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UNDIRECTED VISUAL ATTENTION TO ADVERTISING: A SEGMENT-LEVEL ANALYSIS

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ABSTRACT

We propose a conceptual model of consumers' undirected visual attention to advertising, in which the effects of exogenous factors such as physical ad properties are heterogeneous across consumers. To test the model, we monitored eye movements of consumers during exposure to a consumer magazine, in which experimentally designed ads were inserted. A latent class regression model accounting for heterogeneity across consumers through unobserved segments was used to analyse the eye movement data in detail. Three segments of consumers with distinct patterns of visual attention, and with different profiles of product involvement, brand attitude, and advertising recall, were recovered. The results have implications for visual attention theory, and for advertising research.

> "I believe that today visibility, sheer visibility, is more important than it's been, speaking of printed advertising and that applies to television, of course, too." (Leo Burnett, in: Higgins 1965)

Over twenty years ago, Britt, Adams, and Miller (1972) demonstrated that consumers were, on average, exposed to between 300 and 600 commercial messages daily. As competition for the limited attention of consumers is even more a key issue in today's crowded markets and media, it is important to understand how and when consumers devote attention to commercial stimuli, and what determines their attentional strategies and patterns. However, "... despite the tremendous amount of money spent on buying consumer attention, little to no research is done on consumer attention" (Janiszewski and Bickart 1994, p. 329). More specific, notwithstanding the central position of the attention stage in models of advertising processing and effectiveness (e.g., Greenwald and Leavitt 1984; MacInnis and Jaworski 1990), advertising research to date has emphasized the comprehension (Mick 1992) and elaboration stages (MacInnis and Jaworski 1990) of advertising processing, and although several studies have examined the preattentive stage (Janiszewski 1988, 1993), few have been directed to the focal attention stage. Moreover, although the importance of understanding patterns of attention to advertising is acknowledged (e.g., Miniard et al. 1991), little is known about visual attention to advertising (Kroeber-Riel 1993). In particular, insight in the relationships between physical properties of advertisements and visual attention of consumers is scarce.

After a review of the literature, Van der Heijden (1992) concluded that realistic theories of visual attention should acknowledge exogenous as well as endogenous factors affecting visual attention. In particular, he called for the development of models in which both types of factors are interlinked. He further stressed that since the majority of previous studies on visual attention examined directed (or involuntary) attention in relatively simple tasks, insight in undirected (or voluntary) attention to complex stimuli, such as advertisements, is limited.

Our aim in this study is to extend the limited knowledge of the undirected visual attention that consumers devote to advertising. First, we propose a conceptual framework of undirected visual attention to advertising. Next, we examine empirically the impact of selected exogenous, physical properties of a print

advertisement on consumers' undirected visual attention to the advertisement as a whole and to specific ad elements, by recording eye movements. In addition, we examine whether segments of consumers exist that have different patterns of visual attention for the physical properties, and we profile the segments on a number of consumer characteristics. To accomplish this, a latent class regression model is developed that estimates the impact of physical properties of advertisements on undirected visual attention, and that simultaneously identifies segments of consumers who react differently to the physical properties of the advertisements.

In the next section, we will introduce key dimensions in visual attention to advertising, and stress differences between directed and undirected visual attention, and between internal and external control over the exposure situation.

Undirected visual attention to advertising

Advertising processing is commonly conceptualized as a set of distinct stages of subprocesses (e.g., Greenwald and Leavitt 1984; MacInnis and Jaworski 1989, 1990), comprising preattention, focal attention, comprehension and elaboration. Preattention involves a quick scan of the advertisement for personal relevance, using little cognitive capacity, and usually producing little to no lasting cognitive or affective outcomes (Janiszewski 1988, 1990). Preattentive processes perform basic, rough analyses in a parallel fashion, segmenting the visual field into functional units (Theeuwes 1994). The outcomes of such processes may direct focal attention in the next stage to elements of high priority in the advertisement (Yantis and Johnson 1990). Focal attention is a serial process that involves modest cognitive capacity to decipher the message's sensory content into categorical codes such as object, name or word (Greenwald and Leavitt 1984; Kahneman 1973). During the two subsequent stages of advertising processing, comprehension and elaboration, further cognitive capacity is used to construct a propositional representation of the text and pictures, and to integrate the message content with existing knowledge. That is, the information contained in the stimulus is processed and, eventually, meanings from the message are extracted.

Visual attention and eye fixations

Visual attention is conceptualized as "... a brain operation producing a localized priority in information processing – an attentional `window' or `spotlight' that locally improves the speed and reduces the threshold for processing events" (Deubel and Schneider 1993, p. 575). The attention-as-a-spotlight metaphor has three components (Van der Heijden 1992, pp. 117-118): (a) just as a spotlight is needed for seeing, attention is needed for detection and identification, (b) just as a spotlight can only illuminate a limited region of the stimulus, attention can only deal with a limited region of the visual world, and (c) just as a spotlight can be pointed at important and interesting regions in the world, so can the attentional mechanism concentrate its "resources" at the spatial position containing the information to be processed. In the sequel, we reserve the term visual attention for the spatial, locational process in which eye movements direct the foveal area of the retina upon successive parts of the environment.

Since attending to any aspect of a stimulus (e.g., color or shape) automatically entails directing the eyes to the location of the stimulus or stimulus element and fixating on it (Tsal and Lavie 1993), eye fixations can be used as measures of visual attention (Van der Heijden 1992). A prominent, aggregated measure of eye fixation is gaze duration, which is defined as the sum of fixation durations on a stimulus element or on the stimulus as a whole. Research demonstrates that gaze duration is a valid indicator of visual attention (e.g., Christianson et al. 1991).

Directed versus undirected attention

It is important to distinguish between directed and undirected (or spontaneous) visual attention to advertising. In the case of directed attention, individuals pay attention to stimuli by following instructions that specify the stimulus, output and/or action sets (e.g., Broadbent 1971; Kahneman and Treisman 1984). The stimulus set specifies the source of stimulation that should be attended to; i.e., it defines the location of the attentional window, or the "where" of attention. The output set specifies the kind of information that should be attended to; i.e., it defines the content of the attentional window, or the "what" of attention. The action set specifies if and how the individual should respond; i.e., it defines the "how" aspects of attention (see Van der Heijden

1992). In highly directed attention tasks, such as search tasks, the stimulus, output and action sets are narrowly defined. By contrast, in the case of undirected attention, individuals receive no or only limited instructions on these sets, and hence they construct them according to their own preferences.

Consumer attention in everyday advertising exposure situations is undirected, because external instructions with respect to the stimulus, output and action sets are not provided. Attention research to date, however, tends to focus on directed attention in relatively simple tasks, leaving patterns and mechanisms of undirected attention largely unexplored (Van der Heijden 1992). Of course, a substantial amount of research has examined memory for advertising when the prior exposure situation allowed undirected attention (e.g., Bagozzi and Silk 1983; Finn 1988; Singh et al. 1994). Unfortunately, the results of research on memory for advertising in real-life exposure situations cannot be easily generalized to the domain of undirected visual attention to advertising, since memory scores are limited indicators of visual attention to advertising (e.g., Appel and Blum 1961; Baddeley 1990; Finn 1988; Loftus 1972; Twyman 1973).

Internal versus external exposure control

When examining (undirected) visual attention to advertising, it is also important to distinguish between internal and external control over the exposure situation (Van Raaij 1984). In the case of external exposure control, sources outside of the consumer determine the stimuli that consumers are exposed to, the exposure order and/or the exposure duration of the individual stimuli. For example, both exposure order and duration are externally controlled when consumers watch a string of commercials on television. In the case of internal exposure control, consumers determine the stimuli they are exposed to, the exposure order and/or duration. In many advertising exposure situations, in particular those involving print and interactive media, both exposure order and duration are largely internally controlled. Due to the development and diffusion of TV cable systems, VCR's, remote controls and the new interactive media such as interactive television and CD-rom, traditionally externally controlled advertising exposure situations, such as exposure to television commercials, rapidly become internally controlled as well (see, for instance, Brown and Rothschild 1993).

