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M. Akesson

Halmstad University, maria.akesson@ide.hh.se

C. Ihlstrom

carina.ihlstrom@ide.hh.se

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DESIGNING AND EVALUATING THE CALM ELECTRONIC NEWSPAPER

Åkesson, Maria, Halmstad University, Box 823, 301 18 Halmstad, Sweden,
maria.akesson@ide.hh.se

Ihlström, Carina, Halmstad University, Box 823, 301 18 Halmstad, Sweden,
carina.ihlstrom@ide.hh.se

Abstract

This paper reports from an ongoing action research study concerning the design of the future e-newspaper, i.e. a newspaper on e-paper technology. The e-paper innovation is of great importance to the newspaper publishers since it has the potential of eventually replacing the printed newspaper due to its readability and high contrast. This study addresses the challenge of how to design calm user experience of the e-newspaper. The action research approach followed the canonical action research method, in collaboration with publisher, reader and advertiser clients. The activities include a range of data collection techniques such as project meetings, workshops, interviews and prototype testing. In the diagnosing phase we identified the core challenges for designing the e-newspaper which directed us to the literature of calm technology. Three design principles for calm user experience were formulated in the action planning phase, followed by designing three e-newspaper prototypes, which embeds the design principles, in the action taking phase. The prototypes were evaluated with 36 readers in the evaluating phase and the outcome of these evaluations was later assessed in collaboration with newspaper designers for specifying learning. The results indicate that the design principles support calm user experience.

Keywords: Calm experience, E-newspaper, Action research.

1 INTRODUCTION

Ubiquitous computing has recently attracted attention to the field of Information Systems (IS) (Lyytinen & Yoo, 2002a; Henfridsson & Lindgren, 2005; Sørensen & Yoo, 2005). The research on ubiquitous computing in IS has often been related to organizational and work related settings. However, it is of equal importance to understand ubiquitous information environments in every-day life, beyond work settings (Ehn & Malmberg, 1998; Sørensen & Yoo, 2005). Mobile services and ubiquitous information environment are part of our private as well as working lives. In work related use, technology is regarded as a tool to solve a task, but in our every day activities this might be added with technology in use for pleasure, relaxation etc. The technology will then have changed from being tools, to being a part of the designed environment we live in. With this development at hand, it is desired that technology does not require unnecessary efforts or creates stress. It needs to be calm, i.e. ubiquitous to the user. This was the vision rose as the most challenging to address by Weiser and Brown (1997) - the notion of calm technology. Weiser and Brown (1997) argue that this might be the most profound change and thereby a great challenge to ubiquitous computing research, as information technology often is the enemy of calm. However, the notion of calm user experience has not been clearly addressed in IS literature.

The vision of calm technology withholds that technology better stay out of people's way, so that they are in control (Weiser & Brown, 1997). Calm technology is taken for granted and is embedded in our every day lives in such a way that that it can move back and forth between our periphery and centre of attention. This is what characterizes embedded artifacts with ingrained patterns and behaviors in every-day use. One of the most embedded artifacts in people's every-day life is the daily newspaper. Newspapers have a long tradition and have been tuned in form and function for centuries, to become the user friendly and universally accepted product as it is today (Gurtler, 1984). This commonly taken for granted product involves unnoticeable technology. As Weiser and Brown (1997, p.77) state "... *some technology does lead to true calm and comfort. There is no less technology involved in a comfortable pair of shoes, in a fine writing pen, or in the delivery in The New York Times on a Sunday morning than in a home PC.*"

Technological innovations have of course changed the way newspapers are produced and designed; the scene behind today's printed newspaper is all digital. New newspaper genres have evolved by the introduction of new technology, e.g. the online newspaper genre. The online newspaper is regarded a complementary product to the printed edition, as these fulfill different user needs (Ihlström & Lundberg, 2004). Fidler (1997, p.236) stated that digital news media "...*must be comfortable and convenient to read while lying in bed, riding on a subway, dining in a restaurant, or sitting on a park bench. They will also need to integrate some of the more compelling elements of cybermedia, such as interactivity, hypertext, and audio/video clips, without sacrificing the readability and ease of using paper*". This illustrates a vision of a calm user experience, not applicable to online media. The web is far from living up to the ideas of ubiquitous computing because it is too technology-oriented (Bylund, 2005).

