

# **The relevance of attention for selecting news content. An eye-tracking study on attention patterns in the reception of print and online media**

HANS-JÜRGEN BUCHER and PETER SCHUMACHER

## *Abstract*

*This article argues that a theory of media selectivity needs a theory of attention, because attention to a media stimulus is the starting point of each process of reception. Attention sequences towards media stimuli – pages of newspapers and online-newspapers – were analyzed by eye-tracking patterns from three different perspectives. First, attention patterns were compared under varying task conditions. Second, different types of media were tested. Third, attention sequences towards different forms of news with different design patterns were compared. Attention was seen as a pre-requisite for reception: Its selective functions for these processes are especially important. Reception itself was examined within an action-theoretical framework and therefore described as a form of interaction between recipient and the media. Eye-tracking data were used as indicators of attention. Starting with a hypothesis on the impact of different media such as printed newspapers and online newspapers on the agenda-setting process of their audience, the study examined how the type of media and the form of news influences attention and selectivity. Our findings showed that visual cues such as salient photos or graphics and information hierarchies signalled by design and layout guide attention processes, not as an automatic process driven from the bottom up, but as stimuli for an active, intention-driven selection process. The results indicate that the form of news affects these patterns of interactive attention more than the medium itself.*

*Keywords: reception, selection, attention, eye-tracking, newspaper, online newspaper*

## **Theoretical fundamentals**

Recent studies in mass communication research have attempted to prove that there is a difference between print and online newspapers in terms of the quality and quantity of knowledge acquisition. Tewksbury and

Althaus (2000) compared the recall of newspaper topics of two different groups – one reading the printed version of the *New York Times* and the other its online version – and discovered two different pattern of news selection: “online news readers were less likely to recall having read national and political news topics than appeared in the *Times* and more likely to recall business and other news topics” (472). In a representative survey of almost 1,000 respondents, Schönbach, De Waal, and Lauf (2005) ended up with a similar result: “Reading print newspapers contributes to the awareness of more public events and issues than using online newspaper does” (253). But their data also showed that this effect is dependent upon competence and experience regarding online information usage. Highly educated respondents were assumed to apply a more carefully considered procedure of information selection and to “consciously look for a comprehensive overview of what is going on in the world” (254).

Regarding the rapid diffusion of the Internet as a mass medium, these results are judged to be of great relevance to open democratic societies and have implications for “the long-term health of democratic nations” (Tewksbury, 2003: 694). The overall conclusion of these studies is that the medium from which people get their information has an impact on news selection, with consequences for agenda setting, the fragmentation of media audiences, and public opinion.

#### *Media reception and the form of news*

The most common explanation for differences in news selection between printed and online newspapers is the assumption that the different forms of news presentation have an impact on the patterns of selection. In comparison with television or radio, both types of newspapers could be described as a non-linear type of media, which opens a much greater variety and more self-determined pattern of reception. Tewksbury (2003) notes that “the WWW provides audiences with substantially more control over the news selection process than they enjoy with the traditional media...online readers are particularly likely to pursue their own interests, and they are less likely to follow the cues of news editors and producers” (694). In both online and printed newspapers the audience is exposed to a wide range of visual cues, which signal the relevance and hierarchy of topics and stories. These aspects of newspaper design have the function of mapping “the social world for its readers” (Barnhurst and Nerone, 2001: 22). Regarding online and printed news, however, these cues are supposed to affect the reception in different ways: “Online newspaper users are exposed to a smaller amount of cues compared to their print counterparts” (Schönbach et al., 2005: 248). Taking these re-

sults seriously means that selectivity has to be explained referring to a concept of attention, which could help explain the different effects of visual cues and different forms of news. Two questions are crucial for this kind of explanation:

1. Does the form of news interact with attention and selectivity?
2. Is attention voluntary or involuntary, is it dependent on goals or frames of the recipient (user-driven) or is it dependent on salience, priming, and cues of the media one is exposed to (media-driven)?

The relevance of the second question results from the conflicting assumptions, that on the one hand the form of news should influence the selection process, whereas on the other hand competence and experience were assumed to operate as limiting factors. Our basis for answering these two questions is an action-theoretical approach to media use. In this framework, "media users are acting persons who interpret media messages on the basis of their own objectives, values and plans, and then – more or less carefully – construct their external actions" (Renckstorf and Wester, 2004: 55). From this perspective, media reception is an active process of selection, on the level of different media types as well as on the level of the content of one medium.

Within an action-oriented approach we conclude that the reception of non-linear media could be described with the help of the concept of interactivity. The different approaches to disambiguate this concept can be divided, roughly speaking, into two groups. Members of the first group try to define interactivity technically, which leads to a rather wide conception. Interactivity in this perspective is defined in terms of responsiveness. Members of the second group define interactivity on the basis of sociological or psychological theories (see Downes and McMillan, 2000; McMillan, 2002; Kiouisis, 2002; Bucher, 2004). Crucial for these definitions is the idea of reciprocity: If it is the case that A interacts with B, it implies that B interacts with A. This definition fits all cases of Internet communication where the medium is used as a tool, such as e-mail, chat, or weblogs. But because the criterion of reciprocity does not fit human-computer interaction or the reception of online newspapers well, representatives of the latter group normally argue against using the term 'interactivity' for this kind of communication and try to restrict it to human-human interaction. To escape this dilemma, one can define interactivity based on action theory and a theory of problem-solving in a hypertext environment (Rafaeli and Sudweeks, 1997; Nielsen, 1993). Within this perspective, interactivity in human-computer communication is defined as a kind of 'as-if interactivity': A user who is communicating, for example, on an Internet platform – e. g. a learning

system, an e-business platform, or an online newspaper – implies that he interacts with the online program as if it were a real partner in a face-to-face interaction. Especially the thinking-aloud procedure has provided a lot of evidence for this kind of as-if interaction (Bucher, 2004). The utterances and the behavior of the user show that interactivity in human-computer communication is naturally implicated as a presupposition, which has real consequences for the acquirement of Web sites. We will try to define attention and selectivity within such a paradigm of interactivity. Furthermore, this approach can help to build a conceptual bridge between the two basic types of attention: involuntary attention, which is activated by the stimuli of the media – the form of news – and voluntary attention, which results from the intentions and competences of the recipients. Within this framework of an action-theoretical understanding of media perception, we focus at a micro level on the selectivity of a reader or user during interaction with a medium. To acquire data about these processes, we chose an eye-tracking test setting, which gives indicators for intentional and non-intentional effects on attention. We will discuss the relation between eye-movements, attention, and selectivity. As we see attention in a sequential, process-oriented perspective, we will discuss findings and theories concerning different phases of attention.

