers. Each session lasted approximately one hour.

6.5 Participants

This study constituted a follow up to the initial interviews, and the participants are the same.



Figure 18 Researcher's view of participant (usability study)

6.6 Results

6.6.1 Usability and ease of use (SUS scores)

SUS, System Usability Scale, is a widely validated test. It was designed to measure one single dimension, ease of use. However, recent studies have suggested that it assesses also learnability [24].

SUS yields a single number representing a composite measure of the overall usability of the system being studied [22]. The scores for individual items are not meaningful on their own. The scale of the averaged items ranges from 0 to 100.

The mark obtained by *LinkedTV News* in the SUS questionnaire is 83 with a standard deviation of 10.

The individual participant average rating can be seen in Figure 19.

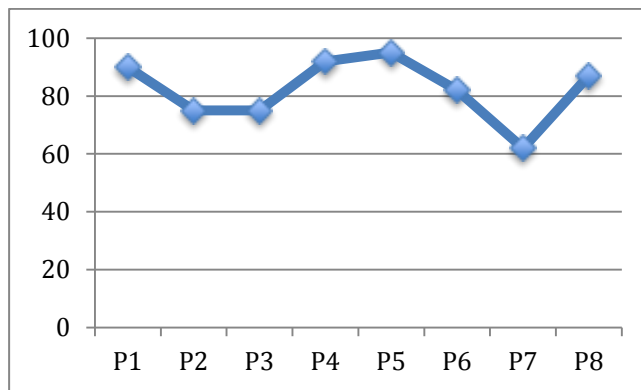


Figure 19 individual participants' SUS score

The average SUS systems grade is 68% [24], and therefore the obtained grade of 83 is above average. Furthermore, it corresponds to the highest grade, a letter A in the letter scale. For a complete table with details about the SUS scores in the evaluation see appendix J.

6.6.2 Perceived usefulness (USE scores)

The perceived usefulness of the system was assessed through 6 items of the USE questionnaire using a 7-point Likert scale where the highest values are the most positive. The resulting score was 5.6 with a standard deviation of .7. This would correspond to a percentile of 80. Table 2 shows the questions and the averaged user responses.

USEFULNESS		
1	It helps me to find information more efficiently.	6.2
2	It is useful.	6.2
3	It makes the things I want to accomplish easier to get done.	5.8
4	It saves me time when I use it.	6
5	It meets my needs.	5
6	It does everything I would expect it to do.	4.5

Table 2 Usefulness

As can be seen the higher marks are for the efficiency of the system that is perceived as time-saving.

The lowest scores, although still tending towards the positive side of the scale are the ones related to user expectations regarding the system and its functionalities. For a complete table with details about the USE usefulness scores in the evaluation see appendix K.

6.6.3 Satisfaction (USE scores)

The user satisfaction with respect to the system was assessed through 7 items of the USE. The resulting score was 5.5 with a standard deviation of .5. This would correspond to a percentile of 78%. Table 3 shows the questions and the user's averaged responses.

SATISFACTION		
7	I am satisfied with it.	5.7
8	I would recommend it to a friend.	6.3

9	It is fun to use.	6
10	It works the way I want it to work.	5.1
11	It is wonderful.	4.7
12	I feel I need to have it.	5
13	It is pleasant to use.	5.7

Table 3 Satisfaction

For a complete table with details about the USE satisfaction scores in the evaluation see appendix L.

6.6.4 Assessment of the slides

In order to assess the suitability of the slides and their components, the participants completed a questionnaire composed by opposite adjectives. The participants received this questionnaire after the task where they were presented with additional information in the slides of the lean-back. The following are the averaged results of the questionnaire. In this questionnaire a 6-point Likert scale with no neutral or “undecided” position was used.

The information contained in the slides was found to be useful, interesting, and easy to browse. Figure 20 summarizes the overall results. On the other hand the simultaneous presentation of TV newscast and the slides was found to be distracting and the pace in which the slides appeared was described as somewhat fast.

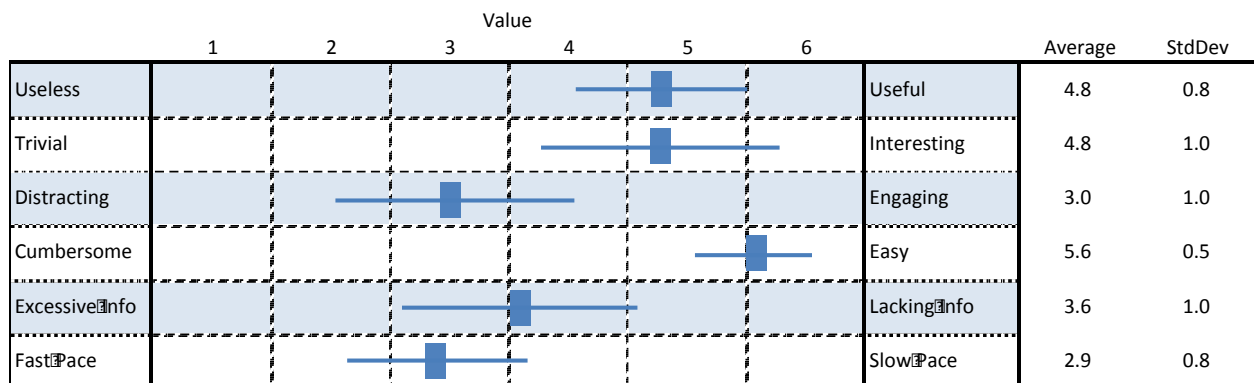


Figure 20 Averaged results of the slideshow questionnaire

6.6.5 Perceived mental effort

Task number 3 was a simulated need task where users were requested to look for certain information while at the same time watching the television program. After completing the task, they were asked to rate the activity through 2 pairs of opposites in a 6-point Likert scale.

It should be noted that participants found it easy to browse the information, but at the same time they tend to describe the activity as distracting as shown in Figure 21.