In visual attention research, exposure duration and order are sometimes under external control (e.g., Janizewski 1993; Kroeber-Riel 1984), whereas in other studies subjects exercise internal control over the exposure duration to advertising (e.g., Pechmann and Stewart 1990). Research shows that average exposure duration to advertisements tends to be significantly smaller when consumers are in control than when experimenters are in control. In an early study among 400 consumers who were in control of exposure duration, Kiss and Wettig (1972, in: Kroeber-Riel 1993) found an average exposure duration across 459 advertisements of less than two seconds (see also Andresen 1988, in: Kroeber-Riel 1993). By contrast, Kroeber-Riel (1984) exposed subjects to target advertisements for three seconds, and Janiszewski (1993, experiment 2) exposed subjects to print ads for either 3.5 seconds or 6.5 seconds. Moreover, although to the authors' knowledge no research has been conducted on this topic, control over exposure duration may not only affect the duration itself, but it may affect patterns of visual attention as well.

In the present study, we examine visual attention to print advertisements in an experimental setting that resembles a regular advertising exposure situation; i.e., attention is undirected and consumers control their exposure to the ads. In the next section, we propose a conceptual model of the effects that advertisement characteristics and consumer characteristics have on visual attention to advertising in such a situation.

Exogenous and endogenous factors affecting undirected visual attention to advertising

Conceptual model

The existence of exogenous and endogenous factors impinging on visual attention, has led to the distinction of different types of attention. For instance, James (1890) distinguished between passive, reflexive attention, in which the environment acts upon the individual, and active, voluntary attention, in which the individual acts upon the environment. Wertheimer (1923) distinguished subjectively controlled concentration of attention from attention that results from structural properties of

perceptual figures. Koffka (1935) defined voluntary and involuntary attention as "forces" acting respectively from the self to an object, and from an object to the self. In Figure 1, we propose a conceptual model in which both exogenous and endogenous factors impinging on undirected visual attention are synthesized.

Insert Figure 1 about here

The model in Figure 1 is based on capacity theories of attention (e.g., Broadbent 1971; Kahneman 1973) as well as on general models of information processing, in which motivation, ability and opportunity factors affecting message processing are synthesized (MacInnis and Jaworski 1990). A key assumption underlying these theories and models is that the attentional capacity (or processing capacity) that is available to a consumer at a specific point in time is limited, and that the part that is allocated to the stimulus studied is a function of both exogenous (opportunity) and endogenous factors (motivation and ability).

Previous research has shown that certain classes of exogenous stimulus properties are better able to capture and hold attention than others (see, for instance, Kahneman 1973), which is reflected in our model as a direct link between physical ad properties and visual attention. Kahneman (1973, p. 52) argued that undirected attention is partly controlled by "... enduring dispositions that determine which parts of the field of view should attract and hold the gaze." In his view, endogenous consumer characteristics indirectly affect the duration of attention for specific elements of the advertisement (i.e., local gaze duration). Our model specifies accordingly that physical properties of the ad and consumer characteristics have an interactive effect on undirected visual attention, such that the effects of physical properties of advertising on gaze duration are moderated by particular consumer characteristics.

As Figure 1 further shows, we expect the two dimensions described in the previous section, directed vs. undirected attention, and internal vs. external exposure control, to influence the size of the moderating effects of consumer characteristics. More specific, directed attention and external control are expected to inhibit the moderating effect of consumer characteristics and, therefore, to reduce consumer heterogeneity in visual attention [1].

Exogenous factors affecting attention

It is a general finding that all intense properties of advertising are likely to capture a disproportionate amount of attention (Lynch and Srull 1982). Finn (1988) found strong evidence that the size of advertisements and of specific ad elements, and whether ad elements are in color rather than in black and white affect the Starch noted and seen scores which he interpreted as measures of attention. Research also suggests that the well-known superiority of pictures over text in memory (e.g., Costley and Brucks 1992) is not only due to the fact that pictures are more vivid, but also because they capture more attention. For instance, Andresen (1988, in: Kroeber-Riel 1993) observed that over 70% of the gaze duration to print advertising was devoted to the picture, about 15% to the headline and the rest to the body text. To date, few reliable results are available concerning the impact that the position of elements in the advertisement has on the attention that the elements capture. In one of the few studies, Bernhard (1978) observed that headlines were attended to longer when located below the body text, or to the right of a picture, than when located above the text, and to the left of pictures.

Besides physical properties of advertisements as discussed above, emotional elements in advertising, such as pictures of people, in particular their faces, affect the duration of attention to advertising as well (Kroeber-Riel 1993). It is well known that people's faces and hands are the elements of pictures including people that receive most visual attention (Buswell 1935).

Consumer heterogeneity in attention

Research frequently finds weak relationships between physical properties of stimuli (ads) and visual attention of consumers (see, for instance, Van der Heijden 1992). This finding may be due to the fact that the impact of physical properties is heterogeneous instead of homogeneous across consumers. In the case of heterogeneity, different segments of consumers may respond differently to the physical properties of stimuli. Aggregating those heterogeneous responses may mask the actual relationships between the physical properties of the ads and consumer attention. Hence, the study of such aggregate relationships may be incorrect and potentially misleading.

The conceptual model in Figure 1 accounts for potential heterogeneity in the effects of exogenous factors on visual attention by presuming these effects to be moderated by endogenous factors. More specific, the model states that the impact of physical properties of advertising, such as size, type and position of the ad elements, on local gaze duration is a function of consumer characteristics. This moderating effect of consumer characteristics is in line with research indicating that undirected attention is affected by consumers' epistemic motivation, i.e., the need to perceive clearly and to reduce uncertainty (e.g., Berlyne 1960; Gould 1976; Yarbus 1967). In fact, heterogeneity in exogenous impact is more likely to occur when undirected instead of directed attention is examined, as undirected attention leaves more room for individual differences in task definition. For similar reasons, heterogeneity in the effects of exogenous factors on attention is also more likely to occur when the exposure situation is under internal, consumer control instead of under external, experimental control. Finally, heterogeneity in the impact of exogenous factors is more likely when complex rather than simple stimuli are employed in the attention task, as complex stimuli will leave more room for personal interpretations and individual differences. In comparison to the stimuli that tend to be used in basic attention research, such as single letters or arrays of digits or dots, (e.g., Van Duuren 1994; Yantis and Johnson 1990), advertisements are very complex. Kahneman and Treisman (1984) stressed that although simple tasks can reveal attentional processes and mechanisms that are also operative in complex tasks, there is no assurance that the same mechanisms hold in both tasks.

While substantial individual differences in overall attention to advertising have been reported (e.g., Twyman 1973), a systematic study of (the causes of) heterogeneity in the effects of exogenous factors on attention has not been performed yet. Endogenous factors that may underly heterogeneity in effects may be product-related such as product involvement, brand-related such as brand-attitude, advertisement-related such as attitude toward the ad, and medium- or advertising-context-related, such as the attitude toward or interest in the magazine or program in which the advertisements are placed. Some research has been done on the role that product involvement plays in undirected visual attention to advertising. For instance, in accordance with capacity theories of attention (Kahneman 1973), Celsi and Olson (1988), and Pratkanis and Greenwald (1993) found that a high level of consumer

involvement leads to increased attention and effort allocated to deriving meaning from advertising.

In this study, we will examine the combined impact of exogenous and endogenous factors on local gaze durations as measures of undirected visual attention to print advertising. We will attempt to identify segments of consumers that respond differently to the physical properties of advertising. To allow heterogeneous responses of different segments to occur, undirected attention of regular consumers to a common, but relatively complex advertisement will be investigated, where both the task and the exposure duration are largely under control of the consumers. Since to-date research on the effects of consumer characteristics on visual attention is largely lacking, we will use an approach that identifies segments on the basis of the local gaze duration patterns themselves. Next, we will profile the emerging segments by a number of potentially relevant consumer characteristics, including involvement. Finding distinct segments of consumers, who react differently to the physical properties of advertising, and who differ in variables related to the advertisement, product, brand and medium, would contribute to theories of advertising processing, and to advertising practice. First, such research may uncover distinct patterns of visual attention and attentional strategies as well as the mechanisms underlying these patterns that have been suggested in the literature (e.g., Twyman 1973; Finn 1988), but not yet examined. Second, it may lead to the development of different advertising strategies and tactics for the segments, to optimize advertising responses.