A requirement for a truly ubiquitous user experience is high-quality displays, which effortlessly lets us interact with the underlying information (Want *et al.*, 2002). Now, yet another technological innovation is on the doorstep for newspaper publishing, i.e. the e-paper. The e-paper is reflecting, giving the same reader experience as paper (such as high contrast and the possibility to read in sunlight) and is thin, flexible and non-sensitive, and as Want *et al.* (2002) point out, e-paper is one of the most exiting advances for ubiquitous interfaces. The e-newspaper (a newspaper published on e-paper) holds the potential to combine the readability from the printed newspaper with the possibilities of digital media such as constant updates, interactivity and video, and is predicted to replace the printed edition in the long run. Given this, the e-newspaper has the potential to meet Fidler's vision. This brings about the challenge of designing the e-newspaper to be as embedded, aesthetic, user-

friendly and taken for granted as the printed newspaper – that is as *calm* – adapted to the possibilities and limitations of digital media.

In this paper, we report from an action research study, engaging researchers, newspaper publishers, advertisers and newspaper readers, in designing the calm e-newspaper. Contributing to the arena of research into ubiquitous information environments, we present a set of principles for designing calm user experience of digital news media. The remainder of this paper is structured as follows, in the next section we are discussing the design of calm user experience followed by our action research method in section 3. The challenges of designing the calm e-newspaper are presented in section 4. The results are discussed in section 5 and section 6 concludes the paper.

2 DESIGNING CALM USER EXPERIENCE

When Weiser coined the term ubiquitous computing in 1991, he also started a discussion of how this new technology era would fit in our every-day lives. This way of thinking of technology is embodied in many of our daily technology uses. One of Weiser's most cited examples is the parallel to writing as another information technology (Weiser, 1991). This is ubiquitous in the sense that without consciously thinking of the underlying technology, we use writing to communicate in many ways. Newspapers, books, letters and signs are all used universally, and in all these cases we focus on what the text means – not on the technology by which the meaning is communicated. In ubiquitous computing, computers will be equally embedded in our natural movements and interactions with our environments, both physically and socially (Lyytinen & Yoo, 2002b)

The goal with calm technology can be described as making hardware less important than the services that it mediates (Bylund, 2005). In some cases, this has been articulated as technology disappeared in the sense that it is not noticeable (Henfridsson & Lindgren, 2005). But “technology out of the way” can also refer to that it is out of centre for attention, i.e. moved to the periphery of the user's experience. If we notice the hardware, it distracts us from our actual task. Therefore, transparency is required for hardware to disappear - if we do not notice it, it is not there (Want *et al.*, 2002). Such a disappearance is a fundamental consequence of human psychology and not of technology (Weiser, 1991). The goal is to minimize user distraction (Satyanarayanan, 2001), users interact at an almost subconscious level if their expectations are met without distraction of unpleasant surprises (Weiser & Brown, 1997). To avoid unpleasant surprises, some level of anticipation may be essential for users to stay in control (Want *et al.*, 2002).

User control is about technology not being in the way of the intentions and purposes of what users want to accomplish with use, and spans a number of issues; control over what services to use, of how to interact, of privacy, and actions taken by the system (Bylund, 2005). One way of giving users control is to make use of natural actions and use patterns. If user interfaces are designed as natural as possible, they support user control by their learnability, general ease of use, and in that they support use without changing the structure of tasks (Aboyd & Mynatt, 2000). As learnability and ease of use are important aspects of calm technology in that no unnecessary effort should be required (Weiser & Brown, 1997), the separation of content and media also means that our models for understanding how users adapt and learn new services have to be reconsidered (Lyytinen & Yoo, 2002a). When we as humans learn new things, we make use of previous experiences and knowledge to create meaning. Thereby, making use of how we interact with the physical world (Aboyd & Mynatt, 2000) as well as the characteristics of digital genres (Ihlström & Åkesson, 2004) in designs can increase learnability.