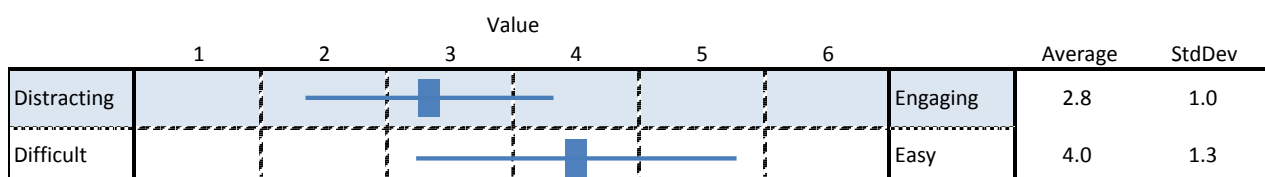


Figure 21 Evaluation of the multitasking search task

6.6.6 Ability to answer freely formulated questions

In the free formulated question tasks every participant asked a question about 2 topics voluntarily selected from the ones included in the study newscast. Sixteen questions were formulated, and participants found answers for ten of them within the application. This means that 62% of their questions were found without the need to consult the Internet in the given amount of time. From the remaining six questions, four were found with ease through Google, and one was partially answered by a Google suggested link and one was not found in the given time. Table 4 shows a list of the questions and indicates whether *LinkedTV News* answered them according to the participants.

Participant Number	1	2	3	4	5	6	7	8
News choice 1	Snowden	Fukushima	Snowden	Snowden	Snowden	Snowden	Fukushima	Fukushima
News choice 2	Zimmerman	Zimmerman	Fukushima	Zimmerman	Fukushima	Egypt	Royal baby	Fukushima
Question 1	Short overview of what happened. What kind of person was the preacher? What are his political positions (also on other past events)	More technical background	More NSA related story	Who is Anatoly Kucherenko?	Where else did he apply for asylum?	Details about extradition treaties between US and Russia	When did the leak start?	Map of current radioactive levels of Japan
Q1 answered?	no	yes	yes	yes	yes	yes	yes	no
Question 2	Snowden: Legal conditions for applying for an asylum in Russia?	More opinions	How big is the leak	Where is Zimmerman's family from?	How do they think to solve the problem?	What were Morsi's political decisions that made the process start	What is the baby's name?	Interviews with Japanese living in Japan about the situation
Q2 answered?	yes	no	yes	yes	no	no	yes	no

Table 4 free formulated questions

6.6.7 Realism of the tasks

Participants' evaluation of the tasks in terms of their realism was very positive, on average 5.5 of realism on a 6-point scale, representing 91% of perceived realism.

6.6.8 Completion time tasks

The average satisfaction with the time that it took to solve the tasks using *LinkedTV News* was 4.9 on a 6-point scale equivalent to 81.8%.

6.6.9 Usability findings

According to the usability logs and observations, the following findings were extracted from participant interactions with the interface. These findings will be taken into account as opportunities for improvement:

- The difference between the concept “save” and “bookmark” is not clear, and users are not always sure of whether their bookmarking will affect the entire news item or just a slide.
- Some users would like to have the VCR controls for the TV present at all times, also when exploring the in-depth information.
- It is not clear to many users what the wording in the title “global to local” refers to.
- The buttons in the “global to local” section are not clearly visible and therefore not often used.
- Some users expect the slide thumbnails to act as markers to navigate the video.

6.6.10 Results of the interviews

Each user evaluation session of *LinkedTV News* ended with an open interview guided by a 15-item questionnaire. The interview assessed participants’ general impressions after interacting with the application as well as their suggestions for improvement. The main goal of the interviews was to recognize whether user requirements identified in the preliminary user study had been fulfilled. The fact that the participants were already acquainted with the researcher and some of the research goals due to the previous interview facilitated their involvement in a dialogue that resembled a co-creation exercise.

The interviews were summarized and transcribed, and comments were clustered according to affinities. We present the most interesting ones.

Positive aspects

- Overall, participants’ reception of the application was very positive. It was described as useful and easy to use. 7 out of 8 participants declared that it had met or surpassed their expectations (all but P7).
P8 I like it, it’s useful. It’s so much better to have this tool than not to have this tool. The best is the easiness, it’s easy to use; it gives you easy access to different kinds of information with just one click.
- 7 out of 8 participants stated that they would use it if it were available (P1, P2, P3, P4, P5, P6, P8).
P8 Yeah I would download it for sure and use it if it’s matched to my news channel I would definitely use it.
- Users appreciated the time-saving aspect of the interface (P3, P5).
P3 The list with limited options is of course much better because it’s quicker. Something with limited options, it limits you, but on the other hand it’s quicker so there is a balance, it’s your choice.
- They were satisfied with the density of the information that it contains (P1, P4, P6).
P6 It really covers most of the things that, usually, the things that you can look for when you look up a news item.
- All participants appreciated the overview of the temporal background of the news through a timeline, and the opportunity to have multiple views and multiple opinions of a subject gathered in one place.
P4 The timeline I found very interesting. Sometimes we hear about the news late, and miss things in between. The timeline updates you about the process of the news.
- Users indicated that they would be likely to use the bookmark functionality to be able to postpone browsing for the time during the advertisement break or after the show. They also said that they would browse during the show if the following news was not interesting (P1, P2, P3, P4, P5, P7).

P7 I would bookmark, both things at once are not compatible. I second screen multitask only when I am not interested.

- Many participants described the presentation of short fragments of information through slides simultaneously with the broadcast as useful and interesting (P4, P5, P8).

P5 I liked the additional information. Sometimes information is needed to understand or go in depth in the news. I saw a person in the Snowden story and I didn't know who he was, but I clicked the slide and found basic information to calm my curiosity and help me understand.

Negative aspects

- Overall, participants perceive interacting with the application simultaneously with watching the news as distracting (P1, P2, P4, P5, P7).

P2 I like the functionalities but not the distraction.

P2 I prefer a screen where nothing moves and I request info. If something moves you have to watch.

- Global to local (geo-localized tweets) was found to be the least useful functionality (P1, P2, P3, P4, P5, P6, P7, P8).

P5 Least useful functionality for me: tweets, though for other people might be good.

- Some participants felt that the time to view the slides was too short (P5, P6, P7, P8).

P8 I don't like to have a specific amount of time to read if I select something.

- The difference between “save” and “bookmark” is not clear (P1, P2, P4, P5, P6, P7).

P1 Had confusion at the beginning between bookmark and saving.