The empirical study presented here consists of three steps:

1. To find out to what extent attention patterns in response to specific media stimuli are driven by a recipient's intention; test persons were confronted with a Web site under different task conditions (so-called modes of use).
2. To investigate the relationship between attention patterns and different types of media, the reception of three different forms of newspaper – the printed newspaper, the classical online newspaper, and the digital edition – was tested with eye-tracking.
3. To find out how attention patterns depend on the form of presentation, we compared the perception of three different styles of online news layout.

#### *Eye-movements, attention, and selectivity*

Eye movement research has long been used to investigate the reader's patterns of selection and attention with regard to questions of how to design newspaper pages (Garcia and Stark, 1991; Küpper, 1990). Because these studies pursue mostly practical ends of user-friendly newspaper design or ask for entry points and reading paths (Holsanova, Rahm, and Holmqvist, 2006), the theoretical background of the relations be-

tween eye-tracking data, and perception are seldom explained. In contrast to these sorts of media-oriented eye-tracking research, we chose an approach which is reception-oriented. To shed light on the relation between reader and media – the reception process – we return to the concepts of attention and selection. Both of these terms are not simple, one-dimensional concepts, but multi-dimensional and closely connected to each other. Selection could be seen as a three-dimensional concept which encompasses attention, perception, and retention, all of which have a selecting function. *Selective attention* determines to what stimuli perception is addressed. During *selective perception*, it is decided how information will be processed and stored. *Selective retention* is the process in which cognitively perceived and processed information is once again selected for recollection (Donsbach, 2004: 147). As Neumann concludes from the history of psychological research traditions, attention is not a homogeneous system, but a concept with different components and functions: Attention can select information for actions, inhibit behavior, reduce the complexity of stimuli, integrate stimuli for reception, and serve to specify actions (Neumann, 1992: 92–96), or it can have a selective function by including certain stimuli and excluding others from further processing (Neumann, 1996: 577, 596). By interpreting our eye-tracking data, we continue this functional approach to attention and work out some of the procedural aspects of media reception. In terms of Donsbach's three-dimensional model of selectivity, the focus of our study lies on the first aspect of selectivity, selective attention.

Attention as well as selection processes are not directly open to observation and are therefore constructions of the observer. Only by observing a number of successive activities can we determine to what and to what extent one pays attention or what has been selected. Eye movements are one indicator of these activities. As they are usually not controlled consciously and can also be non-intentional, we categorize them as *behavioral indicators* (comparable to mimic and gesture) in contrast to *proactive indicators* such as actions (cursor moves, scrolling, clicking, turning over a page), utterances (e.g., comments from the thinking-aloud method), or strategies of problem-solving (back navigation, repeated reading, asking questions). Eye movements usually depend on attentional processes (Hallett, 1986: 10.22). Thus, data recorded by eye-tracking devices used in this study can be interpreted as an indicator of these selective attention sequences. An eye-tracker collects data that allow conclusions about fixations and saccades of the eye on a given stimulus. Fixations are periods when the eye is relatively immobile. They indicate the area where attention is likely to be allocated (Rayner, 1995). Saccades are the eye's jumps from one fixated area to the next. Perception is essentially suppressed during these processes (Stark and Ellis, 1981).

*Bottom-up and top-down effects*

Eye movements are not the result of a simple automatic sensory mechanism, but are interrelated with a person's actions: They are actively used for exploring the environment as directed by a person's intentions (Joos, Rötting, and Velichkovsky, 2003). The question to what extent attention to media content is driven by the stimulus – the form of news – and to what extent it is driven by strategically controlled action of the recipient, is key in the discussion of selectivity. Patterns of interaction with media interfaces are governed by both the interface and the expectations of the reader.

From the perspective of the interface, the process of reception could be described on the basis of a bottom-up model. From the perspective of the recipient, the process could be described as a top-down process driven by the recipient's expectations, knowledge and competence, and intentions. Within an interactional paradigm of media reception, both perspectives are qualified, which means that both effects intermingle: Cues of the media stimulus (bottom-up) are evaluated in relation to the current goals and the actual state of knowledge and competence (top-down) (Duchowski, 2003: 12–14). The latter may also be qualified as schema-driven reception (Donsbach, 2004: 147).

Concerning the stimulus, a distinction is made between low-level and high-level features that influence gaze patterns (Rayner, 1996; McCarthy, Sasse, and Riegelsberger, 2003). Low-level factors such as contrast, color, motion, or grouping can help to explain scan-paths during orientation and scanning periods in the first phase of exploration of a media stimulus. During deeper cognitive processing of media stimuli, that is, when interpretation and integration of information is carried out, high-level factors come into the focus of attention, that allow, e.g., recognition of visual objects and text.

A strict dichotomy between bottom-up phases that are guided only by low-level cues and top-down phases directed only by a person's intentions is difficult to discern with certainty when complex stimuli such as media are tested. Most models assume an interrelated process between both kinds of factors with predominant bottom-up effects only in the very first phase of exploration. Stenfors and Holmqvist (1999) summarized that only the initial fixations on web pages seem to be stimulus-driven, and only to a limited extent. They asked subjects to fulfil search tasks on Web sites and observed a strict avoidance of banner ads. It was concluded that users tend to gain strategic control in a very early phase of media exposure. Stenfors, Morén, and Balkenius (2003) stated that “experienced Internet users seem to have adopted certain schemas of what visual objects to avoid on the web page and what actions to take

in order to keep the search time short. When a page is visited repeatedly, the time for the orienting phase decreases rapidly” (636). In a scene perception study, Henderson and Hollingworth (1999) showed that the initial fixations of a visual scene are the result of a stimulus-driven response. Then a semantic frame for the scene is established and fixations are located at semantically interesting areas.

#### *Phases and patterns of reception*

Attention to a media stimulus can be described in different phases with different functional backgrounds. In the orientation phase, readers or users try to establish with what medium they are confronted, in which section they are located, and what navigational options they have as they explore more deeply into content, other sections, or different media (Ollermann, Reinecke, and Hamborg, 2005). Orientation phases can usually be described by long saccades, non-reading but scanning gaze patterns, views on salient elements and on elements that by position or other design features promise to be informative in confronting the orientation problem (Garcia and Stark, 1991; Stenfors et al., 2003; Ollermann et al., 2005).

