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Digital newspaper as E-Paper

A hybrid medium between print and online newspaper

A comparative study on the utilisation of the three forms of publication of the daily newspaper



Ifra Special Report 6.32

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With the collaboration of Chris Barth

Imprint

Ifra Special Reports, research reports, technical study reports and documents for the standardisation of newspaper production techniques. Published by: Ifra, Washingtonplatz, 64287 Darmstadt, Germany; www.ifra.com; Tel. +49.6151. 733-6; Fax +49.6151.733-800. Chief Executive Officer: Reiner Mittelbach. Research Director and Deputy CEO: Manfred Werfel. Research Manager: Harald Löffler. Republishing – also of excerpts – only with express permission of Ifra and acknowledgement of origin. Price: Ifra Special Reports are sold at the price of 130 EUR* per copy. For Ifra members, the price is covered by the membership fee that entitles them to an allotted number of copies. Ifra members may order additional copies at 13 EUR* per copy.

* plus 7 % in Germany and for companies and persons in the European Union that do not have a VAT number.

Table of contents

Preface	05
1 Introduction: Newspapers undergoing change	06
1.1 From the printed newspaper to the digital edition	06
1.2 The newspaper in the eyes of the users	08
1.3 Research into online reception and E-Paper	09
2 E-Paper: New technologies for new reader markets?	12
2.1 Definition of terms	12
2.2 The newspaper market at the beginning of the new century	12
2.3 E-Paper technologies and their utilisation potentials	13
2.3.1 E-Paper: the hardware	13
2.3.2 E-Paper: the software	13
3 An empirical view of E-Paper: test design and methods	18
3.1 The organisation of the study	18
3.2 The qualitative reception study	18
3.3 The online survey	20
3.4 The logfile analysis	21
3.5 Summary	21
4 How E-Paper is used: a comparison with the newspaper and online utilisation	22
4.1 E-Paper utilisation during the course of the day	22
4.2 Utilisation patterns and topic preferences	23
5 The newspaper interface of E-Paper: Comparative findings on recording and utilisation	25
5.1 E-Paper: a hybrid form of online newspaper and printed newspaper	25
5.1.1 Readability, orientation offers and selection aids: the judgements of the users	28
5.1.2 Limits of transfer: design differences between print and E-Paper	29
5.1.3 The limited hypertext capacity of E-Paper	31
5.2. Attention of readers using E-Paper	32
5.2.1 Where the user clicks on the newspaper page: perception and selection patterns	32
5.2.2 What the user clicks: perception of image and text elements	36
6 Navigating and searching in the E-Paper offering	38
6.1 Scrolling – opening – clicking: navigating in the newspaper, online service and E-Paper	38
6.2 Types of media and their specific reception possibilities	38
6.3 Free navigation in the newspaper, online newspaper and E-Paper: comparative findings	40
6.4 Topic research	41
6.5 Article search	42
6.6 Ad search	43
6.6.1 Ad search via the newspaper interface of the E-Paper version	43
6.6.2 A direct comparison of ad searching in all three types of media	44
7 Embedding the E-Paper offering in the virtual space	45
8 Summary and outlook	48
9 Reference literature	49

Preface

The present study was compiled during the period from November 2002 to July 2003 at the Competence Center Electronic Business (CEB) of Trier university by the faculty of media science. Realisation of the research project was made possible by the generous support of two external partners: *the Ministry for Economics, Transport, Agriculture and Viniculture of the State of Rhineland-Palatinate* provided financial backing within the framework of the rlp-inform multimedia initiative, and the newspaper *Rhein-Zeitung* in Koblenz acted both as an always receptive co-operation partner and, by making available the log files, providing support for the online survey and recruiting the test persons, made a decisive contribution to data gathering. Accordingly, we wish to express our gratitude both to the Ministry of Economics and the Rhein-Zeitung for the successful cooperation.

Our thanks go also to all those who made a major contribution to the realisation of the project: Stefan Kinscher assumed responsibility for the electronic evaluation and preparation of the log file data. Jörg Holdenried, Linda Beitz, Stefan Beyer, Benedikt Bambach, Jörg Hunold, Katja Römer and Hauke Thinius supported us in the gathering and evaluation of the data. Special thanks to Christof Barth for his constructive tips and impulses during the entire project. And last but not least our discussions with Joachim Türk and Heike ter Horst of the Rhein-Zeitung sharpened our awareness for the practical, technical and economic aspects of E-Paper.

The E-Paper offering of the Rhein-Zeitung examined within the framework of this study can be accessed under <http://www.epaper.de>. Additional illustrations from the study can be found on the web under:

<http://www.medienwissenschaft.de/forschung/epaper/>.

Trier in September 2003

Hans-Jürgen Bucher
Steffen Büffel
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1 Introduction: Newspapers undergoing change

1.1 From the printed newspaper to the digital edition

Despite the fact that the newspaper is the oldest mass medium, it never became old-fashioned during the course of its nearly 400-year history. Instead, the newspaper has shown itself to be extremely flexible and adaptable down through the centuries. This is evidenced by a comparison of today's front pages with the first weekly newspapers of the early 17th century: the book-like, linear medium has developed to become a complex, non-linear entity. Continuous text has become modular information units that can consist of text, image, graphic and optical elements. It is by virtue of this change that the daily newspaper has successfully defended its position against the competition from the "new-comer" media of radio and TV. But the fundamental change in appearance of the daily newspaper is not just a superficial, pro forma change. It marks a far-reaching change in the relationship between the medium and its readers, though also a basic change in how the medium sees its role and that of those responsible for its production, i.e. journalists. For example, the "newspaper-makers" in the 17th century were news gatherers who compiled information for the readers more or less in the chronological order of the reported current events – as if for a book. Accordingly, in view of their professional profile, the title of "journalist" was hardly appropriate. Today, journalists are professional news processors who select information in an aimed way, organise it, and see to it that this organisation is reflected in the corresponding design and layout. According to the two newspaper historians Kevin Barnhurst and John Nerone, daily newspapers have transformed themselves from a confusing news jungle to maps through world events (NERONE/BARNHURST 1995). Whereas up to the late 19th century daily newspapers left it to their readers to make their own order out of the random organisation of the articles, today's daily newspapers map-out the news situation for their readers – by way of division into sections, layout and text design (see BLUM/BUCHER 1998). During the course of the history of the newspaper, the so-called "interface" has become more and more the most important means of steering attention. Today's readers must therefore comprehend two "languages" in order to understand the newspaper: the design language, by which they understand the newspaper layout and structure, and the content language for the opinions and information contained in the articles.

However, despite all developments to date at the level of design, content, news gathering and newspaper production, one property has remained constant throughout the centuries: printing of the newspaper using ink on paper. But, already at the turn of the 19th to the 20th century, the visionary view was expressed that this was not a written law and that it must not necessarily remain so for all time.

"The printed newspaper is merely a temporary form of appearance that has nothing to do with the specific nature of the newspaper. (...) A directly telegraphed newspaper is conceivable. (...) Already new forms are emerging as products of the latest development: the spoken newspaper. (...) The prospect that later on other, even more highly perfected methods of reproduction than printing, perhaps of a chemical or physical nature, may be found is not only feasible, but quite likely. After all is said and done, reproduction by printing is not an inherent property of the newspaper." (BRUNHUBER 1907)

Although newspapers, with their online editions, have not found any chemical or physical form, but rather an electronic form of publication, the break from print is achieved, with a number of far-reaching consequences: digital media have changed so dramatically the basic constants of media communication, such as production, product design, distribution and reception, that none of the various media will remain unaffected. For the daily newspaper itself, the online editions mean a radicalisation and continuation of the development since the early beginnings in the 17th century. The shift from the linear book form of the early newspapers towards modular clusters consisting of various information units finds its logical continuation in the hypertext structure of the online media. From that point of view, the daily newspaper is more closely related to the online media than are TV and radio that, despite their combination of image, audio and text, have remained linear media to this very day.

Then again, the transition from the printed to the online newspaper represents a qualitative leap: various studies have shown that the printed newspaper, by organisational specifications concerning layout, section assignment and text design, can exert a major influence on reading habits. Thus the Poynter "Eyes on the News" study shows that how a newspaper page is perceived depends decisively on the optical design elements, such as illustrations, typography and positioning (see GARCIA/STARK, 1991). A comparative study on the behaviour of readers of the print edition of the New York Times and of its online edition came to the conclusion that the readers of the print edition base their choice of topics largely on how the topics are presented and to an especially large degree on the topics appearing on the front page and in the first section (see TEWKSBURY/ALTHAUS 2000 and ALTHAUS/TEWKSBURY 2002). The findings among the readers of the online edition of the New York Times are totally different. Compared to the print readers, their selection of topics to read is much more wide-ranging and less determined by specifications of the medium. The greater self-determination of use results in readers selecting information on the basis of personal criteria and thus giving preference to different topics than readers of the print edition. Readers of the online edition also form different opinions concerning the same topics and, compared to print readers, receive less information. The historical trend indicated by the analysis of BARNHURST and NERONE,

i. e. that newspapers have become maps for the information landscape, seems to be broken in the case of online newspapers: users have apparently here taken the compass into their own hands and map-out the information cyberspace – the “paperspace” – themselves.

In a latest development, the print and online editions have been joined by a third version of the daily newspaper, namely the so-called E-Paper version, also referred to as the “digital edition”. Meant here is the online edition of a daily newspaper that optimally simulates the printed pages by displaying them one-to-one on a smaller scale. Users can navigate on the newspaper page, obtain an overview just as they know it from the print newspaper. The digital simulation of the printed edition permits both specific pages and articles to be retrieved by clicking on them. In this way, E-Paper combines the presentation possibilities of the printed newspaper with those of the online newspaper. This, it is hoped, allows readers to experience the sensation of reading the newspaper also on the web (NET-BUSINESS 2001). To read online as in print and scroll by mouse-click, that sums up the dual character of the E-Paper version. The decisive question here is whether E-Paper, due to its hybrid character, represents a step forwards or a step backwards, or whether the development is leading towards a media dead end, such as was the case with Bildschirmtext in Germany.



Figure 1: The E-Paper edition of the Rhein-Zeitung. Old medium in the new medium: E-Paper combines the optical appearance of the printed newspaper with the methods of use of the online newspaper.

In the meantime, several daily newspapers, besides an online newspaper, are present on the internet with an E-Paper version, e. g. Handelsblatt, New York Times, Kleine Zeitung from Graz (Austria), Berliner Tagesspiegel, Der Standard from Vienna and Neue Zürcher Zeitung. The attraction of the E-Paper solution from the point of view of the newspaper publishers is that a journalistic online product can be produced without online journalists, simply on the basis of a technical transformation. Especially in the current difficult financial situation in which the publishing houses find themselves, this cost aspect acts as one of the central arguments in favour of E-Paper.

At present, more than 20 manufacturers and newspaper publishing houses worldwide use different EDP solutions to transform the printed newspaper into an electronic medium in the form of an E-Paper version. The different technical processes can be attributed to two strategies: output as a PDF file that can be displayed only with corresponding additional software, and output based on HTML or XML files that can be displayed directly in the browser. Something that both processes have in common is that data from the production process of the classical printed newspaper can be put directly to other uses and that the required work steps are either totally automated or can be realised with only minor manual intervention.

The Rhein-Zeitung in Koblenz, Germany, can justifiably claim to be one of the pioneers of E-Paper technology, as it added an E-Paper version to its print and online newspaper as early as 2001. In spring 2003, the Rhein-Zeitung already had 2200 subscribers. According to the company, between 23,000 and 42,000 page hits are registered weekly. But its pioneer status and success are not the only reasons why the Rhein-Zeitung is the object of this study: the fact that

Rhein-Zeitung

Published since: 1946
Circulation: 235,893 (Audit Office of Circulation, 1st quarter 2003)
No. of editions: 19
Editorial offices: 19
Subscribers: ca. 220,000
Personnel: ca. 800 (status: 31st May 2003)

RZ-Online

Online since: 1996
Visits: 1.2 million per day (May 2003)
Page Impressions: 5.2 million per day (May 2003)
Personnel: 8 (2003)

E-Paper

Developed by:
RZ-Online, KEVAG Telekom and Rhein-Zeitung
Start of software development: mid-2000
Test phase: 1st June 2001 to 31st January 2002
Regular operation since: 1st February 2002
Subscribers: 2240 (status: 23rd June 2003)
Costs for the user: EUR 2 more per month on the subscription charge to the printed newspaper for a local edition; each additional local edition: EUR 5 per month.

the Rhein-Zeitung is published in a printed version, a classical online newspaper and an E-Paper version permits a cross-media and comparative study of products offering identical contents. Accordingly, the use-related data allow conclusions to be drawn concerning the medium-specific form of presentation. Because the Rhein-Zeitung uses a comparatively mature E-Paper version that in addition already has an established reader audience, there are good reasons that speak in favour of a general applicability of the findings in relation to utilisation.

The E-Paper solution is financially attractive for newspaper publishers mainly in view of the recent decision on the part of the Audit Office of Circulation to count page retrievals when determining newspaper circulation figures.

Figure 1 shows the E-Paper edition of the Rhein-Zeitung.

1.2 The newspaper in the eyes of the users

With E-Paper, a mix is created in which online and offline elements of the printed newspaper and of the online newspaper are combined. The page layout and page numbering are adopted from the print version, whereas navigation, visualisation, searching and interactivity are taken from the online and hypertext area. For this reason, it is hoped that the E-Paper version of the daily newspaper will bring together all the advantages of its two preceding forms: the historically evolved structures and order of the printed newspaper with its multiple layout and hierarchical options, and the interactive facilities of the online newspaper, therefore the links, search aids or communication possibilities. As research aimed at establishing new technologies has shown, acceptance on the part of the users is a decisive factor. The benefits for the user, the reliability and user-friendliness of the new technology and its observable use by others are the main reasons for its penetration and spreading. For this reason, the study presented in this Special Report deliberately takes the perspectives of the reader and the user in order to be able to judge how the three media disciplines – newspaper, online newspaper and E-Paper – are used and judged in each case.

In order to explain the media utilisation, a basic distinction can be made between four different factors:

- > the *media offering* with its contents and design forms,
- > the *users* with their various competencies and knowledge prerequisites,
- > the *specific interests* and aims of utilisation,
- > the *structural properties* specific to the type of media concerned.

The study on E-Paper sets out to show not only how the three media types of newspaper, online and E-Paper are used, but also what influence the aforementioned factors have on the utilisation process. To hypothesise, it is possible to refer to the aforementioned studies on newspaper utilisation. The findings of these studies evidence that the use of the daily newspaper depends largely on its offering, with the way in which the content is presented playing a major role. Thus the “Eyes on the News” study showed that how a

newspaper page is seen and read depends decisively on the optical design elements, such as illustrations, typography and positioning (GARCIA/STARK 1991). As opposed to this, the comparative study between readers of the printed edition of the New York Times and its online offering clearly show that the use of the online newspaper is influenced only to a very small degree by the properties of the offering, but instead to a large degree by the interests, habits and competencies of the users. The greater self-determination via the utilisation process results in them selecting information on the basis of personal criteria and that they therefore make different selections than the readers of the print medium.

It is characteristic for purposes of empirical reception research to focus research activities on one of the media types. Accordingly, the findings can be divided into TV reception, radio reception, print reception or online reception research. With the extension of the perspectives to the cross-media phenomenon of media utilisation, the focus of research turns to the interaction of the various media types in the utilisation activities of the corresponding audience. Thus the data of the ARD/ZDF online study provides insight into the substitution aspect of TV and internet utilisation: extensive internet utilisation is at the expense of TV and less of newspaper utilisation, though this trend has slowed since 1997 (VAN EIMEREN/GERHARD/FREES 2002, 346–362). As opposed to this, a study on the use of the media during the Iraq war in 2003 revealed a complementary pattern of utilisation. The online version of the news providers, whose programmes are used on the TV at home, serve as the source of information for news updates during the day, e. g. at the workplace (RAINIE/FOX/FALLOWS 2003). But one aspect that such cross-media studies make quantifiable only indirectly are the specific services of the individual media types for the users. It is only possible to directly analyse what the strength of an online offer is compared to the daily newspaper or TV by comparing the reception processes in each case. Research findings on this matter are at present still extremely rare. But corresponding research results would be significant in a situation where it is important to know the strengths and weaknesses of a medium in competition with others and to develop strategies for its specific positioning on the media market.

What is the situation in this regard with the E-Paper version? For its utilisation, are the models of online reception or the models of newspaper reception used? Is the utilisation of the E-Paper version more offering – or user-driven? This is the point from which the study presented here sets out. In order to analyse the performances of the printed daily newspaper, the classical online offering and the still young presentation form of E-Paper, a comparative investigation is carried out of these three offerings on the basis of identical contents. E-Paper represents the electronic and interactively usable variation of a facsimilised newspaper page that simulates the classical newspaper layout on the computer screen.

To answer these research questions, comparative results relating to the following areas of utilisation of the three media types are presented:

- > free navigation in the medium concerned
- > reception of the entry page/front page
- > search by topics
- > aimed search for specific information and articles.

Comparative findings in relation to these utilisation aspects are the preconditioning for answering an entire range of questions concerning the positioning of the three types of media on the current media market:

1. Which of the forms of presentation, the printed newspaper, the online edition or the E-Paper version, is best suited for communicating knowledge?
2. Can utilisation skills, reading habits and demand patterns be transferred from the printed newspaper to the E-Paper version?
3. Can E-Paper combine the outside reader guidance by means of journalistic input with the user self-guidance that is typical for hypertexts?
4. Is it possible with E-Paper to narrow the digital gap between the online professionals and online non-professionals for the daily newspaper?
5. How do the users judge the three presentation forms on the basis of a comparison of their specific information interests in each case?
6. Can E-Paper combine the benefits of the printed newspaper with the benefits of the online newspaper?
7. Do the users of the E-Paper version see themselves more as a variation of the online newspaper or more as a variation of the printed newspaper?
8. Can E-Paper offset the acceptance problems of the daily newspaper among young readers by its modern interface?

At the centre of the study is the E-Paper version of the Rhein-Zeitung from Koblenz, Germany. Accordingly, many of the findings relating to the utilisation are characteristic for the media offer of this provider. In the following, however, findings are presented that are almost exclusively of a general nature and can be applied to E-Paper technology as a whole. There are numerous reasons for a generalisation of the results. Firstly, by virtue of its parallel offering of an E-Paper edition, a print edition and a classical online newspaper, the Rhein-Zeitung has the possibility to conduct research into utilisation largely independent of the content concerned. Because all offerings comprise largely identical contents, a comparative reception study provides information about the relevance of the forms and structures for the media utilisation with which the contents are prepared. In addition, the E-Paper technology developed by the Rhein-Zeitung already has prototype status in the industry. The E-Paper edition of the Rhein-Zeitung is not only one of the oldest and best-established, but also one of the most highly developed variations. That applies both for the technical realisation and for the distribution of

E-Paper among the subscribers to the newspaper. Therefore a generalisation of the findings in relation to utilisation is justified from various points of view.

1.3 Research into online reception and E-Paper

To date, very few results of research into E-Paper itself are available. In the small number of studies, media science and production questions tend to dominate (e.g. RIEFLER 2003; RITTER 2003). However, results from research into the reception and utilisation of online newspapers and printed newspapers are available and these offer important orientation also for E-Paper research. One of the methods for the reception research is the so-called eye-tracking process that is used at the Poynter Institute in Florida both for the print and online newspaper. By evaluating movement of the eyes at the time of media reception, this process allows conclusions to be drawn about attention distribution and perception sequences during reading. One central result of the "Eyes on the News" study for the print area (GARCIA/STARK 1991) was the observation that images are more readily perceived than text on a newspaper page. Accordingly, the reception follows a system based on visual distinctiveness: from the image via the headline to the text. In a second eye-tracking study published in May 2000, the researchers at the Poynter Institute, in cooperation with Stanford University, investigated the typical media reception in online newspapers (LEWENSTEIN/EDWARDS/TARTAR/DE VIGAL et al. 2000). According to their findings, media utilisation in the online medium appears to follow different laws than in the classical print medium. In the online medium, text elements are perceived before images and graphics. Whereas in print the "image before text" principle applies, for the online medium it is "text before image". Although the findings were subsequently called into doubt (summary NIELSEN 2000a), both studies give rise to the interesting question for E-Paper whether it is perceived more in accordance with the model of the printed or the online paper.

