

# Consumer Perception of Online Advertising

The Effects of Animation, Ad Characteristics, Repetition and Task Relevancy on Attention and Memory

Jarmo Kuisma





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**Jarmo Kuisma**

**Main dissertation advisor**

Assistant Professor Alexandre Schwob, Aalto University, Finland

**Co-dissertation advisor**

Professor (Emerita) Liisa Uusitalo, Aalto University, Finland

**Opponent**

Professor Andrew Duchowski, Clemson University, U.S.

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**Author**

Jarmo Kuisma

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**Abstract**

Prior advertising research on advertising perception models has mainly focused on effects that occur after consumers have been exposed to advertising stimuli. Little research has examined how consumers are exposed to advertising and the quality of visual attention during advertising exposure. This doctoral dissertation examines how consumers allocate their visual attention to online ads and how consumers memorize ads in different viewing conditions. More precisely, the dissertation focuses on how ad format and location, animation, repetition, abrupt onsets, and task relevancy affect attention to ads and memory performance.

The thesis employs theories of cognitive psychology, visual marketing and consumer behavior, advertising persuasion models and computer science and applies experimental methodologies such as eye tracking besides consumers' self-reported measures. The thesis consists of four essays. Essay 1 introduces a review of relevant theory and eye tracking methodology for online advertising research. The next three essays present experimental studies. Essay 2 investigates the effects of ad format and animation on attention and memory. Essay 3 examines the effects of repetition of ads on memory. Essay 4 investigates how animation, ad format and abrupt onsets of ads affect reading performance, and how online ads are perceived during free browsing compared to an instructed reading task.

Our findings indicate that attention and memory for ads were significantly affected by consumers' intentions, ad characteristics and web page contents. Consumers are more likely to be attracted by ads when browsing web sites freely without a special task. Ad characteristics, such as animation and ad format interact and influence differently on attention and memory performance for ads depending on the ad's location on a page and the surrounding page content. The thesis also tested the effects of repetition of ads as a potential strategy to improve memory for ads. A significant positive effect was found already at rather low levels of repetition. Moreover, we also tested consumers' attention to abrupt onsets of ads. We registered a significant increase of attention to abrupt onsets of ads as compared with permanent ads especially during free browsing of web pages.

This thesis increases our knowledge of the role and type of ad exposure on consumers' attention by evaluating the effectiveness of advertising exposure in dynamic online environment. This research is also the first attempt to evaluate the applicability of the primary eye tracking measures for online advertising. For advertisers, media traders and graphic designers this research proposes new strategies about how to adjust ad format and placement, animation and repetition to break through advertising clutter and reduce consumers' ad avoidance to develop stronger brand awareness and preferences.

**Keywords** online advertising, animation, attention, eye tracking, ad format, memory, repetition, abrupt onsets, goal-orientation

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*Jarmo Kuisma*



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1. Kuisma, Jarmo (2015). The Use of Eye Tracking to Investigate Consumers' Perceptions of Online Advertisements. (Revised from earlier peer reviewed version published in: Kuisma, Jarmo (2007), Silmänliikementelmä painetun ja verkkomainonnan tutkimuksessa, *Kulutustutkimus.Nyt*, Kulutustutkimuseuran julkaisu. 1/2007, 40–52). Submitted to *Psychology and Marketing*, Wiley Periodicals, Inc., A Wiley Company.
2. Kuisma, Jarmo, Simola, Jaana, Uusitalo Liisa & Anssi Öörni (2010). The Effects of Animation and Format on the Perception and Memory of Online Advertising. *Journal of Interactive Marketing* 24, 269 - 282.
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4. Simola, J., Kuisma, J., Öörni, A., Uusitalo, L. & Hyönä, J. (2011). The impact of salient advertisements on reading and attention on web pages. *Journal of Experimental Psychology: Applied*, 17, 2, 174-190.

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# 1 Introduction

## 1.1 Background

Business and human interrelationships are increasingly mingled online. Tasks, such as searching information and entertainment, shopping and financial transactions or online reading are tasks that require visual attention to process pictorial and textual information and to detect objects in dynamic scenes. Since the launch of the Internet in the early 1990s, the number of users and websites has been growing tremendously. This rapid growth has led to an exponential increase in the amount of online advertising. For the first time, Internet advertising revenue surpassed broadcast television advertising revenue in U.S. in 2013 (IAB, Price, Waterhouse, Coopers 2014a). Consequently, the Internet has nowadays become a challenging channel for advertisers to break through a variety of messages competing for consumers' attention. In order to capture consumers' attention, advertisers employ various ad formats, such as banners and skyscrapers (Appendix 1), which are typically colored and animated to strengthen ad exposure and memorability of the brands advertised. Banner advertising has been a dominating form of online advertising almost two decades but its effectiveness is still debatable and lacks scientific proof (Sajjacholapunt & Ball 2014).

Online consumers are exposed to an abundance of advertising messages demanding sensorial and cognitive capacity during every visit on the Internet. Because of advertising clutter and information overload, consumers' visual search has become selective and they focus their attentive resources mainly to the task at hand and pay little if any attention to ads (Burke, Hornof, Nilsen & Gorman 2005, Drèze & Hussherr 2003). As attention to ads and click through rates have dramatically declined, marketers and media firms have adopted new technologies, such as conspicuous and compulsory ad formats to draw consumers' attention to ads (Franconeri & Simons 2003, Nielsen 2000). Although salient ads on web pages are able to grab viewers' attention for short moments via involuntary attention, the existing research states that the consumer is able to avoid ads, and that ads are typically irrelevant to the consumer's tasks and goals on the web (eg. Benway & Lane 1998, Nielsen 2000, Drèze & Hussherr 2003, Hong, Thong & Tam 2004, Cho & Cheon 2004, Burke & al. 2005, Day, Shyi & Wang 2006, Hervet, Guérard, Tremblay & Chtourou 2011, Duff & Faber 2011, Resnick & Albert 2014).