The Poynter eye-tracking studies on print and online media (Garcia and Stark, 1991; Lewenstein, Edwards, Tatar, and DeVigal, 2000; Outing and Ruel, 2004) analyzed the entry points in a page as a key to further scanning. On the basis of the Poynter studies, locations of key elements are discussed as determining user’s attention in the scanning phase and thus perception as a whole. For Bente (2004), a distinction between the phases of initial scanning and deeper cognitive processing is crucial to avoiding misinterpretations of eye-tracking data (309).

Not only different phases have to be taken into account. There is a cluster of other factors that can influence data and their interpretation:

- A description of the orientation phase will have to consider differences between different types of web pages. Ollermann et al. (2005: 24–25) indicated that patterns during the orientation period vary according to page types. In online bookshops, graphical elements tend to get first attention during orientation, while on newspaper Web sites, headlines are in the focus of first attention.
- An often discussed aspect is the assumption of scan-paths: Noton and Stark (1971a; 1971b) defined them as repetitive sequences of fixations and saccades that occur because of re-exposure to a visual stimulus, facilitating recognition of that stimulus. This means that the reader’s experiences and competence have an impact on the repetitive perception of a stimulus.

- When drawing conclusions about cognitive processes, one has to consider differences in processes with orientation functions (including navigational tasks such as planning and executing routes) and informational tasks such as integrating new information (Eveland and Dunwoody, 2000: 224–225).

### **Eye-tracking study: Comparing the reception of printed and online newspaper**

#### *Methods of research*

Our study is based on eye-tracking analysis as a source for data about attention processes. Questionnaires were additionally used to collect data on sociodemographics and media use of the test persons. Whereas self-reporting methods reflect deeper cognitive processes, eye-tracking data gives a direct insight into interaction with a media stimulus and allows conclusions regarding intentional and strategic reception sequences as well as non-intentional effects. Eye-tracking analysis guarantees primary data on interaction with media at a micro level, where test persons are mostly not conscious of their intentional attention processes. Thus, eye-tracking data is a suitable addition to data from self-reporting measurements such as thinking-aloud procedures or surveys, which can be biased in terms of social expectations or by subjects' efforts to give investigators a good impression (Schiessl, Duda, Thölke, and Fischer, 2003). Eye-tracking research allows for

- describing distribution of attention to a media stimulus (Küpper, 1990; Garcia and Stark, 1991);
- following and comparing patterns of attention to a media stimulus as dependent upon its design features (Stenfors et al., 2003; Outing and Ruel, 2004; Holmqvist and Wartenberg, 2005; Holsanova et al., 2006);
- distinguishing at a micro level different phases of a media reception process such as orientating, scanning, or reading (Holmqvist, Holsanova, Barthelson, and Lundqvist, 2003);
- following patterns of interaction with Web sites (overview in Jacob and Karn, 2003).

To avoid misleading interpretations, some important considerations must be taken into account when analyzing eye-tracking data. First, eye-movement itself should not be regarded as the selection process itself, but “as the outcome of attentional selection processes preceding actual eye shifts” (Theeuwes, 1993: 96). Second, an eye tracker can track overt movements of the eyes; it cannot track covert movement of visual atten-



tion which happens without moving the eyes. Therefore, all eye-tracking work is based on the assumption that attention is linked to foveal gaze direction, but it has also acknowledged that it may not always be so (Duchowski, 2003: 14).

#### *Equipment and test setting*

The eye movements were measured with an IViewX system from Senso Motoric Instruments (SMI). A non-invasive, remote system was used for monitor-presented media and a head mounted device for printed media. The system samples eye position at a rate of 50/60 Hz. Raw eye coordinates are converted to fixations using an algorithm that assumes a fixation time of 100ms. Tests were carried out in the reception laboratory at the Media Studies department of the University of Trier.

The results presented here are from three different studies with different set-ups, stimuli, and test subjects.

1. A study comparing city portals (in this case the Web site of the city of Kaiserslautern, [www.kaiserslautern.de](http://www.kaiserslautern.de)) with different modes of usage, or: different scenarios and tasks.
  - goal mode (investigating, searching for information) with N = 8, 6 men and 2 women; mean age 29.8 years, range 25–40
  - activity mode (open, non-directional exploration) with N = 6, 4 men and 2 women; mean age 36.3 years, range 20–48
2. A study comparing attention processes in an inter-media perspective with different media types, all products of the regional newspaper *Rhein-Zeitung*, based in the city of Koblenz. Test persons were recruited among students.
  - printed newspaper with N = 6, 4 men and 2 women; mean age 23.7 years, range, 22–26
  - online newspaper with N = 5, 4 men and 1 woman; mean age 24 years, range 22–26.
  - digital edition (e-paper) with N = 5, 4 men and 1 woman; mean age 24 years, range 22–26
3. A study in an intra-media perspective comparing different presentation concepts of online news sites ([www.bild.de](http://www.bild.de), [www.zeit.de](http://www.zeit.de), [www.sueddeutsche.de](http://www.sueddeutsche.de)) with N = 14, 9 men, 5 women; mean age 33.7 years, range 20–59.

In studies 2 and 3, subjects were asked to get an overview of the media stimulus. The first exploration phase was recorded. The recorded and

analyzed sequences differ in length because pre-tests showed that for the task 'getting an overview' the processing time for a screen-presented stimulus and a printed newspaper page varied. With longer sequences, test persons would either start reading in depth, try to click on a link on an online stimulus, or turn the page of a printed stimulus.

#### *Study I: Intentionality and selectivity*

*Research question.* Eye-tracking research showed early on that fixation location patterns highly depend on the task that the subjects in the test are given. Yarbus (1967) demonstrated how a person's intention affects the pattern with which he or she looks at a picture. Andrews and Copola (1999) also showed that spatio-temporal dynamics of eye-movements vary with task.

In usability testing for Web sites, a distinction is made between activity mode and goal mode (Hassenzahl, Kekez, and Burmester, 2002). Activity mode is connected with an open, non-directional exploration task such as 'Please try to get an overview of the news'. By contrast, goal mode is connected with a specific task such as 'Please find news on Afghanistan' or 'Search for article xy in the archive'. In applied usability research with eye-tracking (for an overview, see Jacob and Karn, 2003) the dependence of attention strategies on specific tasks is assumed for practical reasons: When optimizing a Web site, e. g., for certain transactions, it is obvious that only observations under the condition of this specific task provide useful data. A strong bias between task orientation and navigational patterns was proven in an inter-media study, which compared reception processes towards newspapers, online newspapers, and digital newspapers (e-paper) (Bucher, Büffel, and Wollscheid, 2005). The assumption of differences in attention patterns for different tasks was tested in the first part of this study. Although the tested Web sites were not online newspapers, the results could easily be transferred to it.