An examination carried out in May 2002 by the trade magazine "w&tv" at MediaAnalyzer in Hamburg into the utilisation behaviour of 150 test persons on selected web sites based on a mouse-tracking process developed there produced a much more highly differentiated result, especially for the area of text and image perception, and would seem to reinforce many of Nielsen's criticisms of the Poynter-Stanford study (MEDIAANALYZER 2002). According to these findings, images in the online medium are clicked on much more frequently compared to the more numerous text elements. An analysis of behaviour broken down by gender revealed that men are attracted more strongly to optical elements than women, who are more likely to approach an advertising offer through the navigation categories.

But the results of various investigations reveal that it is not just in the area of perceiving individual functional elements that the utilisation behaviour differs between the printed and online newspaper. Thus a study carried out by Ohio State University in the year 2000 showed that, in the

case of identical contents in the printed newspaper and the online edition, the print version was considered to have a higher degree of credibility (GRABMEIER/MURPHY 2000). Consequently, does this mean that E-Paper, due to its newspaper-like appearance, benefits from the credibility of the printed medium or is it subject to the online-specific scepticism?

We at the Faculty of Media Science at Trier University have looked into the question of typical patterns of online reception. It was shown in various empirical studies (see box) with the aid of a complex investigative design (see chapter 3) that the adoption practices for the online utilisation are organised along the lines of an implied interaction with a communication partner, i.e. the user acts as if the offering were a communication partner (BUCHER 2001). Therefore the utilisation situation has the character of a dialogue in the eyes of the users. In view of this result, an extended-communication science – interaction concept must be assumed. A purely mechanical interaction concept that reduces the utilisation situation to the interaction between man and computer simply does not suffice. Studies involving various types of online offerings, such as online newspapers, information offers, bookshops, travel shops, portals and E-Brokerage offerings, show that interactive adoption is a form of problem-solving where the users must resolve the following five typical problems:

1. **The orientation problem:** orientation in an online offering confronts the users with the questions of how the online offering is organised, which communication units make up the hypertext and which structuring principles the individual units are based on.
2. **The entry problem:** the homepage constitutes the entry into an online offering. It has the central function of offering both structural and content information, therefore of pre-structuring the entire offering as regards the organisation, navigation possibilities and the available content for the users. Entry pages therefore act as “advance organisers” (see AUSUBEL, 1960).
3. **The navigation problem:** navigation in a hypertext offering confronts the user with the problem that he must be able at all times to establish his location in the virtual space in order to eliminate the risk of losing his way in the offering. For this reason, it must be possible to learn the navigation and orientation aids quickly and with reasonable effort so that the user can answer for himself the questions as to where he is at any given time, how he got there and where he can navigate to next.
4. **The sequencing problem:** although online media are not prepared in a linear way, the individual navigation path of the users always has a linear character. The problem here is that non-linear elements must be brought into a sequential order. In order to guarantee a logical navigation through an online offering, every newly retrieved information unit must fit coherently into the utilisation path of the users.

5. **The classification problem:** a hypertext is a “house with a thousand doors”, meaning that the user does not necessarily always enter the online offering through the homepage, i.e. the official entry page. Direct entry via search engines or cross-links are by no means a rare occurrence. In a network-based medium, the individual elements of hypertext are therefore accessible from many different starting-points. This means that each information unit must be understandable in a wide range of different contexts and that the users can at all times classify it correctly in relation to the total offering.

The findings in connection with these types of problem also permit conclusions to be drawn concerning the problem of user-friendliness, or usability. According to these findings, an online offering is more usable the better it supports the users in their efforts to solve the aforementioned five problem areas. As the various studies of the Trier research group have shown, the online users have already developed patterns – or so-called scripts – for their interaction with the offerings, on which they base their expectations for working with an online offering (see also chapter 6.1). For example, users expect an entry page to offer them a navigation bar on the left, a horizontal navigation bar at the top of the page and a search option. Any disappointment of such standard user expectations automatically results in a poor evaluation of the user-friendliness.

When classifying the results of the comparative reception study included in this Special Report, both the central findings from our own investigations presented in this chapter and the results of studies conducted by other research teams were taken into account.

The Media Science Faculty at Trier University has had continuous experience in the area of qualitative empirical reception research since 1998. Thus, for example, the online offerings of several public broadcasting corporations and newspapers were tested under simulated everyday conditions in an empirical study on the utilisation of the internet offerings of broadcasting corporations and newspapers (BUCHER/BARTH 1998).

With the aid of the methods of Thinking Loud and moderated online utilisation, the test persons were observed by audio, video and display screen recording to establish how they found their way around the offering, which strategies they pursued and what problems of understanding they experienced. The results showed that the structure and information density on the entry page of a web offering are of special importance for the reception behaviour of the users. A balanced combination of structure and content information proved to be the optimal solution. Later studies showed that a continuous use of the online medium led to utilisation competencies among the users in the form of opening-up routines and perception conventions, i.e. the aforementioned scripts. The non-linear, hypertext online media demand that the user constantly take navigation and utilisation decisions in order to be able to access the contents. These active, assimilation actions are organised

as an implied interaction with a communication partner, meaning that the user acts as though the offering were a communication partner (BUCHER 2001). The use of these scripts can be of assistance here, on the one hand to design an entry page to make it more easily understandable and on the other hand to solve the aforementioned sequencing problems of the users on their navigation paths (BUCHER/JÄCKEL 2002) (see also chapter 6.1 Scrolling – Opening – Clicking: how to navigate in the newspaper, online service and E-Paper).

Besides these findings concerning the entry pages of the investigated online offerings, all Trier studies showed that frequently unclear wording within the navigation systems makes orientation more difficult, causes misunderstandings and can lead to discontinued use of an internet offering. The semantics of the terms used to name hyperlinks must always be so unequivocal that they allow users to form concrete expectations and therefore help them decide which navigation path to select. In this connection, the reception studies carried out at Trier University showed that the assumptions of the newsdesks concerning the reception knowledge of the users frequently deviate from the actual level of know-how. These knowledge deficits as well as the absence of possibilities to acquire this knowledge lead to problems of understanding among the users. This problem is especially noticeable in the area of link identification and is relevant also in connection with the E-Paper technology (see chapter 7. Embedding the E-Paper offering in the virtual space).

Research projects conducted to date on the usability and reception of interactive media at the Faculty of Media Science at Trier University

- 1998 Online offering of Südwestrundfunk
- 1999 Online offering of Südwestrundfunk & Handelsblatt
- 1999 ARD-Online and various other online offerings of other TV corporations
- 2000 N24-Online/ProSieben
ARD-Online channel (interactives digital TV Intranet of Südwestrundfunk)
- 2001 e-Business offering: book and travel shops (incl. Amazon, BOL, TUI and Neckermann)
- 2002 SWR-Online, ARD.de and Tagesschau.de
- 2003 Rhein-Zeitung, E-Paper offering of Rheinzeitung and rz-online.de
- 2004 Interactive offering of DPA-Infocom (FLASH graphics, information graphics in newspapers, MMS services for mobile telephones)

2 E-Paper: New technologies for new reader markets?

2.1 Definition of terms

Because the term “E-Paper” is used differently in German and English-speaking regions, it is appropriate at this stage to define precisely what is meant. In German, E-Paper is used to describe the electronic facsimile version of a printed newspaper (see chapter. 2.3.2). This form of the online newspaper is also referred to in English, especially in the U.S.A., as “digital edition” or “replica digital edition”. As opposed to this, the term E-Paper in the English-speaking regions, including the U.S.A., is used to describe various forms of electronic paper, therefore the technology that, at its most developed stage, will bring the flat and flexible display screens of the future (see chapter 2.3.1).

2.2 The newspaper market at the beginning of the new century

Many newspaper publishing companies, as a consequence of the drop in income from the advertising business, have experienced an economic crisis since about the year 2001. Due to cost pressure, even “flagship” newspapers, such as the Frankfurter Allgemeine Zeitung (FAZ) or Süddeutsche Zeitung (SZ), must reduce their editorial staffing levels as well as the page count of their newspaper products. Some newspaper houses attempted to offset the continual drop in advertising income by raising prices. In this connection, the weekly newspaper Die Zeit predicted the downfall of quality journalism (DIE ZEIT, 27/2002) as a result of this financial turbulence. The collapse of the advertising market, caused by the downward spiral of the so-called “New Market”, as well as miscalculations and overambitious projects launched by the publishers at the major publishing houses, also expose the media industry to the pressure of a new wave of rationalisation. The horror vision for the newspaper publishers: companies and advertising agencies turn their backs on newspapers forever. Income drops, readership figures fall, especially young people ignore the printed medium. It would only be a matter of time before the very existence of the newspapers would be threatened.

In these hard economic times, many publishing companies seek new business models to profitably market the produced contents via multiple channels. Cost-cutting alone and re-organising or outsourcing unprofitable areas of activity will not be able to solve the problems of the newspaper houses. Because if the cutbacks in the newsrooms affect the quality of the products, this will further reduce the attraction of the printed newspaper. The danger exists of a downwards spiral that a cost-cutting policy could not stop. It is especially in their internet activities, which are in most cases loss-makers, that the newspaper publishing houses seek new ways to successfully market pay-for content. For example, several U.S. local newspapers have begun using their practically monopoly position to transform free-of-charge offerings in the Web into pay-for digital editions of their print edition and make these available only to paying subscribers.

“If you’re in a market that’s isolated and you’re in a monopoly position, paid content can work.” (Ken Sands, Managing Editor für Online und neue Medien, Spokane Spokesman-Review; (LASICA 2003))

In the opinion of publisher Peter Horvitz, especially smaller local newspapers with their monopoly on local information have a good starting-out position for attracting paying subscribers to their online offerings.

“Smaller newspapers will thrive simply because they are the only source of news and information that is local.” (PETER HORVITZ (GATES 2002))

This example could be followed also by European local newspapers that also in many cases enjoy a regional news monopoly.

Another strategic approach is the attempt to utilise new media technologies to create additional channels of distribution for existing contents (LASICA 2003). Arthur Sulzberger, Jr., publisher of the New York Times, spoke on the topic of convergence stimulated by this multiple utilisation in an interview for Online Journalism Review:

“Newspapers cannot be defined by the second word – paper. They’ve got to be defined by the first – news.” (Arthur Sulzberger, Jr. (GATES 2002))

Examples for this approach, such as the E-Paper offering of the Rhein-Zeitung in Koblenz analysed within the framework of this study and that succeeded in attracting more than 2000 paying subscribers in just one year, give justified reasons for cautious optimism, at least in this area. In contrast, according to the Audit Office of Circulation, other newspaper houses, such as Münchener Abendzeitung or Sächsische Zeitung, are experiencing massive problems in their efforts to find paying customers for their new E-Paper offerings. Thus, in the first quarter of 2003, no more than 11 users were willing to pay EUR 9.50 per month for the E-Paper version of AZ (sold weekday print circulation: 143,485). At the same time, 53 users paid for an E-Paper monthly subscription to the Sächsische Zeitung (print circulation: 318,986). It almost seems as though the established distribution channels (print and classical online offering) must first be put on hold before readers can be convinced by E-Paper (KOROSIDES 2003). But perhaps the different user acceptance of the E-Paper product from Koblenz and the AZ or Sächsische Zeitung respectively is due also to the fact that the Rhein-Zeitung E-Paper version features a much higher level of interactivity of the contents than the PDF-based offering of the two competitors. The present study also investigates these questions of the user acceptance of the new E-Paper technologies.

Beyond the search for new distribution channels, the idea of being able to publish an online edition without a special online newsroom is, naturally, highly interesting, especially from a business economics point of view. Because production of the E-Paper version is usually fully automatic on the basis of the electronic prepress processes of the print version, specialised online editors are in fact largely superfluous, thereby offering publishers additional potential for rationalisation.

2.3 E-Paper technologies and their utilisation potentials

2.3.1 E-Paper: the hardware

Working at present on innovative new display technologies are, for example, the following companies: E-INK¹⁾ (Electronic Ink), Gyricon-Media²⁾ (Smart Paper) and Philips (see also RITTER 2003). For purposes of example, we shall concentrate here on the E-Paper display technology of E-INK. The core of this technology is a layer consisting of millions of tiny microcapsules with a diameter the equivalent of a human hair. Each of these microcapsules contains positively charged white and negatively charged black particles, dissolved in a clear fluid. When a negatively charged stress field is applied, the white particles move to the surface of the microcapsules and become visible for the user. The surface appears white and empty. At the same time, an opposite electrical field presses the black particles to the bottom of the film. If this process is reversed, the black particles move to the surface and the white to the bottom. The result is a black area of the display surface (see Fig. 2). In the E-INK production process, a layer of these microcapsules is superimposed on to a piece of plastic film with integrated circuits for power supply. These circuits can be controlled from the screen driver. According to the manufacturer, the microcapsules, integrated into a fluid carrier medium can be applied to many surfaces, including glass, plastic or also paper.

The companies active in this area today are continuing the work of the technology visionaries who have been working since the 1980s and 1990s on concepts for the newspaper of the future. Special mention should be made in this context of Roger Fidler who, already in 1981, began work on the tablet newspaper concept and between 1991 and 1995 on the development of a prototype electronic newspaper (FIDLER 1999). It was Fidler's dream to create the "wax tablet" of the post-modern information society and therefore in a way continue the antique media traditions:

"The solution, I believe, lies in the development of a new class of digital devices that will enhance and extend the dominant traits of the document domain. These devices, which I have described in the scenario as tablets, in a way take document technologies almost full circle back to their presumed origins in the soft clay of Sumer and Mesopotamia." (FIDLER 1997, 237)

To date, the solution promoted by Fidler has been unable to penetrate the market. The surface feel of today's thin and flexible E-Paper displays tries to very closely approximate that of familiar paper. Consequently, especially for the area of the print media, there is a considerable economic potential that can be expected to surpass by far the

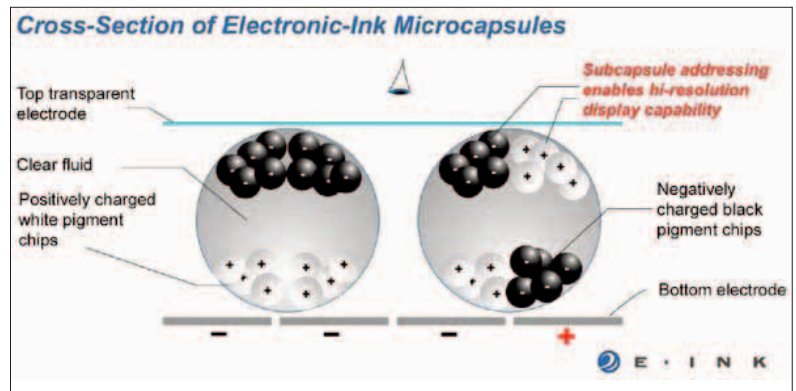


Figure 2: The working method of E-INK display technology (source: E-INK)

existing "rigid" display technologies. However, these new display media are still largely at the prototype stage and some time away from application and use on a mass scale.

Therefore today's users will have to continue to make do with the PC as the carrier medium on which to read their electronic newspaper, whether as a classical online newspaper or as an E-Paper offering in the German sense. Software and hardware producers are currently attempting to pave the way towards E-Paper content on a plastic film display with a number of mobile applications, ranging from mobiles with UMTS capability equipped with a large display to tablet PCs and display on a PDA (Personal Digital Assistant) (see Fig. 3).



Figure 3: Two examples for Tablet-PCs and a mobile phone equipped with a large colour display: the Acer C100 (left), Viewsonic V1100 (centre) and a Nokia UMTS-Handy (right).

¹⁾ For further information, see: <http://www.e-ink.com>

²⁾ Further information under: <http://www.gyriconmedia.com> and <http://www2.parc.com/dhl/projects/gyricon/>

2.3.2 E-Paper: the software

The history of E-Paper in the German sense as a form of electronic information processing that is oriented strongly towards the printed newspaper begins in the year 1999 with the founding of the Olive Software and Newsstand companies. But even previous to this, since about the mid-1990s, some newspapers started sending PDF versions as “Daily Me” via e-Mail to subscribers (RIEFLER 2003, 5).

In June 2003, J. D. Lasica published an article on E-Paper in the Online Journalism Review that examined both the business economics and user aspects (LASICA 2003). It found that, from the business economics point of view, it makes sense to produce offerings mainly if there is the prospect of charging for them and thus generating profits.

From the user point of view, newspaper consultant Vin Crosbie sees the following pros and cons of digital editions compared to online versions (LASICA 2003):

- > **Context:** The layout of the newspaper page indicates to the reader the ranking in importance of the articles from the newsroom’s point of view. This know-how on assessing the context, gained during years of newspaper reading, cannot be applied to an online newspaper.
- > **Familiarity:** Some readers feel more comfortable with the familiar layout of the print edition.
- > **Mobility:** If the digital edition of a daily newspaper downloaded to a laptop or other mobile receiving device, it can be read independently of where the user is located, even without permanent internet access.
- > **Comfort:** Some digital editions are downloaded automatically to the user’s computer, a service comparable to the morning delivery of the printed newspaper. From the point of view of the advertising departments at the newspaper publishing houses, this is relevant in as far as, for example according to data compiled by the New York Times, typical online newspaper users only actually use an online newspaper on average six times per month.
(www.nytimes.com/adinfo/audience_overview.html)

The greatest weakness of digital editions becomes especially apparent in cases of purely PDF solutions. The head developer of World Online, Adrian Holovaty, sums up the drawbacks of the digital editions compared to the classical online newspaper as follows:

“Let’s face it, digital editions are currently nothing more than glorified newspaper screenshots.” (LASICA 2003)

Lasica predicts a positive future for interactive digital editions along the lines of the E-Paper developed by Olive Software, mainly due to its potential to personalise content, and especially in combination with mobile applications based on the described film technology.

Some 20 manufacturers and newspaper publishers worldwide have tackled the task of presenting the newspaper online in a way that is as close as possible to the printed edition. The range of systems developed within the framework of these efforts extends from the possibility to download a PDF edition up to making available HTML-based versions with navigation capacity. On the technical side, two different approaches to E-Paper production have emerged. Some manufacturers set out from PDF or TIFF-G4 files that are automatically created during the newspaper production process. In this case, the finished newspaper product is prepared with the aid of pattern recognition systems, mostly converted to XML data and then used to produce the E-Paper edition. This approach offers the possibility of a relatively fast realisation, as no production metadata are required. Other manufacturers regard E-Paper as a part of newspaper production and use these production data. Metadata from the editorial, advertising and production planning systems can thus be processed, mostly in a completely automated form, to produce an E-Paper version. Naturally, implementing such a solution is by comparison more work-intensive.

From the user point of view, there are in fact only two different types of E-Paper: PDF-based offerings that usually mean having to have the Adobe Acrobat Reader installed on the user’s computer, and HTML or XML solutions that can be converted by the web browsers that are in most widespread use. Moreover, in most cases the PDF versions are not hypertext-based and permit only reception of the facsimilised newspaper page by blowing up to the original scale. In contrast, the HTML or XML versions are dynamic, usually use small, sensitive overview pages with larger-sized views of articles or images in the background. Today, many publishing houses offer both solutions in parallel. The PDF version, that in most cases takes more time to download, can often be downloaded in addition to a HTML facsimile version if required.

The following table gives an overview of the E-Paper solutions at present available on the market and categorises them in accordance with the attributes “PDF” and “XML/HTML” from the user’s point of view, depending on how the contents are presented to the user.

Company, Product name	PDF ¹⁾	XML / HTML ²⁾
Self-generated E-Paper (PDF editions, e. g. from the Netherlands Dagblatt, Abendzeitung, Nordsee-Zeitung, Le Monde)	X	
Alfa "e-dition" (e. g. Financial Times)		X
Atex Media Command: ActivNews from Innovectra		X
Beacon Journal Digital	X	
Comyan: ePaper (Neue Züricher Zeitung)	X	X
Digital Collections: ePaper	X	
Evolver Media: PAPERSTICK	X	
Institute for Cyberinformation: Kent format	X	
MSH-Web: digiPaper		X
multicom: NGen E-Paper	X	X
Newspaper Direct: Web Display	X	X
Newsstand	X	
Olive Software: ActivePaper Daily	X	X
PayperNews: DIGI-dition	X	X
Rhein-Zeitung: E-Paper		X
Sächsische Zeitung: e paper	X	
TechConsult: tcNews	X	X
Tecnavia: News memory		X
Unisys: Hermes e-Paper	X	X
X-CAGO: Daily e-dition	X	X

¹⁾ Software installation necessarily for the reading (Adobe Acrobat Reader)

²⁾ browser based, dynamically

Table 1: Overview of E-Paper technologies at the beginning of 2003. (source: Eown compilation based on Riefler, Katja: E-Paper 2003. Market overview study. More than 20 solutions for newspaper publishing houses in comparison, Munich 2003)

Examples of PDF solutions

The following screenshots of selected examples give an overview of the display possibilities as well as the interface design of several products that are currently available.