Effective advertising is supposed not only to attract attention but also to hold it for elaboration of ad content (Radach, Lemmer, Vorstius, Heller & Radach 2003). This elaboration in turn helps to facilitate affirmative memory effects and attitudes towards an advertised brand and thus to pave the way to actions such as purchase decisions. According to Ros-siter & Bellman (1999), banner advertising effectiveness can be evaluated relating to: 1) the state of processing, e.g. attention, memory and mental workload, 2) to the communication effect, e.g. attitudes towards ads and liking the ad, and 3) user behavior, e.g. click throughs and purchase decisions. Earlier research has investigated several aspects of online advertising effectiveness. These include the effects of animation (Bayles 2000), ad repetition (Lee & Sundar 2002), bottom-up and top down processing of ads (Stenfors, Morén & Balkenius 2003), ad avoidance (Cho & Cheon 2004), congruity, (Moore, Stammerjohan & Coulter 2005), emotional responses to ads (Yoo & Kim 2005), ad format (Burns & Lutz 2006, 2008), clutter (Ha & McCann 2008) and unconscious effects of web ads (Yoo 2008). Also, more recent literature on animation (Chtourou & Abida 2010), format (Goodrich 2010), ad avoidance and user task (Resnick & Albert 2014) shows clearly that research on online advertising effectiveness has produced inconclusive results until today, and the lengthy debate on online advertising effectiveness continues (Appendix 2).

All in all, different aspects of online advertising effectiveness have been discussed in literature including click through rates, ad characteristics that catch attention, memory for ads and implicit unconscious impacts of ads. There are at least three reasons why earlier studies have generated somewhat inconclusive results. First, the Internet has taken giant steps in expansion since it was launched some 20 years ago when online environment was quite different from what we see today. In the early times of the Internet consumers were more curious to explore this new environment and the web sites were less cluttered by ads. The trend of continuously declining click through rates of ads suggests that the interest of web users has shifted to the direction of efficient task performance and ad avoidance. Therefore, the research on online advertising effectiveness requests updating on regular basis and topics such as animation, ad avoidance and memory for ads remain on research agenda still today. Second, our literature (Appendix 2) reveals that the most common topics in the articles reviewed are memory (27) and animation (22), followed by the topics of task relevancy (10), ad format (13) and ad location (14). The topics of repetition (6) and action (8) are less frequently discussed. In spite of fact that a host of variables have concurrent impacts on advertising effectiveness,

only a few studies have taken more than a few interaction effects into account. Third, earlier studies are hardly comparable with each other due to the fact that different ad stimuli have been investigated with different methods, measures and audiences, and user contexts. Especially studies on the relationships between attention to ads and memory have proven to be problematic, because more exposure does not seem to guarantee improved memory performance (e.g. Burke & al. 2005, Lee & Ahn 2012).

Due to the research gaps mentioned above, this doctoral thesis investigates how online ads attract attention, how they are memorized, and how online consumers voluntarily or involuntarily allocate their attention to process ads. In addition, the purpose is to increase our understanding on how task performance, the online consumers' goal orientation and the cluttered nature of online environment affect user behavior, such as online reading. The motivation and need for a better understanding stem from earlier explorative eye tracking experiments and observations which simply asked where to place ads on web pages. Analyzing consumers' eye movement data and interviews with subjects raised further research questions, such as what characteristics make ads effective, in other words, what attracts attention and what do consumers remember best. The aims of this thesis and potential contributions are described more in detail in the following chapter.

## **1.2 Purpose of research**

There is a need to expand our understanding of the aspects of online advertising effectiveness both in theory and practice for the following reasons. First, the history of online display ads is still brief compared to the research history of print advertising (Higgins, Leininger, Rayner 2014, Wedel & Pieters 2008a). Second, earlier online advertising research has been conducted isolated within different research traditions, and mutual debates between perception psychologists, usability researchers and marketing researchers has begun only in recent times. Third, earlier studies of print advertising can be only partially applied to advertising in online environments, because online ads often appear in dynamic forms embedded on web pages, while print ads are static and often can be studied as its own research unit without paying attention to surrounding objects. In addition, measures for visual attention and advertising effectiveness are adopted from other contexts and call for further interpretation about their meaning in the online advertising context. Fourth, marketing and adver-

tising research has been largely based on consumers' self-reported verbal feedback, such as interviews and questionnaires. However, these methods scarcely describe the process occurring between marketing stimuli and behavioral consequences (Wang & Minor 2008).

This study consists of four individual essays of which three are published articles and one has been submitted to a peer reviewed scientific journal. The general aim of this dissertation is to explore the effects of on-line advertising by considering how viewers perceive ads with different qualities and in different situations. More specific issues for our experimental studies are 1) impact of ad format, 2) effects of animation, 3) abrupt onsets, 4) effects of repetition, 5) impact of task relevancy, 6) effects of ads on reading performance and 7) memory for ads. Since these studies originate from practical test experiments, the research has proceeded in abductive manner (Dubois & Gadde 2002) varying between deductive and inductive approaches, which is typical for experimental studies.

The purpose of Essay 1 is to augment marketing knowledge by providing an interdisciplinary perspective in order to improve understanding how ads are processed in online environment from the beginning of an exposure during the whole perceptual process. The paper also suggests to marketing researchers alternative methods to enrich the quality of research data. In addition, the paper proposes applicable eye movement measures, and how they can be applied to evaluate online advertising effectiveness. For online media companies, advertisers and graphic designers the paper gives practical guidance how to break through competitive advertising and clutter, and what ad formats, ad placement and repetition strategies to use depending on ad characteristics and media environments. The paper also emphasizes that highly salient exposure is not necessarily always the best strategy, because conspicuous and irrelevant ads can be seen too intrusive disturbing the task at hand and triggering avoidance and dislike of ads and advertised brands. The paper discusses explicit and implicit memory in connection with attention, recognition and recall measures. In addition, Essay 1 provides a review of ad formats, ad surface size and location effects, repetition of ads, users' goals and online advertising clutter, which all influence advertising effectiveness. Finally, auxiliary methods are introduced to further evaluate the impacts of online ads.