Suggested functionalities and improvements

- Use static slides or use a more subtle transition for the slides (P1, P2, P7).
- VCR TV controls visible at all times (P6, P8)
- Control the video with the slides (P2, P6)
- Allow users to deviate in multiple directions (like the related articles in the newspapers) (P3, P4, P5)
- Read people's comments (as in online newspapers) (p6, p7)
- Map to place of the news geographically (P5, P6)

6.6.11 Proposed changes

In a future version of LinkedTV News, in order to improve the interaction, the following changes should be performed:

- The TV area should become permanently visible and easily accessible in both main screen modes (lean-back and lean-forward).
- The difference between “save” and “bookmark” should be clarified and more widely understood icons should replace the current icons. Otherwise, a label should reinforce the icon meaning.
- The functionalities of the VCR controls of the television area should be expanded to “skip chapter” or to navigate by chapter.
- The thumbnails should allow two modes of interaction, one where selecting a thumbnail affects only the second screen slide show, and one where selecting a thumbnail advances the main TV program to the point where the object depicted on the thumbnail is mentioned. Such double functionality should be thoroughly tested.

- “Related articles” should be added as a browsing route or embedded as a sidebar or footnote to the articles.
- The section “global to local” should be renamed. A good strategy would be to use a card sorting evaluation to find consensus among participants. The buttons of this section should be relocated for clarity. If further evaluations prove that this section is still not used despite the changes, the section should be eliminated.
- A “search” field to perform searches outside the application could be considered, but this requires further study.

7 Conclusion

The work described in this deliverable was driven by two motivations: our primary goal was to design a communication “device” to understand user information needs and integrate them in a technology-driven process. A secondary aim was to explore the role of a second screen interface in coping with the challenges that are inherent to the presentation and consumption of hypermedia.

The *LinkedTV News* companion is an example of the application of hyperlinked video and LinkedTV’s technology to the news. It integrates two activities that are related by subject, but currently often take place through different devices and at different times: watching TV newscasts and consulting online newspapers and videos. These activities are not mutually exclusive. Our contextual research shows that users frequently perform both because they believe that each one of them offers different advantages, for example, some of them watch TV broadcasts to get an overview of the news, and read online newspapers when they want to get in-depth information about specific news.

Our task-based evaluation with a hi-fi prototype showed that the proposed integration is appealing to users who are interested in news and daily dedicate a certain amount of time to get updated.

Participants in the study were generally enthusiastic to have different types of information related to the news concentrated in one application and considered that, in this sense, the interface would be time-saving with respect to their current equivalent practices (e.g. consulting several independent sources). The proposed interface sections were described as very thorough in covering possible user information needs. In particular, the most valued sections were:

- the chronological overview of news delivered through a timeline
- the opportunity to read the same news headline as it was presented in different media sources.
- Participants also valued the possibility of news bookmarking. They would use it to postpone the more cognitively demanding tasks related to in-depth information exploration for after watching the television program.

The possibility of accessing geo-localized information through tweets was, unexpectedly, the functionality that participants liked the least.

In terms of understanding user needs, evaluation with a hi-fi prototype showed that the application succeeds in fulfilling many of the needs identified in the preliminary study. Overall, there seems to be interest from users in an integrated hypermedia solution for the news that resembles the one we proposed, and there is reasonable evidence (see Section 6.6.10) to expect that an application like this would be welcomed by users.

Furthermore, through *LinkedTV News* a continuing dialog was established with the members of the LinkedTV team about what types of links users would be interested in and how to deal

with choosing relevant subsets of them, thus, contributing to guiding the next technological steps of the research project.

With respect to understanding the role of a second screen interface in hypermedia presentation, the goal was partially fulfilled. From the two challenges of web-enriched broadcast video presented in the introduction, *consuming active contents through a passive medium* was most influential in designing the application. The lean back mode of the application was conceptualized to accommodate the passive mode of interaction that is usual when watching TV. The intention behind this was to allow users to choose which level and type of engagement (active or passive) they want to employ in interacting with the hypermedia enrichments.

Though most users valued the additional information presented through a slideshow during the program, and understood that they could use the application to delay the in-depth exploration, they complained about being distracted by the spontaneous movements that occurred on their second screen. These movements forced them to look at the second screen involuntarily, thus introducing an element of disturbance in their peripheral view and their experience of media consumption.

8 Discussion of current work

The initial contextual studies were performed with nineteen participants in total. However, we decided to continue working only with the eight who more closely matched our target audience. We performed in-depth open interviews with each of them, and gathered information about their experiences and their information needs. They suggested functionalities and helped envision an application that would potentially fulfill those needs. In a second iteration, they assessed to what extent the application met their initial motivations and validated our proposal.

This iterative approach with one group of users lent itself to in-depth exploration bordering on a co-creation exercise. This in-depth character of the study was intended to compensate for the small number of participants. There is a possibility, nonetheless, that the familiarity of the users with the project might cause some bias. Therefore we recommend testing the application with a group of independent participants in order to compare results.

Another element that could be improved is the temporal aspect of the news used in the study. The news articles were manually fed in the system by a process that took a few weeks, and thus they were outdated as the evaluation was performed. Ideally, the evaluation should be repeated with “fresh”, up-to-date news.

9 Future work

In order to explore further the role of a second screen and the cognitive load that a dual screen set-up demands, the lean-back mode screen should be studied separately in a series of controlled experiments. The number of enrichments, length of the information contained, pace in which they change, topics to which they refer, colors and animations they use should be studied in order to prevent overload of users' attention.

Group evaluations should also be performed in order to test the performance of the second screen application when watching the news collectively. This refers to the second challenge of supporting Web-enriched broadcast mentioned in the introduction (Section 1.2).

LinkedTV News could be turned into a valuable commercial application if the following conditions are met:

- Lean-back and lean-forward modes are both available and switching between them is easily possible.
- The cognitive load of the lean-back mode with respect to peripheral vision is reduced.
- Necessary link types are implemented and high quality information is provided.
- Accurate synchronization of the second screen with the television is achieved.
- Easily configurable user-controlled personalization is enabled.