Designing calm user experience challenges us to focus on content - not the IT artifact. Many of the interaction models interwoven in user interfaces have features not being part of the content, such as icons, buttons, and drop down menus that require pointers, keyboards, pens, or touch – often designed to suit a specific class of applications (Want *et al.*, 2002). Given that many of these user interfaces are too complex to be transparent, they require user's attention and effort, and thereby disturb the experience of the content. Therefore, developing new, and more natural, input capabilities is the next

step towards ubiquitous interfaces (Aboyd & Mynatt, 2000). This requires alternate ways of addressing design. Weiser and Brown (1997, p.79) express this shift of focus as follows, "... *too much design focuses on the object itself and its surface features without regard for context.*" The content and media should be separated as much as possible when designing services, as design can not be based on assumptions on the media by which the content is delivered (Lyytinen & Yoo, 2002a). This separation will also have implications on how to design user interaction, it is desired to allow users to interact naturally with the information rather than with the technology as such (Saha & Mukherjee, 2003).

It is appropriate to emphasize that not all user experience are neither intended to, nor expected to be calm. One obvious example is computer games that are designed to attract user's attention and effort. One goal when designing game interaction can be to enhance the gaming experiences and allowed the players to immerse into a virtual game world (Magerkurth *et al.*, 2004).

On the basis of this literature, we have defined designing calm user experience to be focused on users interacting in a controlled, transparent, natural and intuitive manner with content, with minimized disturbance and distraction from system actions. In designing the e-newspaper, we are testing these criteria for calm user experience for digital news media, taking an action research approach as recommended by Henfridsson and Lindgren (2005).

3 RESEARCH METHOD

3.1 Research approach

The study reported in this paper is part of a project called DigiNews. The overall goal of this project is to explore research and development issues for a future electronic newspaper. The project aims at combining the accessibility, simplicity and mobility of printed newspapers, with the advantages of digital media, communication technologies and portable consumer electronics. The DigiNews project (ITEA 03015) consists of partners from Belgium, Spain, Netherlands, France and Sweden. The project was initiated by Philips Applied Technology in Belgium together with the Swedish Newspaper Publishers' Association, and started in February 2004 and will be finished at mid-year 2006. European partners beside Philips are Concentra Media, De Telegraaf, Le Monde, dZine, K.U. Leuven, Ibermatica and Robotiker. The Swedish partners are Aftonbladet, Göteborgs-Posten, Nerikes Allehanda, Norrköpings Tidningar, Sundsvalls Tidning, Sydsvenskan, Östgöta Correspondenten, the Swedish Newspaper Publishers' Association, the Royal Institute of Technology and Halmstad University (the Media IT research group).

Media IT's part of the project mainly concerns the design of and business models for the e-newspaper. We have chosen to handle our two research areas (i.e. design and business models) as two different sub-projects. The sub-project reported in this paper concerns the design area and addresses how to design the e-newspaper with the calm philosophy (Weiser & Brown, 1997) in mind, and has been conducted with an action research approach. There are three main clients in our research approach, i.e. publishers, advertisers and readers. In this sub-project, ranging from May 2005 to November 2005, we focus on reader experiences while designing the calm e-newspaper in close collaboration with the Swedish publishers (e.g. managers, designers, editors-in chiefs, CTO etc), but the study also includes sessions with advertisers and European DigiNews partners.