*Test design.* Test persons ( $N = 8$ ) in goal mode were asked to get a new tax card with the help of the homepage of the city of Kaiserslautern. This is a typical task for e-government solutions: finding information, forms, and documents on a Web site to fulfill a simple structured transaction.

*Results and discussion.* The pattern of attention showed that fixations accumulated on navigation and search boxes. In comparison, gaze data recorded in activity mode ( $N = 6$ ) did not show a specific pattern of accumulation.

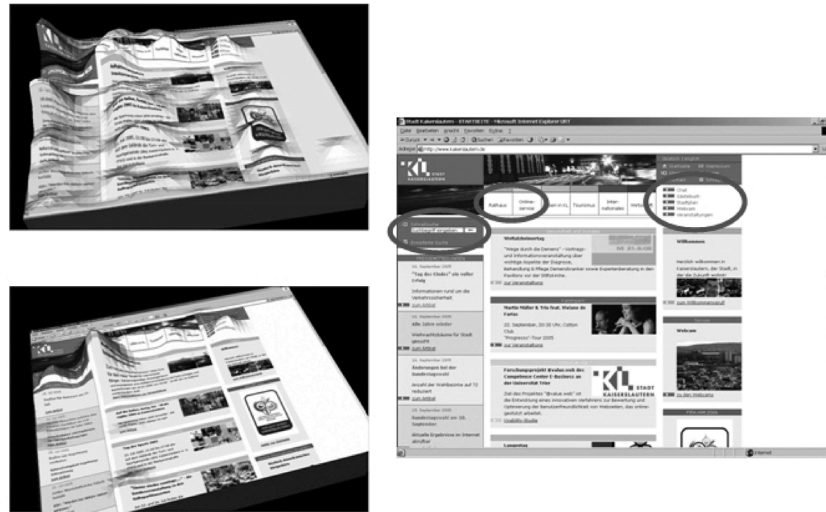


Figure 1. Distribution of attention to a Web site comparing activity mode (top left) and goal mode (bottom left, on the right: areas with attention peaks).

The results prove that, especially in clearly defined tasks, media users do have a wide-ranging strategic control over their attention and selection processes. Although the visual cues and the form of the web page were the same, the two modes led to very different patterns of attention. Of course this does not mean that certain features of the stimulus – the cues of the Web site – have no impact on the reception process. The different patterns of attention, expressed by the eye-tracking data, prove that, depending upon the recipient's intention, different schemata are at work in selecting the relevant aspects of the stimulus. This observation corresponds with findings on avoidance strategies such as banner-blindness (Stenfors and Holmqvist, 1999; Benway, 1998).

#### *Study II: Comparing different media: Orientation and attention to elements of the lead story*

**Research question.** One of the main findings of the Stanford-Poynter eye-tracking study on online newspapers was the thesis that there is “a strong preference for text over graphics as entry points” (Lewenstein, 2000), whereas in case of printed newspaper, visual elements such as photographs or information grab the eye first. Because the text-before-graphic hypothesis was criticized for different reasons, we developed a research scenario that allowed us to compare users' receptions of three

basic types of newspaper: the traditional printed newspaper, the classical online newspaper, and the so-called digital newspaper, which is a screen-based, true-to-scale representation of the printed newspaper and which can be navigated like a digital hypertext (Bucher et al., 2005). Of course, screen content is not completely identical to page content because of the differences in navigational tools. But as the journalistic content is the same, the influence of content and content-oriented interests of the test persons could be controlled.

*Test design.* Test persons' data were aggregated in a so-called binning chart, which shows the distribution of attention for every second of the process of reception during the first 20 seconds for the printed paper and 9 seconds for the online media. For every second, the graph shows the percentage distribution of fixation times of all test persons on defined areas as a stacked column. For reasons of comparability between each of the three interfaces, zones with the same functions such as header, lead story, sidebars, article, or graphics were defined (see Figure 1 and 2). With the help of the binning charts, a process-oriented exploration of the reception process in relation to these zones was possible.

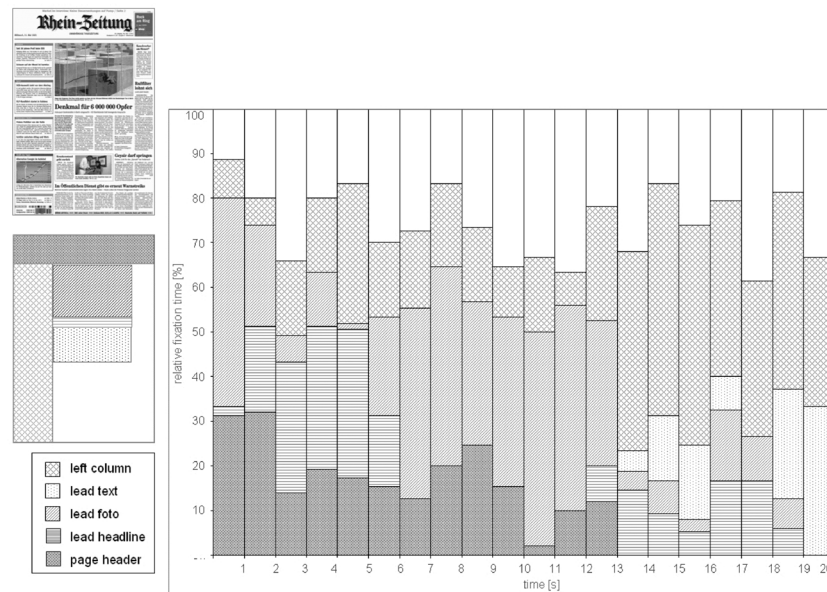


Figure 2. Distribution of duration of fixations during exploration of title page of Rhein-Zeitung ( $N = 6$ , 20 seconds of exploration, data aggregated for intervals of 1 second).