Essays 2-4 are empirical studies that examine issues of online advertising research that has earlier produced inconclusive results, such as the effects of animation, ad format and location on memory. Essay 2 investigates the effects of animation and format. It considers two ad formats, namely banners and skyscrapers, and how these attract attention and affect memory meas-

ured by recognition and recall. Examples of these ad formats embedded on our experiential web pages are illustrated in Appendix 3. Earlier research has largely focused on banners, and therefore there is a gap to investigate other formats as well. As earlier studies have found only little evidence of individual variances in processing ads, we decided to measure also participants' visual short-term memory capacity (visuospatial span) by computerized Corsi block tapping task test (Berch, Krikorian & Huha 1998). Finally, the majority of earlier experiments have used student samples and artificial banners as stimuli. Therefore, we deployed real banners and page layouts and samples of adult working citizens. The discussion in Essay 2 clarifies discrepancies of earlier studies on the relationships of attention and memory and provides marketers relevant insights when they decide which ad formats should be used and whether to use animation or not.

In Essay 3 we investigate the impact of the frequency of ad repetition. Repeated exposures of ads have been a popular technique in conventional media to increase ad and brand familiarity and thus advertising effectiveness. Even though online display advertising repetition costs are low on the Internet, research on repetition effects in online environments is scarce (Yaveroglu & Donthu 2008, Fang, Singh & Ahluwalia 2007). Repetition of ads is a typical strategy for advertisers to draw more attention and to create more positive attitudes and response towards ads and brands. Repetition enhances familiarity and priming of those ads and brands that are seen more repeatedly. We test whether higher frequency of ad exposures improves recognition accuracy of ads independently of ad format and animation.

The main purpose of essay 4 is to investigate attention to ads during reading other texts for comprehension compared with attention to ads during free browsing without task instructions to read. When users search information online, reading is an important task but nevertheless online reading is little examined. Prior research suggests that ad avoidance is largely caused by the fact that ads are irrelevant to users' goals and frequently incongruent with web page contents. However, further experiments on ad avoidance and task relevancy is needed. Moreover, the purpose of the experiments in Essay 4 is to supplement the findings of attention and animation and format of Essay 2 by investigating abrupt (delayed) onsets of ads. As far as we know, the impact of abrupt onsets has not been studied before in online advertising context. In brief, Essay 4 increases our knowledge on overt and covert attention to ads during task-oriented reading versus free browsing, examines the effects of combinations of ad formats and abrupt onsets of ads on attention as well as the distraction effects of ads on reading performance.



### **1.3 Structure of the thesis**

Following this introduction (Chapter 1), Chapter 2 introduces principal theories and key concepts of the thesis, which are related to attention and memory and processing of online advertising. In addition, the chapter defines the interdisciplinary approach of this thesis and introduces the essential literature on online display advertising.

Chapter 3 introduces the eye tracking method, empirical research design and measures, sampling and data acquisition and describes the nature of advertising stimuli and the experimental procedures applied. Data analyses, reliability, validity and applicability issues are discussed.

Chapter 4 summarizes the main findings of the literature (Essay 1) and the experimental studies (Essays 2-4).

Chapter 5 discusses on the main findings and implications. It evaluates the impacts of ad format, location, repetition, clutter and task relevancy on attention and memory. Theoretical contribution to visual marketing, online advertising theory and perception psychology is also discussed. Several strategies to improve online advertising effectiveness are proposed as managerial contribution. Finally, the limitations of this research and opportunities for further research are presented.

## 2 Background theories and previous research

### 2.1 Attention and eye movements

Visual attention is tightly coupled to eye movements and the areas that are fixated by the eye (Posner 1980). Although, it is possible occasionally to stare at an object of a scene while attention is detached from that target of vision. Eye movements are sequential and eye movement measures have a spatial (e.g. saccade length) and a temporal (e.g. duration of fixation) dimension. Therefore, these measures are feasible to study attention to ads as they reveal shifts and dispersion of visual attention (Wedel & Pieters 2008a). The viewer's usage of voluntary attention control, for example to complete a task, is called *top down* processing. Conversely, "automatic" attentional reactions to irrelevant ads represent stimulus driven *bottom-up* attention. In online environments bottom-up processing of ads typically occurs at the beginning of viewing when viewers change to a new site or page (Stenfors & al. 2003). These modes of attention alternate during information processing, for the reason that salient stimuli, such as motion are able to grab involuntary attention. Salient cues of web ads commonly trigger stimulus driven attention and bottom-up attention. Visual attention to animated ads and pop-ups is a good example of stimulus driven attention capture. However, viewers are also able to focus their visual attention according to their goals by top down control and avoid paying attention to online ads (Cho & Cheon 2004).

The visual field is typically divided into three regions. Fovea covers 2 degrees of visual field and is the central region where our sight is sharp and sensitive to colors. Parafoveal region extends out to 5 degrees from the center of a fixation. The remaining area is called periphery, which is sensitive to motion but less sensitive to colors. Peripheral vision enables us to react to movements without directly looking at (fixating) the moving object. This safety mechanism is needed in daily life to protect us in numerous situations in which instant attention and reactions are necessary like in traffic (Duchowski 2007). The visual field can also be divided into upper and lower visual fields referring to the upper and lower parts of a screen in our case. Experiments of visual tasks have suggested "a lower visual field advantage" which may have implications when considering online ad placement (Goodrich 2010). Despite the fact that the sharp area of focal

vision is small, we observe objects also outside fovea. When reading text, the functional visual field or perceptual span typically extends to 3-4 letters left and up to 14-15 letters to the right among the readers of western cultures (Rayner 1998). Periphery is not fixated and consequently the effects of peripheral processing can be measured only by implicit memory measures, such as sentence completion tests (e.g. Yoo 2008). Even though most of our vision is typically peripheral (Krugman 1977), the knowledge of the peripheral processes in advertising is limited. It has been found that mere exposure effects and pre-attentive processing can affect memory and brand attitudes concerning both print (e.g. Janiszewski 1993) and on-line ads (Ryu, Lim, Tan & Han 2007).