Our action research in this sub-project followed the canonical action research method (Davison *et al.*, 2004; Susman and Evered 1978) and thus corresponded to the five traditional phases: diagnosing, action planning, action taking, evaluating, and specifying learning. The *diagnosing phase* included project meetings, workshops and interview sessions with publishers (Ihlström, 2005; Åkesson & Ihlström, 2006), workshops with readers (Ihlström *et al.*, 2005a; Ihlström *et al.*, 2005b) and

advertisers. The initial workshops intended to identify core challenges for designing the e-newspaper. From these initial results we found that it is essential to design an e-newspaper that is as easy to use, easy to read and is perceived as familiar as the printed newspaper, which constitutes the challenge for the newspapers. This directed us to the literature of calm technology. The workshops and interviews were documented and were all audio taped (some of it was also video taped). The diagnosing phase was followed by an *action planning phase* to specify actions and a working hypothesis that would allow us to test how using the calm philosophy would affect the design of the e-newspaper. In collaboration with newspaper designers we developed three design principles that address the identified problems and operationalized this philosophy into a design direction. In the *action taking phase* we developed e-newspaper prototypes of Aftonbladet, Göteborgs-Posten and Sundsvalls Tidning, together with newspaper designers, which embedded our design principles. In this way we could use the prototypes to test our design principles. In the *evaluating phase* we tested the prototypes with 36 readers, 12 each at the locations of Göteborgs-Posten and Sundsvalls Tidning since they are regional newspapers and 12 at Halmstad University since readers of Aftonbladet are spread all over the country. The data collected and analyzed were later assessed jointly by researchers and publishers in a design workshop for *specifying learning* with regard to both research and practice.

3.2 Data collection

As with a typical action research project, our data collection involved multiple data sources (see Germonprez and Mathiassen 2004) including project and workshop sessions, prototype testing, and qualitative interviews. So far, 6 project meetings, 7 future workshops with publishers, 3 future workshops with advertisers, 4 future workshops with readers, 13 interviews with publishers, 8 design workshops with newspaper designers (i.e. the newspaper designer focus group), and 36 evaluations of the prototypes with readers have been conducted. The *project meetings* took place in Belgium (2 times), Sweden (2 times) and in Spain (2 times). The meetings had a strict agenda but allowed for discussions regarding the design of the e-newspaper as it is one of the most essential ingredients in the project. The *future workshop* (Jungk & Müllert, 1996) approach was designed to be carried out during a three hours session, including three different phases; a visioning phase, a scenario building phase and a mock-up phase. Each of the semi-structured interviews with publishers was about 90 minutes in length whereas the interviews with readers lasted about 45 minutes. The semi-structured interview guides (different depending on stakeholder) used at all sites facilitated the consistency of data collected between sites and interviewees. While allowing individual perspectives and experiences to emerge, the interview guide provided a systematic way of delimiting issues discussed in the interview (Patton, 2002). The e-newspaper prototypes were *evaluated* with readers from each newspaper, during the fall of 2005. The evaluation included 36 individuals for a 2 hours session. The selection of respondents was made in order to have diversity of gender and age. The readers were given a brief introduction to the DigiNews project and were introduced to e-paper technology. The evaluations included a test session followed by an in-depth 45 minutes interview.

4 DESIGNING THE E-NEWSPAPER

4.1 Diagnosing

We started our action research by investigating the possibilities and limitations of the e-newspaper. In one of the sessions with the newspaper designer focus group, we outlined advantages and shortcomings of the currently used publishing channels, which were later elaborated in several workshops. This gave us a clear idea of the main advantages of the e-paper as a publishing media. The readability of the display, mobility, actuality and interactivity form a bundle of advantages. Given this, the e-newspaper will be read anytime, anywhere, anyhow by anyone, which in turn creates design challenges. The overlying challenge is how to design the newspaper to be very simple and familiar, so

that anyone can read it without having previous experience of digital media or having to learn a new interaction model.