10 References

1. Pérez Romero, L., Traub, M. C., Leyssen, M. H. R. 2013. Hardman, L., Second Screen Interactions for Automatically Web-enriched Broadcast Video. In Workshop proceedings of EuroITV 2013, Como, Italy. TO APPEAR
2. Hauptmann, A. G. and Witbrock, M. J. 1997. Informedia: News-on-demand multimedia information acquisition and retrieval. In Intelligent Multimedia Information Retrieval, AAAI Press, Cambridge, MA.
3. Dowman, M., Tablan, V., Ursu, C., Cunningham, H., And Pobov, B. 2005. Semantically enhanced television news through web and video integration. In Proceedings of the Workshop on Multimedia and the Semantic Web at the European Semantic Web Conference.
4. Ardissono, L., Kobsa, A., and Maybury, M., (eds.) 2004. Personalized Digital Television: Targeting Programs to Individual Users. Springer Verlag, London.
5. Lindstedt, I., Löwgren, J., Reimer, B., and Topgaard, R. 2009. Nonlinear news production and consumption: A collaborative approach. ACM Comput. Entertain. 7, 3.
6. Olsen, D. R., Bunn, D., Boulter, T., and Walz, R. 2012. Interactive television news. ACM Trans. Multimedia Comput. Commun. Appl. 8, 2.
7. Pulse, <https://www.pulse.me/> [Accessed: 10 Sep 2013]
8. Flipboard, <https://flipboard.com/> [Accessed: 10 Sep 2013]
9. Hanson, G., Haridakis, P. 2008. YouTube Users Watching and Sharing the News: A Uses and Gratifications Approach. JEP, Journal of Electronic Publishing 11, 3.
[<http://www.journalofelectronicpublishing.org/>]
10. Lockhorn, J. 2011. Forget Mobile, Think Multiscreen in Razorfish Outlook, Report 10
[<http://razorfishoutlook.razorfish.com>]
11. Basapur, S., Harboe, G., Mandalia, H., Novak, A., Vuong, V., and Metcalf C. 2011. Field Trial of a Dual Device User Experience for iTV. In 9th European interactive TV conference (EuroITV), pp. 127-135. ACM.
12. Fleury, A., Pedersen, J. S., Baunstrup, M., & Larsen, L. B. 2012. Interactive TV: Interaction and Control in Second-screen TV Consumption. In Adjunct proceedings of the 10th European interactive TV conference (EuroITV), pp. 104-107. Fraunhofer Institute for Open Communication Systems, FOKUS.
13. Cesar, P., Bulterman, D.C.A., and Jansen, A.J. 2008. Usages of the Secondary Screen in an Interactive Television Environment: Control, Enrich, Share, and Transfer Television Content. Springer-Verlag Berlin Heidelberg.
14. Cesar, P., Bulterman, D.C.A., and Jansen, A.J. 2009. Leveraging the User Impact: An Architecture for Secondary Screens Usage in an Interactive Television Environment. Springer Multimedia Systems Journal 15, 3, pp127-142, Springer.
15. IntoNow, <http://www.intonow.com/ci>

16. Goodman E., Kuniavsky M., Moed A. 2012. Observing the User Experience, A Practitioner's Guide to User Research, Morgan Kaufmann (eds.)
17. PEW 2010 Media Consumption Survey; Princeton Survey Research Associates International for the Pew Research Center, Princeton, NJ.
18. Nielsen 2012. Nielsen State of the media: cross-platform report Q2 2012 [<http://www.nielsen.com/us/en/reports/2012/state-of-the-media--cross-platform-report-q2-2012.html>]
19. Maguire, M. 2001. Context of Use within usability activities, Int. J. Human-Computer Studies 55, pp 453-483
20. PEW 2013. Tablet Ownership Report. Princeton Survey Research Associates International for the Pew Research Center.
21. Leyssen, M., Hardman, L., van Ossenbruggen, J., Baltussen, L., Abreu, N. 2012. LinkedTV Deliverable 3.1: Specification of Functional Requirements Satisfying User Information Needs, CWI, Amsterdam, NL
22. Brooke, J. 1996. "SUS: a "quick and dirty" usability scale". In P. W. Jordan, B. Thomas, B. A. Weerdmeester, & A. L. McClelland. *Usability Evaluation in Industry*. London: Taylor and Francis.
23. Lund, A.M. .2001. *Measuring Usability with the USE Questionnaire*. STC Usability SIG Newsletter, 8:2
24. Lewis, J.R. & Sauro, J. 2009. *The factor structure of the system usability scale*. International conference (HCII 2009), San Diego CA, USA.

11 Appendix A: News Items presented in the focus group

NEWS SECTION	FILE NAME AND TOPIC	Track	Length
International News Summary	One-minute World News.FLV	1	00:01:00
International News	Floods wreak havoc in Mauritius.FLV	2	00:01:15
	Bird Flu in China		
Politics	N Korea in 'state of war' with South.FLV	3	00:01:26
Local News	'Psychedelic' tulip show in the Netherlands.FLV	4	00:02:33
Arts and Entertainment	Iran planning to sue over Argo.FLV	5	00:01:44
Science and Technology	Touchscreen 'that reacts even without touching' .l	6	00:01:08
Sport	Messi UEFA Best Player of the Year.mp4	7	00:01:30
Finance/business	Why do banks go bust?.FLV	8	00:01:10
Human interest story	Human parents for a baby gorilla .FLV	9	0:01:17
Weather	Europe weather forecast.FLV	10	00:01:20
		TOTAL	0:14:23

12 Appendix B: Focus group protocol

WORKSHOP/FOCUS GROUP APRIL 5 @CWI – BY LILIA PÉREZ AND KRISTINA ANDERSEN

- **Goal:** gathering input and inspiration for formulating a concept design (high-level functionalities for a second- screen companion intended to deliver additional information while watching the news broadcasts).
- **Total duration:** 45min
- **Location:** living room setting, Pampus room M366 at CWI
- **Reward for participants:** digital voucher for Pathé movies.
- **Date and time:** 5 of April from 13 to 17h.
- **Target user profiles of focus group participants:**
 - 12 users (4 groups of 3) or 16 users (4 groups of 4). At least 60% of them should be TV newscasts viewers. The other 40% can be on-line news readers even if they don't regularly watch the news.
- **Who:** two moderators, one acting as host (Kristina) and the other one as technical facilitator (Lilia)

INTRODUCTION / COLLECT PARTICIPANTS OUTSIDE ROOM (5 MIN PREVIOUS TO START)

(KRISTINA + LILIA)

- 1) A poster is placed outside the room to indicate that participants have reached the right location. It indicates that they should wait there for the others to arrive.
- 2) Participants wait outside the room or are collected at the entrance of CWI (external visitors).