Method

Subjects

Subjects in the study were 115 female consumers ranging in age from 20 to 39 years, recruited by a market research company in The Netherlands. Subjects were selected who read women's magazines regularly and to whom the purchase of shampoo (the product in the target ad) is of some relevance. Subjects were invited to come to the market research company, where the study took place. The experiment lasted approximately half an hour and subjects were paid the equivalent of ten dollars for their participation.

Materials

To investigate the effects of physical properties of advertisements, four different versions of an advertisement for an existing brand of shampoo (7-herbs shampoo of Schwarzkopf) were professionally designed by an advertising agency. Each version contained four elements: a pictorial of a female with long hair, a body text, a headline, and a packshot of a shampoo bottle. The four versions differed with respect to the position and the amount of space allocated to the four elements of the advertisement, and with respect to the background color of the headline. Figure 2 presents the four versions of the advertisement as used in the study. It should be noted that each version of the ad contained all four elements, and that they had an identical message and arguments.

Insert Figure 2 about here

The text of the headline is: “So good, so soft, so natural, it's Schwarzkopf's familiar seven herbs shampoo.” The body text explains that seven herbs shampoo provides everything the hair needs, and that it ensures natural, beautiful hair. The text subsequently introduces the other shampoos of Schwarzkopf: every-day shampoo, anti-dandruff shampoo, egg-lecithine shampoo and protein shampoo.

As shown in Figure 2, the size of the pictorial element varies considerably between the different versions of the advertisement. For the text element, there are only small differences in size between the four versions of the advertisement. The main differences with regard to the headline element are its position in the advertisement and its background color. In two versions of the advertisement the headline is at the top, and in the two others it is in the middle. Furthermore, in two versions the background of the headline is in full color, whereas in the other two the background is white. Across the four versions, the packshot element differs only in size, not in position or color.

Each version of the advertisement was professionally inserted in a specially developed issue of a popular Dutch weekly women's magazine (Libelle). The advertisements were positioned on page 25. Each subject read only one of the four versions of the magazine, which were identical except for the advertisement inserted, and therefore saw only one version of the advertisement (26 subjects were exposed to

version 1 of the advertisement, 29 subjects to version 2, 29 subjects to version 3, and 31 subjects to version 4). Subjects were randomly assigned to one of the four versions. The issue of the magazine contained six advertisements for other products before the target advertisement, and thirty-six advertisements after the target advertisement. Articles before the target advertisement covered topics like gardening, the work of nurses in hospitals and clothing accessories. Post-experimental interviews revealed that none of the subjects was aware of the goal of the study.

Procedure

Upon entering the experimental room, subjects were informed that the study concerned "... the way people read and use magazines." They were explained that their eye movements would be recorded while they were leafing through and reading a women's magazine. Subjects were asked to use the magazine as they normally would at home, starting at page one. When they reached page 31, six pages after the location of the target advertisement in the magazine, subjects were informed that they could stop reading.

To make eye-tracking possible, subjects were seated and were asked to place their chin on a small, comfortable chinrest. The magazine was in front of the subjects on a small stand. None of the subjects wore glasses or contact lenses. Eye movements were recorded by infrared scleral reflection (IR). IR allows linear eye-movement recordings up to approximately 10-15 degrees of visual angle from central fixation, and provides accurate measurement down to movements of 0.25-0.5 degree in amplitude. An infrared camera was located towards the left side of the subjects, so as not to interfere with the subjects' normal reading behaviors. A semi-transparent sheet of special glass between the stand and the subject's eyes, close to the stand, allowed infrared rays to reflect off the surface of the subject's right eye while measuring the position of the pupil. Subjects could see through the sheet of glass, and it did not hinder them in leafing through the magazine.

The eye-tracking system was explained to the subject, and the system was calibrated to the subject's eye. During calibration, the distance and the angle between the infrared reflection and the center of the pupil were measured while subjects looked at predefined areas on the magazine stand. These areas were identified with x,y location coordinates, so that distance and angle could be directly related to the x,y

locations. During the actual task, the eye-tracking system recorded the distance between the infrared reflection and the center of the pupil fifty times a second, and simultaneously converted this distance into the x,y location. By relating these x,y locations to the position of the four ad elements, for each measurement it was determined at which element of the advertisement the subject's eye was fixated. To account for measurement unreliability, five successive measurements of the eye-tracking system were joined, yielding a unit of measurement of gaze duration of 100 milliseconds, which is still substantially shorter than the average fixation duration (e.g., Kroeber-Riel 1993). The eye-tracking data were subsequently aggregated to yield gaze durations for each of the ad elements.

Other measures

Ad Recall

After the eye-tracking experiment, female interviewers who were unaware of the goal of the study assessed unaided advertising recall. Interviewers read the following text to the subjects: "You have just seen a copy of Libelle. Can you remember any advertisements in the magazine? If so, can you please tell me which advertisements you have just seen? Please name the brand and the product of the advertisements that you have seen." The interviewer was instructed to prompt the subjects by asking repetitively "and which more?" Next, aided recall was assessed, first by asking subjects for which brands from a list of fourteen, including Schwarzkopf, they had seen an advertisement, and then by asking subjects for which products from a list of fourteen, including shampoo, they had seen an advertisement. If in this procedure the brand Schwarzkopf was mentioned, the interviewer continued to the next stage. If subjects did not mention Schwarzkopf, the interviewer read: "The magazine contained an advertisement for a haircare product of Schwarzkopf. Can you remember having seen this advertisement?" (yes-no). If subjects did not report having seen the advertisement, it was shown for one second and subjects were asked whether they could remember having seen this advertisement.

After the assessment of advertising recall, subjects completed a questionnaire containing measures of attitude toward the ad, shampoo usage frequency, familiarity with the shampoo category, product involvement, and brand attitude at their own

pace.

Attitude toward the advertisement

Attitude toward the advertisement was assessed with three 5-point items, which were worded as follows: "Please indicate what your opinion is of the Schwarzkopf advertisement ..." worth watching-not worth watching, attractive-unattractive, bad-good (Cronbach's $\alpha = 0.77$). After reverse coding the relevant items, the scores were averaged in such a way that a low score denotes a negative attitude toward the advertisement (minimum = 1) and a high score denotes a positive attitude toward the advertisement (maximum = 5).

Shampoo usage frequency and familiarity

Shampoo usage frequency was measured by asking subjects how many times a week they shampooed their hair. To measure their familiarity with the shampoo category, subjects were asked to write down all the brands of shampoo they knew. Familiarity was operationalized by the number of brands mentioned by each subject.

Product involvement

To measure product involvement, we used the New Involvement Profile (NIP) proposed by Jain and Srinivasan (1990). This measure synthesizes earlier single- (Ratchford 1987; Zaichkowski 1985) and multi-component measures (Higie and Feick 1989; Laurent and Kapferer 1985; McQuarrie and Munson 1987), and it is in line with recent suggestions in social psychology about different components or sources of involvement (e.g., Johnson and Eagly 1989). NIP is a fifteen-item scale that measures five components of product involvement: sign, relevance, pleasure, and risk probability and risk importance. As one of the original fifteen items could not be translated into Dutch properly, fourteen 5-point items were included in the questionnaire. A confirmatory factor analysis (Jöreskog and Sörbom 1989) revealed that the five-dimensional model fits the data well ($\chi^2(67) = 87.75$, $p = 0.045$; GFI = 0.90). Construct reliabilities of all five components were satisfactory [2], and the five components are uncorrelated. Scores on the five components were calculated by averaging the scores on the appropriate items, such that a high score (maximum = 5)

indicates high involvement for a specific component and a low score (minimum = 1) indicates low involvement.

Attitude toward the brand

Following the work of Batra and Ahtola (1991), attitude toward the brand was assessed with two measures. The first measure assessed utilitarian brand attitude by averaging the scores of three 5-point items, which were worded as follows: "To me Schwarzkopf is ..." good-bad, value for money-no value for money, high quality-low quality ($\alpha = 0.85$). A low score (minimum= 1) denotes a negative utilitarian brand attitude, a high score (maximum = 5) denotes a positive utilitarian brand attitude. In addition, a three-item measure of hedonic brand attitude was included in the questionnaire ($\alpha = 0.69$). The items were worded as follows: "To me Schwarzkopf is ..." luxury-regular, expensive-cheap, normal-chique. After reverse coding the relevant items, the scores were averaged in such a way that a low score denotes negative hedonic brand attitude (minimum = 1), and that a high score denotes positive hedonic brand attitude (maximum = 5).