The internet is leaned forward, this should be leaned back. This must be a very, very simple and cheap product. [Group discussion with advertisers and TU]

The keys issues for a successful e-newspaper are that it is mobile, easy to use, that it is likeable and fits with your habits, and that it is sociable and interactive in the sense of being the talk of the day that you can take part in. [Concentra Media]

The newspaper publishers, especially the designers, recognized the problems related to navigation and orientation by providing structure and overview in this flat and small media which initially is likely to be in between an A5 size, up to A4. Questions raised were: How can the e-newspaper be designed to be as easy to navigate as the printed newspaper, give the same sense for the amount and type of content and the same controlled and relaxed reading experience? How can we create the reader experience of going through page by page – knowing where it starts and ends, and the position in the newspaper? How can the e-newspaper be designed, to make use of the possibilities with hyperlinking and direct navigation without making users loose control or get lost?

You should be able to go directly to one section, for example the sports section, if you don't want to go through the whole newspaper page by page. [Design focus group session]

The web is more like searching your way through content, it is often messy. That we can not have. Think about clarity and orientation. [Editor]

The issue of how to interact with the newspaper also gives the question of how to make use of the display surface without using too much space for non newspaper content, such as buttons, icons or menus. Further, it is challenging how to handle multimedia content in a newspaper that is intended to be relaxed, e.g. to incorporate advertisements in a restrained manner, still taking advantage of the depth of the media. The tolerance level is difficult to predict. It is also of importance that other multimedia content, such as video clips, do not disturb the reader.

I would like to see video, but then in photographs where you can choose to see it if you like to. You should also be able to listen for example to music from an artist that is reviewed, but again in conjunction with the article and a picture. The design should be close to the printed paper with hints indicating video or sound, maybe with icons in pictures. [Chief designer]

A whole post order catalogue can be linked to and ad to make use of the capabilities of the media. [Design Focus group session]

Another issue is news updates. Should the publishers provide constant updates or several editions a day? Several editions and constant updates can create stressful reading experience and therefore has to be designed with care. Equally, it is important to communicate news and updates with the newspaper identity. A newspaper is not only news, it is also a brand signaling the credibility and style that their readers associate the newspaper with. It is of importance for the newspaper publishers to take this aspect into account in the design.

Constant updates – I don't think so. You should be able to turn page by page and think – I want to read this tonight – and then page 7 should still be there. [Workshop]

Learned lesson from mobile projects is that branding is very important. We must give more than raw news-feeds. [Le Monde]

From the activities with newspaper publishers, challenges as well as new possibilities unfold. Given this data, the researchers concluded that the problem of how to design calm user experience with digital news media has to be addressed. On the basis of the diagnosing phase, we have identified three problem areas related to a) genre awareness, b) stress and lack of control, and c) obstruction.

4.2 Action planning

In the action planning phase we set out to develop a design framework on the basis of the working hypothesis. In iterated design work, in collaboration with the newspaper designer focus group, we have articulated design principles to test the working hypothesis. These principles are all from a user experience point of view, since we believe this relation is the core of calm design philosophy. The design principles we have formulated for a calm user experience of digital media are:

(1) The principle of *providing media recognition support*: The e-newspaper should be easy to learn and be very familiar to newspaper readers. This means that the patterns of interaction, layout, structure, order and aesthetics characteristic for news media, feasible for the e-newspaper, should be used. This principle addresses the problem of genre awareness expressed in the diagnosing phase.

(2) *The principle of supporting user command*: The e-newspaper reading should be stress-free and relaxed. This means that interaction with the content should be user controlled, and not forced on the reader by actions taken by the system (e.g. by blinking or entering ads). The stress and lack of control problem identified in the diagnosing phase are addressed in this principle.

(3) *The principle of supporting focus on content*: The e-newspaper should provide a reading experience as opposed to computer use experience. This means that the e-newspaper content should be directly accessible without unnecessary hindrance by system or interface components. This addresses the problem of obstruction identified in the diagnosing phase.

These design principles have served as guidance for the researchers together with the newspaper designers when designing e-newspaper prototypes. The purpose of embedding these principles into the design is to provide a calm reading experience.