Figure 4: The E-Paper edition of the Rhein Zeitung of 30.11.2002.

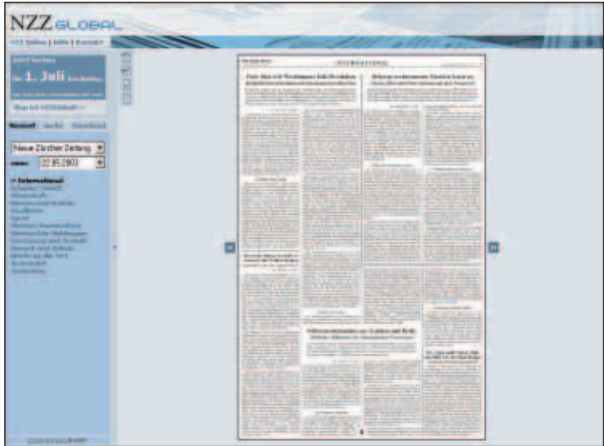


Figure 7: A typical E-Paper page of the NZZ of 22.5.03 (COMYAN).



Figure 5: The E-Paper edition of the Kleine Zeitung (Rhein-Zeitungs technology) of 12.3.2003. The smaller format of the printed newspaper enables the presentation of a two-page-spread on the display screen.



Figure 6: By its separation from the head-based navigation of the online offering, the E-Paper version of the Standard (COMYAN) of 30.9.2003 makes optimal use of the display screen area. The complete navigational means are located in the small-sized menu box between the overview of the various sections on the left and the newspaper interface.



Figure 8: The E-Paper version of the Handelsblatt of 4.4.2003. The newspaper interface, as also in the E-Paper editions of RZ-Online and the Kleine Zeitung, is embedded into the navigation module of the classical online offering. The Handelsblatt E-Paper offers the user, in addition to the dynamic newspaper interface, the possibility to download the viewed newspaper page as a PDF.



Figure 11: An example of a PDF-based E-Paper from Germany: the Sächsische Zeitung from Dresden uses an own development to produce its E-Paper.



Figure 9: An overview of several newspapers that use the PDF-based Newsstand technology.



Figure 12: An example of a PDF-based archive: the full-page archive of Die Welt allows online researching in facsimiles of the print product since 1st March 2001.



Figure 10: An example of the PDF-supported Newsstand technology: the New York Times.

3 An empirical view of E-Paper: test design and methods

In the following chapters, we will describe the processes and survey methods applied to investigate the utilisation and acceptance of the E-Paper edition of the Rhein-Zeitung, the classical online edition RZ-Online and the print edition.

3.1 The organisation of the study

The study deals with the questions of acceptance, utilisation patterns and potentials of E-Paper posed in chapter 1.2 from the user's point of view. In concrete terms, it examines how the three different forms of presentation of the daily newspaper are used by the readers, what benefits the presentation forms have and which specific utilisation problems are experienced. The three forms of publication of the newspaper, i. e. print, classical online offering and E-Paper, are compared, with the focus on the reception and utilisation strategies of the test persons. Accordingly, the study belongs equally in both the media reception research and usability research categories. Findings relating to utilisation problems and utilisation strategies can provide reliable information about the potential for optimising the E-Paper edition.

Due to the complex questions, the study is organised in accordance with a multi-method design comprising the following five modules (see Fig. 13 for an overview of the chronological sequence):

- > **Module 1 – Online polling of subscribers to the Rhein-Zeitung:** the online questionnaire was linked to the home page of the Rhein-Zeitung for one week in November 2002. Of the then approximately 1900 E-Paper subscribers, 464 participated in the survey. Data was gathered on the E-Paper users themselves, their utilisation habits, their media experience and their satisfaction with the E-Paper edition of the Rhein-Zeitung.
- > **Module 2 – Qualitative reception study:** this involved 24 test persons divided into four groups: E-Paper users, RZ-Online users, readers of the Rhein-Zeitung and a control group that, at the time of the study, had not yet used any of the aforementioned offerings. The investigation of the reception actions is based on the thinking out method, where the test persons duly express everything that “goes through their head” during utilisation. The sound recordings of the spontaneous comments are complemented by a video recording of the test persons as well as a digital documentation of their navigation actions. The qualitative study was carried out at the end of 2002 in the Usability Laboratory of the Faculty of Media Science at Trier University (see Fig. 14 and 15).
- > **Module 3 – questionnaire within the framework of the qualitative part-study:** for this purpose, data about the person concerned, internet experience, media preferences and – after the test session – an evaluation of the tested offerings were asked.

- > **Module 4 – logfile analysis:** the technical department of the Rhein-Zeitung collected the access data to the E-Paper edition for the periods 18-24 November and 2-8 Dezember 2002 and made it available for evaluation.
- > **Module 5 – problem-oriented preliminary analysis:** as a first step, the printed Rhein-Zeitung, the online offering RZ-Online and the E-Paper edition were analysed. On the basis of this preliminary analysis, a problem typology and a guideline were developed that could be used with all 24 test persons within the framework of the qualitative reception study. In this way, it was ensured that comparable findings for all 24 test participants were available for the subsequent evaluation.

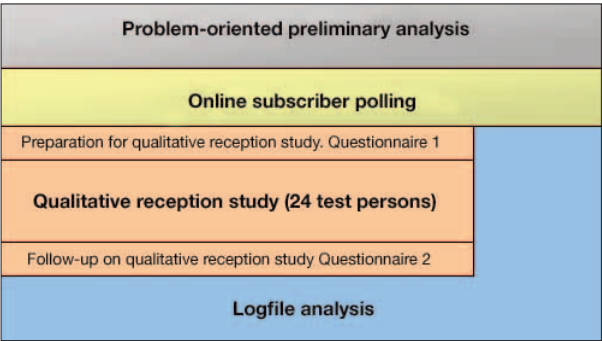


Fig. 13: Overview of the methods used and their sequence during the study.

The diversity of the gathered data reflects the complexity of the utilisation procedure. Besides this, the multi-method design can compensate the one-sidedness of individual ways of proceeding. To this extent, the investigative method used had the following special features:

- > the study combines quantitative and qualitative methods;
- > the study is comparative and analyses the use of the print version, classical online edition and E-Paper;
- > the study combines the evaluation of indirect utilisation data from the logfile analysis and the results of the questionnaires, with the evaluation of the direct utilisation data from the qualitative reception study collected with the aid of the thinking out loud method.

3.2 The qualitative reception study

The core of the research project as a whole is the comparative qualitative reception study. For this purpose, direct utilisation data were gathered in order to establish how the three different forms of presentation are used. It is this data that allows a more exact interpretation of the quantitative findings from the online survey and the logfile analysis. The reception study is organised in such a way as to permit gathering of the direct reception data simultaneously at different levels: the thinking out loud method records the spontaneous statements of the test persons, a digital record of what is happening on the computer screen at the



Fig. 14.1: The interview situation for the print products analysis.



Fig. 14.2: The camera perspective.



Fig. 14.3: The interview situation for the online offerings test.



Fig. 14.4: The mixing and editing desk for the production of the analysis videos.

same time documents the navigation activities of the test persons in the online offering or E-Paper edition respectively. Furthermore, with the aid of a video camera, the behaviour, i.e. the facial expressions of the test persons at the computer screen or while reading the newspaper, is recorded. The synchronous gathering of all this data provides sufficient material for further evaluation and analysis of the complex reception process. The following figures show the organisation of the test design in the usability laboratory (see Fig. 14.1–14.4).

The recorded audio and video data are summarised in an analysis video that provides the basis for the evaluation (see Fig. 16).

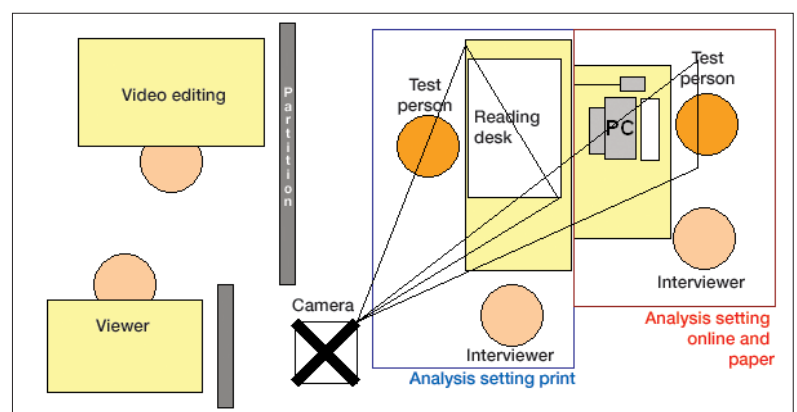


Fig. 15: The reception laboratory. The reading desk (left) is used in the analysis of the user behaviour in the print media, while at the computer (right) the user behaviour in electronic media can be analysed.

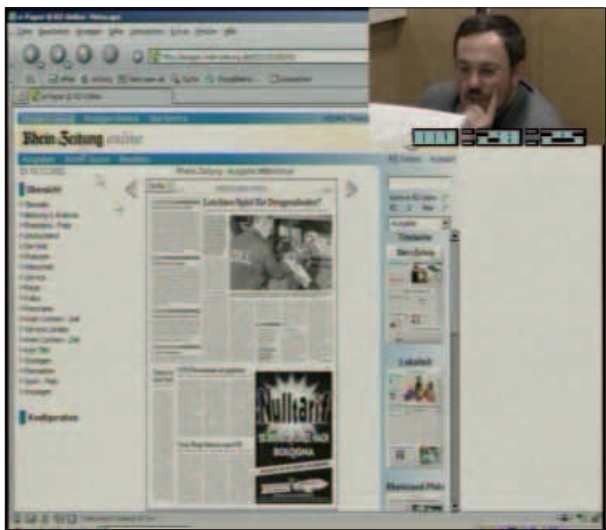


Abbildung 16: links: Das Analysevideo dokumentiert die Aktionen der Probanden am Bildschirm und zeigt deren Gestik und Mimik. Rechts: Ein Proband bei der Nutzung der gedruckten Zeitung.

The test is organised to simulate in a communication situation as many points as possible the everyday utilisation situation. For this reason, the utilisation of the offerings during the test situation is arranged as a mixture of free exploring, aimed objectives and a research task. This covers the three typical strategies of media utilisation: firstly, free exploring or browsing where the recipient allows himself to be inspired by the offered contents, secondly aimed searching, and thirdly topic-related researching. Hassenzahl makes a distinction here between the so-called “Activity Mode”, corresponding to browsing, and the so-called “Goal Mode”, corresponding to aimed searching (HASSENZAHL 2002).

The computer that was used to explore the online offering was connected to the WWW via the campus network of Trier University. The test persons had the possibility for their test sessions to choose between the Microsoft Internet Explorer 6.0 and Netscape Navigator 7.0 browsers. In this way, it was guaranteed that the test persons were largely familiar with the browser software and consequently did not require time to familiarise themselves with a new browser interface. The online offerings were tested with a screen resolution of 1024 x 768 pixels.

For the empirical reception study, 24 test persons were selected on the basis of four criteria and divided into groups:

- > **Group 1:** regular readers of the printed newspaper and E-Paper (4 test persons).
- > **Group 2:** regular readers of the printed newspaper (5 test persons).
- > **Group 3:** test persons who use the online version of the Rheinzeitung (8 persons).
- > **Group 4:** test persons to whom the Rheinzeitung and the online version of the Rhein-Zeitung are unknown/control group (7 persons).

The composition of the individual groups (age structure, job position, etc.) should reflect as closely as possible the readership of the Rheinzeitung, E-Paper and RZ-Online. For additional characteristic data, see the following box.

3.3 The online survey

The online survey was carried out by the Rhein-Zeitung prior to the qualitative study. For this purpose, a questionnaire compiled by the Faculty for Media Science at Trier University was used that was made available online to the

Summary of the qualitative study conditions	
Survey period: 2–11 December 2002	
Total:	24 test persons
Average age:	43 years
Sex:	
Female:	42 percent
Male:	58 percent
Professional status:	
Salaried employee/public servant:	15
Pensioner:	3
Trainee/no employment:	6
Rhein-Zeitung subscribers:	10 (42 percent)
Internet experience:	
Self-evaluation of own knowledge	
> novice (almost no knowledge):	2
> beginner (basic knowledge):	5
> advanced (further knowledge):	13
> professional (extensive knowledge):	5
> 19 test persons online on at least 5 weekdays	

some 1900 E-Paper subscribers during the period 19 to 25 November 2002. This questionnaire was able to draw on the experiences gained in a survey that had been conducted by the Rhein-Zeitung at an earlier implementation stage of the E-Paper project.

Within the framework of the survey, socio-demographic user data (age, sex, education, profession), data on utilisation habits (utilisation times, utilisation locations, topics of interest), media experience (especially internet experience) and satisfaction with the E-Paper edition of the Rhein-Zeitung (possibility to evaluate and offer criticism), were gathered. The following box contains a summary of the profile data and central results from the survey.

The results obtained from the online survey were incorporated into the preparations for the qualitative study, where they served to highlight the central problem areas for closer examination.

3.4 The logfile analysis

The logfiles contain a record of the page retrievals by the users, thus allowing a reconstruction of the individual navigation through the offering or of which contents on a page were retrieved. Because E-Paper strongly channels the user perception (e.g. entry via an image or heading, further penetration via an intro text and only then reception of the

body text), evaluation of the logfiles supplies data whose quality can compete with viewing recording data that requires much more elaborate means to compile.

Logfiles covering a period of one week from different periods, namely the end of November and beginning of December 2002, were available for evaluation. The results complement the qualitative examination and indicate special characteristics of the navigation and interface design in the E-Paper offering.

In addition, the logfile analysis offers the possibility to put the process data gathered in the qualitative study that, for example, provided information about the typical behaviour patterns of the test persons, on an extended data foundation by means of a comparison with the logfile data. Moreover, the logfiles indicate the preferred topics of the users or their preferred utilisation times and therefore can be used to put the findings from the online survey more exactly in perspective against this background.

3.5 Summary

The method modules of the study are interlocked to a large degree, as illustrated by the organisation of the study described above (Fig. 13). In this way, the strengths of the individual methods can be combined and the resulting synergies offset any possible weaknesses. For example, the results of the quantitative modules "online survey" and "logfile analysis" permit the findings of the qualitative study, that are based on relatively few case figures, to be put on a wider empirical basis. In return, the qualitative part-study, by direct observation of user behaviour, enables process data to be gathered that cannot be compiled by quantitative processes (via the online survey) or only with difficulty (via the logfile analysis). Moreover, the staggered time schedule of the individual modules allow existing knowledge and new aspects to be taken into account in the following part-studies.

Summary of data and results of the preparatory online survey

Survey period: 19–25 November 2002

Total:	1.900 E-Paper subscribers
Response:	464
Age structure	
under 40:	33.6 percent
between 40 and 60:	55.2 percent
over 60:	11.2 percent
Sex	
Female:	13.8 percent
Male:	86.2 percent
Professional status:	
Salaried employee:	51.9 percent
Public servant:	20.7 percent
Freelancer:	5.4 percent
Self-employed:	14.0 percent

Internet experience

- > 95 percent have used the internet for more than one year
- > In their use of the WWW, 49.8 percent of the surveyed users describe themselves as "advanced" and 42.2 percent as "professional".
- > 28.9 percent are online once daily
- > 52.4 percent are online several times daily
- > 75 percent use the Web to carry out professional research.

4 How E-Paper is used: a comparison with the newspaper and online utilisation

4.1 E-Paper utilisation during the course of the day

Taken together, the logfile data from two test weeks and the data from the online survey with 464 completed questionnaires give a clear picture of the utilisation habits of E-Paper on a daily and weekly basis. Thus the online survey reveals the utilisation habits of the E-Paper readers, their expectations, but also the deficits they see in this form of processing the newspaper content. Some 70.7 percent of those surveyed stated that they use E-Paper several times during the week or more frequently ("several times daily": 5.6 percent; "once daily": 29.3 percent; "several times during the week": 35.8 percent). In contrast to the printed daily newspaper, the surveyed E-Paper subscribers use their subscription in most cases alone (59.5 percent), or share it with only one other person (25.2 percent). The vast majority of those surveyed (87.3 percent) spend on average a maximum of 20 minutes reading their E-Paper. This value is far below the average time spent reading the daily newspaper (30 minutes) established by a long-term mass communication study conducted by the German public broadcasting corporations ARD/ZDF for the year 2000 (VAN EIMEREN/RIDDER 2001, 538-553). This indicates that E-Paper is seen as a complement to the daily newspaper and therefore used in a much more highly selective way.

The surveyed persons stated that they use E-Paper mainly in the morning (before noon: 65.1 percent) or evening (after 18.00 h: 51.9 percent; see Fig. 17. In this connection also, there is a clear difference between the use of E-Paper on the one hand and the average use of the print product on the other hand. Thus the ARD/-ZDF long-term mass communication study established for the year 2000 a peak utilisation for the printed newspaper at 9.00 h (VAN EIMEREN/RIDDER 2001, 550)). Accordingly, the printed newspaper is a breakfast medium. In contrast, E-Paper is used mainly in offices, either for professional text research or as a substitute for the printed newspaper between 8.00 and noon.

The data from the logfile analysis confirmed these findings. For both test weeks, this revealed that on weekdays the number of recorded clicks is significantly higher than on the weekend and totals on average 120,000. Monday is a special day, as the values then are more than one-third higher. The values for the weekend are considerably lower: on Saturday, the number of clicks dropped by 50 percent on average, on Sunday by as much as two-thirds. This clear difference between weekday and weekend use is a further indication that the E-Paper offering is used mainly at the workplace. The second utilisation peak between 18.00 h and 21.00 h clearly shows that the pattern of online use during the day is transferred to E-Paper (VAN EIMEREN/GERHARD/FREES 2002, 358), because whereas online utilisation also takes place in the evening, that is untypical for newspaper reading. Therefore the hybrid character of the E-Paper medium is reflected already in the daily rhythm of its use.

A comparison of the information provided by the test persons about themselves from the online survey with the logfile data gives a more differentiated picture. On weekdays, E-Paper is used primarily between 9.00 h and 11.00 h and between 13.00 h and 15.00 h – therefore during working hours. On weekends, utilisation peaks are between 9.00 h and 10.00 h and in the evening between 18.00 h and 20.00 h (see Fig. 19). Accordingly, it seems that E-Paper takes on a more independent function on weekends, whereas E-Paper during the week is used as a complement to the daily newspaper.

The preferred utilisation times for E-Paper correspond closely to the preferred utilisation sites: 73.5 percent of the surveyed persons stated that they use E-Paper at home and 59.7 percent at work. Some 19.8 percent avail of the possibility of mobile use in internet cafés or on vacation. For 64.6 percent, the possibility of mobile use is the most important motivation for utilisation. The high utilisation figures for the workplace compared to the general online use can be explained partially by the fact that many of those surveyed use the regional newspaper for professional reasons. For example, 61.4 percent claim that the E-Paper archive is their main motivation for using E-Paper, something that is reflected also in the frequency of utilisation: 44.8 percent of those surveyed use the research possibilities in old E-Paper editions daily. As opposed to this, for 36.6 percent of users this function does not exert any influence. Compared to this, the results of the test persons participating in the qualitative part-study reveal a somewhat more balanced picture: 45 percent state that they use E-Paper at home, 44 percent access the E-Paper offering at work and 11 percent had, at the time of the survey, already used the mobile utilisation possibility of E-Paper on vacation.