A latent class regression model for undirected visual attention to advertising

Conventional statistical techniques that are commonly used to analyse gaze duration data, such as t-tests, ANOVAs or standard regression analysis, assume that (1) gaze durations are normally distributed, and that (2) subjects are homogeneous in their visual attention to advertisements. If one or both of these assumptions are violated, the explanatory power of the statistical technique is reduced, and the likelihood of drawing wrong conclusions is increased. Figure 3, which depicts the distribution of gaze durations per ad element, clearly indicates that the assumption of normality is violated for the local gaze durations. The figure shows, for instance, that 69 out of 115 subjects gazed for less than 0.1 seconds at the body text. Moreover, our conceptual model already stressed the relevance of accounting for heterogeneity in undirected visual attention to advertising. Therefore, we propose a latent class regres-

sion model that assumes an appropriate statistical distribution of local gaze durations, and that allows for heterogeneity in local gaze durations between subjects.

Insert Figure 3 about here

Latent class regression models have been shown to be an effective tool to investigate behavioral heterogeneity between unobserved consumer segments (Wedel and DeSarbo 1994). The latent class regression model proposed in this study simultaneously estimates the effects of physical ad properties on undirected visual attention for different segments, and the probability that a subject belongs to a particular segment. The model assumes that gaze durations follow a Gamma distribution. The Gamma distribution accounts for the extreme skewness to the right which is present in the data [3] (see Figure 3), and is a commonly used, flexible distribution to model duration times of task completion (e.g., Law and Kelton 1982).

The latent class regression model proposed explains the length of time subject i (i = 1,...,115) spends attending to each ad element j (j = 1,...,4), represented by y_{ij}, from the physical properties of this element, represented by $x_j = (x_{jp})$ (p = 1,...,P). The model assumes that subjects are drawn from a population which consists of a number of segments, S, in proportions $\pi_1,...,\pi_S$. It is not known in advance from which segment a particular subject comes. For the probabilities π_s it holds:

$$\sum_{s=1}^{S} \pi_s = 1, \quad \pi_s \geq 0 \quad (s=1,...,S) \tag{1}$$

The conditional probability density function of y_{ij}, given that y_{ij} comes from segment s, is the Gamma-distribution, represented by $G_{ij|s}$, and takes the following form:

$$G_{ij|s}(y_{ij}|\mu_{j|s},\nu_s) = \frac{1}{\Gamma(\nu_s)}\left(\frac{\nu_s}{\mu_{j|s}}\right)^{\nu_s} y_{ij}^{(\nu_s-1)} \exp\left(\frac{-\nu_s y_{ij}}{\mu_{j|s}}\right), \tag{2}$$

where

$\Gamma(\cdot)$ = the Gamma-function,

ν_s = the shape parameter of the Gamma distribution for segment s ($\nu_s > 0$), and

$\mu_{j|s}$ = the conditional expectation of the Gamma distribution, i.e., the expected time a subject attends to ad element j, given that she belongs to segment s.

The expected mean duration that a subject gazes at ad element j, given that she belongs to segment s, $\mu_{j|s}$, is modeled as a log-linear function of a constant term, x_{j0}, the physical ad properties, x_{jp}, and the parameter vector $\beta_s = (\beta_{ps})$:

$$\log \mu_{j|s} = \sum_{p=0}^{P} x_{jp} \beta_{ps}. \tag{3}$$

The log-linear function is used because it ensures positivity of the expected gaze durations, which is logically consistent. The unconditional probability density function of an observation y_{ij}, $f_{ij}(y_{ij})$, can now be expressed as a function of the parameters π_s, β_s, and ν_s:

$$f_{ij}(y_{ij}|\Phi) = \sum_{s=1}^{S} \pi_s G_{ij|s}(y_{ij}|\beta_s, \nu_s), \tag{4}$$

where $\Phi = (\pi_1,...,\pi_S, \beta_1,...,\beta_S, \nu_1,...,\nu_S)$. The purpose is to obtain estimates for the parameter vector Φ and for the posterior probability that a subject i belongs to a segment s. For a prespecified value of S the estimates are obtained by maximizing the likelihood of the model,

$$L = \prod_{i=1}^{115} \prod_{j=1}^{4} f_{ij}(y_{ij}|\Phi), \tag{5}$$

using an EM algorithm (Dempster, Laird, and Rubin 1977; see also Wedel and DeSarbo 1994). The posterior membership probability that subject i belongs to segment s, α_{is}, can be calculated on the basis of the estimated parameters, according to:

$$\hat{\alpha}_{is} = \frac{\hat{\pi}_s \prod_{j=1}^{4} G_{ij|s}(y_{ij}|\hat{\beta}_s, \hat{\nu}_s)}{\sum_{s=1}^{S} \hat{\pi}_s \prod_{j=1}^{4} G_{ij|s}(y_{ij}|\hat{\beta}_s, \hat{\nu}_s)}. \tag{6}$$

The appropriate number of segments S, which is usually unknown in applications, is

determined by optimizing the likelihood for different values of S, and comparing the values of Bozdogan's (1987) Consistent Akaike's Information Criterion, CAIC:

$$CAIC = -2\ln L + (S(P+1)-1)(\ln(n)+1) \quad (7)$$

where

P = the number of ad characteristics, and

n = the number of observations (= the number of subjects times the number of ad elements = 460).

The optimum value of S is the value that minimizes CAIC.

Before applying the latent class regression model, we will first analyse the data of our study using more conventional statistical techniques, in order to show the incorrect conclusions that may be drawn when inappropriate assumptions are made.

Exploratory analyses of gaze durations

As described before, the four versions of the advertisement differed with respect to the size, position and background color of four elements within the ad; i.e., pictorial, packshot, headline and body text. To examine the effect of these physical ad properties, each element is described in terms of the following seven variables: (a) SIZE indicates the size of an element in hundreds of square centimetres; (b) PICTORIAL is a dummy variable which indicates whether an element contains the pictorial of a female (= 1) or not (0); (c) PACKSHOT indicates whether the element contains the packshot (1) or not (0); (d) HEADLINE indicates whether the element contains the headline (1) or not (0) [4]; (e) RIGHT indicates whether the element connects to the right margin of the page (1) or not (0); (f) UPPER indicates whether the element is in the upper half of the page (1) or not (0); and (g) COLOR indicates whether the element is in full color (1) or in black and white (0). For each element, the actual values of the seven properties for each of the four versions of the advertisement are presented in Table 1.

Insert Table 1 about here

Exploratory statistical analyses of local gaze durations as presented in Figure 3, show that the correlation between the SIZE of the ad elements and local gaze durations is small but significant ($r = 0.1211$, $p < 0.01$), which indicates that the larger the size of an element the longer the gaze duration for the element tends to be. In addition, t-tests indicate that gaze durations are longer for ad elements that connect to the RIGHT margin ($t_{458} = 2.88$, $p = 0.004$) and that are in the UPPER half of the page ($t_{458} = 2.79$, $p = 0.005$), but that there is no significant effect of COLOR on gaze durations ($t_{458} = 1.21$, $p = 0.228$). Analysis of variance further reveals that the average gaze duration is significantly longer for the PICTORIAL and for the HEADLINE than for the BODY TEXT, while the average gaze duration for the PACKSHOT does not significantly differ from the average gaze durations for the other three ad elements ($F_{3,456} = 3.1561$, $p = 0.025$). On the other hand, the ad version has no effect on overall gaze duration for the ad as a whole ($F_{3,111} = 0.73$, $p = 0.54$), which indicates that our manipulation of the advertisement is not confounded with individual differences in visual attention.