4.3 Action taking

The e-newspapers were designed in an iterative process between researchers and the newspaper designer focus group, and the design principles were built into the design of prototypes. The newspaper designers provided the news content, layout and structure and the researchers provided the coding to implement interactive elements and touch sensitive spaces. The three different e-newspapers were designed in different formats ranging from A5 to A4, and with some differences in structure and interaction techniques, still within the range of the design principles. In the following we give a short description of some design decisions and design examples.

We designed the interaction to be user controlled. Unless there is user action – nothing will happen. If a user is reading an article, there is nothing that will disturb the reading, e.g. a changing image, a flying banner, or a news update. All video clips, sound files, multi-slide presentations, advertiser catalogues and such are only presented on user action, and users can stop at any time, returning to the page they were reading before, only one entrance and exit. The base for the interaction model is the page by page reading from printed newspapers, we have therefore integrated paging, but have also built in hyperlinks to support direct navigation, such as on the web. When we designed the interaction, we made some initial decisions. For example, no scrolling or dropdown menus were to be implemented, everything on a page should be visible to the reader. We also decided to use clearly marked buttons and icons in the GUI to indicate user action. All these decisions were made with the goal of making the e-newspaper as intuitive and simple as possible, i.e. *calm*.

The principle of providing media recognition support is exemplified in figure 1, which shows the front page of Göteborgs-Posten. One could easily recognize the resemblance to the printed edition with entrances to the different sections through headlines and ingresses, which in turn leads to genre awareness. It is also illustrated in figure 4 with the index page of local news of Sundsvalls Tidning. Here all content of this section is shown, all clickable, i.e. directly linked to the corresponding page as in the online newspaper. All sections are available on one click.

In figure 2, *the principle of supporting user command* is exemplified by a sports page of Aftonbladet (which is pink as in the printed edition). The intent is for the user to be in control, e.g. choose to click on the icon in the picture to start a video clip. The “Sport” heading at the top and the page number to the top left indicates the current position in the e-newspaper. User command support is also illustrated in figure 5, which shows a product catalogue that the readers can assess by clicking on the ad in the bottom on the front page (figure 1). Note that the reader can shut this catalogue down at any time by clicking on “Stäng”, and will then return to the page where the catalogue was entered.

The principle of supporting focus on content is illustrated in figure 3, which is the index for the sports section of Aftonbladet. The reader chooses one of the pages by touching them and come directly to that page. The buttons can be used to go back and forth (indicated by the arrows) as well as to show the index of all content (Innehåll). In figure 6, the content focus is exemplified by the navigation tool “the thumb” (the gray box to the right). This emerges wherever one puts one’s thumb on the screen, and allows navigating back, forward and directly to the index page. The reader can also choose not to use the thumb by clicking on “hide”.



Figure 1. Recognition



Figure 2. User command



Figure 3. Focus on content



Figure 4. Recognition



Figure 5. User command



Figure 6. Focus on content

4.4 Evaluating

The evaluation phase was designed to evaluate the e-newspaper prototypes as well as the incorporated design principles. In the following we describe results from the evaluation in accordance with these principles. **The first design principle, supporting user recognition**, appears to have had a positive impact on the users reading experience. Our intention with the design of the prototypes was a very familiar and well-known feeling about the interaction; thereby supporting the type of reading behavior as in printed newspapers as well as in online newspapers.

The first thing I thought when I saw how small it is, was that I'm not going to like this. At first it was a bit unaccustomed with the smaller format but after just a little while it felt pretty familiar. I got used to it surprisingly fast. I really didn't think I would like a newspaper like this, but it is not at all bad.

This really feels like a printed newspaper, not that there is a lot missing like on the web. You actually get even more, video and sound and a whole catalogue. Here you get the best from both, the smoothness and the readability.

In general, readers thought that the overview is better than in the online newspaper, but in relation to the printed newspaper the feelings were mixed. Readers had no problems navigating the newspaper, the paging, index and menus proved to be good support.