START OF WORKSHOP

FILLING OF QUESTIONNAIRE AND CONSENT FORM (10 MINUTES)

- 3) Once all participants have been gathered outside the room, they are introduced in the living room (by both researchers) and given:
 - a) Consent form
 - b) Brief questionnaire
 - Documents obtained: filled questionnaires and consent forms

WELCOME AND INSTRUCTIONS (2 MINUTES)

KRISTINA

- 4) After collecting the questionnaire, participants are shortly briefed by the host. They are then given a pack comprised by pens, colored post-its, and a folder with the following documents:
 - a. Blank A4 sheets of paper with mock up frames of ipad, iphone and laptop, labeled according to the videos (annex C, D, E)

VIDEO + ADITIONAL INFORMATION EXERCISE (15 TO 20 MINUTES)

KRISTINA AS HOST + VIDEO DOCUMENTER / LILIA AS VIDEO JOCKEY AND TECHNICAL FACILITATOR

- 5) Participants are asked to take a seat on the sofa in front of the TV with the pens and the blank mock up frames ready. They then receive the following instructions: You will now watch 6 to 10 blocks of news (see annex F for a specification of the video news fragments). Each one lasts between 1 to 3 minutes.

- a. Please think about the additional information that you would like to have about each piece of news. Feel free to ask, it doesn't matter how difficult or how strange the request for additional information seems.
 - b. Choose the blank sheets with the mock up frame corresponding to the device that you think you would more likely use in real life to look for the answer to your questions.
 - c. Write down the question on the blank paper. For each video, use the paper labeled with the corresponding number.
 - d. After the video has finished playing, you will be given a couple of more minutes to finish writing the questions, so don't worry if you don't finish before the video does. You can also choose to first watch and then write.
 - e. Rate the video from 1 to 5 stars according to your preference (1 low 5 is high).
 - f. If you have things that you would like to be able to do with the video besides looking for information (for example, you would like to be able to bookmark the video) write down those ideas too.
- 6) After each video host approaches the participant with a camera and asks him/her to explain, in a mode similar to the think aloud method, what they wrote and why. Whenever a participant does not feel comfortable with her face being shown on video, only her hands will be recorded.
- Documents obtained: lists with set of questions (types of additional information desired) and an indication of second screen devices and sources used. Videos rated according to preference. Video + audio documentation of the whole process and video shots with people explaining their choices and needs aloud.

HOSTED BRAINSTORM: FUNCTIONALITIES (10 MINUTES)

KRISTINA AS HOST – VIDEO DOCUMENTER

- 7) Participants remain seated on the sofa. A flip board and markers are introduced into the living room space. Participants are given the following instructions:
- a) Reflect on the previous exercise and think about functionalities that you would like a second screen companion for the news broadcasts to have. The functionalities should not be constrained by what is possible in the present, by existing applications or by what you know about technology.
 - b) Make a brainstormed list of functionalities with your group.
 - c) Vote within the group for your favorite functionality.
- Documents obtained: rated lists of desired functionalities.

WILDCARD : TELEVISION OF THE FUTURE (5 MINUTES)

KRISTINA AS HOST

- 8) Participants are asked to speak to the camera and briefly explain how the news of the future look like for them, or how we will access the news in the future (Head shot, vox –pop, blue sky thinking).
- Documents obtained: video snapshots of futuristic views on the news.

13 Appendix C: Extended list of focus group findings

1. **Need for more in-depth specific information.**
(11 comments / 7 participants + 1 brainstorm list)
P6 About the bird flu - *I was wondering just how expensive it is to make all those vaccines, you know? I was just wondering if it is a good idea to even make a lot of it or how hard it is to make.*
2. **Would like an overview related events that occurred in the past.**
(5 comments / 3 participants + 1 brainstorm list)
P7 About North Korea's state of war - *my search would be something like "South Korea state of war ramp up" (...) I would like to know, what happened two years ago and how they solved it...*
3. **Search for different opinions.**
(3 comments / 3 participants + 1 brainstorm list)
P7 About North Korea's state of War - *I'd start with Wikipedia, probably, and then I always look at AP and Al Jazeera to get two different opinions...*
4. **Information about how this ends, updates when important changes occur**
(3 comments / 3 participants + 1 brainstorm list)
P8 About "Human parents for a baby gorilla" - *I would like to know if the story succeeded, if the gorilla was saved ...*
5. **Local effect of global news – What is the impact in my life?**
(4 comments / 2 participants + 2 comments in 1 brainstorm list)
P1 About the bird flu - *Yes then I would look it up, what is the effect in the Netherlands... (of the bird flu virus)*

Secondary information needs expressed by participants:

6. More information about people in the news - the ones provoking the events (2 comments / 2 participants)
7. Information about watching a film (2 comments / 2 participants)
8. How can I help? (1 comments / 1 participants + 1 comment in 1 brainstorm list)
9. Access-related publications, documentaries and news from that time. (1 comments / 1 participant + 1 comment in 1 brainstorm list)
10. Opinion from a specific expert-thinker (1 comments / 1 participant + 1 comment in 1 brainstorm list)
11. Access-related information selected by experts and suggested by broadcasters. (1 comments / 1 participant + 1 comment in 1 brainstorm list)
12. Information about who is behind the news (1 comments / 1 participant)
13. Where is that location? (1 comments / 1 participants)

Actions triggered by information needs

14. Google the information (12 comments / 6 participants)
15. Consult different sources (4 comments / 4 participants)
16. Look it up (no specified source) (3 comments / 3 participants)
17. Check the newspaper (printed) (2 comments / 2 participants)
18. Make a note for later sharing (2 comments / 2 participants)
19. Go to Wikipedia (2 comments / 2 participants)
20. Compare weather in two locations (2 comments / 2 participants)
21. Look up movie schedule (2 comments / 2 participants)

22. Wait to see the outcome (2 comments / 2 participants)

Sources currently used

23. Google (6 participants)
24. Wikipedia (3 participants)
25. BBC (2 participants)
26. US government (1 participant)
27. AP (1 participant)
28. Al Jazeera (1 participant)
29. Volkskrant (1 participant)
30. Buienradar (1 participant)

Functionalities mentioned during the brainstorm sessions

31. VCR capabilities, pause, replay, skip (5 comments / 2 participants + 3 brainstorm lists)
32. Bookmark for later viewing (2 comments/ 1 participant + 2 brainstorm lists)
33. Get an alert or update when something changes in that particular news (2 comments / 2 + 1 brainstorm list)
34. Buying tickets, reserving (1 comment/ 1 participant + 1 brainstorm list)
35. See longer versions of stories that I like / or make playlist of similar stories – to keep on watching (2 comments / 2 participants)
36. Share information like warnings (about bad weather) (1 brainstorm list)
37. Recommender system (1 brainstorm list)