Furthermore, standard regression analysis shows that the seven physical properties of the ad elements together account for only 4.6% of the variance in the local gaze durations, and that HEADLINE is the only physical ad property that has a significant impact on local gaze durations ($\beta = 0.328$, $t = 2.28$). We also conducted a Tobit regression analysis, which contrary to standard regression analysis does account for skewed distributions (Amemiya 1985). The parameter estimates once more indicate that only the property HEADLINE ($\beta = 0.628$, $t = 2.85$) has a significant impact on local gaze durations. The seven physical properties explain 8.4%[5] of the variance in local gaze duration. Although this percentage is higher than the 4.6% that is found for the standard regression analysis, it also indicates that over 90% of the variance still remains to be explained.

Segment-level analysis of undirected visual attention

The latent class regression model was estimated for $S = 1$ to $S = 5$. To increase the likelihood of obtaining a global optimum, the estimation procedure was repeated

using 20 different random starting values of α_{is}. Table 2 presents the log-likelihood and CAIC statistics for the S = 1 to S = 5 solutions. The table shows that the CAIC statistic is minimal for S = 3. The optimal S = 3 solution is found in ten out of the twenty random starts, which strongly supports the conclusion that a global optimum is reached. The R^2 for the S = 3 solution is 71.0%, over 6 times more than the R^2 for the aggregate (S = 1) solution, which is 10.4%. This result underlines the strong heterogeneity in the effects of exogenous factors on undirected visual attention, and therefore the relevance of distinguishing segments of consumers. Furthermore, the increase in the amount of variance explained by the aggregate (S = 1) solution compared to the amount explained by the standard and Tobit regression analyses supports the appropriateness of the Gamma distribution to model gaze durations.

Insert Table 2 about here

Since each of the four versions of the advertisement was shown to a different group of consumers, it may well be that the three consumer segments recovered here represent in some way the four ad versions that we used. A crosstabulation of ad versions by consumer segments, with consumers being allocated to the segment for which their estimated membership, $\hat{\alpha}_{is}$, was highest [6], produced a non-significant P^2 ($P^2_6 = 4.51$, p = 0.61), which rules out this possibility.

In Table 3, the estimated effects of the physical ad properties on gaze duration for each of the segments of the S = 3 solution are presented. The mixing proportions at the bottom row of the table indicate the size of the segments. For comparison, Table 3 presents the aggregate (S = 1) solution as well. Inspection of the table reveals the incorrect conclusions that would have been drawn about the impact of physical ad properties on undirected visual attention, if this impact had been assumed to be homogeneous across consumers. In the aggregate (S = 1) solution, only one of the seven physical ad properties, HEADLINE, significantly affects local gaze duration, which is consistent with the results of the standard and Tobit regression analyses. By contrast, in the S = 3 solution, four physical ad properties have a significant impact on local gaze duration for segment 1, six properties for segment 2, and two properties for segment 3.

Insert Table 3 about here

Table 4 provides the mean actual gaze duration for the four ad elements, pictorial, packshot, headline and bodytext, for each of the three segments separately as well as for the total sample (differences between the segments are tested using Gamma-regression models). Note that across the 115 consumers, the average gaze duration for the advertisement is a mere 1.77 seconds. This is closely in line with the results reported in similar research on gaze duration to print advertisements under natural conditions (see Kroeber-Riel 1993), but it is significantly lower than the exposure durations that are frequently afforded to consumers in experimental research. We will return to this result in the final section.

Insert Table 4 about here

Effects of exogenous factors on local gaze duration per segment

The results reported in Table 3 and 4 together provide a concise description of the patterns of local gaze duration for each of the segments. Segment 1, which is the smallest of the three segments, with 23.2% of the subjects belonging to it, gazes for the shortest period (0.633 seconds on average) at the advertisement as a whole. Subjects in this segment divide their attention equally between the pictorial and the headline of the advertisement, whereas the packshot and body text receive virtually no attention. These findings are supported by the parameter estimates in Table 3. The positive and significant HEADLINE parameter indicates that these subjects attend for a longer period to the headline than to the body text. The PICTORIAL parameter is also positive, but not significant. The negative and significant PACKSHOT parameter indicates that their attention for the packshot of the advertisement is even less than for the body text, which is confirmed by the mean local gaze durations for these two elements. Given the fact that they attend to only those elements that are likely to provide an overview or summary of the content of the advertisement, i.e., pictorial and headline, subjects in segment 1 appear to be "scanning" the advertisement, in which case the dominant illustration and similar ankers play a

crucial role (Finn 1988; Greenwald and Leavitt 1984). From Table 3, we further conclude that this segment pays more attention to ad elements that are part of the right and upper half of the page. Finally, whether the ad element is in full color or in black and white has no effect on local gaze duration for segment 1.

Segment 2, to which 24.3% of the subjects belong, pays significantly more attention to the advertisement than segment 1 (1.013 seconds on average). The largest part (43%) of this attention is devoted to the pictorial. The headline and the packshot receive respectively 32% and 25% of the attention, whereas the body text receives no attention at all. This finding is supported by the positive and significant parameter estimates for the variables PICTORIAL, PACKSHOT and HEADLINE. The gaze pattern of subjects in segment 2 appears to be indicative of "initial attention" for the advertisement. Table 4 further shows that local gaze durations of these subjects are longer for ad elements at the right and lower half of the page, and for ad elements that are in black and white.

Finally, subjects belonging to segment 3 (52.5% of the sample) have the longest gaze duration (2.712 seconds on average) to the advertisement as a whole. They divide their attention equally between pictures (pictorial and packshot) and text (headline and body text), which indicates "sustained attention" for the advertisement. The non-significant parameter estimates for the variables PICTORIAL, PACKSHOT and HEADLINE bear out the fact that no differences in visual attention across ad elements are found. In fact, Table 4 shows that local gaze duration is not affected by the content of the ad elements, but only by the size of the ad elements, where larger elements receive more attention, and by the position of the ad elements, i.e., ad elements at the right part of the page receive more attention than ad elements at the left part. Whether or not the ad elements are part of the upper half of the page and whether the ad elements are in full color or in black and white does not affect local gaze durations for subjects belonging to segment 3.

Differences between segments regarding endogenous factors

According to Figure 1, effects of physical ad properties on local gaze duration are moderated by endogenous factors or consumer characteristics, and the differences in gaze duration patterns between segments as described above demonstrate that this, in fact, occurs. The question remains to what extent these differences can be ascribed to

consumer characteristics. Table 5 presents a profile of the differences between the three segments regarding the consumer characteristics assessed in this study, i.e., product-related, brand-related, ad-related, and media-related characteristics. With respect to the product-related variables, subjects in the initial-attention-segment (S2) consider the risk involved in purchasing shampoo to be significantly higher than subjects in the scanning-segment (S1). In addition, the advertised brand scores higher on hedonic brand attitude for the initial-attention-segment (S2) than for the scanning-segment (S1). Table 5 also indicates that subjects in the sustained-attention-segment (S3) attend significantly longer to the pages just before the target advertisement than the scanning-segment (S1) does.

Insert Table 5 about here

A canonical discriminant analysis was conducted to consider differences between the three segments in consumer characteristics simultaneously. Consumer characteristics were entered into the discriminant functions in a stepwise fashion. Results indicate that both discriminant functions are statistically significant ($p = 0.0064$ and $p = 0.0316$ for function 1 and 2 respectively). Reallocation of the subjects to the segments using the discriminant functions results in a classification accuracy of 61.1%, which is significantly higher than the chance criterium of 37.6%. In Figure 4, the segments as well as the consumer characteristics entered into the two discriminant functions are graphically portrayed in a two-dimensional space, in which dots represent the position of the three segments and arrows the consumer characteristics that significantly contribute to the profile of the segments. The arrows point in the direction of the segments for which the label of the arrow holds most, and the length of the arrows indicates the discriminating power of the associated consumer characteristic between the three segments.