Focal visual processing leads to longer fixations and shorter saccades. In contrast, short fixations and relatively long saccades indicate pre-attentive or ambient visual processing (Unema, Pannasch, Joos & Velichkovsky 2005). In a viewing task study of a print advertisement, Wedel, Pieters & Liechty (2008) distinguished a global state and a local state of processing magazine advertisements and found that consumers actively switched back and forth between local-to-global attentive processing.

Previous research suggests that consumers pay attention to less than half of online ads on web pages (Drèze & Hussherr 2003), and that they use top down control to avoid them, especially, when the ads are task irrelevant (Burke & al. 2005). Furthermore, those consumers who look at ads are mostly irritated by them when irrelevant ads disturb and interrupt the consumer's online task performance (McCoy, Everard, Polak & Galletta 2007). On the other hand, when the consumer is browsing web sites without a special task, ads attract more attention as viewers probably employ relatively more global than local way of processing (Chatterjee 2005).

Implicit scene perception refers to a phenomenon that the viewer has seen something but is not able to report anything what has been seen (Henderson & Castelhana 2005). Eye movement theory assumes that attention is suppressed during the short saccadic eye movements of 20-40 milliseconds. Some experiments have generated subliminal effects on preferences during brand exposures of equal duration than that of a saccade (see Karremans, Stroebe & Claus 2006). Perhaps it is thinkable that some visual representations can be generated unconsciously during a shorter time than a fixation (100 ms).

In sum, visual attention to online ads is contingent to salient features of advertising stimuli, ad-page congruency, clutter, repetition and viewers' search goals. The optimal match of these conditions is seldom realized in practice. Pages found by search engines are a noticeable exception, since

they are optimized to match to users' goals by accepting only search relevant ads, and the page clutter is minimized by permitting only textual ads without any salient gimmicks.

## 2.2 Memory and effectiveness of online ads

Consumers pay only little attention to the ads on a web page if ads are not the goal of their task and visual search. Accordingly, memory for ads decays quickly and ads are easily forgotten (Burke & al. 2005). The effectiveness of ads is frequently measured by recall and recognition. Both of these measures are explicit memory measures and yield to different results depending on the time delay between the exposure and the measurements (Alba, Hutchinson & Lynch 1991). Recognition memory is a method of retrieval in which the consumer is required to identify stimuli as having been experienced before, whereas recall requires the consumer to reproduce the information previously presented. Recall can be spontaneous or aided by giving cues of the message to be remembered, and recall of ads is extremely poor after longer delays (Shapiro & Krishnan 2001). On the other hand, research has shown that high recall or recognition rates do not necessarily correlate with the attractiveness of the advertisement or liking of the brand advertised (Aaker, Batra & Myers 1992), and the majority of online ads are not remembered because they are seldom the target of examination but rather irrelevant distractors on a web page when viewers are involved in other tasks than processing ads.

In the studies of print advertising, ads are recognized and discriminated well from distractor ads. Several studies have shown that readers can recognize some 90% of print ads in magazines correctly (Pieters & Wedel 2004, Rayner, Rotello, Stewart, Keir & Duffy 2001, Radach & al. 2003). In these studies, the memory performance of print ads has been significantly better compared to online ads because participants' only task in the experiments has been to elaborate the ads for brand selection. In contrast, in online studies consumers do not actively engage in ad processing but perform some other task, and ads are not necessarily relevant to that task. In addition, online ads are not separated from their surroundings but embedded on web pages. Nevertheless, most of these studies propose that accurate memory performance usually requires focal visual attention.

Studies on neuroscience suggest that there are two visual routes of attention (*ventral and dorsal pathways*) and they have different depth of attention and different access to memory representations (Velichkovsky,

Joos, Helmert & Pannasch 2005). For example, in their study of dynamic and static scenes of pictures of house interiors Velichkovsky & al. (2005) registered that more focal processing with longer fixations (over 180 ms) generated better recognition performance than ambient processing with short fixations (under 180 ms). In addition, participants generating longer fixations and more focal processing reported higher confidence in the correctness of their answers in recognition test. We can assume that irrelevant online ads are primarily processed by ambient attention reducing recognition memory performance. Whether, ambient processing of stimuli equals to pre-attentive processing is not quite clear. Pre-attentive processing may also be affected by implicit stimuli representations generated by peripheral vision. Moreover, two-level attention models suggest viewers' dynamic attention shifts between global and local attention to ads (Wedel, Pieters & Liechty 2008). Most of the prior studies conclude that memory for an ad is enhanced by increased focal attention but may decay quickly and be deteriorated by clutter for example (Ha & McCann 2008).

Different quality or depth of attention generates different types of memory representations. Recently, there has been a growing interest among researchers to examine the effect of advertising on implicit memory in contrast to explicit memory (Northup & Mulligan 2013). Implicit memory can be described as unawareness of stimuli or their effects during a task (Krishnan & Trappey 1999). Implicit memory is more durable than explicit memory, and implicit memory representations can last weeks and months for online ads (Courbet, Fourquet-Courbet, Kazan & Intartaglia 2014). Also, explicit and implicit retrieval can take place concurrently (Shapiro & Krishnan 2001). In addition, advertising effects on implicit memory are different for textual and pictorial ad contents. Online ads are usually combinations of text, images and motion and thus more complex than stimuli used in the tests of perception psychology and print advertising research. Consequently, many of these stimulus effects may not translate directly to online advertising (Shapiro & Krishnan 2001).