It feels like the printed newspaper when you turn page by page and go through the newspaper. You get a good overview from the index pages and you know what you have and have not read....This is even easier than the printed newspaper.

It is good that you can turn page by page as well as taking the fast way, that you control it your self.

Nevertheless, not only intended reactions to the reading experience regarding recognition were observed. One unanticipated reaction was the frustration that there was not enough linking. In trying to follow the second principle, user command, we decided not to link everything and thereby risking a very web style interaction pattern. It turned out that readers, especially those with experiences from online newspapers, were annoyed when for example headlines in an index were not linked. Further, we expected the sections to be a very familiar structure, but it proved that for some readers it was not so.

I miss links to the news in the index, I want more links and maximum two clicks to get where I want.

I don't think in sections, it is something I have to learn.

Another important aspect of recognition is the brand, communicating the credibility and trustworthiness of the newspaper. Readers had no trouble recognizing the brands and did associate the e-newspaper to the printed newspaper rather than the online newspaper. As expected, there are very strong feelings related to the printed newspaper.

This feels very trustworthy, same style and layout as the printed newspaper, same brand. The trustworthiness is really in the brand. And the calmness, you have succeeded to bring that. I miss the two page spread that is part of the newspaper feeling.

I love my newspaper, I do not want to exchange it! But when I travel it might be good, and then I can have my newspaper every day anyway.

The second principle, supporting user command, seems to have had a great importance for users experiencing calmness. Readers really stressed how important controlling the reading is and that disturbing objects or sounds have a negative impact on the reading experience. The model of user controlled multimedia also proved to be much appreciated.

Here, you can turn page by page. I always have the feeling that I have missed something on the web, feels bad. Here you know when you have read everything. And you get surprised, you don't get surprised when you have to search for the information.

I think it is very good with video, the football goal for example. If you don't want to see it you can choose not to, and read on. That feels good, you are not forced upon it but it is there for you if you want it, video and such.

Readers made many comments about the web newspapers model for advertising being disturbing, and the model closer to the printed newspaper, as we decided to implement, was more in line with reader's preferences. There was a consensus among readers that updated news is a very important feature of the e-newspaper. Nevertheless, there is a tension between updates and stress.

This feels more like ads in a newspaper, that's good. On the web it's not ads, its commercials – like on TV and that's stressful, you get interrupted.

I would feel stressed if the newspaper was updated several times a day. In that case you would never be finished reading the newspaper.

The third principle, supporting focus on content, was to some extent difficult to evaluate. If it is intuitive and not noticeable, readers do not comment on it. We did, however, get some comments that indicate that we managed to design the interaction in such a way that readers were able to concentrate on the content as separated from the device.

You really don't think about the thing, I mean the screen – how it works.

It was a relief not having to think about the computer, to get rid of the computer feeling.

The touch model for interaction played out to be very natural for readers. All readers understood instinctively how to turn pages. Some of the interactions support that was designed with the principle of intuitive interaction in mind, turned out to be disturbing for some readers. The thumb for example, was perceived as very helpful by some readers and disturbing by others. The e-newspaper seems to have been appreciated as a transparent media.

It was a faster to find your way around than in the printed newspaper and better overview than the web newspaper...It feels natural to use touch.

This touch makes you forget that you are using a computer, no mouse or keyboard and so on, there is nothing in the way of reading the newspaper.

4.5 Specifying learning

The principle of providing media recognition support recommends making use of for example interaction, layout, structure, order and aesthetics that users are accustomed to. This principle was developed to address the challenge of genre awareness, i.e. meeting reader expectations, support use patterns and sociability as well as sustain the credibility from today's newspaper products. This principle relates to the criteria of facilitating use and learning, as described in the literature (Abowd & Mynatt, 2000; Ihlström & Åkesson, 2004). The evaluation showed that the implementation of this principle supported readers in appreciating e-newspaper to have the look and feel of a printed newspaper, to be as easy, pleasurable, comfortable and credible as the printed newspaper. However, it was also noted in the evaluation that readers expectations on for example order, structure and linking vary more than expected, due to variations in reading habits and use patterns. In the prototypes, with support for e.g. turning page by page, direct navigation to sections, using the thumb or not, still some users felt that they had expected more alternatives. This implies that providing recognition support is important for a calm user experience.