Insert Figure 4 about here

As shown in Figure 4, more consumer characteristics contribute to the differences in gaze duration patterns among segments than the bivariate tests suggest. For instance, Figure 4 shows that the three segments do not only differ with respect

to the "risk importance"-component of involvement, but with respect to "risk probability", "pleasure" and "relevance" as well. As expected, for the scanning-segment (S1), the risk involved in purchasing shampoo is of less importance than for the initial- and sustained-attention-segments (S2 and S3 respectively), while the latter segment estimates the risk probability to be highest. This provides an explanation for the fact that the sustained-attention-segment (S3) is the only segment that spends a substantial amount of attention to the body text, since such verbal information is effective in reducing perceived risk. On the other hand, shampoo is a more pleasurable and relevant product for subjects belonging to the initial-attention-segment (S2) than for subjects belonging to the sustained-attention-segment (S3). This might explain why subjects in the initial-attention-segment devote relatively more attention to the pictorial information in the ads (pictorial and packshot) as compared to the other two segments, since they might derive more pleasurable brand-related information from these visual ad elements. For the scanning-segment (S1), finally, shampoo is of some relevance, but this segment scores low on the other involvement components. This finding is consistent with the very low overall gaze duration as well as with the fact that subjects in the scanning-segment only fixate the pictorial and headline of the ad. In conclusion, from the involvement-profiles of the three segments, we might conclude that the scanning-segment (S1) is hardly involved in the product class "shampoo" at all, that shampoo is a pleasurable and relevant product to the initial-attention-segment (S2), and that the sustained-attention-segment (S3) is risk-involved with respect to shampoo. The results appear to be very consistent both with overall and local gaze duration patterns.

As the bivariate tests already indicated, the sustained-attention-segment (S3) attends longer to the pages just before the target advertisement ("Prior gaze duration" = mean gaze duration across page 16 to 21) than the other segments, which might point to a high involvement in the task for subjects in the sustained-attention-segment. We further see that the advertised brand is more special (i.e., higher score on hedonic brand attitude) to members of the initial-attention-segment (S2) than to members of the other two segments. In addition, note that subjects in the initial-attention-segment are more familiar with brands of shampoo than subjects in the other segments. Finally, subjects in the sustained-attention-segment (S3) shampoo their hair more often than subjects in segment 1 and 2, which fits with their higher

risk involvement.

Differences between segments regarding advertising memory

Finally, we examined whether differences in undirected visual attention result in differences in memory for the target advertisement. Table 5 shows that sustained-attention-segment (S3) in general recalled more advertised brands than the initial-attention-segment (S2), and that this result holds for target advertisement as well. For the scanning-segment (S1), the recall score for the target advertisement is even lower than for the initial-attention-segment. These results can be explained from the length of the overall gaze duration, which increases from the scanning-segment (S1) to the initial-attention-segment (S2) to the sustained-attention-segment (S3). The segments do not differ on the recognition scores nor on the memory scores with respect to the advertised products, but the number of products recalled tends to increase from the scanning-segment to initial-attention-segment to the sustained-attention-segment as well.

Conclusion and discussion

Our study is a first step toward a better understanding of the patterns of visual attention to advertising in situations where consumers control the exposure duration and define the task during exposure themselves. The conceptual model that we propose as well as the latent class regression model, which builds on it, proves useful in gaining insight in these patterns, and both reveal mechanisms of undirected visual attention that would otherwise have remained hidden. In our study, local gaze duration was used as a measure for undirected visual attention. The average gaze duration for the target advertisement as a whole that we found (1.77 seconds) corresponds with the average exposure time in natural settings as found by Kiss and Wettig (1972, in: Kroeber-Riel 1993) and Andresen (1988, in: Kroeber-Riel 1993), but not with that in forced exposure situations (e.g., Janiszewski 1993; Kroeber-Riel 1984). This finding suggests that our experimental setting, in which subjects were exposed to the target ad, did not make subjects pay any more attention to the advertisement than consumers do, on average, in natural settings. Furthermore, the low

average gaze duration suggests that forced exposure durations in previous studies may sometimes have been optimistically long.

Heterogeneity in visual attention

The latent class regression model identified segments of consumers that react very differently to the physical properties of advertising. By distinguishing three segments, we gained an improved insight in the impact of these properties on undirected visual attention to advertising. In fact, the amount of variance in local gaze durations that the physical ad properties accounted for increased from a low 10% for the aggregate-level solution to a high 70% for the segment-level solution. Moreover, if subjects had been assumed homogeneous, the impact of several physical ad properties on local gaze duration would have been underestimated. For instance, whereas all subjects paid attention to the pictorial and the headline of the advertisement, only part of the sample paid attention to the packshot (76.8%, segment 2 and 3) and to the body text (52.5%, segment 3) as well. The aggregate-level (S = 1) solution, where only the headline-parameter was significant, however, did not reveal this attention pattern. Furthermore, on the basis of an aggregate-level analysis we would have concluded incorrectly that physical ad properties regarding size, position and color of the ad elements do not have a significant impact on undirected visual attention, while each of these properties significantly contributed in the segment-level solution.

Our results strongly suggest that the three segments of consumers that were identified have qualitatively different patterns of attention, which can be described as scanning, initial attention, and sustained attention. The segments react differently to the elements of the advertisement, and they have distinct profiles of consumer characteristics. Since the effects of the ad properties differ per segment, our results warn against formulating general hypotheses about the effects of exogenous factors, and they underline the importance of specifying and appropriately modeling the endogenous factors accounting for heterogeneity in undirected visual attention to advertising.

Limitations

In this study, we concentrated on local gaze duration for the elements of an advertisement. Unfortunately, the available data did not enable us to investigate sequences of gazes on ad elements. Hence, we could not determine the order in which subjects paid attention to the elements within the advertisements. Although the differences in average local gaze duration between the three segments suggest that the dominant sequence of attention was (1/2) headline and/or visual, (3) packshot and (4) body text, support for this contention can only come from analyses of eye fixation sequences. Research on eye fixation sequences, and on the antecedents and consequences of particular eye fixations may also be used in determining the correspondence between visual attention patterns and higher order cognitive processes (Russo 1978; Russo and LeClerc 1994).

Although we have compared the three segments of consumers with respect to a set of consumer characteristics (most importantly involvement), the design of the study does not allow definitive conclusions about the direction of causality between local gaze duration patterns and consumer specific variables. For instance, the design does not allow to distinguish a situation in which longer gaze durations led to more positive evaluations of the advertised brand, from a situation in which an a-priori more positive brand evaluation led to longer gaze durations. The goal of the present study was not to determine the direction of causality between evaluations of products, brands and ads and undirected visual attention, but to provide more insight into patterns of undirected visual attention to advertising, and into consumer correlates of these patterns, in particular components of involvement. The direction of causality for these and other consumer specific variables remains to be tested in future experiments.

Directions for future research

The analyses revealed that gaze duration patterns within segments are very consistent with differences among the segments with respect to involvement, brand attitude and ad recall. Whereas previous research has emphasized the relationship between a single involvement construct and advertising processing (e.g., Cacioppo, Petty, and Sidera 1982; Miniard et al. 1991; Yalch and Elmore Yalch 1984), we have demonstrated that different components of involvement, as suggested by Jain and Srinivasan (1990), Laurent and Kapferer (1985), and others (e.g., McQuarrie and

Munson 1987), differentially affect visual attention patterns. Our results converge with the suggestions of Johnson and Eagly (1989), who stated that different components or sources of involvement have distinct effects on persuasion.

The discriminant analysis indicated that subjects in the sustained-attention-segment (S3), who scored high on the "risk probability"- and "risk importance"-components of involvement, attended to all elements of the advertisement more closely. Especially, they devoted more attention to the body text, which contained (verbal) information that typically serves to reduce risk. This segment of consumers also had higher levels of recall for the brand in question.

In addition, we found that the sustained-attention-segment (S3), which devoted significantly more attention to the target advertisement than the other two segments, spent more time leafing through the magazine as well. This difference is only significant for the pages that are closer to the advertisement and not for the first pages in the magazine; i.e., the average amount of attention spent per page decreased less for this segment than for the other segments. This result might indicate that subjects in the sustained-attention-segment (S3) remained more involved either in the magazine itself or in the experimental task than the other subjects. Both the visual attention patterns for the target ad, and the information from the profile of consumer characteristics indicate that the former was the case. In situations where the latter occurs, researchers using eye-tracking equipment should account for the fact that a proportion of the subjects remains task-involved throughout the complete task and, therefore, pay more attention to the target ad. According to Janiszewski and Warlop (1993), results of behavioral research under such procedural constraints are best applicable when they concern natural settings. In line with their argument, we tried to maximize the degree of realism of the exposure situation.