### **2.3 Hierarchy of effects and persuasion models**

The hierarchy of effects models assume that consumers have to pay attention to an ad before other influences take place. Originally, in their model Lavidge & Steiner (1961) stated that hierarchical steps of ad exposure, namely, awareness, knowledge, liking, preference, conviction and purchase, are based on the assumption that these steps occur in chronolog-

ical sequences, but there is little empirical evidence that consumers' ad processing follows a strict hierarchy (Pieters & Wedel, 2008). Thus, visual perception can be relevant not only at the beginning of exposure but also independently in subsequent phases of the information processing. The hierarchy of effect models have been criticised for lacking empirical evidence of temporal sequences (Vakratsas & Ambler 1999) and there is no solid evidence as to whether these models are applicable to websites with animated banners (Yoo, Kim & Stout 2004). Contrary to Yoo & al. (2004), Poh & Adam (2002) claim that traditional advertising hierarchy of effects models are relevant in the online marketing environment, and that the budgets for online marketing communication can be evaluated by using these models as a framework. However, recent study suggests that AIDA principle (attention, interest, desire, and action) has become insufficient, especially in online advertising (Barreto 2013).

Elaboration Likelihood Model (ELM) distinguishes central and peripheral routes for processing advertising messages depending on the consumer's involvement (Petty, Cacioppo & Schumann 1983). However, the routes of the ELM-model do not completely explain how the consumer's experience of ad exposure or the impacts of the quality of attention (conscious, pre-attentive, unconscious and focal or peripheral) effect on the following phases ad of processing. In online environment, the sensitivity to allocate attention to ads is largely determined by the relevancy but also by the saliency of ads. Cho (1999) modified the ELM model for banner advertising suggesting that central processing can shift to peripheral processing due to salient banner features, such as, large size, bright colour and animation. This shift may also happen due to distraction as well as better processing fluency provided by easier message comprehensibility for instance. Moreover, relevancy, repeated exposure, attitude toward the site and toward web advertising in general mediate the shift between central and peripheral routes both ways (Cho 1999). However, the model does not completely describe the quality of attention to ads or information encoding into memory during elaboration process in online environments. There may be more routes than the central or the peripheral route to advertising effectiveness (attitude change). For instance, there could be a direct attentional route without explicit memory and rational elaboration.

Taken all together, it may be assumed that attention is relevant at each stages of traditional hierarchy of effects models, but all the effects are not necessarily sensed on a conscious level. Regarding online ads, awareness is mainly formed by visual and textual stimuli leaving both explicit and implicit visual memory traces, and there seems to be no evidence on which

steps of hierarchy the effects occur and in which order before action. In fact, more recent literature and empirical findings suggest that neither implicit nor explicit processing of online ads is strictly hierarchical but rather interplay between the diverse stages or steps of the process (Wedel & al., 2008, Stenfors & al. 2003). In practice, online consumers may start a search for a product or service by being fully convinced what they are looking for, or alternatively, they may end up to buy something triggered by an eye-catching advertising message only, without any further need for message elaboration depending on their task. Findings on visual attention, measured by fixation durations, indicate on general level that the type of task generates dissimilar temporal perceptual processes depending on whether consumers read, look at scenes or do visual search (Rayner & Castelhana 2008, Higgins & al. 2014). Visual search processes differ as well accordingly whether the search is guided or unplanned (Wolfe 1998).

## **2.4 Interdisciplinary positioning of the thesis**

The theory of this study is principally based on applying cognitive psychology to marketing and advertising persuasion models. The main areas of cognitive psychology employed are theories of attention, human perception and memory. The findings of visual attention during scene perception, visual search and reading are essential areas when evaluating how online advertising is perceived. Usability studies have enriched this research by testing the effects of various techniques such as flash (Hong & al. 2004) and developing procedures and measures for dynamic online environment (e.g. Jacob & Karn 2003) to design more user friendly web sites. The literature on eye tracking methodology and perception of online advertising is extensively discussed in Essay 1. Related both to literature (Essay 1) and our experimental studies (Essays 2-4), the thesis discusses the following topics of online advertising: 1) attention to ads and ad avoidance, 2), ad location, 3) animation, 4) memory for ads, 5) ad formats, 6) repetition, 7) online reading, 8) users goal-orientation and task relevancy, 9) advertising clutter, 10) ad-webpage congruence, 11) pre-attentive and unconscious processing of ads, 12) emotions, arousal, liking 13) size and text length effects, and 14) attention within ad contents. The topics from 1 to 8 are relevant to both empirical experiments and literature whereas points 9 to 14 are reviewed by literature but not tested by experiments. Marketing, usability and eye movement researchers have a long time been interested in investigating ad properties, such as animation and format

and their effects on memory, whereas discussion on unconscious effects of ads has begun more recently, and the research on ad contents is only in the beginning. Especially, experimental studies that take into account the interaction of several variables simultaneously are rare. The evolution, topics and key findings of the essential online advertising studies are presented in more detail in Appendix 2.



## 3 Methodology

### 3.1 Eye tracking

Essay 1 reviewed eye tracking literature for familiarization with the theory of eye tracking methodology and its applications. Theoretical background of perception psychology, marketing and advertising and usability has been adopted in the context of online advertising research. Some 130 scientific papers and text books were selected for the review. The text books were dealing with attention (Pashler 1998), usability (Nielsen 2000), eye tracking methodology (Duchowski 2007, Hyönä, Munoz, Heide & Radach 2002, Liversedge, Gilchrist & Everling 2011, Holmqvist, Nyström, Andersson, Dewhurst, Jarodzka & van de Weijer 2011) and eye tracking for visual marketing (Wedel & Pieters 2008b). The readings comprised some 3500 pages in total. The review covered basic principles of eye movements during reading, scene perception and visual search. Print advertising literature and other supplementing research papers were reviewed when they were relevant and related to perception and memory of advertising.