Perceptions of technology

38. Perception of TV as a passive medium that will remain so (3 comments / 2 participants + 2 in 1 brainstorm)
<i>P9 - TV works very well because it sort of blocks you out. Second screens just distract from just watching the TV. So although it's news it's also sort of a relaxing moment if you don't have to do anything, don't have to think about it.</i>
39. News in the future will not be linked to a certain space and time (2 comments/2 participants)
<i>P1 - I think that it's more that when you want to look the news you can everywhere see the news and not at a specific time or place...</i>
40. TV is outdated (2 comments/2 participants)
<i>P6 - I think that television in itself is kind of outdated</i>

14 Appendix D: Qualitative interview findings

Attitudes toward media (TV and newspapers) based on habits

1. **It is possible to be more selective and control time better when you are reading. (P3, P4, P8)**

P4 - *When you read, you manage your time and read what interests you versus when you watch a video you have to watch all the video, and you cannot select video stuff. When you see a report [...] one look and you can know what you need, and then it is much faster to find information...*

2. **TV is sometimes perceived as a way to get a general overview of the news, and newspaper a medium that goes more in-depth. (P1, P6)**

P1 - *I think the main difference (between news on TV and online newspapers) is that when I read it I only read the articles that I am really interested in and I watch it on TV to get a general overview on what is happening in the world.*

3. **Some users consider that watching video news is a social act while newspaper reading is a solitary act (P2).**

P2 - *So having the video footage, that you have more in the television news, I think adds value there, and maybe also the fact that you can watch it together, adds value, so when you read the newspaper I think that you really read alone.*

4. **Newscasts lend themselves to a passive behavior and relaxation. (P8)**

P8 - *I guess this is one of the benefits of having just this 50 minutes newscast, that you can have a really passive behavior, right? You can just be in bed, listen to everything and you don't have to concentrate, just focus in what they are talking about. This is also nice.*

Desired functionalities regarding information

5. **Some users would like to have a link between TV and other sources (P1, P2, P6)**

P5 - *I think, I would expect that you would include like the main links to what they're talking about like if it was about Hugo Chávez, links to Wikipedia or some articles about him, the country, and stuff like that because I think that's the thing that I would look for myself.*

6. **Some users would like to be able to compare different opinions about a subject, different scenarios, and different sources. (P8, P7)**

P8 - *I think that the German news are still kind of OK, but still, I mean everybody is biased in their opinion, so no matter which news you read you always have some bias. It is good to have different and diverse opinions and first-hand information.*

7. **To access and compare the international view on local news. (P2)**

P2 - *Typically I will look up for some confirmation I think sometimes I'm interested for instance on national news, how international news would cover the same thing.*

8. **Access opinions of locals, regular people, preferably friends that are where the news take place (P8)**

P8 *When I think about this now, about this communication aspect, what really is interesting for me is to talk with people preferably friends who are in the situation. For example in Korea if there is this tension between north and south, I want to talk with someone from there, to see like the real opinion of people there, because it's very different if you have a news reporter talking about this and if you just have an ordinary people talking about it.*

Other desired functionalities (not related to information needs)

9. **Notifications and the app itself should be turned on and off on demand. (P3, P1, P5)**

P1 - *I think I would like to open it for myself and request information. I am a control freak.*

10. **Bookmark news and delay reading. (P1)**


P1 - *Maybe, ahh some sort of bookmark, so that just like a red button that I could hit in the moment that I think something is interesting and that I could get back to it later. And then maybe, in the meantime it could collect some information for me.*

11. P5 would like to follow a story through time, but would also like it to contain an indication about what he has already seen. (P6)
12. When watching with others through Skype, P6 would like to have video synchronization to be sure both persons are watching exactly the same. (P6)
13. Having a small lateral screen showing short information pieces about what appears in the text. For example the context.

Personalization


14. Users prefer pull and user controlled instead of push.
15. In general a user-controlled personalization that is easy configurable and doesn't personalize regarding political inclinations, only categories or topics and sources
16. Personalization, but easy to configure, general categories and known sources.
17. People don't want to miss important information because of personalization.

15 Appendix E: Personas

 <p>Nina (Mother of Lisa)</p>	<i>Occupation: teacher</i>
	<i>Age: 32</i>
	<i>Nationality / place of residence: German / Prenzlauer Berg</i>
	<i>Digital literacy: interested in new media and “hip” technology</i>

Nina is a typical inhabitant of Berlin’s hippest quarter, Prenzlauer Berg. She is a well-educated and well-informed young mother. She really likes discussing things. She especially likes to talk about politics and culture. Therefore, she likes to get deeper and not just superficial information. When a subject is interesting for her, she will take the time to understand it properly. She likes Berlin with its constant changes and she feels very much at home in her family-friendly neighborhood. She likes to visit exhibitions and also to go to the theatre and readings. Because she is very interested in culture, she would like to be informed about the city life, current events and new galleries. She does not like it at all when things are complicated and take a long time to understand. She can get impatient very quickly, so every application or service has to be smooth and easy. Nina is not interested in technological background information on how a system works, it should just work well and adapt to her life.

Time-independence is also very important for her, because of her little girl. She only has time to watch infotainment programs whenever her daughter is asleep.

 <p>Alonso (Maria’s husband)</p>	<i>Occupation: civil engineer</i>
	<i>Age: 42</i>
	<i>Nationality / place of residence: Spanish / Amsterdam, the Netherlands</i>
	<i>Digital literacy: loves gadgets, has some knowledge of programming</i>

Alonso is a civil engineer specialized in hydraulic systems. He lives in the Pijp quarter in Amsterdam. He has a postgraduate degree in engineering and an MBA. He works for an international company in the Netherlands. His job is well paid, and he likes it very much although he really misses Spain. Alonso lives with his wife, Maria, who is also Spanish and studied art history. Alonso is a workaholic and stays in the office until late. He uses a car as a means of transportation when going to work. In Spain, Alonso used to listen to the news on the car’s radio, but he can’t understand Dutch, so he can’t do that in his new place of residence. Instead, every night at nine, he watches the Spanish news in TVE. He likes that moment when he can relax and sit with Maria watching as they both have dinner.

Alonso is crazy about gadgets; he buys and tries them all. He also likes to read about tech news in blogs like End Gadget or Gizmodo. He doesn’t have time to read his blogs or twitter during his working hours, so he does so at home, mainly multitasking while he watches a TV series. Alonso is also interested in politics and likes political satire, he reads El Pais daily in the morning, while Maria is taking a shower. He secretly loves this time for himself.