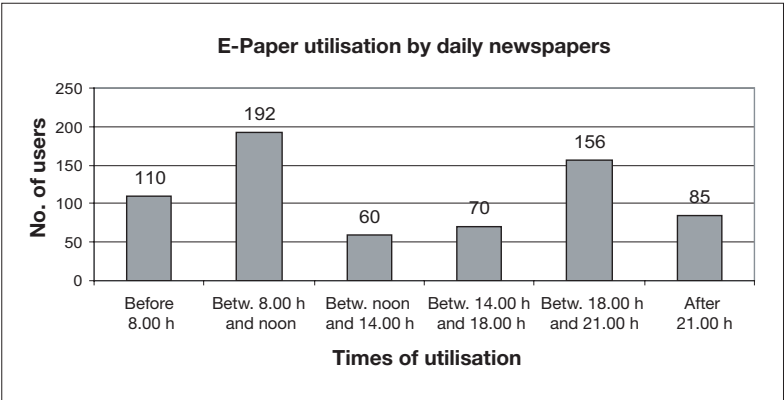


Fig. 17: E-Paper utilisation by time of day
(source: Quantitative part-study; n = 464).

4.2 Utilisation patterns and topic preferences

What interests the users of the E-Paper offering and consequently what are their motives for using it? In relation to content, the main focus of interest is clearly on local information (see Fig. 20). Some 86.2 percent classify local news as a section of special interest, followed by coverage of the region of "Rhineland-Palatinate" (50.6 percent).

Compared to the classical web offering of the Rhein-Zeitung, RZ-Online.de that focuses on national topics, the strength of the E-Paper offering lies in local and regional reporting. Also in relation to topic preferences, E-Paper is proving to be a variation of the printed newspaper: whereas online users in general make more frequent use of topical news about Germany and other countries than regional or local information (VAN EIMEREN/GERHARD/FREES 2002, 356), the situation is exactly the opposite in the case of the daily newspaper (BDZV (Hrsg.) 2001, 457).

This strong focus on content concerning local topics is reflected also in the logfiles (see Fig. 21). An evaluation of the pages retrieved based on their headings reveals that, particularly in this area, sports reporting is especially popular. The high page retrieval numbers in the "Advertising" section appear at first to contradict the comparatively low level of interest among E-Paper users in ads (see Fig. 20). In fact, the retrieval figures do not necessarily indicate an especially high level of interest in advertising pages. Firstly, the share of ad pages in an edition is already above average (ca. four to five on a normal weekday). When scrolling through the E-Paper, the user automatically retrieves several ad pages, something that is included accordingly in the logfile data. Secondly, ad pages are often clicked on in the reproduction when scrolling through the newspaper because they must be enlarged in order to be able to recognise the page contents.

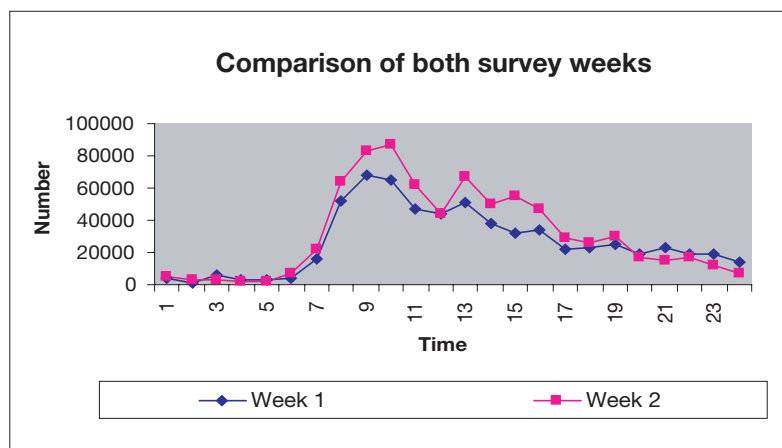


Fig. 18: A comparison of the day curves during the two test weeks
(source: logfile analysis).

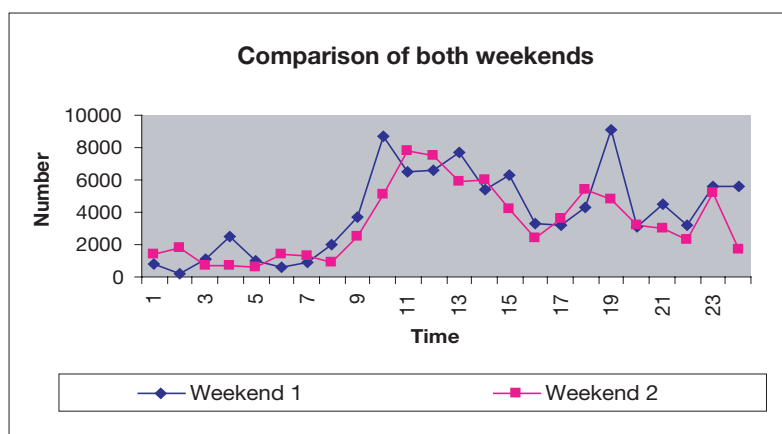


Fig. 19: A direct comparison of the day curves of the two weekends
(source: logfile analysis).

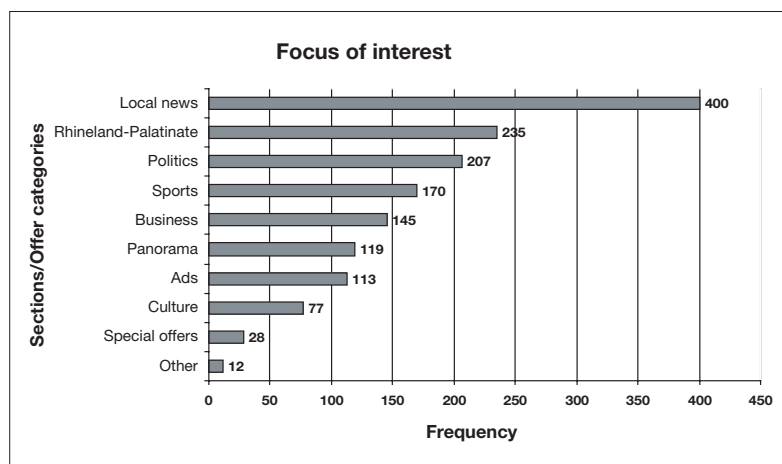


Fig. 20: The focus of interest of the surveyed users.
(source: own production based on the online survey; n = 464)

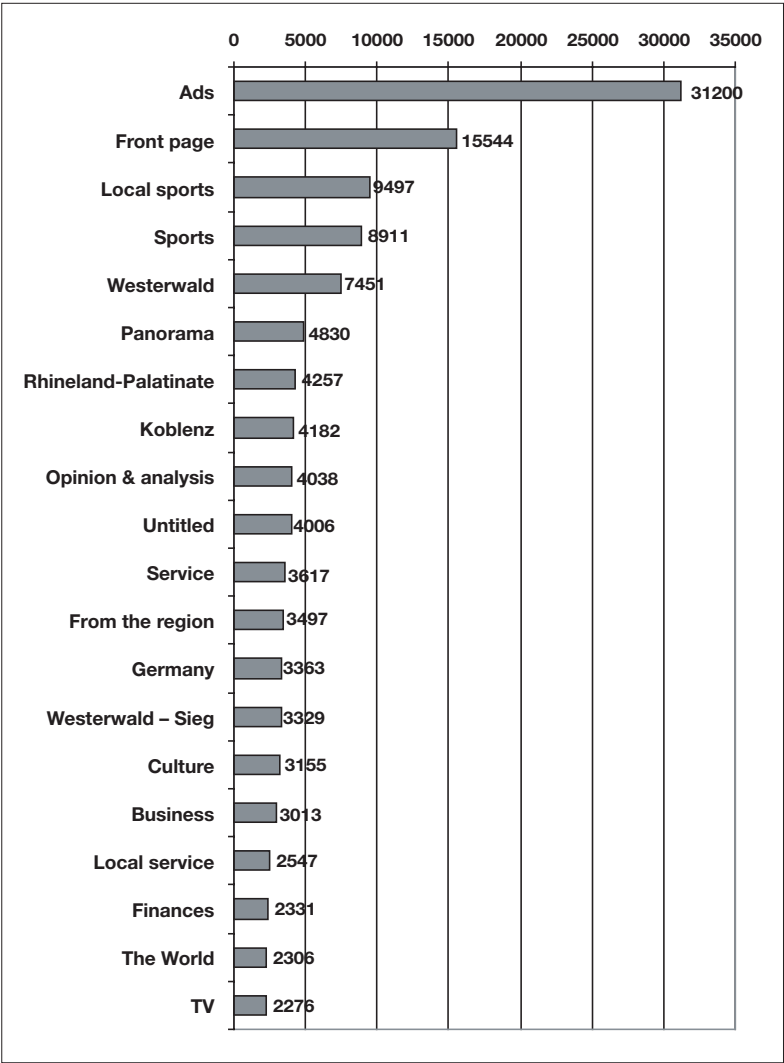


Fig. 21: Overview of the TOP 20 most-retrieved pages by heading (source: logfile analysis, total survey period).

5 The newspaper interface of E-Paper: Comparative findings on recording and utilisation

5.1 E-Paper: a hybrid form of online newspaper and printed newspaper

A comparison between the design possibilities for the online newspaper on the computer screen and the design space and design possibilities of the printed newspaper reveals a very clear difference: the printed newspaper needs no downloading time, everything can be seen at a glance and can be presented simultaneously and in a well organised way on a relatively large space (see Fig. 22). In contrast, most remains invisible in the online newspaper: the online newspaper works with most information in the background, it is three-dimensional, the paper newspaper offers a broad presentation and is accordingly two-dimensional. Consequently, users of online newspapers are handicapped by the phenomenon of information short-sightedness: the computer screen can never present more than just a small excerpt from the total offering. It is only by navigation actions, such as scrolling or clicking on links, that information can be retrieved on to the screen "from the depths of the offering". Therefore the entry page of an online newspaper presents the users with a complex demand. On the one hand, they must sort and prioritise the information offering for themselves, they must distinguish between what is information and what operational aids – i. e. links, buttons, search aids, etc. –, and they must learn to understand these operational aids as guides to what is offered behind the visible interface. Various empirical studies on the use of online information offerings have shown that users rapidly feel overwhelmed by the complexity of the entry pages. For this reason, users claiming to feel confused by entry pages are almost typical for online media (BUCHER/JÄCKEL 2002, 36–38).

The task of design is no less complex, as the entry page must fulfil two functions simultaneously: it must inform and it must structure. Therefore it must offer both attractive contents and indicate the depth of the offering, its structures, so that users can plan their strategies. So how should an entry page look that does not overwhelm the user, offers him interesting and relevant contents, and at the same time structures the information in the total offering, thus making visible the third dimension?

E-Paper is a new solution to this problem with old means, namely the means of the printed newspaper. The E-Paper developers are counting on the transfer effect of the proven newspaper medium to the new internet medium:

"We want to have a product corresponding to a navigable version of the printed product (...) This results in new criteria for the readers, as the position within the page, a design element such as a large-sized, decorative or dramatic photo or a gloss determine the orientation of selection already at the first glance, distinguishing the important from the less important, the interesting from the frivolous. Just as the newspaper readers have long learned to do." (JOACHIM TÜRK, Netzeitung.de of 25 May 2001)

Indeed, the advantages of the printed newspaper compared to the online newspaper in relation to structure and order are clear:

1. The size of the design space permits more information to be presented simultaneously than on a computer screen. The newspaper layout also allows a wide range of information structures that can be recognised at a glance.
2. The newspaper page can be scanned as a whole to select relevant information. The user can choose the navigation paths to be followed himself without technical assistance.



Fig. 22: The front page of the Rhein-Zeitung of 20th March 2003.

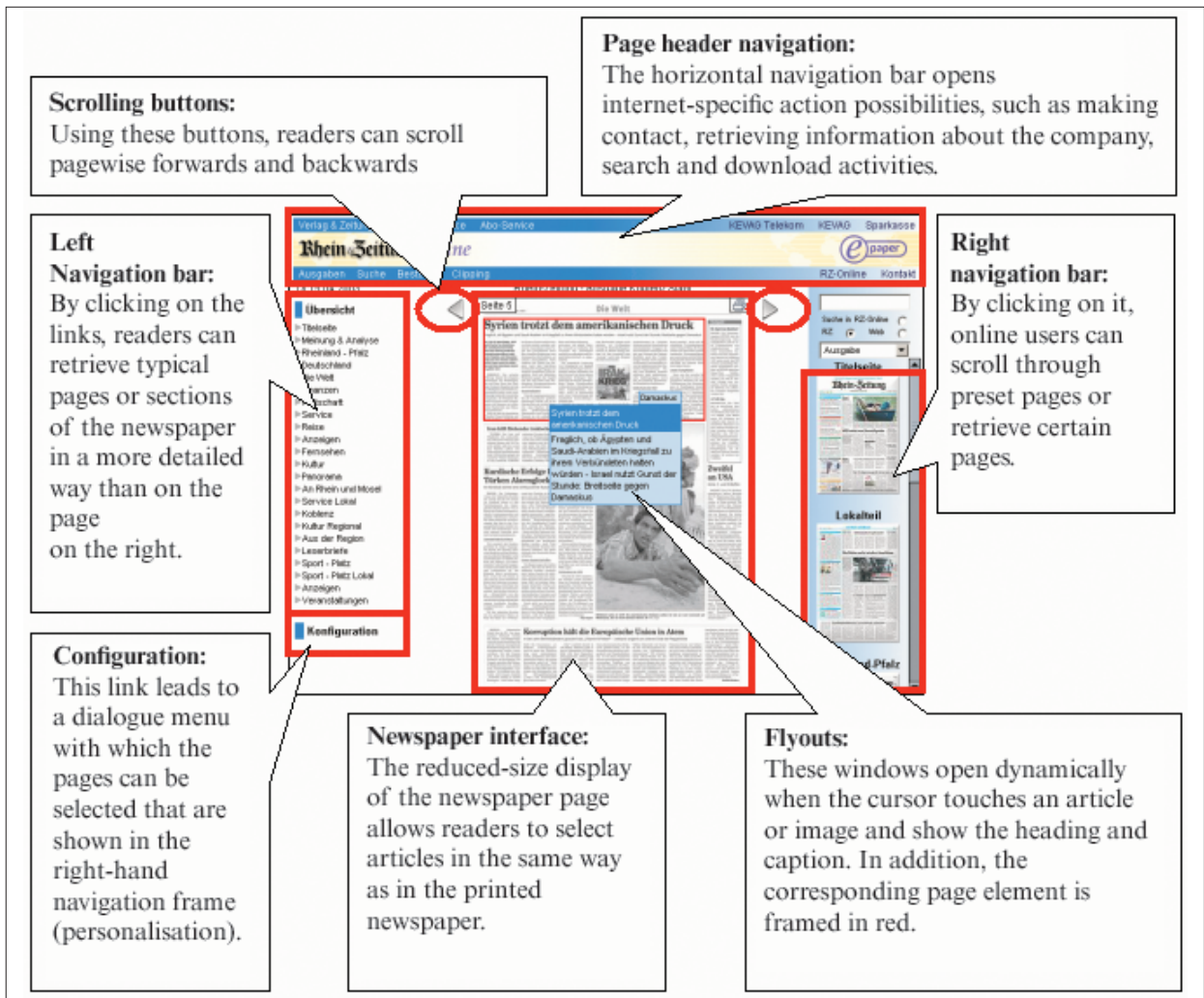


Fig. 23: The navigation and recording possibilities in the E-Paper offering of the Rhein-Zeitung.

3. The newspaper page can be explored with various levels of intensity, without having to click or scroll. At the first level, the user can decide the type of page or to continue scrolling- am I interested in the sports, opinion or business page?; at a second level, via the headings, intros, leaders and images, it is possible to select concrete articles and exclude others, and at a third level, via the teaser texts, it is possible to plan the exploration of the next pages in the edition (for more details: BLUM/BUCHER 1998).
4. The design vehicles of layout and text design have developed through the nearly four centuries of newspaper history and are correspondingly functionally aligned and familiar to the users.

In order to process information as an E-Paper edition, the Rhein-Zeitung uses a facsimilised newspaper page. This is provided with links to the corresponding articles. The display forms of the printed newspaper are complemented by two visual orientation aids. Firstly, article units and ar-

ticle clusters are marked by frames when the user moves the mouse cursor across the newspaper page. Secondly, when the cursor is moved to an article, context-sensitive information boxes, so-called Fly-Outs, are opened that contain the article heading and intro. Two-dimensional design area, total perception, differentiated depth of exploration and familiarity with the newspaper medium are advantages of newspaper design that are simulated with E-Paper (see Fig. 23).

From the user's point of view, the interface design of E-Paper has several important advantages compared to the classical online newspaper. The orientation competency of the daily newspaper can be applied, the page offers a complete overview, gives rapid content orientation via the headings and accordingly can be assimilated by reading across the page without any navigation operations, such as scrolling or clicking. In addition, page exploration is supported by the Fly-Outs. Two test persons clearly described the advantages of E-Paper from a comparison with the daily newspaper:

“Yes, I am especially pleased by the fact that the newspaper basically looks just like the real newspaper. The reader does not have to get used to any new format where he would first have to find out where things are. It somehow makes a familiar impression. I also like the function that when I go with the mouse to an article it is then marked and I can click further on.”

“The advantage (of E-Paper) is that the reader is familiar with the printed edition and can refer to it in an aimed way. Because this is so, the reader knows where everything is. For example, if I am interested in the local section and retrieve it, then I know that I have three pages of local content containing everything that is at present of importance for the region.”

However, the realisation of the print concept in the form of an electronically available E-Paper is not without problems. The evaluation of three comparative assessments in questionnaires completed by the 24 test persons participating in the qualitative reception study reveals a series of findings (see Fig. 24) that also indicate the weakpoints of E-Paper.

For example, although the three presentation variations rank almost equally in relation to clarity, both the printed newspaper and classical online newspaper are considered to have decisive advantages over E-Paper as regards readability. In the category of user-friendliness, the print edition has clear advantages over the two electronic variations, E-Paper comes in last behind RZ-Online. The test persons ranked the operating comfort of all three media offerings equally. When asked only for their assessment of E-Paper, eleven of the 24 test persons gave the electronic interface a wholly positive rating; more than half (13) find it poor, mainly because of the poor readability due to the size of the display.

In contrast, the online survey of the subscribers carried out before the qualitative study produces a more positive picture. 26.3 percent of the 464 persons surveyed claimed to use E-Paper due to the user-friendly design of the interface.

This result is supported by the consistently good or very good assessment of the criteria „clarity” (82.5 percent judge the clarity as “good” or “very good”), “readability” (67.7 percent state “good” or “very good”) and “user-friendliness” (70.9 percent rate the user-friendliness as “good” or “very good”). Similarly, the operating comfort is “good” or “very good” for 68.5 percent of the surveyed persons. The search function also got a good rating in the preliminary subscriber survey: 53 percent of the interviewed users judge the performance of the search function as “good” and “very good”. Consequently, the vast majority of the surveyed experienced E-Paper users had no problem with navigating through the offering: 59.3 percent describe the navigation as “good” or “very good” and only 3.2 percent as “poor” or “very poor” (see Fig. 25).

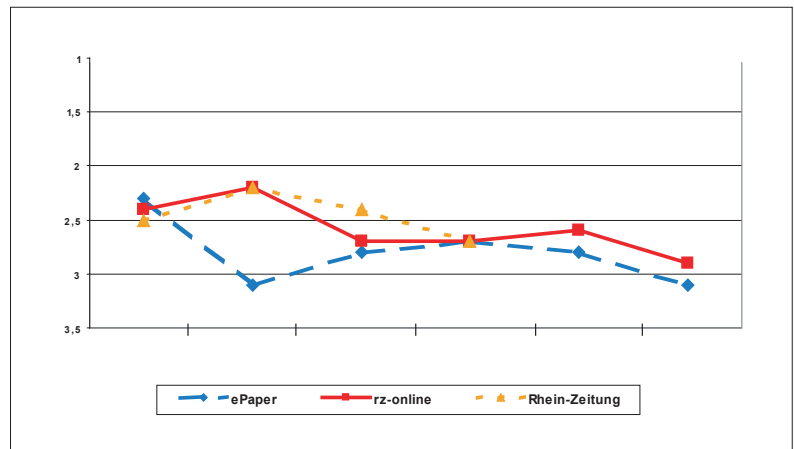


Fig. 24: A direct comparison of E-Paper, RZ-Online and the printed Rhein-Zeitung. In the category “search function” and “navigation”, no data were collected for the printed newspaper. The values are mean values based on marks (source: Qualitative part-study).