Eye tracking is a dominant method across the experiments in Essays 2–4. Eye movement data consist mainly of fixation frequency, locations and durations. In addition, saccadic eye movements were the main variables to determine the shifts of attention between areas of interest and to evaluate regressions in reading. In this study the main areas of interest were the following: the central task area (text), the banner ads above the text area, and the skyscraper ads on the right side of the task area (see Appendix 3). The benefits of eye tracking are that the method gives direct data on locations of visual attention moment by moment during the viewing of web pages and performing tasks, whereas self-reported measures are biased by time delay. Empirical experience has revealed that participants' self-reported comments are often incomplete and influenced by their earlier experiences. Besides, viewers are seldom aware of everything they actually have looked at, but they can provide relevant information of ad processing during retrospective think aloud procedures i.e. when participants comment video recordings of their own eye movements retrospectively (Hyrskykari, Ovaska, Majaranta, Rähä & Lehtinen 2008). Viewers may have illusory recalls what they actually have looked at and therefore we combined participants' eye movement data with the questionnaire data on what they said having been looking at.

### 3.2 Research design and measures

Essay 2 examined the effects of ad formats and animation to attention capture and memory. We studied how different ad characteristics influence consumers' attention to ads and memory for ads. When studying ad properties and not the variances in individual behavior, it is justified to employ within sample research design across the experiments (e.g. Rosenthal & Rosnow 2008). To control the effects of ad contents, individual likings and recency effects, a careful randomizing of the order of presentation and formats of ads is required, when presenting ads to participants (Duchowski 2007, Holmqvist & al. 2011). Therefore, the order of stimuli presentation was counterbalanced across the samples. In addition, when two ads were shown, the option that the same ad content should appear in different formats simultaneously had to be excluded. In addition, one separate experiment was performed to test if individual differences mattered, namely, whether the short term memory capacity of participants could explain attention and memory for ads.

Attention was measured by the number of fixations and fixation durations on the three previously mentioned areas of interest, namely the text/task area in the middle of the screen, the banner ad above the text and the skyscraper ad along the right side of the task area as depicted in Appendix 3. Memorizing was measured by recognition and recall. Recognition memory measures were calculated by hits and false alarms and recall by qualitative spontaneous response from test participants. 16 ads presented during experiments and 16 new distractor ads of similar type of design with the same company logos were presented to test participants to attain 50/50 guess threshold. Error distances of visuospatial span were reduced to a single value per participant to measure short term memory capacity. Participants' self-reported data were collected to measure whether ads affected (disturbed or assisted) task performance. Research framework of the Study 2 is depicted in Figure 2.

Essay 3 explored the effects of repetition, ad format and attention on memory. In addition to recognition measures employed in Essay 2, response times were added to measure participants' confidence level when recognizing ads. Essay 3 was completed with two separate experiments using between-subjects design. The research framework is illustrated in Figure 2.

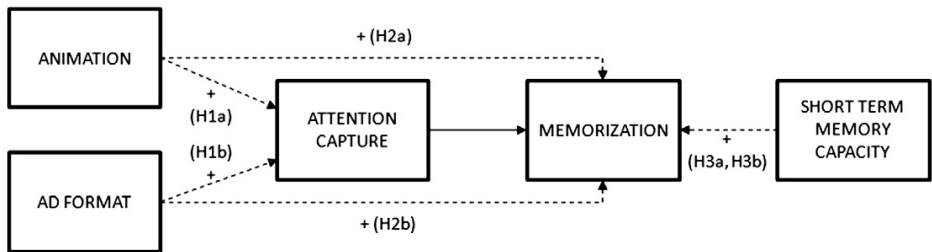


Figure 1. Essay 2 research framework

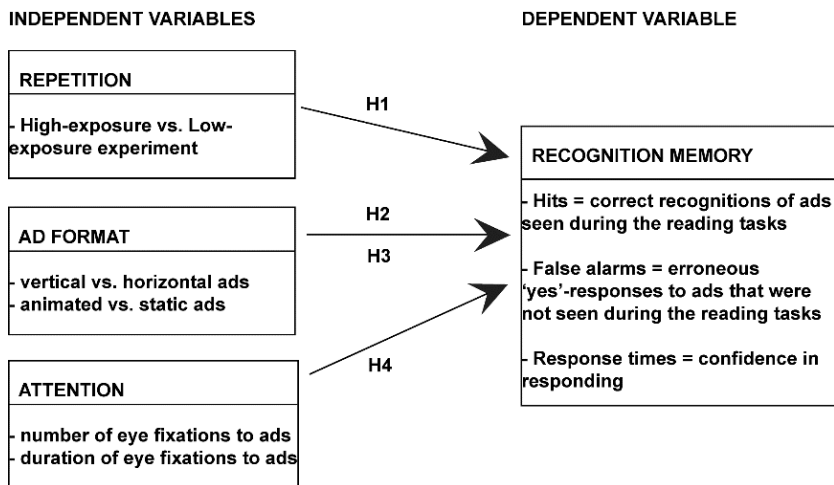


Figure 2. Essay 3 research framework

The main focus of Essay 4 was to examine how ads influence on reading task. Essay 4 supplemented Essay 2 by investigating whether animation or abrupt onsets of ads distract online reading. Essay 4 employed similar designs as the experiments in Essay 2 but investigated also reading comprehension and abrupt onsets. Moreover, Essay 4 augmented research of Essay 2 by investigating the effects of task relevancy on attention to ads during task performance as compared to free browsing of web pages.

### **3.3 Sample and data acquisition**

Across the Essays 2–4 all the samples of various experiments represented educated and adult working population. The samples were designed to be comparable with each other. The number of participants per experiment varied from 28 to 32, half females and another half males. Participants were volunteers with normal or corrected-to-normal vision. They were native Finnish at the age range between 18–58 years. In our experiments the average age of 120 participants was 34 years. Due to the nature of stimuli and experiments, and that of ecological validity, student samples were omitted. In each sample, some subjects represented experts, such as graphic designers, but it was controlled that they did not indicate any different behavior in comparison with the rest of the sample concerning eye movements, response times or visuospatial span (i.e. short term visual memory capacity). Each participant was exposed to 32 web pages with 2 different types of ads on each page. For example, the total number of page exposures in Essay 2 was 896 with 2 ads on each page adding up to  $N=1792$  ad exposures. An overview of the experiments is presented in Table 1.