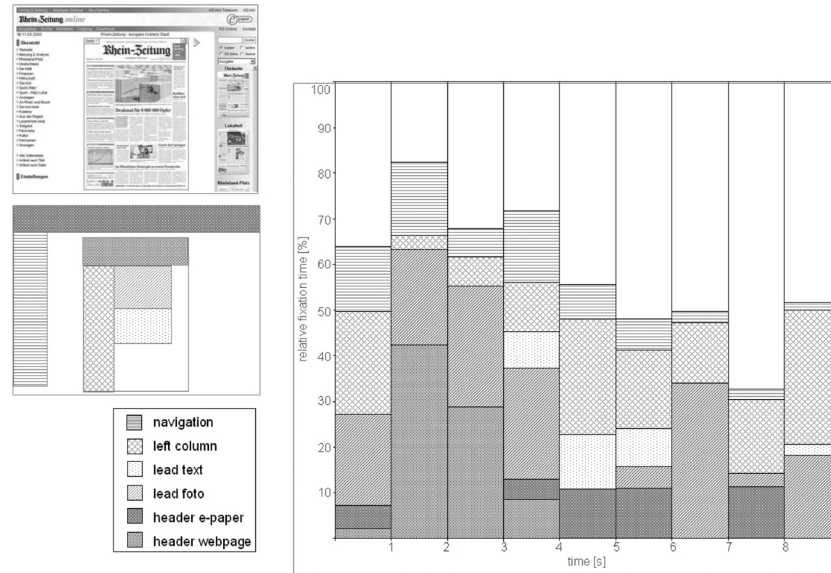


Figure 3. Distribution of duration of fixations during exploration of Rhein-Zeitung's digital edition (e-paper) ( $N = 5$ , 9 seconds of exploration, data aggregated for intervals of 1 second).

*Results and discussion.* First, our results showed that for all three media there were different patterns in different stages of the process of reception. Second, the results showed some similarities and differences in the patterns of attention for the three tested media types. In all three media, during the first 5 seconds an orientation phase was identifiable in which subjects shifted attention to page headers or navigation systems: Readers try to identify the medium and their own position within that medium.

In the case of the printed newspaper, the first 13 seconds showed a sequential pattern between the main picture of the page and the headline of the main article: After fixating the picture in second 1 and 2, there was a reading sequence of the headline of the main article and then a refixation of the picture. This sequential pattern is a strong indication that the recipients read the headline as a legend to the photograph, which for viewers is not easy to understand. After the 13th second, this interpretation process finished because neither of the two elements were fixed upon after this point in time. Additionally, the page header was not fixed upon after the 13th second either, which altogether seems to indicate the end of the orientation phase. In contrast to these page elements, the left column, in which short news items were put together,

was fixated in quite a balanced way during the whole of the first 20 seconds.

The exploration of the digital paper version was highly influenced by the poor readability of this kind of newspaper: Because of the true-to-scale miniaturization of the whole newspaper page, only the biggest elements such as pictures and headlines could be identified at first glance. Consequently, the eye-tracking data showed a clear concentration on elements such as page header, newspaper header, and the picture of the main article.

In contrast to the digital paper, scanning the entrance page of the classical online-newspaper *rzone* was more content-oriented than medium-oriented. Therefore, the pattern of attention was very similar to that of the printed newspaper: The user's main attention went to the picture and to the text, which they seemed to read as a legend to the picture. The interaction between viewing the picture and reading the text could be an indication that users try to build up an understanding of the picture with the help of the text. The binning chart shows this interactional process very clearly within the first 9 seconds of exploration. We will try to elaborate on this assumption of an interactional process for solving a problem of comprehension by analyzing attention processes in regard to the elements of the lead story.

The distribution of attention to the three elements that constitute the lead story showed differences between different media: Regarding the printed newspaper, the dominant lead photo got the very first attention, followed by the headline, followed again by the photo. The text was not seen or read in the first ten seconds. In contrast, regarding online newspapers, the text got much attention, even in the first phase of exploration, whereas the headline was almost ignored. Again, the eye-tracking data showed a distinct pattern of mutual perception of text and picture. Comparing these results with the Stanford-Poynter-study (Lewenstein et al., 2000), the text-before-graphic thesis and its interpretation for cognitive processing of media content has to be questioned. The process-oriented analysis leads to a different result: Elements on pages – be it a printed or an online newspaper – are perceived in an alternating manner in order to build up an understanding of one element within the context of the other. This principle of context is proven in the case of the printed newspaper, where the context for the picture was the headline below the picture, as well as in the case of the online newspaper, where context was the text beside the picture. In this view, conclusions about cognitive processing of media stimuli cannot be drawn from an analysis of first fixations as Lewenstein et al. (2000) did, but one has to consider a sequence of attention processes.

*Study III: Comparing different presentation concepts*

*Research question.* The observed differences and similarities across media types might also be influenced by design factors or by the form of news presentation. Eye-tracking research on the effects of design factors has been done in a few studies comparing different design options in an intramedia perspective (e. g., for Web sites, Stenfors et al., 2003; Outing and Ruel, 2004; for printed newspapers, Holmqvist and Wartenberg, 2005; Holsanova et al., 2006). All of these studies showed a certain influence of design factors, but most of this research was in the form of case studies, which makes it difficult to generalize the findings.

Nevertheless, eye-tracking studies on media design factors have lead to interesting results. For example, Holmqvist and Wartenberg (2005) found indications that the size and position of an article in a printed newspaper have the effect of attracting early reading, whereas article size and the use of (large) pictures and information graphics increase dwelling time (15–16). Additionally, Wartenberg and Holmqvist (2004) compared readers' visual behavior with newspaper designers' predictions of this behavior, based on traditional knowledge and intuition. In our context, we focused again on the very first exploration of a media stimulus. The guiding question was: Are there differences in attention patterns on Web sites with clearly distinct presentation concepts?

*Test design.* Three online editions of newspapers – two dailies and a weekly – with different presentation concepts were chosen as test stimuli. The homepages of these sites differed in their presentation of the lead story. The online tabloid *bild.de* had a salient integrated cluster of headline and photo as lead story; from *sueddeutsche.de* we chose an edition with a text-only presentation with headline, teaser, and a link collection; the page taken from *zeit.de* had a classical text-with-photo lead story, which consists of photo, headline, teaser, and a link collection. The stimuli were presented in a randomized sequence to 12 test persons; exploration time was 15 seconds.