The principle of supporting user command specifies that interaction should be user controlled and not forced by system actions. The intention with this principle was to provide a relaxed and comfortable use experience with a newspaper including updates, multimedia and advertising. The criteria of control (Bylund, 2005) and minimized disturbance (Satyanarayanan, 2001), are related to this principle. As the evaluation illustrates, this principle had a strong impact on reader's acceptance of the e-newspaper as comparable with the reading of a printed newspaper. Many readers expressed strong aversion to the online model of multimedia and advertising, making them feel interrupted and out of control. The restrained implementations of multimedia were appreciated as these features were regarded as attractive if they are not disturbing. Nonetheless, the evaluation also highlighted that the preferences for how to provide updates and the individual stress tolerance level differs. This indicates that providing different models for updates can be of importance for calm interaction.

The principle of supporting focus on content stipulates that the user interaction should be natural and as close to the content as possible so that users do not have to reflect on how to interact. The intention with this principle was to make possible for the e-newspaper to be as taken for granted and instinctive to use as the printed newspaper. The criteria of natural interaction (Abowd & Myant, 2000; Saha & Mukherjees, 2003) and transparency (Want *et al.*, 2002) relate to this principle. The evaluation shows that the interaction was very intuitive and transparent, e.g. readers claim they were not occupied with thinking about how to read or turn pages. Neither were they occupied with thinking about how the device worked. Touch played out to be very natural, even though a few felt the thumb as a support for

touch interaction was in the way. This implies that individual differences require alternative ways of interacting, and options to drop elements perceived as disturbing.

Design principle	Problem addressed	Design outcome	Lesson learned	Design implication
Provide media recognition support	Genre awareness	Well-known feeling and familiarity	Differences in media use patterns complicate recognition support	Providing alternative recognition support, based on differentiated media patterns
Support user command	Stress and lack of control	Smooth and uninterrupted reading experience	Individuals different stress-levels complicate supporting user command	Providing alternative models for updates
Support focus on content	Obstruction	Natural and transparent interaction	Individual differences in what was perceived as disturbing	Offering the option to drop obstructive features

Table 1. Evaluation outcome and design implications

5 DISCUSSION AND CONCLUSION

In this paper, we have addressed the challenge of designing calm user experience with digital news media, in an action research study regarding the design of the e-newspaper. This design is very interesting for research, as the daily newspaper is a common artifact interwoven in people's every-day lives. Together with a newspaper designer focus group we have formulated three design principles. This research effort indicates that these design principles are contributing to designing calm user experience of digital news media.

Our research empirically demonstrate that an every day artifact, as interwoven into the fabric of our every day lives can be transformed to a digital and ubiquitous information environment, still being perceived as calm. Contributing to the early stage of the ubiquitous computing research arena, we argue that our design principles contribute to designing calm user experience of digital news media. However, our research shows that individual differences in use patters, expectation and preferences, influence the experience of calm interaction. Designing for anyone, anywhere, anyhow, anytime is indeed a challenging venture, as little assumptions can be made on the basis of media, contexts or users. The user experience presumably gains from the design and interaction being adaptable to a number of uncertainties. This is a demanding research challenge in ubiquitous computing.

The limitations of this study are that we were not able to conduct the evaluations of the prototypes in real-life settings and not on real e-paper technology. In this evaluation we conducted the tests at the newspaper locations or at the university on tablet PCs with touch capabilities. Consequently, it remains to be investigated if there are implications for the design principles based on the qualities of e-paper and reading in real-life situations. In our future work, when the e-paper devices are available, we intend to conduct such evaluations, contributing to the organizations continuous learning.

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