Our study provides indicative answers about the impact of the risk-components of involvement (risk importance and risk probability) on undirected visual attention. Future experimental research could manipulate different sources of involvement, in order to confirm whether consumers to whom the risk-components are important devote attention to each of the different types of elements within the advertisement, and pay more attention to the body text and the packshot.

The results further show that compared to the other segments, the initial-attention-segment (S2) derived more pleasure from shampoo, while it perceived an

equally high risk involved in the purchase of shampoo as the sustained-attention-segment (S3) does. In addition, the results indicate that subjects in the initial-attention-segment devoted the largest part of their attention (67.9%) to the visual elements of the advertisement, whereas these percentages equaled about 50% for subjects in the other segments. This suggests that for the initial-attention-segment the visual ad elements contain more pleasurable brand-related information than the text elements do. Interestingly, the initial-attention-segment also scored higher on hedonic brand attitude. Future research could be conducted to test whether consumers for whom the "pleasure"-component is specifically important, devote more attention to the visual elements of an advertisement in order to obtain brand-related information, and whether this affects their hedonic brand attitude more.

The "relevance"-component of involvement hardly contributed to the profiles of the three segments. Shampoo appeared to be more relevant to the initial-attention-segment (S2) than to the scanning-segment (S1), which may explain the finding that the initial-attention-segment paid much more attention to the packshot containing the brand-logo as compared to the scanning-segment. For subjects in the initial-attention-segment, familiarity with brands of shampoo was largest, and the target brand was a more special brand to them than to subjects in the other segments. However, the study does not provide a clear picture of the way in which these product-related consumer characteristics relate to undirected visual attention. Future visual attention research could, therefore, study the effects of those characteristics in situations and for products, for which large differences with respect to the "relevance"-component of involvement are expected to exist. This research could then examine whether consumers for whom this component is important have higher levels of attention to elements in advertisements that contain pictorial representations of the brand, such as the packshot. In general, replication of this study with other advertisements, products, consumers and exposure situations may contribute to the generalizability of the results found.

Finally, the results reveal that one of the involvement components, sign, did not affect the visual attention patterns at all. This component was unimportant for all three segments identified, which suggests that the subjects in the sample considered it hard to impress others with the brand of shampoo used. More research is needed to examine the role of the "sign"-component of involvement on visual attention for

product categories where brands have a more expressive function.

In conclusion, our results show that a segment-level analysis provides an improved understanding of the impact that physical ad properties and consumer characteristics have on patterns of undirected visual attention to advertising. We hope that our research has suggested profitable directions for future research, and that it stimulates further efforts to exa-mine and specify the interplay of exogenous and endogenous fac-tors in this critical, early stage of advertising processing.

Footnotes

1. Note that this situation corresponds to James' (1890) passive attention, Wertheimer's (1923) attention that results from structural properties, and Koffka's (1935) involuntary attention.

2. Construct reliabilities are respectively 0.87 for sign, 0.76 for relevance, 0.66 for pleasure, 0.72 for risk probability, and 0.83 for risk importance.

3. The Gamma distribution does not allow for durations exactly equal to zero. To account for this, a small number (50 milliseconds) was added to observations equal to zero. The generalized subject-wise correlation coefficient (Krijnen 1994) between the original data and the adjusted data equals 0.9993, which indicates that the data structure is hardly influenced by this adjustment.

4. By defining the variables PICTORIAL, PACKSHOT and HEADLINE in this way, the constant term will indicate the amount of attention that is paid to the body text.

5. Since the relationship $\sigma_y^2 = \hat{\sigma}_y^2 + \hat{\sigma}_e^2$, which underlies the computation of R^2, does no longer hold due to the censoring of the data, the figure presented here is an estimate of the amount of variance explained, and is defined by $R^2 = \frac{\sigma_y^2}{\sigma_y^2 + \sigma_e^2}$, where y is the actual value of the variable to be explained, y^* is the estimated value for this variable, and e is the error component.

6. The allocation of subjects to the segments is based on the probability that a subject belongs to that segment. To justify this allocation procedure, an entropy-based measure E is calculated, where E is between 0 and 1, and 1 indicates that the segments are perfectly separated (Wedel and DeSarbo 1994). For the S = 3 solution, E equals 0.81, which indicates that the segments are well-separated, and that the use of this allocation procedure is justified.

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TABLE 1

VALUE OF THE PHYSICAL PROPERTIES

FOR THE DIFFERENT AD ELEMENTS

Advertisement	Size (x 100 cm^2)	Pictorial	Packshot	Headline	Right	Upper	Color
Version 1							
1. Pictorial	3.56	1	0	0	1	1	1
2. Packshot	0.45	0	1	0	1	0	1
3. Headline	0.44	0	0	1	0	0	0
4. Body text	1.15	0	0	0	0	0	0
Version 2							
1. Pictorial	2.78	1	0	0	1	1	1
2. Packshot	0.89	0	1	0	1	0	1
3. Headline	0.72	0	0	1	1	1	1
4. Body text	1.30	0	0	0	0	0	0
Version 3							
1. Pictorial	1.72	1	0	0	0	1	1
2. Packshot	2.11	0	1	0	1	0	1
3. Headline	0.88	0	0	1	1	1	0
4. Body text	1.14	0	0	0	0	0	0
Version 4							
1. Pictorial	2.41	1	0	0	1	1	1
2. Packshot	0.83	0	1	0	1	0	1
3. Headline	0.86	0	0	1	0	0	1
4. Body text	1.30	0	0	0	0	0	0

TABLE 2

LOG-LIKELIHOOD AND CAIC STATISTICS FOR MODEL SELECTION

Number of segments (S)	Log-likelihood (ln L)	CAIC
1	-790.828	1631.575
2	-743.589	1594.146
3	-704.138	1573.138 [a]
4	-683.636	1588.339
5	-662.810	1603.738

[a] denotes minimum CAIC value

TABLE 3
MODEL ESTIMATES OF THE PHYSICAL AD PROPERTIES
ON LOCAL GAZE DURATION
FOR THE AGGREGATE SOLUTION AND PER SEGMENT

Ad characteristic	Aggregate (S = 1) solution	(S = 3) solution		
		Segment 1 Scanning	Segment 2 Initial Attention	Segment 3 Sustained Attention
Constant	-1.470 (-6.67) [c]	-2.789 (-23.92) [c]	-3.132 (-26.57) [c]	-0.968 (-4.76) [c]
Size	0.283 (1.84)	-0.122 (-1.48)	0.122 (1.49)	0.335 (2.38) [a]
Pictorial	0.300 (0.69)	0.239 (1.09)	4.705 (19.77) [c]	-0.312 (-0.76)
Packshot	-0.006 (-0.01)	-0.586 (-2.59) [a]	1.424 (5.68) [c]	-0.381 (-0.92)
Headline	0.681 (2.66) [b]	0.324 (2.38) [a]	2.566 (19.17) [c]	0.337 (1.41)
Right	0.573 (1.78)	0.551 (3.37) [b]	0.579 (3.23) [b]	0.721 (2.45) [a]
Upper	-0.377 (-0.97)	1.352 (6.91) [c]	-2.858 (-13.34) [c]	-0.414 (-1.16)
Color	-0.277 (-1.19)	-0.039 (-0.33)	-0.293 (-2.26) [a]	-0.175 (-0.80)
Mixing proportion	(1.000)	0.232	0.243	0.525

Note.–t-values are between parameters
[a] Significant at .05; [b] Significant at .01; [c] Significant at .001.

TABLE 4

AVERAGE LOCAL GAZE DURATION AGGREGATE AND PER SEGMENT (IN SECONDS)

Ad element	Aggregate	Segment 1 Scanning	Segment 2 Initial Attention	Segment 3 Sustained Atention
Pictorial	0.547	0.330[a]	0.436[a]	0.711[b]
Packshot	0.402	0.000[a]	0.252[b]	0.674[c]
Headline	0.523	0.300[a]	0.326[a]	0.735[b]
Body text	0.295	0.004[a]	0.000[a]	0.593[b]
Overall	1.766	0.633[a]	1.013[b]	2.712[c]

Note.–Means in a given row with the same superscript are not significantl y different at $p < 0.05$.