*Results and discussion.* The analysis of the order of first fixations on defined Areas of Interest (AOI) of the online newspapers' entrance pages showed that areas with text elements (headline or teaser) of the lead story got the first fixations, followed by either elements with orientation functions such as the page header (*zeit.de* and *sueddeutsche.de*) or other salient visual elements on the page (*bild.de*). In this short-term focus on the very first fixations, our findings confirmed those of the Stanford-Poynter-Study (Lewenstein et al., 2000): There seems to be a text-before-graphics pattern on Web sites, which contrasts with findings of a graph-

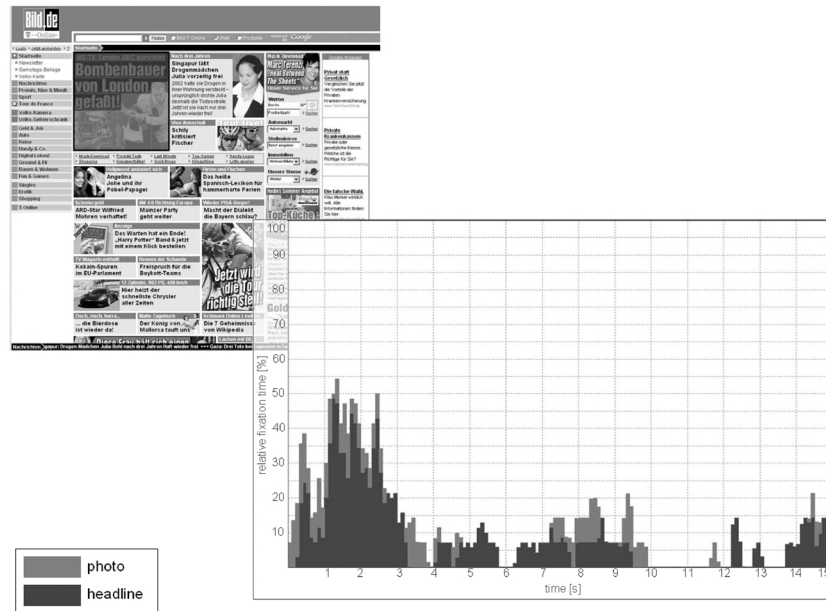


Figure 4. Distribution of duration of fixations during exploration of lead headline and photo on *bild.de* ( $N=12$ , 15 seconds of exploration, data aggregated for intervals of 0.1 second).

ics-before-text pattern for printed newspapers (Garcia and Stark, 1991). First fixations give hints at the entry points in a page, but they might also be influenced by the test setting (e. g., the position of markers shown on the screen before the stimulus which are necessary to calibrate the system). First fixations are the starting point of an initial orientation and scanning phase, but they do not allow one to draw conclusions regarding the cognitive processing of content (Bente, 2004: 309). Therefore, an analysis of sequences of attention to the tested Web sites is necessary to get deeper insights into processes of attention.

The comparison between the three different presentation concepts (plain text, text and photo, text integrated in a photo) for the lead story in online newspapers again shows that the form of news leads to different patterns in the readers' perception processes – even within the same medium. If there is a photo integrated in the lead story, attention is grabbed by this element in an early phase of exploration. After a peak in the first three seconds, these photos get very little attention in the following process. They seem to be worked off. Attention then shifts to



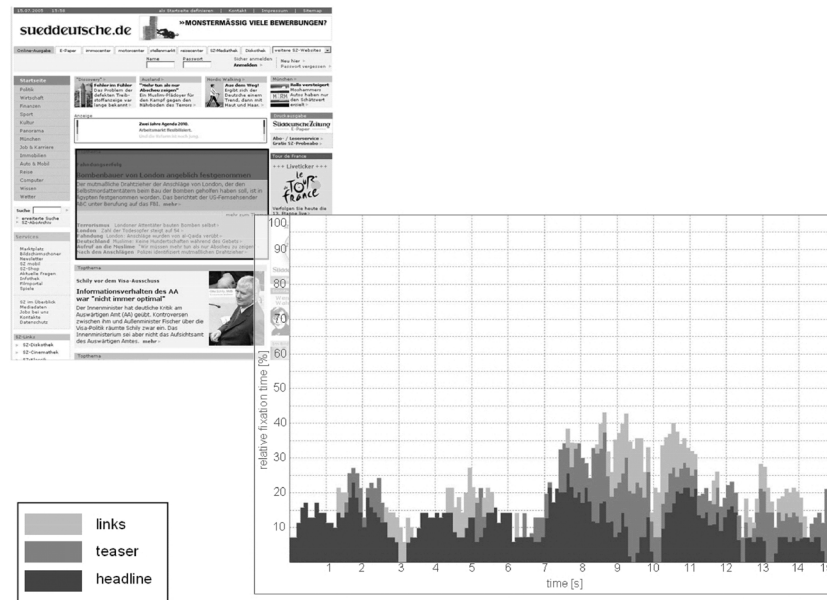


Figure 5. Distribution of duration of fixations during exploration of lead headline, text, and links on *sueddeutsche.de* ( $N=12$ , 15 seconds of exploration, data aggregated for intervals of 0.1 second).

the text and a reading phase begins. In text-oriented presentations as in *sueddeutsche.de*, the reading process is much more continuous throughout the whole observed exposure time, with long-lasting phases of attention to text elements. Pictures that are positioned peripherally get no attention at all. The example of the online weekly *zeit.de* shows that more centralized pictures get more attention, but only in a later phase of the reception process. As the eye-tracking data show, headlines, text, and headers are more important cues for news selections. The text-before-picture pattern is also apparent when picture and headline are intertwined, as in the case of the online tabloid *bild.de*.

All eye-tracking data show a strong impact of news design on attention and news selection. The use of visual salient elements and their location are two of the key factors for that. Text design and the use and size of photos and graphics play an important role in readers' interaction with the medium, but they do not determine the reception process in a causal way: Readers combine bottom-up with top-down strategies and they scan pages in a holistic and an atomistic way, depending on their intentions and their mode of perception. Understanding the selectivity

of news means to understand the interactional process between readers or users and the cues with which the form of news appeals to their attention.

### **Conclusions and discussion**

Visual cues have a directing effect on attention processes in all media, especially in the very first phase of exploration. It is important to note that the reader or user is not a passive receiver of information. Visual cues are not only guides for passive reading, but are also used for an active process of evaluation of the media stimulus (Stenfors et al., 2003: 641). Effects such as banner blindness or ignoring advertisements in printed media show that visual cues can also have an effect when users or readers apply an already acquired strategy of avoidance. Differences in gaze patterns during different exploration modes or with different intentions underline this interpretation of media reception as an intentional, user-driven interaction process. Especially the strategy of problem-solving in cases where elements of news cannot be understood at once indicate the intentional nature of reception: The recipient's interaction with the exposed media outlet is documented in the alternating fixation of text and photo to use them as mutually interpretative information devices.