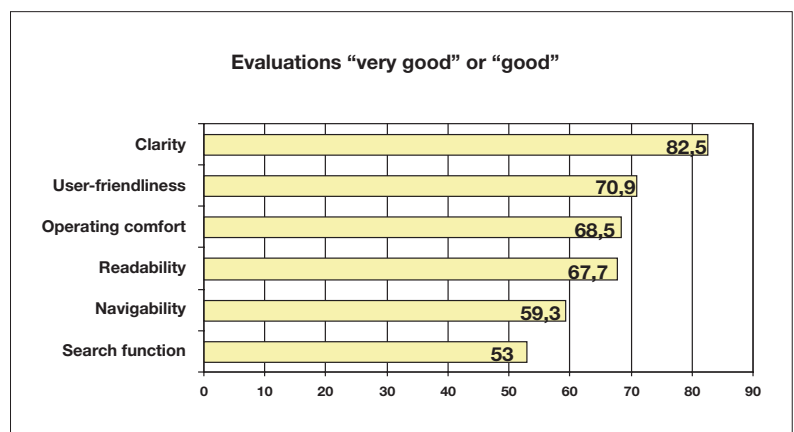


Fig. 25: The judgements of the E-Paper users from the online subscriber survey; all information given in percent (n = 464).

Even though the findings of the accompanying online survey are more favourable for E-Paper, the question concerning the reasons for this discrepancy must still be asked. It seems clear that the user considers the classical newspaper interface to be a good solution for information processing. But why can the design principles of the printed newspaper not be wholly transferred to the online medium? The qualitative reception study provided three reasons for this in which the central weakpoints of E-Paper are evident:

1. The limited readability of the E-Paper interface represents a significant hindrance to the transfer of reading habits from the printed newspaper. Skimming across the page, entry into an article through prominent optical characteristics of the text design, such as sub-title, by-line, caption or bold type, are not possible.

- 2. E-Paper falls short of the design and utilisation possibilities of the printed newspaper. The cluster-oriented presentation of the printed newspaper, where several elements are “clustered” by topic – e.g. various texts, images and photos – can be transferred only to the classical online edition, but not (yet) to the E-Paper version.
- 3. The E-Paper variation as a simulation of the printed newspaper falls short of the hypertext design possibilities of digital media, as they are expected also by the users.

We shall now take a closer look at these three problem areas in E-Paper design in the following.

5.1.1 Readability, orientation offers and selection aids: the judgements of the users

Although it is true that the E-Paper version simulates the printed newspaper page one-to-one, it does so on a reduced scale. This leads to a reduced text readability in many places. Skimming across the page, entry into an article via typographically prominent characteristics of the text are therefore not possible throughout. Optical clarity is at the expense of limited readability. The result is a media break such as is commonplace in the transmission of a live concert on the radio, the transmission of a telephone interview from the radio to TV, or the presentation of TV video sequences on the internet. This media break is reflected also in the evaluations of the E-Paper offering: of the 24 test persons who compared the three media types of E-Paper, online newspaper and printed newspaper, 13 rated the user-friendliness of the printed newspaper as the best, followed by five advocates of RZ-Online and three who most preferred E-Paper (see Fig. 26).

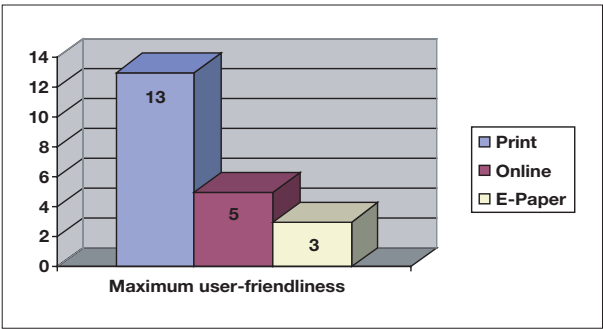


Fig. 26: The evaluation of the user-friendliness of the printed newspaper, the online newspaper and E-Paper in direct comparison; all information in absolute figures (source: Qualitative part-study).

From the user’s point of view, the context-sensitive information boxes, the Fly-Outs that are intended to compensate for limited readability, are not a full-value substitute. Asked whether they glanced at the readable headings when skimming the page or used the offered “flags” or “boxes”, the replies of the test persons were unequivocal: the strategy of use from the printed newspaper of selecting on the basis of the headings is preferred and transferred consistently to the E-Paper version. Typical answers to the question about what is important for orientation on the newspaper interface of the E-Paper offering are:

“The heading. I tend to consider the Fly-Outs as a disturbing factor, because they prevent me from reading the heading. Therefore I would probably not go over them with the mouse. Only, I consider everything here too small. It would also be of no benefit.”

“I would say that the first glance, because it is so small, is probably directed to the title, therefore to the page itself. And only when you are over it with the cursor do you take a closer look and then at the Fly-Out too, as it is written relatively small and naturally does not stand out so much. You must really take a close look to be able to read.”

“Yes, I have to take a look at this Fly-Out, as otherwise I cannot read it.”

“The headings, to the extent that I can make them out.”

“Provided that it is large enough, the heading. And if I am unable to read it, as is the case here (“Local News”), then I must look into this new little window.”

The comments of the users show that a design principle holds true here. Totally independent of the type of presentation, the reader’s attention is attracted primarily by the optical size of the individual elements – a finding that is supported also by the “Eyes on the News” view tracking studies for newspaper pages (see GARCIA/STARK 1991). The context-sensitive information boxes, designed as orientation aids, are used only if the traditional and familiar exploration strategy for the printed newspaper page is hampered by poor readability.

Old medium before new medium is the principle also in the case of competency and utilisation strategies. The following information provided by a user demonstrates that the problems with the Fly-Outs are connected also with the fact that the possibilities of online technology are not fully utilised: for example, because the headings in the Fly-Outs are not linked, and that is exactly what users expect in a hypertext context:

"I look at the actual article, at the heading. I read it like a real newspaper and less like as E-Paper version. Therefore I actually look at this heading and less at this blue box because I do not enter it with the mouse, ok? That bothers me. Perhaps it would be of interest if I were able to hop into the Fly-Out with the mouse and click on it. I must in any case go here [to the marked article in the newspaper interface] to click, therefore I read it there also. The other does not help me much, on the contrary it is more of a distraction."

The findings concerning the exploration of the front page of the E-Paper version show that, in the case of the larger and therefore readable or recognisable elements, the users apply their competency and habits from reading the printed newspaper. However, a series of limitations exist for this transfer. For example, the compensation for poor readability by the Fly-Outs does not work when text elements other than the heading are used for purposes of deciding which text to read. These can be sub-headings, as the Eyes-on-the-News study showed, or author by-lines for deciding which reader letters to read:

"In principle, I see the same main lines as in the print edition. Therefore I can act in exactly the same way as with the print edition, i. e. I have a quick run through to see what interests. Usually I am interested in readers' letters and look first at the heading and who wrote it. Occasionally I know the writer, in which case I read everything about the topic concerned. (...) If I look at this page, even with my reading glasses, I am only able to read at most one, two, three, four, or five headings. This means that I have first to click on them to be able to read the headings. I find that a bit too much work."

The typographic limitations of the E-Paper version lead to an unreadability of the orientation text parts, thus preventing the transfer of the utilisation pattern from the printed newspaper.

The problem of readability is especially evident in the case of the advertising pages, on which the typography is relatively small already in the print edition. Accordingly, ads cannot be read at all in the E-Paper edition. For this reason, it is not possible to skim in the same way as with the printed newspaper, which explains why the findings concerning the utilisation of the ad pages are correspondingly sobering:

"This is no use to me at all! Of course, I can see all the various ads here, but they are not of much use to me because no Fly-Out pops up and, due to the tiny type, I would have to click through each ad individually."

The poor readability not only prevents aimed searching for an ad, but also tracking which ads have already been viewed. Because whoever closes an ad opened by a mouse click can no longer recognise, due to the unreadability of the individual ads, which ads were already opened and read. Accordingly, the test persons seek alternative navigation possibilities in the advertising sections, such as a possibility to blow-up the page or a corresponding search function. As the evaluation of the search strategies will show, a database-oriented processing is the better variation for an online advertising section. The weakpoints of the newspaper interface can no longer be compensated at optical level for this newspaper section, but must be taken into a completely new, online-specific presentation form. (see 6.6.1 Ad search via the newspaper interface).

5.1.2 Limits of transfer: design differences between print and E-Paper

Modern newspaper design is characterised by modularisation: complex topics are broken down into independent functional information units that can be texts, graphics or photos, and concentrated in a cluster on one page or two-page spread or distributed on various pages as a feature. For the print media, orientation aids have emerged both for the cluster and the feature solution that clearly show the readers which modules belong together and how. Such means can be in the form of text, e. g. topic boxes with references to articles. But they can also be visual, e. g. in the form of the various layout techniques for optical marking of a topic cluster. Can E-Paper simulate this modern processing form that is specific to newspapers and make it distinguishable for the reader?



Fig. 27: The article as facsimile: the selection frame covers picture and text.

On the first exploration level of the newspaper interface, article clusters are highlighted by a corresponding marking with a frame: depending on the cursor position, all elements are framed that belong to a cluster, or individual elements of the topic cluster, e. g. photos. However, the cluster cannot be activated by clicking, only individual cluster elements, which means that the connection between the modules can no longer be recognised – here also, this leads to a “media break”. The absence of hypertext processing of E-Paper prevents a linking of the cluster elements, the poor readability prevents a registering of the cluster by the means of the printed newspaper. In this respect, E-Paper ranks behind the other two types of media. This is testified to also by the quality judgements of the users as well as the shortcomings they list. The exploration comments of the following test person reveal the typical irritation with this type of media break (Fig. 27):

The user fully applies his knowledge of using the printed newspaper to E-Paper. He expects that, exactly as in the printed newspaper, text and image can be received both alternately and together also in the digital newspaper.

Readers therefore expect consistency also in the article processing. The following objection of one test person – who is accustomed to using the Rhein-Zeitung – that clicking on the article text disrupts the newspaper layout is typical for this finding:

“It has always irritated me in the past, and continues to do so now, that although I get the layout of the newspaper, when I click on an article I am no longer in the newspaper layout but instead obtain the article simply in text form.”

Since then, the Rhein-Zeitung has accommodated this reader wish with the new measure introduced after this study was completed that permits also the individual articles to be presented via a link “as printed” in the newspaper layout form (see Fig. 28). If the newspaper is what you want, then that is what you get.

Similarly, the quantitative findings from the online survey show that 89.6 percent of the persons survey expressed the wish for additional and in-depth information in the form of background reports and pictures. Moreover, 65.1 percent of users consider a processing of the contents that fully utilises the hypertext possibilities of the online medium, e.g. in the form of additional links, to be of major importance. Therefore a specific added value is demanded that the classical online version may be able to meet, but that E-Paper seemingly at present is not yet in a position to provide to the satisfaction of the users. This applies also in relation to interactivity: 60.8 percent of the persons polled wished to have electronic surveys on topics of current interest.

Comments of the test persons	Navigation actions and gestures
What I find a bit strange is that, if I go for example to this article here, it surrounds not just the text that then appears, but the entire photo is also surrounded. And if the entire photo is surrounded, then I expect to see it completely, too ...	
	(clicks on the article “Afghanistan forms national army” / moves with the mit scroll bar to the bottom of the article / clicks on the Back button of the browser / marks the text and picture of the article concerned / clicks on the article)
In fact, the surrounding should only be in this frame here if it really refers only to the text. I can always click on the photo separately.	Points at the text of the article / clicks on the photo
No, there is also no direct connection here. I see no connection directly from the article itself ... I wouldn’t know now how to get from there There is no connection on the link directly to the picture. That is a bit silly. But if I click on the picture ... what happens then? Ah, so there is no direct link from the picture to the text. That is a bit weird	

Table 2: An excerpt from a transcription protocol provides a perfect example of the irritations felt due to a media break.

5.1.3 The limited hypertext capacity of E-Paper

The principle of hypertext processing can be found not only in online newspapers, but developed in printed newspapers with the establishment of the modern, modular newspaper layout. The versatile linking system of today's daily newspapers, consisting of teasers, promotional boxes, content boxes and indices, logos, cross-references, and orientation texts make these to hypertext information offerings through which the readers navigate in a similar, non-linear way as they do in the online versions. How can the E-Paper version of a daily newspaper convert this hypertext aspect? To date, E-Paper has produced poorer results here than the two parallel media (see chapter. 5.1.2). This can be illustrated by taking an example (see Fig. 29 and Fig. 30).

The contents box and the logo for the Gulf War reporting act in the printed newspaper as signals for focus topic reports consisting of several article units. The contents box "Topic of the day" lists the articles belonging to the focus topic. In an online newspaper, the logo, as a link, would usually lead to the corresponding main topic or special feature, the entries in the topic box would be links to the individual articles. In the printed newspaper, the "Gulf War" logo would be used in all places in the newspaper where articles on this main topic are positioned. Although the reader could not directly retrieve the articles via the logo and the contents box – as in the classical online version – but using them when navigating through the newspaper would help him locate the articles easily. Neither finding by clicking nor finding by aimed searching can be done in the E-Paper version because, for example, the page numbers are not listed in the topics box. The user can only scroll and search the individual pages for the articles, an action that can be extremely troublesome due to the limited readability of the headings. Accordingly, it is not surprising that the test persons complain about missing links – e. g. to topic/content-related articles. Although this is realised in individual cases in the display mode of the individual article, it is not in a hypertext environment.

In the qualitative part-study, this became especially clear in relation to the processing of focus topics consisting of several, large-volume article clusters. At present E-Paper is unable to work with the hypertext structures specific to the online medium. Instead, users must have recourse to navigation strategies that correspond to the recording strategies in the utilisation of the printed newspaper. A systematic linking of the utilisation patterns, navigation and orientation aids from the print edition and the classical online version is at present not offered.

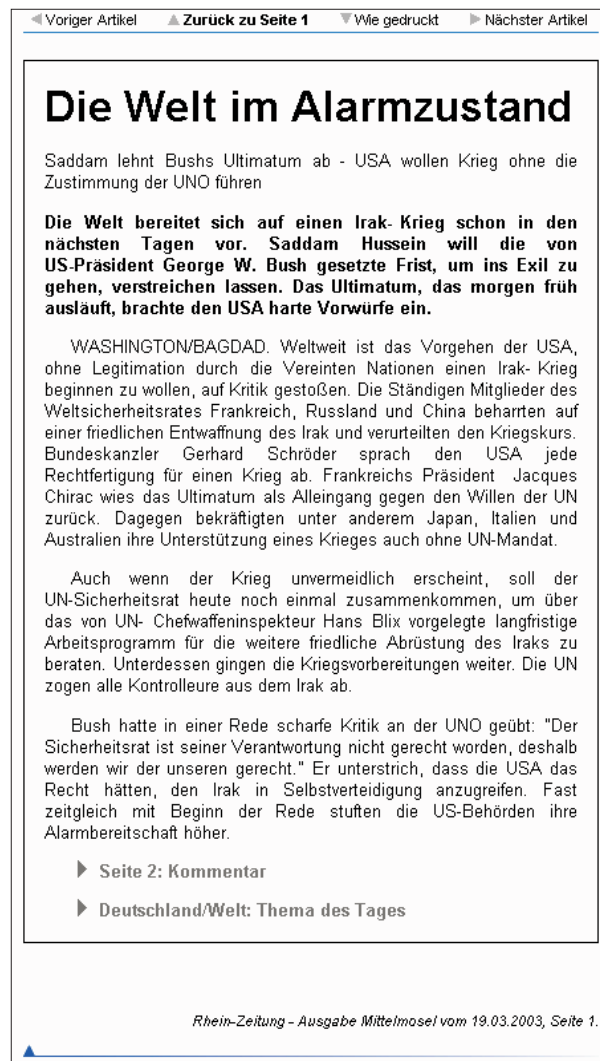


Fig. 28: A direct comparison of the two display modes: top, the "old" text version that was criticised during the present study, bottom the "new" article presentation "As printed". (Example from the edition of 19.3.2003)



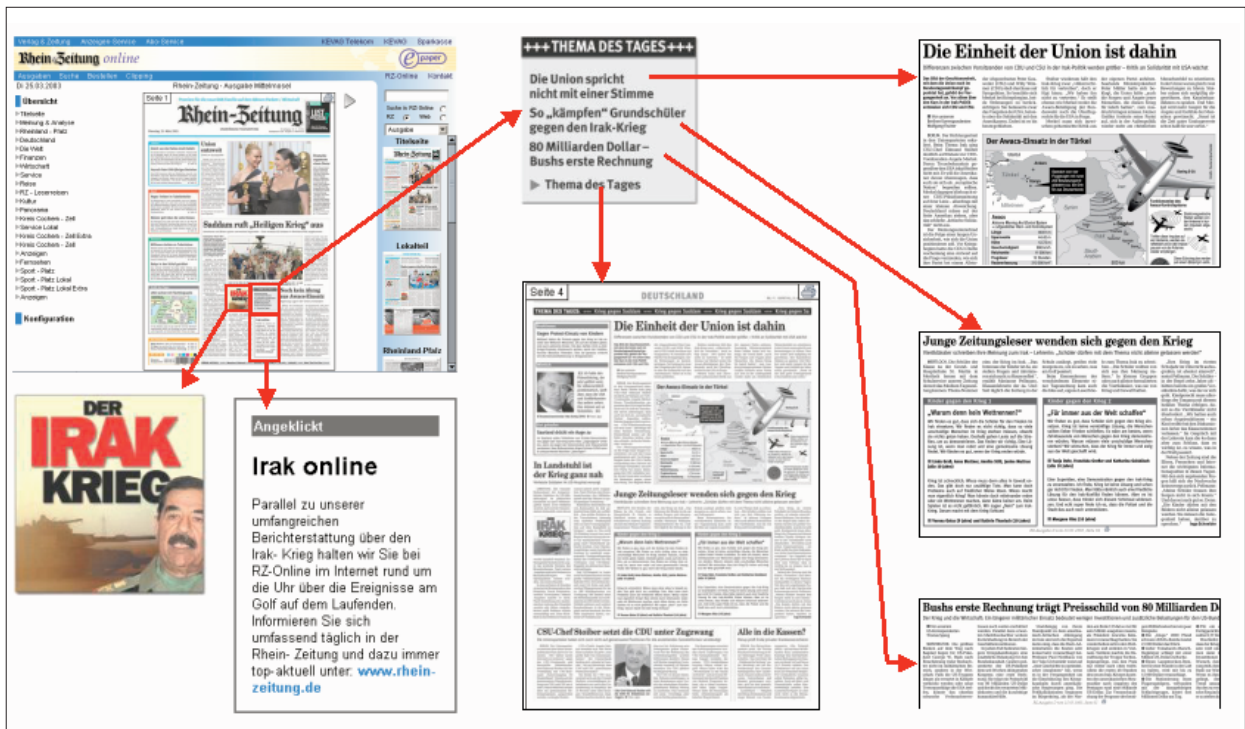


Fig. 29: Example for preparation of a topic cluster on the Iraq conflict from the E-Paper version of 25th March 2003.

5.2. Attention of readers using E-Paper

5.2.1 Where the user clicks on the newspaper page: perception and selection patterns

For media design purposes, it is of major importance to know where the readers, viewers or users first direct their attention. However, the Poynter “Eyes on the News” study for the newspaper has proved that the long-held assumptions concerning how the newspaper layout is perceived are, in fact, myths. It is not the position of an article or illustration – for example right before left or top before bottom – that decides where attention is steered, but the design and layout of the corresponding unit.

“Readers don’t enter the front page with a preconceived visual map. The dominant elements of the design determine the reader’s route, and these elements can be affected by story content, placement, size, and colour.” (GARCIA/STARK 1991, 26)

Against this background, the question arises whether the findings from the research into how the printed newspaper is perceived can be transferred to the E-Paper version. Are the miniaturised newspaper pages on the display screen perceived in the same way as the printed originals?

An important element of the interaction of the users with E-Paper is clicking on the miniaturised texts, photos, graphics or ads on the display newspaper page. In contrast to clicking on a link in the classical online newspaper, clicking on an article in the E-Paper version is also a magnifying act. Accordingly, there are two motives for this action:

- > **Motive 1:** The user cannot read an article heading, or clearly recognise a picture.
- > **Motive 2:** The user finds the article interesting and wants to read it because he has already understood the heading in the E-Paper format.