TABLE 5

DIFFERENCES IN ENDOGENOUS FACTORS AND ADVERTISING MEMORY BETWEEN SEGMENTS

	Segment 1 Scanning	Segment 2 Initial Attention	Segment 3 Sustained Attention	Statistic
ENDOGENOUS FACTORS				
Product-related variables	3.296 [a]	4.000 [b]	3.929 [ab]	$F_{2,112}$ =
Involvement subscales:	4.231	4.290	4.474	3.408 [2]
Risk importance	3.691	3.989	3.845	$F_{2,112} = 1.186$
Risk probability	4.506	4.527	4.497	$F_{2,112} = 1.348$
Pleasure	1.778	2.000	1.976	$F_{2,112} = 0.022$
Relevance	2.963	2.548	3.088	$F_{2,112} = 0.405$
Sign				$F_{2,112} = 1.332$
Frequency of shampooing	4.444	4.968	4.474	$F_{2,112} = 0.937$
Familiarity with	3.667	3.944	3.754	
brands of	2.074 [a]	2.527 [b]	2.473 [ab]	$F_{2,112} = 1.009$
shampoo				$F_{2,112}$ =
Brand-related variables	0.630	0.871	0.719	2.473 [1]
Utilitarian brand attitude				$P^2_2 = 4.590$
Hedonic brand attitude	3.630	3.69	3.726	
Familiarity with				
"Schwarzkopf"				$F_{2,112} = 0.098$
Advertisement-related variable	4.993	5.891	6.644	
	4.043 [a]	5.026 [ab]	5.906 [b]	
Attitude toward the ad	2.915 [a]	3.193 [ab]	4.259 [b]	$F_{2,112} = 1.055$
Media-related variables				$F_{2,112}$ =
Average gaze duration for				2.566 [1]
				$F_{2,112}$ =
page 3-9				3.634 [2]
page 10-15				
page 16-21				

ADVERTISING MEMORY				
Recall of brand "Schwarzkopf"	0.074	0.161	0.333	$P^2_2 = 8.057$ [2]
Recall of product "shampoo"	0.222	0.323	0.421	$P^2_2 = 3.312$
Recognition of brand "Schwarzkopf"	0.407	0.516	0.579	$P^2_2 = 2.166$
Recognition of product "shampoo"	0.481	0.581	0.632	$P^2_2 = 1.698$
Number of advertised brands recalled	0.593 [ab]	0.581 [a]	1.035 [b]	$F_{2,112} =$ 2.847 [1]
Number of advertised products recalled	1.444	1.323	1.790	$F_{2,112} = 1.826$

Note.–Means in a given row with the same or no superscript are no t significantly different at $p < 0.05$.

[1] Significant at .10; [2] Significant at .05.

FIGURE 1
CONCEPTUAL MODEL OF FACTORS AFFECTING
VISUAL ATTENTION TO ADVERTISING

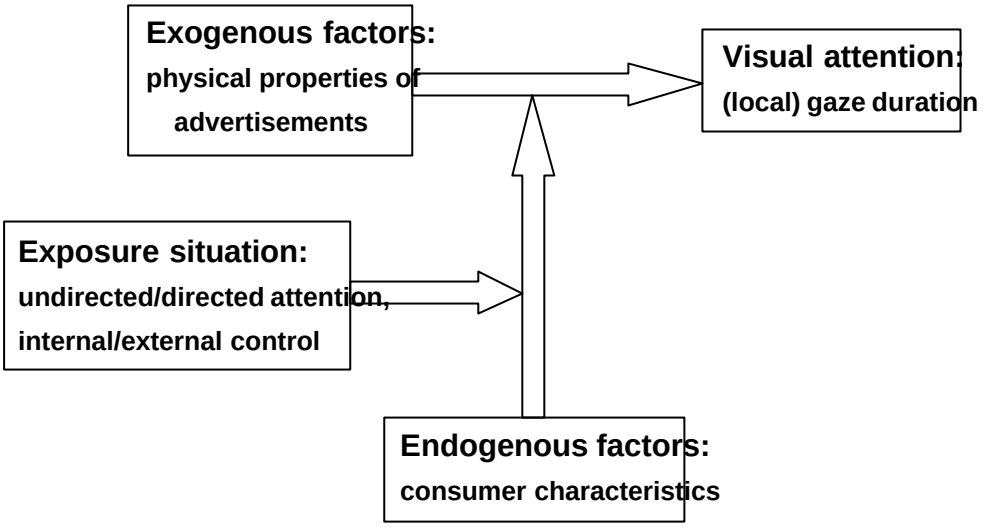

FIGURE 2A
VERSION 1 OF THE SHAMPOO ADVERTISEMENT

FIGURE 2B
VERSION 2 OF THE SHAMPOO ADVERTISEMENT

FIGURE 2C
VERSION 3 OF THE SHAMPOO ADVERTISEMENT

FIGURE 2D
VERSION 4 OF THE SHAMPOO ADVERTISEMENT

FIGURE 3
DISTRIBUTION OF GAZE DURATIONS PER AD ELEMENT

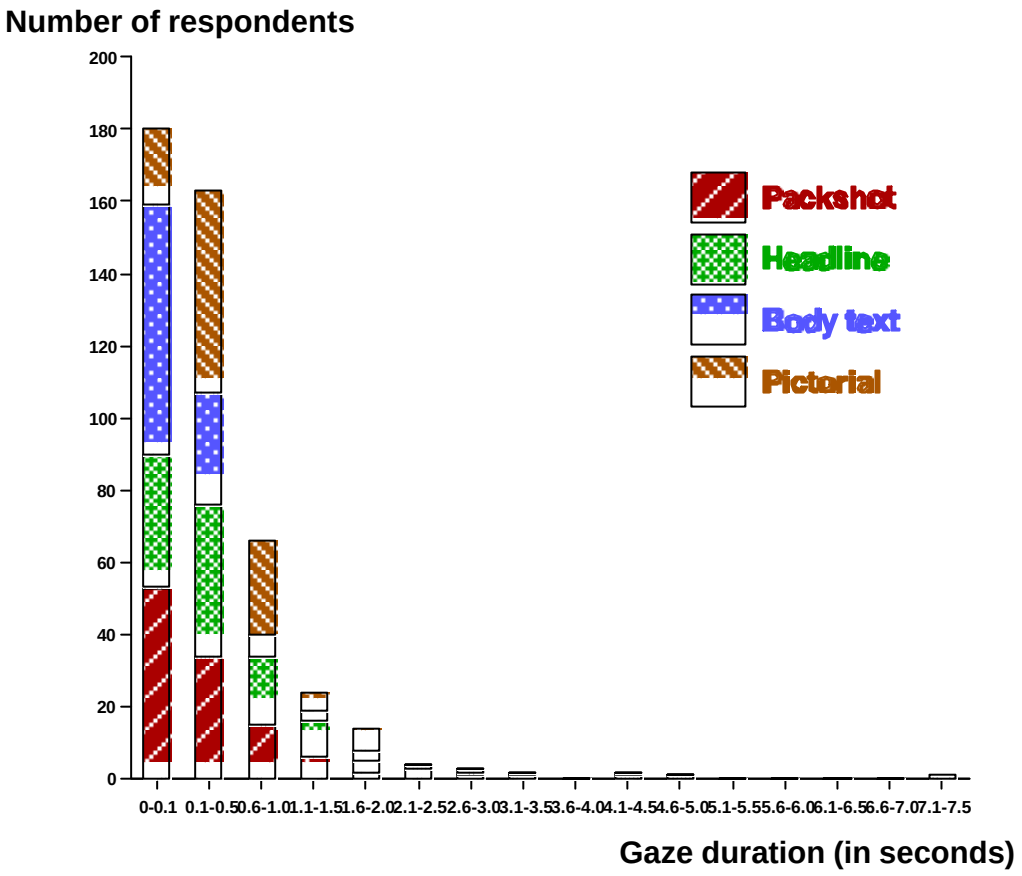

FIGURE 4
DISCRIMINANT SPACE