In the experiments of Essays 2–4, eye movements were recorded with Tobii 1750 remote eye tracking system in which cameras are mounted in the monitor frames under the screen thus making cameras and recording practically invisible to participants. The system samples eye positions at 50 Hz sampling frequency, and it allows relatively large degree of head movements. Therefore, the system provides participants more comfortable test circumstances than in earlier lab experiments where e.g. chin and forehead rests were used to keep the viewing position stable. The same calibration procedures and eye movement recording values were applied across the studies.

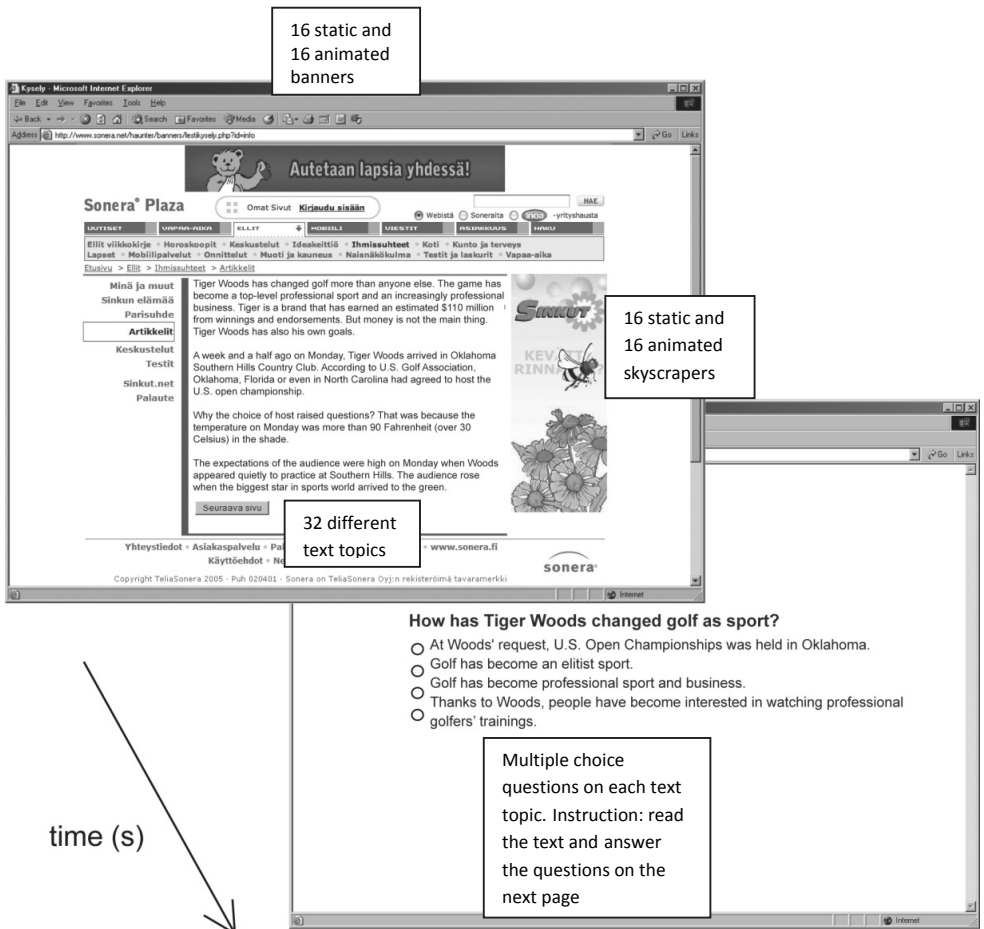
**Table 1.** Overview of experiments of Essays 1- 4

<i>Essay</i>	<i>Focus</i>	<i>Main Hypotheses</i>	<i>Sample</i>	<i>General Findings</i>
1	♦Theory and methodology	♦Review	♦Some 130 books and scientific papers	♦Eye tracking measures ad processing during ad exposure, not afterwards ♦Ad processing is not hierarchical ♦Attention to ads can take place unconsciously and affect implicit memory ♦Amount of clutter decreases effectiveness of ads ♦Eye movement analyses profit of complementing self-reported measures
2: Exp. 1	♦Attention to online ads, animation, format, memory	♦Animation and conspicuous ad format attract attention	♦30 adults (age 20 -46, females 15)	♦Interaction of animation and format, ad avoidance
2: Exp. 2	♦Recognition test	♦Animation, size and proximity to task area enhance memory performance	♦30 adults (age 20 -46, females 15)	♦Animation enhanced memory for banners but had no effect on skyscrapers
2: Exp. 3	♦Visual memory capacity	♦High short term visual memory capacity improves recognition of ads and decreases distraction ads	♦30 adults (age 20 -46, females 15)	♦No significant results
4: Exp. 1	♦Online reading process, top down control	♦Ads are avoided during online reading process	♦28 adults (age 19-49, females 14)	♦A combination of an animated and a static ad (moderate animation) disrupted reading most. Online ads are not ignored.
4: Exp. 2	♦Abrupt onsets, saliency	♦Delayed onsets of ads distract online reading	♦30 adults (age 20 -58, females 15)	♦Abrupt onsets of ads capture attention, especially in proximity of task area. Delayed onsets of ads in periphery may improve reading comprehension
4: Exp. 3A	♦Task orientation	♦Viewers pay less attention to ads when performing a reading task	♦32 adults (age 18-53, females 16)	♦Absence of ads did not improve reading performance
4: Exp. 3B	♦Free browsing task	♦Viewers pay more attention to ads when browsing the pages without a task	♦30 adults (age 19-54, females 15)	♦More frequent eye entries, fixations and longer dwell times on both ad formats when free browsing vs. in a task oriented activity

### 3.4 Stimuli and procedure

The stimuli were constructed according to the original layout of the tele operator TeliaSonera's consumer portal. In addition to standard navigation menus, the page contained a text area of approximately 100 words, one banner (468x60 pixels) at the top of the page and one skyscraper (140x350 pixels) on the right side of the page beside the text (Figure 1). The selected 32 texts dealt with eight topics such as music, education, advertising psychology, golf, immigrants and so forth, but each text theme had a different content. The length of the texts was balanced ca. into 100 words per page to keep cognitive load in reasonable limits and to place all text on the visible part of a page to control that scrolling does not affect reading performance. The banner and skyscraper ads in 16 layouts represented TeliaSonera's original ads and were presented to participants in random order in a both banner and skyscraper formats and in both static and animated modes. The combinations of ads generated 4 conditions: 1) both ads static, 2) both ads animated, 3) banner animated, skyscraper static, 4) banner static, skyscraper animated. In addition, the experiments in Essay 4 also employed conditions in which no ads or only one ad was present and ads were presented after a random delay.