The first motive will undoubtedly come into play more often in the case of smaller texts and images than with larger units that can be read and recognised already in their facsimilised form. Therefore establishing the number of clicks does not necessarily directly indicate the level of interest among the users.

Each click leaves behind an entry in the logfiles on the data server. Evaluating these entries can provide information about the clicking behaviour of the users. However, the difference between the two motives cannot be recognised by a logfile analysis. Therefore the following data give no information about the reasons why an article was clicked on. But they do show some clear basic patterns in the interaction between the users and the E-Paper version concerned, e.g. where most clicks are carried out, which types of article are frequently retrieved, or in what ratio texts and images are used more intensively.

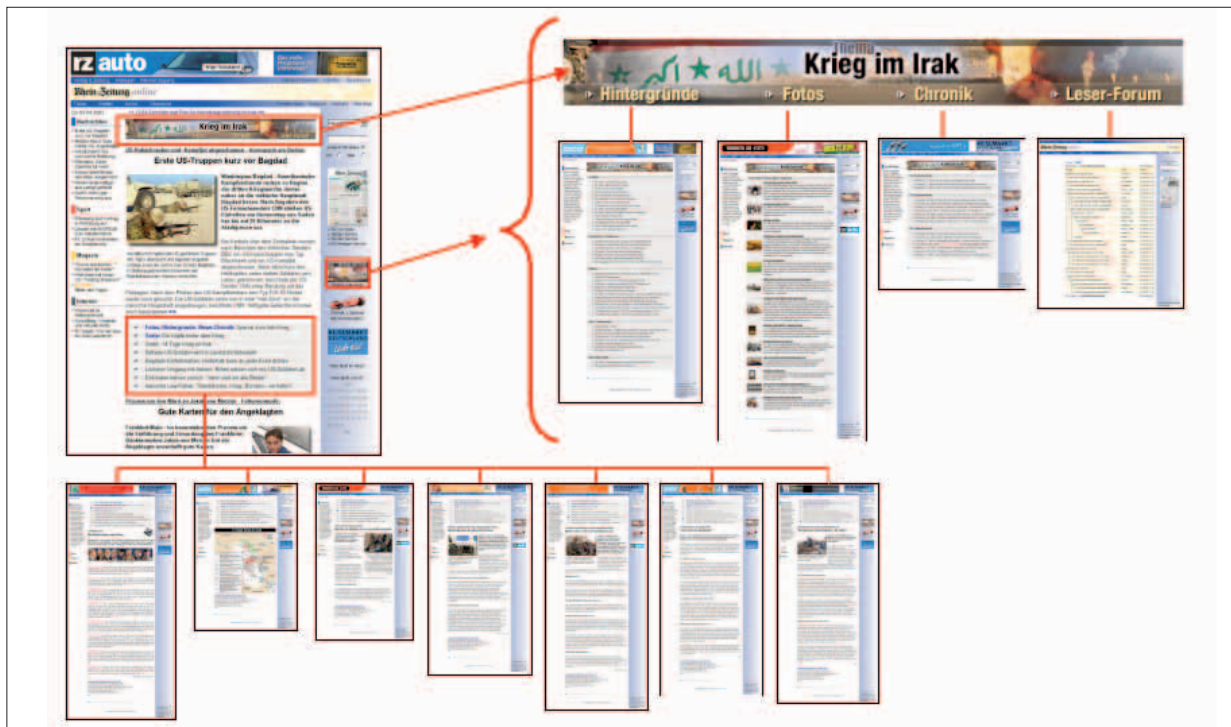


Fig. 30: A corresponding sequence from the online newspaper RZ-Online of 3rd April 2003.

The data that were evaluated within the framework of the logfile analysis also include information regarding the zones of an E-Paper page in which articles are retrieved. They allow an evaluation in accordance with the following positions:

Top, left	Top, centre	Top, right
Left	Centre	Right
Bottom, left	Bottom, centre	Bottom, right

Table 3: An overview of the position data.

For technical reasons, the individual articles were recorded in such a way that, for example, the elements beside which there were no further elements on the left were counted as left; all elements above which no further elements were arranged, top etc. An evaluation of this position data for the individual articles from the logfiles (basis for analysis, see chapter 3.4) provides information on especially prominent positions on an E-Paper page, as shown by Fig. 31.

To the extent that it was possible to document the action by “clicking”, it seems that the users concentrate their attention on all E-Paper pages on a “L”-shaped zone on the left edge of the facsimilised newspaper page. That reflected the typical layout structure of many pages of the Rhein-Zeitung that often contains overview bars on the left side of the page as well as a large number of explanatory articles relating to large, topic-focused units at the foot of the

page. Similar behaviour was observed in the “Eyes on the News” studies for printed newspapers (GARCIA/STARK 1991, 26–37). This indicates that users perceive the E-Paper interface similar to the printed newspaper.

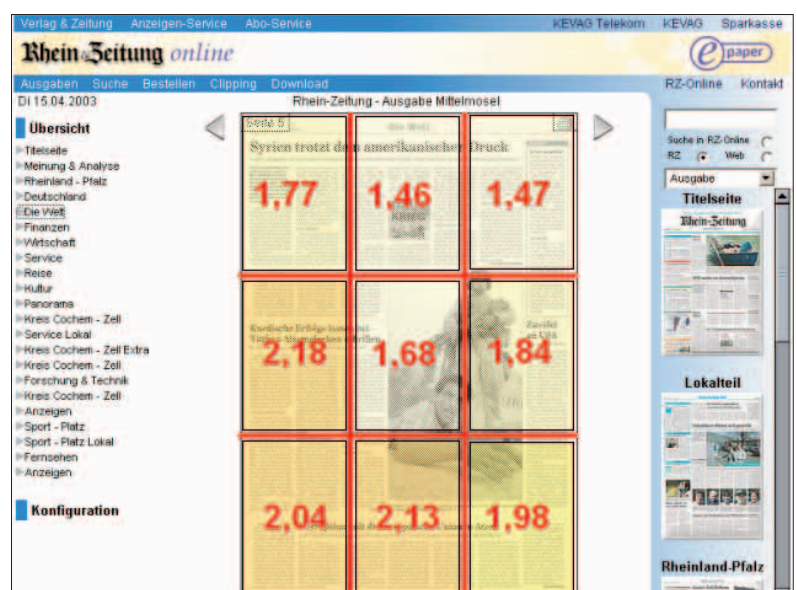


Fig. 31: The distribution of click frequency (click intensity) on the clicked elements (only articles, no pictures) across the newspaper interface on all E-Paper pages of the entire recording period. (Quotient from the number of all clicks and the number of clicked elements per zone).



Fig. 32: The distribution of the frequency of clicks (click intensity) on the clicked elements (only articles, no pictures) across the newspaper interface on all E-Paper front pages during the entire recording period. (Quotient from the number of all clicks and the number of clicked elements per zone).

Examination of the distribution of the user clicks on the clicked elements of the front pages of the E-Paper version shows that the actual layout of the front page has only a minor effect on the user clicking behaviour (see Fig. 32).

On the front pages, the click distribution takes the shape of a “T” at a 90° angle, therefore a clear preference for the contents positioned at the left edge and the centre of the page (see Fig. 32). In the case of the front page, the preference for the left side can be explained both by the obvious attractiveness of the day’s and the descriptions of the utilisation patterns by the test persons themselves. In their comments concerning their reading strategy, the specifically mention the relevance of the left column and of the centre for their selection decisions. This finding is confirmed also by the statements of the test persons in the reception study:

“Yes, otherwise here, as with the print edition. The two left columns with these corresponding boxes that then draw the reader’s attention to the various sections, such as local news, sports and panorama/culture. And then here this graphic of the day.”

The following two comments on the reception strategy for the front page of the printed Rhein-Zeitung clearly demonstrate that the above pattern for the E-Paper interface is transferred from the print newspaper.

[Interviewer: “Which parts of the front page would you read? What do you see first? How do you find your way around the page? What is important to you?”] “First of all, I always look at the photos, then the accompanying heading. If they capture my interest, I go directly to where the topic is reported in detail. If there was nothing there, then I would probably proceed to the left column, local news, and what is contained in the panorama/culture part. I never look at sports. Perhaps a glance at the “graphic of the day”, and then on to the next part.”

“Here the photo is dominant, so logically I look at it first. I am always interested in the brief news items as they provide a rapid overview of what the day has in store. I always read here with interest, it sometimes has attractive graphics or impulses, this I know ...[stops the cursor, graphic of the day]. Politics, I read only seldom, but probably read the headings if they interest me, something like “SPD puts on the brakes” does not interest me in the slightest!”

The page head registers considerably fewer clicks, presumably because the share of information units in this area, due to the positioning of the photo and the Rhein-Zeitungs logo in the page head, is relatively small and the larger-sized articles can still be read also in the newspaper page mode. As Table 4 shows, the typical structure of the front page is reflected also in the distribution of the users’ attention. The attributes used to indicate position use the same, nine-part model as in the evaluations of the attention distribution.

The retrieval figures on the left side of the page show that there, from top to bottom, it is especially two-columned articles that are clicked on, whereas in the lower area it is relatively wide articles that are clicked. Therefore the findings from reading-tracking studies for daily newspapers are confirmed also for the E-Paper version: i.e. the brief news items in the left part of the page attract the most reader attention. This is obviously a case of transferring a pattern from reading the front page of the Rhein-Zeitung to E-Paper, namely orientation on the basis of the two-columned overview items on the left edge of the page. This position has become the established place for orientation items, also internationally, and is obviously familiar to the readers.

By analysing the logfile data, it is possible also to examine individual newspaper pages in an aimed way in order to determine structurally-determined perception areas. The specific structure of the layout of the front pages in each case and of the selected page from a local part clearly indicates that single elements of the newspaper page in the E-Paper version, like the print edition, have a higher degree of priority than others. This clearly shows that the reception behaviour and reading decisions of the readers are not a matter of chance and chaotic, but are guided by patterns and principles. We shall examine in the following how the structural characteristics of the media offering and

Title	Position and size	No. of clicks on position
Front page	left, 2 columns	1176
Front page	centre, 3 columns	462
Front page	centre, 2 columns	453
Front page	centre, 4 columns	420
Front page	right, 5 columns	415
Front page	right, 4 columns	366
Front page	right, one columned	308
Front page	centre, one-columned	305
Front page	right, 2 columns	266
Front page	right, 3 columns	213

Table 4: Top 10 of the clicked elements on the front page during the entire test period, taking into account the size and position of the individual units.

the competencies, interests, customs, and levels of knowledge of the readers and users interact.

In order to be able to specify the utilisation findings more exactly, in a second step the nine-part analysis matrix was refined with a process for the high-precision (down to a pixel) evaluation of the click distribution among the clicked page elements. For this purpose, each article was broken down into its individual pixels. If a user clicks on the corresponding article, these pixels are transferred to an analysis matrix where, by combining the pixels from all test runs, a relief is produced whose peaks indicate zones of high click intensity and valleys lower click intensity. This relief is visualised by a special colour system: a high click value is represented by a dark colour, light areas stand for zones with low click activity.

The analysis of these evaluations of the logfiles revealed major deviations between the utilisation patterns on weekdays and weekends. On Saturday, the E-Paper offering is apparently read very closely, presumably because of its extensive advertising section, a fact that is reflected by the consistently high numbers of article retrievals across the entire page. In contrast, on Sunday, when the contents of the E-Paper offering are not updated, the numbers of users and clicks drop rapidly. It appears that only the larger, prominently positioned articles in the top part of the page are read (see Figs. 33 and 34).

A separate evaluation of the two survey weeks and an overall evaluation shows that there are obviously two zones on the E-Paper interface in which the numbers of user clicks rise. Articles positioned in the centre of the top half of the interface and in a field demarked by a diagonal in the bottom left corner are clicked on especially frequently (see Fig. 33). A direct comparison of the individual day's

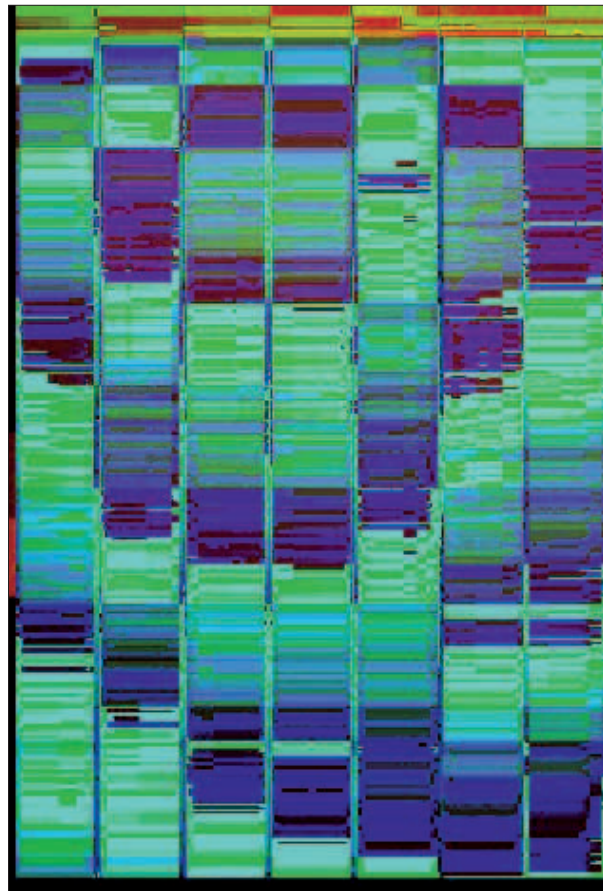


Fig. 33: The high-precision evaluation of click distribution over all pages of the E-Paper interface. The graphic shows the evaluation of the clicks from both test weeks.

evaluations showed that the click distributions, with the exception of these two general global trends, the weekend use that varies from weekday use and the preference for “top centre” and “bottom left”, are very different. That is a surprising finding in view of the highly consistent design of the newspaper pages in the Rhein-Zeitung that gives rise to an assumption that we will define in greater detail in the following. Despite the fact that E-Paper in many respects is used like a printed newspaper, utilisation patterns can also be found that were transferred from the classical online offerings. This seemingly includes the selection controlled a lot more by the user himself of the units that are of interest to him. Whereas in the case of the printed newspaper it is the layout and design that strongly influence the selection and attention, the use of online media is controlled to a greater degree by the user himself. The fact that the evaluation of the clicked-on page elements did not reveal any clear pattern, but instead the situation remains essentially disparate, indicates that this is valid also for E-Paper: it is not the offering that defines a perception pattern through its structures, but the users themselves who determine the distribution of attention.

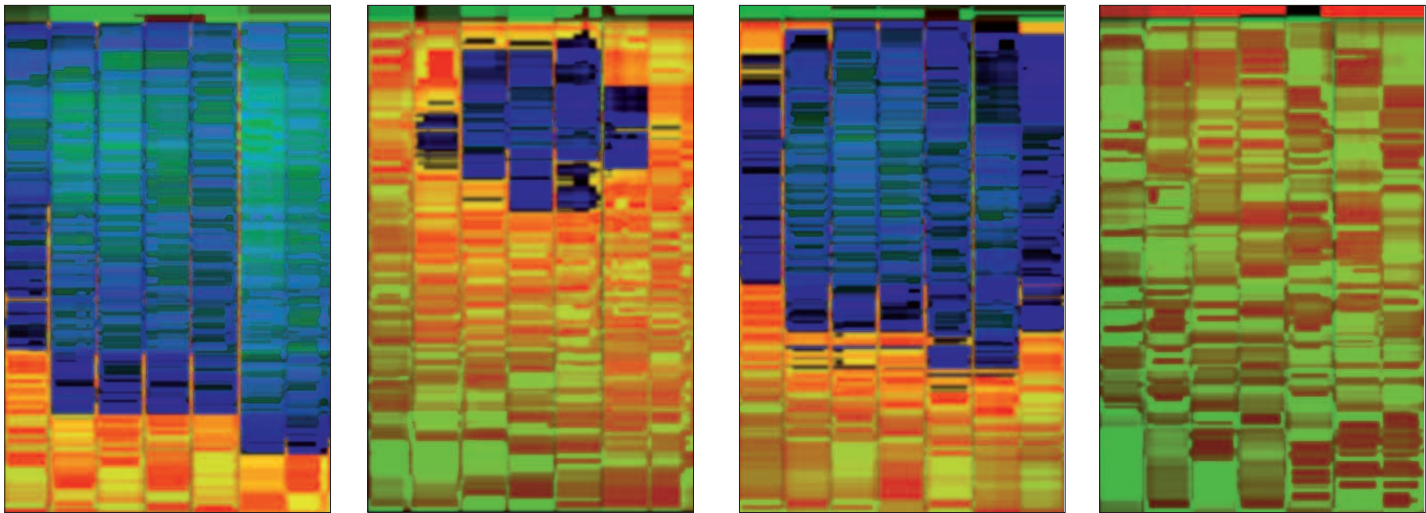


Fig. 34: The evaluation of the click distribution on the weekends two survey weeks. From left to right: Saturday Week 1; Sunday Week 1; Saturday Week 2; Sunday Week 2.

Due to the structure of the available data, it was only possible to apply the process developed as part of this study for the high-precision evaluation of the logfile data for all E-Paper pages of a day together. In case of a modification of the data structures that would allow a page-related evaluation of the data, the developed process offers the potential for an exact analysis of the user behaviour on the individual pages based on the logfiles. Then a correlation between individual, page-specific design characteristics, e.g. graphics or promotional boxes, and user behaviour would be possible. A page-specific evaluation of the clicks could also provide interesting indications of the attraction of the topic dealt with in individual articles.

5.2.2 What the user clicks: perception of image and text elements

An investigation of the Poynter Institute in which eye-tracking devices were used revealed that, in a printed newspaper, photos hold the attention of the readers to a stronger degree than blocks of text (GARCIA/STARK 1991, 41). Since this study, photos are considered to be the entry points to the newspaper page. In contrast, a second study, conducted by Stanford University and the Poynter-Institute in 2000 that examined the reception of online newspapers by eye-tracking analyses, showed that the situation is exactly reversed with online newspapers: the text elements tend to be perceived before the picture elements (LEWENSTEIN et al. 2000 and chapter 1.3.).

In view of this difference between the media, the question arises how text and picture elements are perceived in the E-Paper version. Are the pictures perceived first when using the digital newspaper interface, as in the printed newspaper, or are the texts used sooner and more frequently? An evaluation of the logfiles can provide first indications in this question.

Fig. 35 shows clearly that pictures are opened significantly less frequently than text articles. On average, about 40 percent fewer pictures are clicked than texts. This result indicates that the E-Paper reception in this point more closely follows the pattern of use of the classical online version than that of the printed newspaper. Accordingly, the attention pattern in the case of E-Paper corresponds more closely to the principle familiar from classical online newspapers, i.e. text before pictures.

But the significance of the logfile data is subject to two major limitations. On the one hand, due to their size, picture elements can usually be regarded via the newspaper interface in overview mode, while most texts must be clicked because only large headings can be read on the reduced-size newspaper page and the Fly-Outs provide only

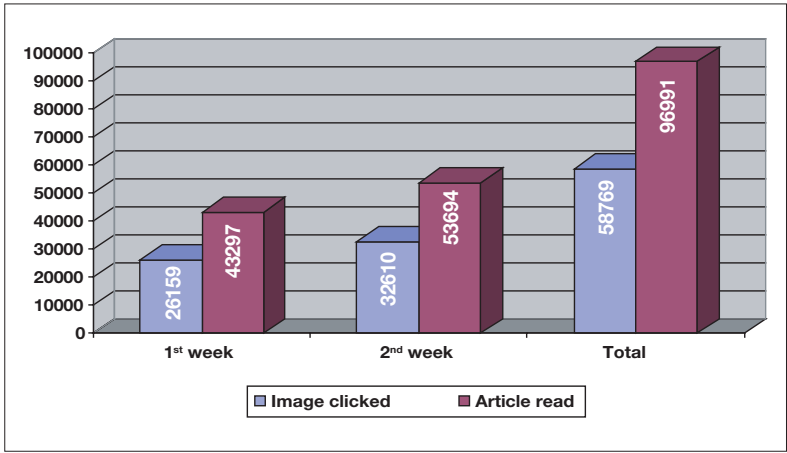


Fig. 35: The ratio of clicked text and picture elements. The results of both weeks and an evaluation of all data in direct comparison.

basic information about the content of the articles. On the other hand, it is impossible via the logfiles to provide information concerning the text-picture ratio in the E-Paper versions of the survey period. For this reason, it is entirely possible that the examined editions contained more text elements than picture elements that could accordingly be clicked, and that this partly explains the trend towards more clicks on the text elements.