Alonso and Maria have no kids. They like going to the movies together and like to travel a lot. They both are fond of building things so often they get involved in *bricolage* projects and decorate the house together.

16 Appendix F: Scenarios

The numbers within parenthesis indicate the requirement that each part of the scenario relates to. The user requirements are found in section 4.6 of the report.

Urban mom

Nina's baby has fallen asleep after feeding, so Nina switches on the TV to get informed. Browsing the television guide in her tablet EPG (electronic program guide), she sees that "rbb AKTUELL" evening edition is available and starts the program.

She sits comfortably on her favorite couch with her tablet on her lap. LinkedTV News knows what she has chosen and loads the enrichments for rbb AKTUELL (11). The first news is, again, about the failed construction of the Berlin Brandenburg airport. While she listens to what the anchor says, a picture of Willy Brandt shows up automatically in the LinkedTV News enrichment screen (8). He is the Nobel Prize winner after whom the airport will be named. There are a few things about him that she didn't know and finds out with one quick look at the short information on her tablet screen. He was a city mayor in the sixties, she wasn't aware, that was before her time, but now she knows. The next enrichment tells her about the new company taking over the construction (8); she gets a nice and quick overview of whom these people are and what they did before. Nina is amazed at how new this old news feels when she uses her second screen companion.

Watching a news spot about Berlin's Green Party leader, Volker Ratzmann, who withdrew from his office yesterday, Nina is kind of frustrated as she voted for him and feels her vote is now "used" by someone she might not have voted for. She would like to know what other politicians and people who voted for him think about Ratzmann's decision to resign. She uses LinkedTV News to pause the TV (15), because she doesn't want to lose any detail of this story that concerns her a lot and looks for such information in her LinkedTV News application sitting on her lap (13). She goes to the "opinion" section and checks what is available there (3). She chooses to read one article from a special contributor for Der Spiegel and watches a selection of video statements of politicians and voters. She finds all kinds of opinions that help her understand better what is happening.

Watching a news spot about a debate on the mandatory change of uniform for police officers, Nina wonders why the usual green uniform should be changed. Out of interest, she looks at the application and browses the in-depth section (1) where she quickly finds the answer. In the news over time overview (2) of the app she even finds out how German uniforms looked before being green and who the designer of the current uniforms was. Some of the uniforms are very classy. This makes her think of her friend Gama who is a fashion designer, so she decides to share the article with him. She clicks "share" in the LinkedTV News app and chooses to send him an email with the link (17).

Technology savvy couple

On Monday, Alonso comes back as always around 8:00PM in the evening. After greeting Maria, who has also just arrived, they start cooking dinner together. Soon it's time for the evening news. They set the table in front of the TV and sit in order to eat and watch. Next to them they place a tablet with the LinkedTV News application they use the smart cover so that the tablet stands on the table within sight while they eat (14,12,16). The app synchs automatically with the TV (11). Soon, his mood changes while he listens to the anchor speaking about how king Juan Carlos got injured while hunting elephants during an expensive trip to Botswana. The injury hadn't been serious, but the trip for Alonso was a serious matter. How can the king go on luxury vacations with his lover while the country is in recession? Alonso wants to know what people in Spain think about this, and if anyone is as

angry as he is, but he is busy eating now, so he bookmarks the news and continues watching (13).

The following news is interesting for Maria, it is about a movie that they both watch together: Argo. The makers of the movie are being sued by the Iranian government who claims that the film distorts the facts and the country's image. Maria asks Alonso to bookmark this news for her (13).

After dinner, Alonso starts his usual multitasking while the TV plays some comedy show. He does so by browsing the LinkedTV News application's twitter feed where he filters the tweets in relation to a location: Spain (9). Because he is already browsing his bookmarked news, he doesn't need to filter the subject. There he finds many that think like him. He also consults other media, and what they are saying about this news (4). He expects El Pais to agree with him, but El Mundo for sure will be trying to speak in favor of the king (5). He always compares those two newspapers of opposed tendencies that represent the two main political parties. He used to do this before by going to the online versions of the papers, but now it is much easier and faster. He configured EL Pais and El Mundo in his personal list of sources (20,21,22) with a couple of simple steps and now it is all already there in LinkedTV News. He has also included some international newspapers in his configuration, so he can even read about how the rest of the world sees this royal scandal.

Maria postpones reading about Argo until the next day after work (13), but activates alerts because she wants to know if anything changes while she's distracted with other things (18). When she is waiting for Alonso to come home, she gets a message alerting her of an update in this bookmarked news (6). Apparently Isabelle Coutant-Peyre, a lawyer of a very questionable reputation who also represented Venezuelan terrorist Ilich Ramirez Sanchez, will act as Iran's lawyer. "This is getting serious" she thinks, and sits to read as she waits. Maria wonders to what extent the movie was really lying. She browses the in-depth information in the application (1,2) and checks the timeline, and that allows her to decide for herself.

17 Appendix G: Requirements related to participants' comments

The following list shows the user requirements of *LinkedTV News* on the left column and on the right column it states which comment or report section originated the requirement. The letter A stands for Appendix, it is followed by the Appendix letter (e.g. Appendix C = AC) the number refers to the number of item in that appendix that corresponds to the relevant remark.

Requirements about information needs

Related user comment

1. Give in-depth information about the news on TV	AC1
2. Give an overview of past-related news	AC2
3. Illustrate a multiplicity of opinions about the news	AC3
4. Allow users to the consult news in diverse sources	AC15, AD46, AD47
5. Build a link between TV and user's habitual newspapers	AD45
6. Update users about important changes in news	AC4
7. Give contextual information about setting of the news	AC13/AD53
8. Give information about people and organizations mentioned in the news	AC6
9. Allow to access opinions of locals	AD47

General requirements

10. Programmed and designed for running in a tablet PC	Report Sections 3.1.3 and 3.2.4
11. Automatically synchronized to user's program choice	Report Sections 3.1.3 and 3.2.4
12. Allow for group or single television watching	Report Sections 3.1.3 and 3.2.4
13. Enable synchronous and asynchronous modes of interaction (bookmarking)	Report Sections 3.1.3 and 3.2.4
14. Allow some hands free mode of viewing or interacting	Report Sections 3.1.3 and 3.2.4
15. VCR capabilities pause, replay, skip	AC31
16. Portable	AC39
17. Share information through the application	AC36
18. Notifications turned on/off on demand	AD49