These results lead to some interesting consequences regarding the function of attention for selecting media stimuli. As we discussed earlier, attention is not a homogeneous, one-dimensional concept, but rather a complex one with different levels and functions. First, our results show that attention is a means to reduce the complexity of the media outlet to which one is exposed. The interplay of top-down- and bottom-up-processes, of stimuli-driven and intentional aspects of reception leads readers to a decision as to what is relevant and what is not. Second, our results shed light on the procedural aspect of attention: Attention is used to organize the sequential order of actions of exploration of pages of both print and online newspapers. During different phases, different elements are relevant. Orienting elements such as page headers, photographs, headlines, and text are processed in sequences that are closely connected to active cognitive information acquisition. Thus, thirdly, our results indicate that attention could have an integrating function. Especially the alternating perception of text elements and visual elements indicates this integrating function of attention as a necessary component for understanding.

Besides these theoretical consequences, our findings could qualify some of the hypotheses concerning the impact of media type on news selection. As was developed in the beginning of this article, most of the

cited studies assert that attention to print media is appeal-directed, while attention to online media is more content-directed (Garcia and Stark, 1991; Lewenstein et al., 2000; Outing and Ruel, 2004). Our findings cast some doubt on this assumption, because in the background of our results they seem to be determined by the poor developed design of early online newspapers. The more the form of online news uses visual cues for building informational hierarchies, the more the pattern of attention changes from content-directed to appeal-directed style and the more online and printed newspapers are perceived as similar. Attention and selection are primarily not affected by the medium, but by the form of news. Thus, comparisons of media reception in an inter-media perspective should take the form of news into account when stating differences between attention and selection processes towards different types of media.

In this study we focused on the very first phase of media exploration. To get a full picture of selectivity in printed and online media, the whole navigation process should be considered. The process-oriented approach should be expanded from page navigation to the navigation of the whole paper or the whole Web site.

### **Acknowledgements**

The authors thank Charles Ess and Nicole Oberg for useful suggestions and corrections to earlier versions of this article. We would also like to thank Sebastian Erlhofer, Dagmar Diener, Nina Hertel and Philipp Niemann for their support during data collection.

### **References**

- Althaus, S. L. and Tewksbury, D. (2000). Differences in knowledge acquisition among readers of the paper and online versions of a national newspaper. *Journalism and Mass Communication Quarterly*, 77(2), 457–479.
- Andrews, T. and Coppola, D. M. (1999). Idiosyncratic characteristics of saccadic eye movements when viewing different visual environments. *Vision Research*, 39, 2947–2953.
- Barnhurst, K. G. and Nerone, J. (2001). *The form of news: A history*. New York: Guilford Press.
- Bente, G. (2004). Erfassung und Analyse des Blickverhaltens [Registration and analysis of eye movements]. In R. Mangold (Ed.), *Lehrbuch der Medienpsychologie* (pp. 297–324). Göttingen: Hogrefe.
- Benway, J. P. (1998). Banner blindness: The irony of attention grabbing on the World Wide Web. In *Proceedings of the Human Factors and Ergonomics Society 42nd Annual Meeting* (pp. 463–467). Santa Monica, CA: Human Factors and Ergonomics Society.
- Bucher, H.-J. (2004). Online-Interaktivität – Ein hybrider Begriff für eine hybride Kommunikationsform [Online-interactivity – A hybrid concept for a hybrid form of communication]. In C. Bieber and C. Leggewie (Eds.), *Interaktivität: Ein transdisziplinärer Schlüsselbegriff* (pp. 132–167). Frankfurt: Campus.

- Bucher, H.-J., Büffel, S., and Wollscheid, J. (2005). *Digital newspaper as E-paper. A hybrid medium between print and online newspaper* (Ifra Special Report 6.32). Darmstadt: Ifra.
- Donsbach, W. (2004). Psychology of news decisions factors behind journalists' professional behavior. *Journalism*, 5(2), 131–157.
- Downes, E. J. and McMillan, S. J. (2000). Defining interactivity. *New Media and Society*, 2(2), 157–179.
- Duchowski, A. T. (2003). *Eye tracking methodology: Theory and practice*. London: Springer.
- Eveland, W. P. and Dunwoody, S. (2000). Examining information processing on the World Wide Web using think aloud protocols. *Media Psychology*, 2, 219–244.
- Garcia, M. R. and Stark, P. (1991). *Eyes on the news*. St. Petersburg, FL: Poynter Institute.
- Hallett, P. E. (1986). Eye movements. In K. R. Boff, L. Kaufman, and J. P. Thomas (Eds.), *Handbook of Perception and Human Performance* (pp. 10.1–10.112). New York: John Wiley.
- Hassenzahl, M., Kekez, R., and Burmester, M. (2002). The importance of software's pragmatic quality depends on usage modes. In H. Luczak, A. E. Cakir, and G. Cakir (Eds.), *Proceedings of the 6th international conference on Work With Display Units (WWDU 2002)* (pp. 275–276). Berlin: ERGONOMIC Institut für Arbeits- und Sozialforschung.
- Henderson, J. M. and Hollingworth, A. (1999). High level scene perception. *Annual Review of Psychology*, 50, 243–271.
- Holmqvist, K. and Wartenberg, C. (2005). *The role of local design factors for newspaper reading behaviour – An eye-tracking perspective*. Available (consulted 8 March 2006) at: <http://www.sol.lu.se/humlab/eyetracking/Projectpapers/SNDSa.pdf>
- Holmqvist, K., Holsanova, J., Barthelson, M., and Lundqvist, D. (2003). Reading or scanning? A study of newspaper and net paper reading. In R. Radach, J. Hyönä, and H. Deubel (Eds.), *The mind's eye: Cognitive and applied aspects of eye movement research* (pp. 657–670). Amsterdam: Elsevier.
- Holsanova, J., Rahm, H., and Holmqvist, K. (2006). Entry points and reading paths on the newspaper spread: Comparing a semiotic analysis with eye-tracking measurements. *Visual Communication*, 5(1), 65–93.
- Jacob, R. J. K. and Karn, K. S. (2003). Eye tracking in human-computer interaction and usability research: Ready to deliver the promises. In J. Hyönä, R. Radach and H. Deubel (Eds.), *The mind's eye* (pp. 573–605). Amsterdam: Elsevier.
- Joos, M., Rötting, M., and Velichkovsky, B. M. (2003). Die Bewegungen des menschlichen Auges: Fakten, Methoden, innovative Anwendungen [Movements of the human eye: Facts, methods, innovative applications]. In G. Rickheit (Ed.), *Psycholinguistik* (pp. 142–168). Berlin: Stauffenburg.
- Kiouris, S. (2002). Interactivity: A concept explication. *New Media and Society*, 4(3), 355–383.
- Küpper, N. (1990). *Research into newspaper reading behaviour. Recording of visual reading activity*. Available (consulted 8 March 2006) at: <http://www.editorial-design.com/leseforschung/Eyetrackstudy.pdf>
- Lewenstein, M. (2000). *A deeper probe confirms findings*. Available (consulted 8 March 2006) at: [http://www.poynter.org/content/content\\_view.asp?id=38354](http://www.poynter.org/content/content_view.asp?id=38354)
- Lewenstein, M., Edwards, G., Tatar, D., and DeVigal, A. (2000). *Stanford Poynter Project*. Available (consulted 10 May 2005) at: <http://www.poynterextra.org/eti.htm>
- McCarthy, J., Sasse, M. A., and Riegelsberger, J. (2003). *Could I have the menu please? An eye tracking study of design conventions* (Proceedings of HCI 2003). Berlin: Springer UK.