However, taken together, the data shows that the attention pattern in the case of E-Paper is clearly guided by the principle of size. User behaviour reveals a general tendency always to view the largest-sized information units first of all. In the case of the Fly-Outs, this principle, as described already, was demonstrated by the fact that the test persons only read these if the headings in the facsimilised overview mode cannot be discerned (see chapter 5.1.1). In contrast, pictures, as relatively large units, can be understood already in the reduced-sized presentation on the overview pages of the newspaper interface.

Even if analysis of the corresponding retrieval data is unable to reconstruct the attention distribution between picture and text, the evaluation reveals the tendency that, when reading the E-Paper version on the display screen, texts attract more attention than pictures. The findings concerning attention distribution can be determined more precisely by carrying out an eye-tracking study along the lines of the aforementioned studies of the Poynter Institute. A study of this type is already planned as a concluding test.

6 Navigating and searching in the E-Paper offering

6.1 Scrolling – opening – clicking: navigating in the newspaper, online service and E-Paper

The printed newspaper, the classical online newspaper and the new presentation form of E-Paper are all media offerings with a non-linear structure. For the recipients, compared to the utilisation of the linear radio and TV media, this means that they must constantly take navigation and utilisation decisions in order to be able to appropriate the contents of the media offering. These active appropriation moves are organised in the sense of a supposed interaction with a communication partner, i. e. the user acts as if the offering were a communication partner (BUCHER 2001). With such an interactionist view of reception, the question arises as to which role is played by the media offering and which role the competence of the users. Utilisation competencies can be understood as the mastery of models for appropriating certain types of media. The fact that appropriation routines exist for online media was proved in various earlier studies (BUCHER/JÄCKEL 2002). The following figure shows the three central strategies for exploring a typical internet page, as they emerged from several reception studies on a range of very different online offerings – journalistic online offerings, e-Business offerings and eLearning offerings. Accordingly, these strategies can be combined to a so-called exploration script or model (see Fig. 36).

Also the studies on the reception of printed newspapers, referred to several times before, clearly indicate established utilisation conventions in the print medium (i. a. GARCIA/STARK 1991).

In the E-Paper version, the facsimilised form of the printed newspaper page replaces the classical processing form of the content area of an online newspaper. It must be noted that the transformation of the newspaper page into the E-Paper version is not a 1:1 conversion. Instead, the newspaper page in the E-Paper version represents an

orientation metaphor that is intended to facilitate user navigation. The sensitive headings, photos and texts, the navigation bars left and right are elements from the digital media world that are added to the newspaper-typical design characteristics of layout and text design. Accordingly, for using E-Paper it is necessary to combine competencies in newspaper reading and hypertext utilisation. The hybrid presentation form of E-Paper therefore calls for a hybrid utilisation competence that draws on the utilisation models for the two older types of media – print and online newspaper. For this reason, the question arises as to whether the use of E-Paper calls for either the application of the appropriation models of the online or the appropriation models of the daily newspaper. In order to clarify this point, the typical model for each type of medium for each test person for each of the offerings was recorded. By comparing the models, it is possible to conclude which competencies are transferred from the predecessor media.

It is known from the usability research that utilisation strategies are closely connected with the corresponding utilisation purposes. A distinction is made here between two basic utilisation modes (HASSENZAHL 2002, 275–277): Firstly, the so-called “Activity Mode”, or browsing through a hypertext or an online offering where the users allow themselves to be guided strongly by the offering itself and make ad hoc navigation decisions. Secondly, the so-called “Goal Mode”, i.e. aimed searching, either for specific information unit or collecting information on a specific topic. Consequently, the aforementioned E-Paper study investigated three basic types of navigation in the E-Paper offering of the Rhein-Zeitung. Firstly, the test persons were allowed to surf freely through the offering, secondly they were given the task of collecting articles from a newspaper issue on a specific topic, and thirdly they were asked to seek a specific article. These three basic types of navigating take full account of the range of utilisation possibilities of E-Paper.

6.2 Types of media and their specific reception possibilities

The E-Paper offering of the Rhein-Zeitung can be used via four different navigation possibilities. Special tools are available for each of these strategies, as shown in Fig. 37:

1. Sequential navigation: this navigation strategy mainly uses the “Forward” and “Back” buttons to scroll through the offering in much the same way as reading the newspaper (see Fig. 38).

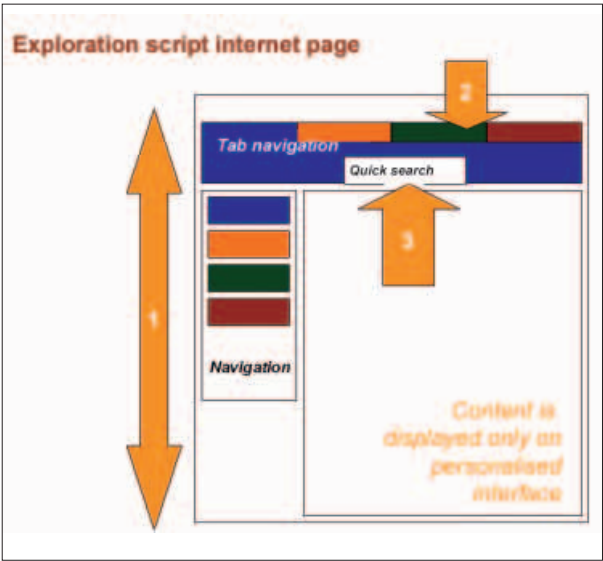


Fig. 36: The prototypical reception of an internet page (BUCHER/BÜFFEL/WOLLSCHIED 2002/38).



Fig. 38: The buttons for sequential navigation – moving from page to page. (newspaper interface)



Fig. 37: An overview of the navigation possibilities in the E-Paper offering.

Sequential navigation is possible at two levels: at newspaper page level (overview mode) it is possible to move from page to page and at article level (view mode) from article to article. Navigation from article to article in the view mode is possible without first having to return to the overview mode by “Back to page XY” (see Fig. 39). This type of navigation possibility supports an additive reading strategy that covers all articles on a page. However, for the reader it is not transparent which system this function uses to access the next article. He more or less blindly uses the forward or back button.

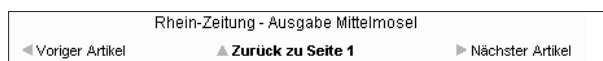


Fig. 39: The navigation elements in the content area in the article level.

2. Section-oriented navigation: this navigation strategy is not sequential, but uses the thumbnails of the front pages of the sections from the printed newspaper, as they can be found in the right-hand navigation frame. Accessing the individual pages within the section is done usually by means of the sequential browsing strategy.

3. Page-related navigation: this navigation strategy uses the hyperlinks to individual E-Paper pages positioned in the left-hand navigation frame.

4. Individualised navigation: using the “Configuration” option at the left side of the page, it is possible to personalise navigation. By doing so, the user can programme the pages for the right-hand navigation frame in accordance with personal preferences and interests.

The fourth variation is used independently by only one test person. When using the entry page, eight test persons, at the suggestion of the interviewer, click on the corresponding link and familiarise themselves with the personalisation possibilities. This observation indicates that the offerings for individualisation and personalisation are barely noticed to date and that, especially in the area of the examined E-Paper offering, there exists only little interest in such a function.

The sequential navigation is a microstructural strategy. Section-oriented and page-oriented navigation can be described as macrostrategies. Whereas in linear media only microstrategies are used to get from one unit to another, non-linear media use a mixture of micro- and macrostrategies. It is the macrostrategies that permit the free navigation possibilities, such as are typical for a hypertext-based offering. Accordingly, the hybrid character of E-Paper should be reflected also in a corresponding mixture of both

types of navigation. For this reason, a central research question is whether, with the use of E-Paper, it is more microstrategies such as are typical for linear media that are used, or more hypertext-specific macrostrategies. In order to settle this question, a distinction was made for the three types of media between the following typical use models:

- > For the daily newspaper: scrolling as a sequential model and section navigation, therefore the direct opening of specific parts of the newspaper, such as the sports section, local news, etc..
- > For the classical online offering: navigation via the left navigation frame, use of specific content offers on the entry page and navigation to the sections via a pull-down menu on the right side of the page of the online offering.
- > For E-Paper: as sequential model, scrolling using the corresponding buttons, navigation to certain pages via the links on the left side of the page and section navigation to various sections of the E-Paper version via the miniaturised newspaper pages at the side of the screen window.

6.3 Free navigation in the newspaper, online newspaper and E-Paper: comparative findings

The two main navigation strategies for the free utilisation of the printed newspaper, i. e. sequential and section-oriented navigating, are used with different levels of frequency by the test persons. Ten test persons systematically scroll through the printed newspaper. However, seven test persons (2 men and 5 women) begin reading the newspaper usually not on the front page, but scroll from back to front through their daily newspaper “because it is easier to skim through it that way”. The majority of test persons (14) use the section-oriented method. They deliberately select certain sections of the newspaper and start reading there.

The dominant navigation strategy in the case of free exploring in the RZ-Online offering is the use of the left navigation column with hyperlinks to the various columns of the online newspaper (news, sports, magazine, internet). Sixteen test persons use this **navigation method**, which con-

firms the utilisation pattern established in previous studies (see BUCHER/BÜFFEL/WOLLSCHIED 2002): the intensive use of the left navigation frame is by now a standard feature in online media utilisation.

On the entry page of the RZ-Online offering, under the individual sections in the left navigation frame several especially interesting, important or topical articles are linked by means of brief, two-lined teasers. Besides structural knowledge, this is intended also to give the user an overview of the central contents.

Six test persons use the so-called **content navigation**, i.e. they access the offering via the individual articles in the content part of the entry page. They then use the links that lead further in order to access additional information on topics that interest them.

Only two test persons choose the third navigation strategy, i. e. the so-called **section navigation**. It is possible to retrieve specific parts of the online newspaper via a pull-down menu and thumbnails on the right side of the page as well as a site map. This finding also confirms a previously established utilisation pattern: links on the right side of the page are not noticed as much and considered less important by the users.

A direct comparison of the dominant navigation strategies presented here at the stages of free exploration gives an indication of whether the test persons have tended to transfer their use and reception habits from the printed newspaper (Rhein-Zeitung) or from the classical online newspaper (RZ-Online) to the E-Paper version. Table 5 summarises the findings and highlights the relationships between the utilisation patterns for the three types of media.

With seven test persons, no such transfer can be recognised. Five persons apply the navigation strategy of online utilisation to E-Paper. In doing so, these test persons show a clear concentration of their attention to page-related navigation in the E-Paper offering and section navigation in RZ-Online.

“Yes, here is the overview. And I select directly, here the local pages.” [Moves with the cursor over the left navigation bar and clicks on Cochem/Zell]

It is most of all models of newspaper utilisation that are transferred to E-Paper. This transfer was observed in the case of twelve test persons. Four test persons utilise E-Paper and the printed newspaper by sequential scrolling. Eight persons navigate in a section-oriented way directly to individual sections by clicking the miniature views of the front pages of different sections, so-called thumbnails. Therefore the E-Paper offering activates an appropriation process among most users that they have learned already from the printed newspaper.

No “infection” effects from the test sequence can be recognised. But the use patterns that the test persons learned during the “everyday media usage”, already before the test sessions, do seem to exert an influence. However, due to the small number of cases, only first hypotheses

No. of test persons	Print strategy	E-Paper strategy	RZ Online strategy
5	Section-oriented	Page-related	Left navigation
4	Sequential	Sequential	Left navigation
7	No relationship discernable		
8	Section-oriented	Section-related	Content area or left navigation

Table 5: A comparison of the predominant navigation strategies of a total 24 test persons in the three types of offerings. Highlighted are similarities that indicate an influencing of the navigation strategy by customs learned from print or online.

about the effects of the preliminary knowledge on the use of the examined offerings can be developed. Experienced web users show a clear concentration of attention on the left navigation elements, both in RZ-Online and the E-Paper version. Obviously it is already a component of utilisation competence to have navigation elements positioned on the left side in web offerings, and this is then transferred to as yet unknown online offerings. The test group is informative in this respect. Only two of the six test persons who do not know the Rhein-Zeitung use E-Paper in the same way as the printed newspaper. Users who are unfamiliar with the printed base medium apparently allow themselves to be guided more by the online scripts, as they have no structural knowledge concerning the design of the print version. Consequently, users tend to view E-Paper more as an online newspaper, because they are able to deduce the required routines or patterns from their online experience.

The observation that the E-Paper offering in the majority of cases tends to activate the utilisation patterns from the printed newspaper and less from the classical online newspaper is confirmed by the results of the logfile analysis (see Fig. 40). By far the most-applied navigation operation is the action "clicked on from previous page", which indicates a sequential utilisation pattern. The users "scrolled" through the offering more than 100,000 times during the examined period, therefore using E-Paper as a printed newspaper. In general, the logfile analysis reveals a clear dominance of microstructural navigation steps, such as are typical for a sequential utilisation pattern. Retrieving an article and switching from one article to the next are used a lot more frequently than macrostructural navigation operations, such as jumping within a version via the left or right navigation bar, or changing between versions. The dominance of microstructural navigation over macrostructural, such as is typical for hypertext-based online offerings, clearly evidences that the users E-Paper perceive as a variation of the printed newspaper.

The relatively small number of cases for the navigation action "clicked on a link in the article" indicates a very low level of hypertext-based information processing. In this respect, neither the structure nor the utilisation of the E-Paper version corresponds to the hypertext-based patterns of an online offering.

6.4 Topic research

Besides free exploring of the three types of media, the test persons were asked to assemble various articles to a topic-dedicated feature. Examples of such topic features during the study period were the move to expel German politician Jürgen Möllemann from the FDP (German Liberal Party), the budget debate in the German parliament or general assembly of the Green party. Table 6 shows the frequency distribution for each of the chosen search strategies. This reveals a basic trend. The change of the mode of utilisation from free exploring with given objective, i. e. browsing or activity mode (HASSENZAHL 2002), towards a greater objective orientation, corresponding to

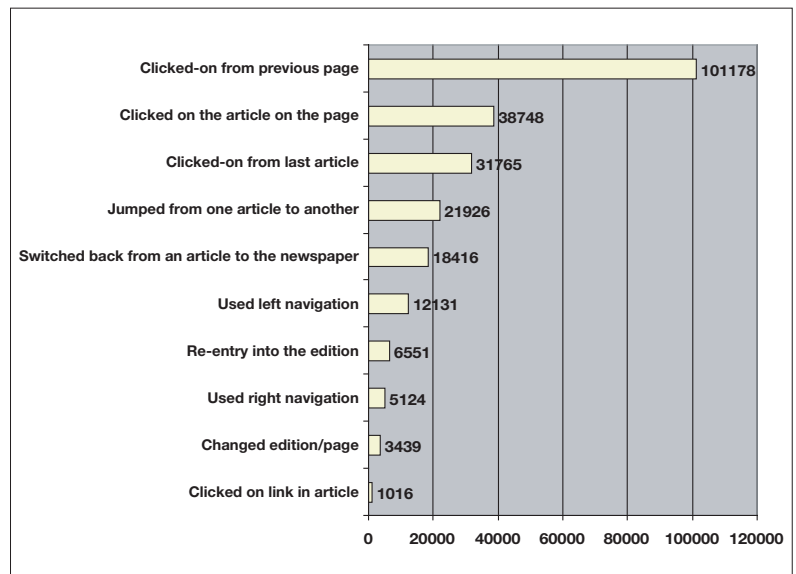


Fig. 40: The use of navigation possibilities in the E-Paper offering.

(Total result: evaluation of both test weeks; all data in absolute figures).

the so-called Goal Mode, also brings about a change in utilisation strategy. E-Paper uses more online-based than print-based navigation strategies for the topic research. This reduces scrolling, which continues to be the most-used strategy in the newspaper version, to a single case. In contrast, typical online-based strategies, such as the use of a search engine, utilisation of forwarding links or recourse to standardised navigation aids such as the sections in the left navigation frame, are becoming increasingly commonplace.

An examination of the research behaviour of the test group reveals a growing impetus in this change in utilisation behaviour: this group uses E-Paper for topic research almost exclusively in the same way as a classical online offering.

The clearly poorer assessment values for E-Paper in relation to search function and navigation have their origins in this area of aimed research. Expressed in a drastic way, it could be stated that E-Paper, in its present forms, does not yet offer the research and navigation tools users expect in a non-linear medium.

Type	Direct-links	Searchmaschine	Scrolling	Orientation text	Section-orientation	Direct navigation
Online	6	10	–	–	7	–
E-Paper	8	7	1	2	10	–
Print	4	–	13	6	2	3

Table 6: Comparative evaluation of the navigation paths used in topic research (source: Qualitative part-study; n=24; multiple replies possible)

6.5 Article search

With the task to carry out a goal-oriented search for a specific article or ad, the object-oriented utilisation purpose is once again contrasted to the topic research method. In contrast to the browsing mode of free navigation, the test persons stay in the Goal Mode, where the objective is exactly defined. For aimed searching for individual articles, fewer navigation possibilities were used compared to the more associative topic research. The strategies selected in each media type concentrate on two of the following possibilities (see also Table 7):

- > use of the search engine (E-Paper and online offering)
- > sequential scrolling (E-Paper, print newspaper)
- > orientation towards the arrangement into sections Print (sections), Online (columns) and E-Paper (combination of left and right navigation bars)
- > use of the orientation texts, such as teasers, puller-in items, topic boxes (E-Paper, print).
- > direct navigation by means of knowledge of position.

Even though in the case of E-Paper scrolling, as opposed to topic research, is used occasionally, there is a clear trend in the utilisation strategies towards more online-based forms. The use of search engines and searching via the corresponding navigation tools in the left navigation frame are the dominant approaches. This applies also for regular E-Paper users.

Generally speaking, the following tendency can be discerned: the more precise the goals for a search task are, the more the online-specific search strategies are used. It is obvious that the newspaper interface of the E-Paper version is only suitable to a limited degree for the Goal Mode with clearly defined objectives. If the browsing reader of the daily newspaper has a macrostructural search strategy at his disposal, this no longer works in the E-Paper version due to the limited readability. The following comment by one of the test persons clearly evidences this E-Paper limitation:

“Hm, for me as a confirmed reader of the printed newspaper, this way of reading is a bit strange, as you only have the headings and cannot simply skim through the article to get an impression of the content. At least at first glance this is not possible.”

To that degree, a change of strategy towards the online-based navigation patterns can be understood. The weakpoint of the E-Paper interface is therefore most evident in the advertising content: the limited readability hinders the locating of ads by the skimming process that is familiar from the daily newspaper. Not even the division into sections can be recognised, so that any delimiting of the search, e.g to a specific make of car, is not possible. To that degree, it is only consequential that the test persons should themselves explicitly demand a corresponding search engine for search tasks in the advertising section.

Type	Searchmaschine	Scrolling	Orientation text	Section-orientation	Direct navigation
Online	9	–	9	–	–
E-Paper	12	5	11	–	–
Print	–	15	12	2	2

Table 7: Comparative evaluation of the navigation paths used in topic research (source: Qualitative part-study; n=24)

6.6 Ad search

In order to evaluate the ad processing in the three types of media, the test persons were assigned two different ad search tasks, consisting of the search for a used car and search for an apartment. The tasks were formulated as follows:

Assume that you want to buy a new car: look for a Golf, it should not cost more than EUR 7000 and have mileage not excess of 100,000 km.

Or:

Assume you are looking for an apartment. Look for a 2-room apartment in the Koblenz region with at least 70 sqm and up to EUR 600 monthly rent (incl. utilities).

E-Paper offers two possible ways to search in the advertising content:

1. Ad search via the newspaper interface
2. Ad search via the common RZ-Online and E-Paper ad database.

6.6.1 Ad search via the newspaper interface of the E-Paper version

The ad search in the E-Paper version via the newspaper interface is greatly hampered by the limited readability. As a result of the ad typography, neither the ad categories nor the ad texts can be read directly on the miniaturised newspaper pages (see Fig. 41).