Requirements about personalization

19. User-controlled personalization	AD54
20. Easy configurable with a couple of clicks	AD55
21. Selection of preferred sources or influence the ranking of sources	AD55
22. Selection of preferred categories	AD55
23. Personalization does not override the importance of the news	AD57

18 Appendix H: List of the functionalities implemented in the hi-fi prototype

Functionalities implemented in the hi-fi prototype:

Lean-back mode

- VRC type controls for the main screen (TV or PC) through a second screen controller interface.
- Presentation of additional information in the form of thumbnails and slides synchronized to the main screen program.
- Browsing through the slides
- Bookmark news
- Slide timer (to update slides when there is no activity after selection)
- Pause slide presentation
- Save slides (partially implemented)
- Menu
- *Lean-forward mode*
- Browse bookmarked news
- Browse current program
- The browsing routes:
 - In other Media
 - Opinions
 - In-Depth
 - Timeline
 - Global to local (geo-located tweets)
 - Manually browse map and select tweets
 - Browse map through buttons
 - “Near me” and “near the news” buttons
 - Select a news heading
 - Select a browsing route
 - Go to original article
 - Swipe through articles
 - Airplay videos
 - Menu

At this stage functionalities were implemented only in the horizontal screen mode though it is contemplated to use also the vertical mode in the future.

19 Appendix I: Example of task types included in the task-based study

Exploratory tasks

The purpose of exploratory tasks was to allow participants to get acquainted with the system and to experience it freely without being directed. These tasks were combined with small subtasks intended to evaluate specific elements of the interface.

... Today you are in a relaxed mood so you decide to sit and watch the television program and postpone other activities.

- Watch the first three news items of the program without stopping or leaving the “slideshow” screen.
- Bookmark at least one news item that you consider interesting.
- Feel free to browse the slides, if you wish and to save the ones that you would like to explore later.
- When the three first news items are over, please press “pause” then return to this booklet and turn the page. The researcher will remind you when to do this.

Please press play to start the task

Simulated information needs tasks

The purpose of simulated information need tasks was to evaluate whether the browsing route’s purpose was clear and whether they match participants’ structure of thought when performing an information seeking related task. Another goal was also to find out whether participants could find their way through the interface in a given amount of time.

Find out the opinion of a local about the riots in Egypt:

You have heard a lot in the news about riots going on in Egypt. You know that there are two main groups of people in conflict: those that are in favor of the president, and those who are against. However, you mistrust the information presented by foreign media and would like to have some first hand information and testimonies from common people living in Cairo.

See if you can find such information with the help of the application.

Return to this booklet and turn the page when you have completed the task. You have 3 to 5 minutes to find information.

Free formulated question tasks

The purpose of free formulated question tasks was to approach as much as possible a real life (non-study) situation in which the participants would have an authentic, self-motivated, doubt about the news and the need to solve it, and to determine to which extent the application would be useful to solve such doubts in a given amount of time. A secondary intention of these tasks was to observe the sequence of actions that participants would take to search for an answer on the Internet in case that they couldn’t find it in the application.

From this list of the news that you have just watched, please mark the two that you find more interesting.

- Snowden applies for Russia asylum
- Egypt's Morsi vows to stay in office
- Fukushima leak causes Japan concern
- Rallies in US over Zimmerman verdict
- Royal baby prince named George

Which additional information would you like to have about these news items?

For each of the chosen news items, please write down a question or information need that you have:

Please turn the page when you finish the task.

(Next page) Please search the application for an answer to your first question.

20 Appendix J: SUS OF INDIVIDUAL PARTICIPANTS

	Question	P1	SUS	P2	SUS	P3	SUS	P4	SUS	P5	SUS	P6	SUS	P7	SUS	P8	SUS
1	I think that I would like to use this website frequently:	5	4	5	4	4	3	4	3	5	4	4	3	3	2	4	3
2	I found the website unnecessarily complex:	1	4	1	4	2	3	1	4	1	4	1	4	2	3	1	4
3	I thought the website was easy to use:	4	3	4	3	4	3	4	3	5	4	4	3	3	2	4	3
4	I think that I would need the support of a technical person to be able to use this website:	1	4	1	4	2	3	1	4	1	4	1	4	2	3	1	4
5	I found the various functions in this website were well integrated:	5	4	2	1	4	3	4	3	4	3	3	2	3	2	3	2
6	I thought there was too much inconsistency in this website:	1	4	4	1	2	3	1	4	1	4	2	3	1	4	1	4
7	I would imagine that most people would learn to use this website very quickly:	4	3	4	3	4	3	5	4	5	4	4	3	3	2	5	4
8	I found the website very cumbersome to use:	1	4	2	3	2	3	1	4	1	4	1	4	2	3	1	4
9	I felt very confident using the website:	4	3	4	3	4	3	5	4	4	3	4	3	3	2	4	3
10	I needed to learn a lot of things before I could get going with this website:	2	3	1	4	2	3	1	4	1	4	1	4	3	2	1	4
	Individual SUS Score		90		75		75		92.5		95		82.5		62.5		87.5

P = participant scores

SUS = sus value

21 Appendix K: USE usefulness scores

USEFULNESS		1	2	3	4	5	6	7	8	Average
1	It helps me to find information more efficiently.	6	6	6	7	6	7	6	6	6.3
2	It is useful.	7	6	6	6	7	7	5	6	6.3
3	It makes the things I want to accomplish easier to get done.	6	6	6	6	6	6	5	6	5.9
4	It saves me time when I use it.	7	7	4	6	6	6	6	6	6.0
5	It meets my needs.	5	5	4	5	6	6	4	5	5.0
6	It does everything I would expect it to do.	7	5	3	4	4	5	3	5	4.5

22 Appendix L: USE satisfaction scores

SATISFACTION										
7	I am satisfied with it.	7	5	5	6	6	6	5	6	5.8
8	I would recommend it to a friend.	7	6	5	7	7	7	6	6	6.4
9	It is fun to use.	6	6	6	7	7	5	6	5	6.0
10	It works the way I want it to work.	7	5	4	5	5	6	4	5	5.1
11	It is wonderful.	6	4	5	6	6	4	3	4	4.8
12	I feel I need to have it.	6	4	5	6	6	5	4	4	5.0
13	It is pleasant to use.	7	5	5	5	7	6	5	6	5.8