- McMillan, S. J. (2002). Exploring models of interactivity from multiple research traditions: Users, documents, and systems. In L. A. Lievrouw and S. Livingston (Eds.), *Handbook of new media. Social shaping and consequences of ICTs* (pp. 162–182). London: Sage.
- Neumann, O. (1992). Theorien der Aufmerksamkeit – Von Metaphern zu Mechanismen [Theories of attention – From metaphor to mechanism]. *Psychologische Rundschau*, 43, 83–101.
- Neumann, O. (1996). Theorien der Aufmerksamkeit [Theories of attention]. In O. Neumann and A. F. Sanders (Eds.), *Aufmerksamkeit* (pp. 559–643). Göttingen: Hogrefe.
- Nielsen, J. (1993). *Usability engineering*. Boston, MA: AP Professional.
- Noton, D. and Stark, L. W. (1971a). Scanpaths in eye movements during pattern perception. *Science*, 171, 308–311.
- Noton, D. and Stark, L. W. (1971b). Scanpaths in saccadic eye movements while viewing and recognizing patterns. *Vision Research*, 11, 929–942.
- Ollermann, F., Reinecke, S., and Hamborg, K. (2005). Visuelles Orientierungsverhalten auf Webseiten [Visual orientation on websites]. *i-com*, 4(1), 20–25.
- Outing, S. and Ruel, L. (2004). *Eyetrack III. Online news consumer behavior in the age of multimedia*. Available (consulted 17 October 2004) at: <http://www.poynterextra.org/eyetrack2004/>
- Rafaeli, S. and Sudweeks F. (1997). Networked interactivity. *Journal of Computer-Mediated Communication*, 2(4). Available (consulted 8 March 2006 ) at: [www.ascusc.org/jcmc/vol2/issue4/rafaeli.sudweeks.html](http://www.ascusc.org/jcmc/vol2/issue4/rafaeli.sudweeks.html)
- Rayner, K. (1995). Eye movements and cognitive processes in reading, visual search, and scene perception. In J. M. Findlay (Ed.), *Eye movement research: Mechanisms, processes and applications* (pp. 3–22). Amsterdam: Elsevier.
- Rayner, K. (1996). Models of oculomotor function: An appraisal of the engineer's intrusion into oculomotor physiology. In H. Bouma and D. G. Bouwhuis (Eds.), *Attention and performance* (pp. 3–22). Hillsdale, NJ: Erlbaum.
- Renckstorf, K. and Wester, F. (2004). The 'media use as social action' approach: Theory, methodology, and research evidence so far. In K. Renckstorf, D. McQuail, J. E. Rosenbaum, and G. Schaap (Eds.), *Action theory and communication research. Recent developments in Europe* (pp. 51–83). Berlin: Mouton de Gruyter.
- Schiessl, M., Duda, S., Thölke, A., and Fischer, R. (2003). *Eye tracking and its application in usability and media research*. Available (consulted 21 October 2004) at: <http://www.eye-square.de/documents/EyeTracking-ResearchApplications.pdf>
- Schönbach, K., Waal, E. de, and Lauf, E. (2005). Research note: Online and print newspaper. Their impact on the extent of the perceived public agenda. *European Journal of Communication*, 20(2), 245–258.
- Stark, L. W. and Ellis, S. R. (1981). Scanpath revisited: Cognitive models direct active looking. In D. F. Fisher (Ed.), *Eye movements: Cognition and visual perception* (pp. 193–226). London: Lawrence Erlbaum.
- Stenfors, I. and Holmqvist, K. (1999). *The strategic control of gaze direction when avoiding Internet ads* [Abstract]. Paper presented at the European Conference on Eye Movements 10, Utrecht, 23–25 September 1999. Available (consulted March 8 2006) at: [http://www.phys.uu.nl/~ecem10/Abstracts/Stenfors\\_L.I.C.html](http://www.phys.uu.nl/~ecem10/Abstracts/Stenfors_L.I.C.html)
- Stenfors, I., Morén, J., and Balkenius, C. (2003). Behavioural strategies in Web interaction: A view from eye-movement research. In R. Radach, J. Hyönä, and H. Deubel (Eds.), *The mind's eye: Cognitive and applied aspects of eye movement research* (pp. 633–644). Amsterdam: Elsevier.
- Tewksbury, D. (2003). What do Americans really want to know? Tracking the behavior of news readers on the Internet. *Journal of Communication*, 53(4), 694–710.

- Theeuwes, J. (1993). Visual selective attention: A theoretical analysis. *Acta Psychologica*, 83, 93–154.
- Wartenberg, C. and Holmqvist, K. (2004). *Daily newspaper layout – Designers' predictions of readers' visual behaviour – A case study*. Project paper (draft version), Lund University. Available (consulted 8 March 2006) at: <http://www.sol.lu.se/humlab/eyetracking/Projectpapers/SNDSb.pdf>
- Yarbus, A. L. (1967). *Eye movements and vision*. New York: Plenum Press.