The typical search strategy from the printed newspaper is three-phased, as evidenced by the following remarks of a test person: firstly, the suitable section is sought (e. g. cars), then the suitable category (VW) and finally the columns systematically run through from top to bottom:

"I go to 'cars', take out this section, and then I know that the used car offers are located after the texts, arranged in alphabetic order. VW is naturally way at the back. What should I look for? Eh, Golf? It is naturally a drawback of this newspaper that they are not listed by price, so that I have to go through all the Golfs."

In the case of the E-Paper version of the Rhein-Zeitung, the test person can fail already at the first step if he is to find the relevant ad page. In the navigation frame on the left, the ad pages are always linked under the non-specific term of "Ads". Therefore the user does not know where, for example, he can access the used car market or real estate section and must practically work blindly through all possibilities. Also the second step, i.e. finding the corresponding section, can prove to be a stumbling block because neither the page heads nor the column headings are legible. The third research step, going through the ads column by column, is not possible in an E-Paper version of the Rhein-Zeitung for reasons of readability. The following quotes give an impression of how these difficulties cause problems for ad searching:

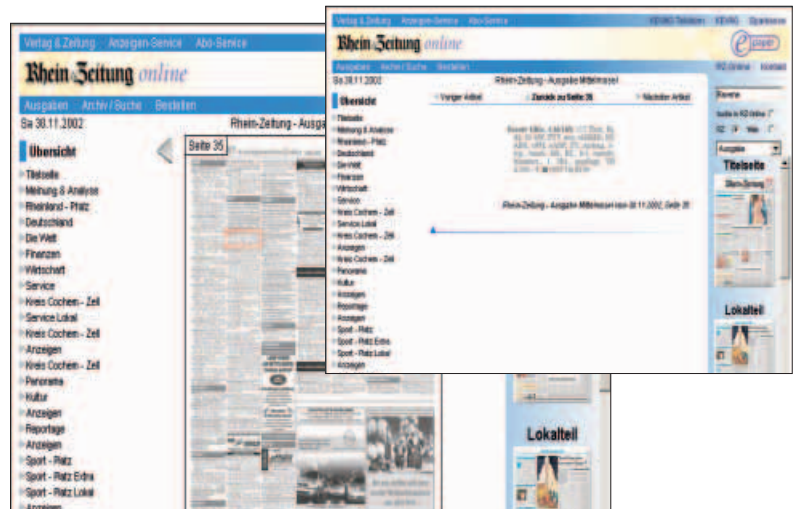


Fig. 41: Ad searching via the newspaper interface fails due to the too-small display. The small window shows the marked ad in full-size display.

"I cannot even guess where things are. I really have to go to a field and search. If Opel is there, then VW must be further behind."

"I'll take a look now first at the ads. Oh no! [laughs] This is no good to me at all! Here are the individual, different ads, but they are no good to me because no kein Fly-Out comes and naturally I cannot recognise anything from this tiny type and would therefore have to click through each single ad."

"I have to read through everything until I find what I want. I do not know whether this is for cars."

"When I click here (on the ad), then I would not know what I read last ..."

"I have it here in Automobiles, I find the right page, then I scroll further. Now I would have to blow it up a bit, how do I do it? I know that the ads come here because I see that below - Automobiles - I still remember that. And how do I get to VW? OK, but I cannot read it, I would have to blow it up."

None of the test persons succeeded in solving the re-search task and finding a car that matched the search criteria via the newspaper interface. The proposed solutions developed by the users themselves range from the demand for a blow-up possibility to programme larger type under “Configuration” and a zoom function. The farthest-reaching demand of the users, namely a search function for ads, serves once again to evidence the aforementioned hypothesis: the more specific search tasks become, the more users expect online-specific search and research aids. The following quotation from a test persons shows just how clear the ideas for an aimed search strategy can be:

“I need to have a search function, then I write into it, search the two values, e. g. car, 7,000, therefore three and three bars, those are the most important attributes when you are searching ... car, mileage, and maximum price. The three buttons [meaning entry lines] should appear, and then it should be no problem for the system to get what you want.”

The E-Paper offering of the Rhein-Zeitung is linked via the navigation in the page head with the advertising market of the RZ-Online online offer (“Search”). But this search function is difficult to find and its input mask has serious design faults. The above quote lists the input fields and functions desired by an average user: brand, type, mileage and price. However, the search function only represents a filter (full-text search), one input field for a P. O. area code and one pull-down menu each to select the car brand and date on which the ad was posted (see Fig. 42). “From-To” queries are not possible. This discrepancy between user requirements and offer functions produces a poor evaluation of the search function in the RZ-Online offering. The potentials of a comfortable, online-specific search function are negated by these deficits and the resulting user irritation.

6.2.2 A direct comparison of ad searching in all three types of media

At the end of the test session, the test persons were asked which types of media in their opinion offered the most comfortable ad search possibilities. Seven selected “Print”, six “RZ-Online” and only three “E-Paper” (see Fig. 43).

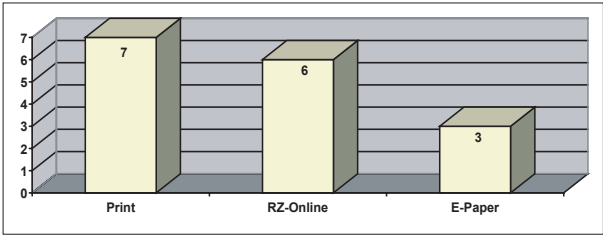


Fig. 43: Evaluation of the replies to the question “In which of the three types of media did you find carrying out ad searches the most comfortable?”(source: Qualitative part-study; n = 16; all data in absolute figures).

The fact that print and RZ-Online rate almost equally is because they offer both readers and users familiar search possibilities: the daily newspaper, skimming over the orientation aids, such as page heads, ad categories, bold type and column arrangement, the online version by providing a search engine. An E-Paper-specific search possibility for ads, e.g. blowing-up the newspaper page or a zooming function, is not provided. On the other hand, the transfer of the methods of procedure learned from the other two types of media is prevented by the specific E-Paper properties. A solution to the problem lies here in the consequential decision in favour of an online-specific search aid that systematically facilitates the use of the ad database. At design level, this would realise the step that the users have already taken in the case of aimed search and research tasks: the step towards online-specific navigation strategies.

“Compared to the printed version, after you have found your way around the page, I find it a lot faster for getting to certain ads, also those subdivided into categories, therefore it is more transparent (...) There does not seem to be a price limitation, or I have not discovered it. I think there could perhaps be even more options for how I can search in a more aimed way, perhaps for a certain colour or something like that.”

Accordingly, the display weakness of the E-Paper interface is most evident in the advertising section. The limited readability prevents the finding of ads by the method that is familiar from the daily newspaper, i.e. skimming across the page. Not even the division into columns can be recognised, so that also the search cannot be narrowed down, e.g. to a specific brand of car. To this extent it is consequential that, for searching in the advertising section, the test persons themselves call explicitly for a search engine to satisfy their requirements.



Fig. 42: The search function of RZ-Online: the input mask parameters match the requirements of the users.

7 Embedding the E-Paper offering in the virtual space

A central difference between the printed newspaper and the der E-Paper version is that that latter, due to its internet environment is embedded in a larger communication and information space. Whereas the paper newspaper is used as an isolated product, the E-Paper version opens up further communication spaces. For example, in the case of the E-Paper version of the Rhein-Zeitung the following connections to communication spaces are created:

- > The connection to the Rhein-Zeitung media company.
- > The connection to the Rhein-Zeitung archive.
- > The connection to further editions of the Rhein-Zeitung.
- > The connection to the RZ-Online classical online offering.
- > The connection to the joint advertising market of RZ-Online and E-Paper.

It is one of the tasks of the interface to organise access to these communication spaces for the users. Another task of the interface is to enable reception of the corresponding E-Paper version itself – the primary information space. The user-friendliness – the degree of usability – of an E-Paper offering depends also on how this dual task is resolved. The gateways to the various communication spaces are the hyperlinks on the interface of the E-Paper offering. If you cannot find the gateways or cannot open them, you will also not find the way into the virtual information space:

"Links are the most important part of hypertext: They connect the pages and allow users to get to new and exiting places on the Web." (NIELSEN 2000, 53)

In the E-Paper version of the Rhein-Zeitung, there are many different types of links that can be divided into the following groups (see Fig. 44, the numbering of the link types corresponds to the following listing):

1. Links within the E-Paper interface to retrieve the corresponding articles and figures or the links to additional information units in the retrieved articles. Hotspots, i. e. the linked spaces, are the articles or figures on the facsimilised overview page.
2. Links for receiving the edition concerned in each case of the Rhein-Zeitung in the navigation frames on the left (text links) and on the right (thumbnails) of the E-Paper page.
3. Links to additional E-Paper regional editions of the Rhein-Zeitung.
4. Links to receive the Rhein-Zeitung company and its cooperation partners. Hotspots are the text links in the page head.
5. Links to the reader services of the Rhein-Zeitung.
6. Links for searches and to the archive.
7. Links to the parallel medium of the online service of the Rhein-Zeitung (RZ-Online).

To enable the users to understand these complicated reference structures, several criteria must be satisfied for the individual links: users must recognise what counts as a link, they must be able to understand to which target a link refers and must be in a position to recognise the communication space to which a link refers.

The empirical findings concerning the utilisation of the E-Paper version of the Rhein-Zeitung indicate some of the fundamental problems encountered when attempting to solve these design tasks. Above all, the design and identification of the links as well as their systematic organisation are decisive factors for guaranteeing a user-friendly interface design. As Figure 44 shows, the Rhein-Zeitung interface attempts to organise the access points to the various communication spaces also by their arrangement.

Thus the links to the secondary communication spaces, such as reader service, company and partner companies, are situated in the page head, while the links for reading the E-Paper version are accommodated in the classical navigation fields on the left and right page edge. However, users experience orientation difficulties because this space organisation is not followed systematically. For example, with the links "Issue", "Archive" and "epaper" in the headband there are links to primary communication spaces in an interface region that is, in fact, intended for the navigation aids to the secondary communication spaces. The transparent connection of the various information spaces with the E-Paper interface represents one of the major sources of problems encountered when using the E-Paper offering of the Rhein-Zeitung offering. User irritation was observed during the qualitative reception study especially



Fig. 44: The link types on the entry page to the E-Paper offering (30.11.2002). The numbering of the link types is in accordance with the above listing.

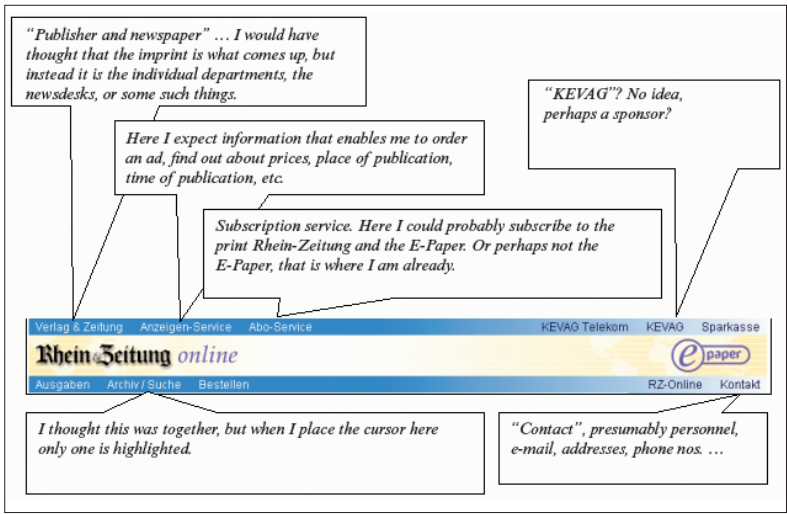


Fig. 45: Typical assumptions of the test persons concerning the hyperlinks in the page head of the E-Paper offering of the Rhein-Zeitung.

where the managing of search and research tasks leads to a change of the information spaces. For example, because E-Paper and RZ-Online share an advertising market but this itself does not offer any link back to E-Paper, none of the test persons found the way back to the E-Paper version. The unmarked change into a different communication space led to an orientation problem that could be described as Lost-in-Hyperspace.

Inconsistencies between the various communication spaces cause an additional problem. If the same link means different things in two communication spaces, this will result in problems that users will hardly be in a position to resolve by themselves. In order to fully utilise the potential of E-Paper technology in a complex communication environment, the web design must allow the user to clearly distinguish between the different information spaces and the crossovers clearly marked.

Besides facilitating finding the links by means of a corresponding optical design, the marking of the links is of central importance for understanding the links. Ideally, the term used to mark the individual links should be so clear that users can see clearly where they lead. Accordingly, the ability to understand a hyperlink, either by the language used or visual means, is a major factor for the understanding of hypertext offerings, especially if they are so complicated as in the case of an embedded E-Paper offering. Clear link markings give the user an answer to the question "Where to?" and therefore help him to build up a structured knowledge concerning the corresponding offering and its information spaces.

As Figure 45 and Table 8 show, the marking of the links within this E-Paper offering is in many cases too vaguely expressed. Especially noticeable here is the fact that all test persons assume behind "Ad Service" a possibility to place an ad order. No one assumes the possibility to search for an ad.

As the previous online reception studies have shown, one of the main sources of irritation among users is an excessively company-centered perspective in the selection of terms to identify links. It frequently happens that in-house names are used for offerings or services that are familiar to the company personnel, but only seldom to the users. In the case of the Rhein-Zeitung, the test persons were unable to understand why links to KEVAG or the Sparkasse (savings bank) in the page head were linked between content columns in the E-Paper version. Consequently, as the brief quote in Fig. 45 indicates, most regarded these links as advertising.

A poor distinction between the link names are another cause of irritation among users. For example, "Subscription Service" and "Order" are, semantically, nearly identical. "Subscription Service" is a service offer for subscribers for subscribers to the printed Rhein-Zeitung, whereas the E-Paper subscriber can use "Order" to sign up to additional services (e.g. additional regional editions). When the test persons were called on to clearly distinguish the columns on the basis of the names alone, they were unable to do so.

The findings concerning the understanding of the links and user orientation in the communication spaces of an E-Paper offering clearly show that the design tasks in fact cover more than only the E-Paper interface. E-Paper is more than just digitising newspaper pages. It is a complex information offer embedded in several communication spaces. The usability of the E-Paper offering depends decisively also on how the navigation in these various communication spaces for the users is organised. If the wishes of the users for more hypertext, more multimedia and a closer networking with other offerings are taken seriously, this level of design will become even more important in the future.

Link indications	Predicates of the users for assumed meaning	Frequency
Archive/Search	Difference between both unclear	3
	Archive = search in old newspapers	2
	General search function	4
Order	Unclear separation from subscription service	4
	Order the printed newspaper	2
	Order an E-Paper subscription	1
	RZ shop (merchandising)	2
	Generally unclear	2
Ad service	Placing ads	7
	Search in ads	1
Subs. service	Unclear separation from "order"	4
	Print subscription services	3
	Print and E-Paper subscription services	1
Overview	Overview of all editions	1
	Chronological overview of old editions	1
KEVAG	Advertising	5
KEVAG Telekom	Advertising	6
	Internet access	1
	Participation in Rhein-Zeitung	2
Sparkasse	Advertising	7
	Internet banking	1
RZ-Online-Logo	Generally unclear	1
	Link to the RZ-Online start page	2
RZ-Online-Link	Link to the RZ-Online start page	6
Configuration	Sending comments	1
	Some sort of settings	2
	Display settings	2
Contact	Personnel, addresses, phone nos., e-Mail	3
Publishing house and newspaper	Imprint	2
	Infos on publishing house (history, editions, etc.)	4
Editions	Overview of regional editions	4
	Chronological overview of several editions	1

Tab. 8: Overview of the expectations of the test persons in the qualitative part-study on the hyperlinks in the page head of the E-Paper offering (n = 24; all data in absolute figures).

8 Summary and outlook

1. E-Paper is both old and new for the users. It has a hybrid character for them. For this reason, the use of E-Paper involves two utilisation scripts: that from the printed newspaper and that from the online newspaper. Two effects can be observed here. Firstly, a transfer effect in which familiar practices are transferred to the “new, old medium”, and secondly an incompatibility effect if the two familiar patterns are not mutually compatible. The overall poorer evaluation of the user-friendliness of E-Paper compared to the print and classical online newspaper can be attributed to these incompatibilities. It emerged in the study that the test persons referred mainly to their competencies acquired from reading the daily newspaper when using the E-Paper version. Accordingly, all qualitative and quantitative findings showed that E-Paper is regarded more as a variation of the daily newspaper than as a variation of the classical online offering.

2. Simulation of newspaper reading by the facsimilised newspaper page succeeds only in part at present. The reduced readability of the E-Paper interface considerably limits the transfer of reading habits from the printed newspaper to E-Paper. Skimming across the page, entering an article through prominent optical text design features, such as sub-headings, bylines, captions or bold type, are therefore not possible. From the design point of view, E-Paper ranks behind both the hypermedia and hypertext design possibilities of other digital media, as well as of the daily newspaper. Although it is possible to transfer the cluster-oriented layout of the printed newspaper, where several related elements are combined – e. g. various texts, images and photos – to the classical online version in the form of hypertext and hypermedia, this is not (yet) the case with the E-Paper version. The interactivity of the E-Paper version of the Rhein-Zeitung examined in the study is already more highly developed than the majority of the other models available on the market. For the latter, the findings presented here apply to an even greater degree. A purely PDF version, where any form of online-specific interaction possibilities is absent, is in any case not attractive in the light of user judgements.

3. Despite retaining the newspaper layout, E-Paper is unable to guide the attention of the users and their reception patterns in the same way that is characteristic for the daily newspaper. The evaluation of the retrieved articles in the logfile analysis does not reveal any clear pattern of attention guidance. Obviously, the reception of E-Paper is more user- than offering-dependent, as is typical for online media in general. However, the utilisation purpose is a determining variable. The utilisation patterns of E-Paper and the printed newspaper are closest in free navigation, therefore in the activity mode. The more specific the utilisation purposes become, as is the case in the goal mode, the more clearly the users have recourse to online-specific navigation strategies. This is most apparent in the aimed search for articles or ads. The test persons explicitly demanded online-specific search aids for ad searches, such as a search engine or zoom and blow-up options.

4. E-Paper is more than digitisation of printed newspaper pages. Due to the embedding in the online offering of a media company, the E-Paper version is integrated into a mesh of different communication spaces: the media company, its service offerings, the additional online services, the archives, the networking into the internet or also the partner companies. For this reason, the user-friendliness of an E-Paper offering is decided not only by the question of how simple or difficult it is made for the user to utilise the E-Paper content. Decisive for the usability is also how transparent the mesh of these communication spaces for the user becomes, how he finds the entry into these communication spaces or how the crossovers are marked for him. The interface design plays a central role in solving this problem. At both levels, the level of E-Paper reception and the level of transparency of the communication spaces, the design also influences the awareness.

5. From the point of view of design and utilisation, E-Paper is at present a secondary variation of the daily newspaper. For this reason, it is unlikely that E-Paper can attract groups of users to the daily newspaper, e. g. young people for whom the newspaper to date has not been a consideration or only a minor consideration in their media consumption. E-Paper's strength lies in its function as a complement to the printed version. This strength could be turned to best advantage if it were possible to feed E-Paper into mobile receiving devices with an affinity to newspapers. Several companies are currently developing these forms of digital paper as plastic displays. The latest edition of the daily newspaper can be downloaded from the Web to this carrier and read anywhere. A second development possibility that can be combined with the aforementioned one is to enhance the existing model with additional, online-specific added value elements, such as multimedia capacity, extension of linking and improved search strategies. One thing that the findings of the study has made clear: despite the fact that E-Paper is regarded as a counterpart to the printed newspaper, its users do not want to forego the internet-specific operating comfort, networking possibilities and research options.

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<http://epaper.rhein-zeitung.de>

The E-Paper offering of the Kleine Zeitung is accessible (registration required) via the classical online offering:
<http://www.kleinezeitung.at>

The E-Paper offering of the Vienna Standard:
<http://derstandarddigital.at/>

The E-Paper offering of the Neue Züricher Zeitung:
<http://www.nzz-global.ch/>

The E-Paper offering of the Handelsblatt (registration required) is accessible via the classical online offering:
<http://www.handelsblatt.com>

Information on Newsstand technology and links to Newsstand customers under: <http://www.newsstand.com>

The E-Paper offering of the Sächsische Zeitung:
<http://www.sz-online.de/epaper/>

The full-page archive of Die Welt is accessible via "Archiv" under <http://www.welt.de>.

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