The test procedure was approximately the following: At the first phase of the experiment, subjects' task was to read different texts during the four experimental ad conditions (both ads animated, both ads static, the banner animated – the skyscraper static, the skyscraper animated– the banner static). After each text page, a multiple-choice question concerning text content was presented. Eye movements were recorded simultaneously during the task. The random presentation of web pages was controlled with a Java servlet developed specifically for this project. Second, subjects went through a recognition memory test in which single ads were shown to them one by one among new distractor ads. All ads were presented standalone and separated from their page content when shown to participants. Recognition memory was measured by showing participants 16 original ads from the experiments among 16 distractor ads they had not seen before. Based on this the number of misses and false alarms were calculated and the level of guesses evaluated. Third, free recall was tested by asking participants to memorize and write down the ads and/or some features of the ads that they remembered having seen during reading. Fourth, the interference of advertisements that participants experienced during the experiment was measured by multiple-choice questions and verbal self-reported measures.



**Figure 3.** A black and white example of a web page employed across the experiments (original in colors, task text translated in English).

Adding up calibration and technical preparations before the actual experiment, and wrapping up the results with participants (by telling the research goals and showing them their own eye movements on video afterwards) took some half an hour per participant. For the manipulation checks the whole experimental procedure was carefully pretested in advance before each experiment with participants that were representative to real samples. Pretests were completed according to saturation principle and pretest data was not included in final analyses. Because our advertising stimuli represented a real tele operator's web site we also asked test participants whether they had seen some of the ads before or could

retrieve them from memory. However, none of participants mentioned seeing ads before as the ads had not been online during the last 2 years before our experiments. The pretests also confirmed that our rigorous task instructions did not reveal the final research purposes to participants. Figure 1 illustrates experimental stimuli and the experimental procedure and a detailed example of test instructions is described in Appendix 4.

### **3.5 Analyses**

In Essay 2, paired samples t-tests were used to test the equality of mean fixation frequencies on ads versus total number of fixations on the screen. This was to measure attention capture effects of animation and ad format. Interaction effects between animation and format were tested by a multiple regression. The effects of animation and format on the number of fixations and fixation duration were further analyzed with repeated ANOVA measures and post hoc paired samples t-test in each experimental condition.

Recognition memory results were corrected by applying the two-high-threshold method to eliminate the bias of lucky and unlucky guesses (Snodgrass & Corwin 1988). Hit and false alarm rates were transformed into a single measure of memory in order to evaluate the probability of test ads and/or distractor ads exceeding the corresponding threshold and the probability of “uncertain yes” answers. The distance and order errors to assess the short term visual capacity were reduced to a single value per a test participant which was compared with participants’ memory results and demographic data by cross tabs and cluster analysis.

Essay 3 compared participants’ memory performance under low-exposure and high exposure conditions. Hit and false alarm scores were analyzed with mixed ANOVA with repetition as a between subject variable. Independent samples t-tests were performed for animated and static ads between high- and low-exposure conditions and for response times. Spontaneous recall was assessed according to participants’ self-reports.

Study 4 introduced a few new measures, such as words per minute, number of entries, time to first entry, dwell time and number of regressions. In addition, eye blinks were recorded to be analyzed in companion with eye fixation measures to assess text processing difficulty. Differences in reading performance were analyzed by ANOVA. General Estimation Equations (GEE) model was utilized to analyze eye movement measures, and to test participants’ self-reported attention to ads, the disturbance of ads and text comprehension accuracy. Fixation data tend to be skewed on



right probably due to our western reading habit (Rayner 2009, Holmqvist & al. 2011), and GEE model is well suited for skewed data sets. GEE model, as an extension of the array of general linear models, can handle missing values of data more efficiently than ANOVA (Hardin & Hilbe 2003).

### **3.6 Reliability, validity and applicability**

Wang and Minor (2008), in their review of psychophysiological techniques in marketing research, discuss about the validity, reliability and applicability of eye tracking methodology and question all these points. However, their review is based on very old literature (e.g. Krugman 1972, King 1972, Morrison & Dainoff 1972) and their most recent reference dates back to 14 years (Wedel & Pieters 2000). During 1970s optical eye tracking technology was something totally different from the digital applications at present. Modern eye trackers are often portable and can be mounted within the computer screen, thus allowing natural viewing arrangements to test participants. Although eye tracking experiments mainly take place in labs, it is feasible to make experiments at people's home, in shops and cafes or even when walking or driving through real world environments. The rapid technical development and the new findings of marketing and advertising research employing eye tracking methods have significantly increased the reliability, validity and applicability of eye tracking measures.

Numerous eye tracking studies give evidence that eye movements are tightly coupled with attention and able to forecast not only spatial attention but also the depth of attention. Eye movement measures are reliable to assess information processing during reading, scene perception and visual search, all essential tasks in processing advertising. Eye tracking has proved to be a feasible method also beyond advertising studies and applied in studying artworks (e.g. Uusitalo, Simola & Kuisma 2012) and driving (e.g. Duchowski 2007) for example. Interrelation of attention and memory has been widely researched by analyzing eye movements, and the results clearly suggest that the more attention, the better memory for ads. Moreover, attention to ads facilitates consumers' liking and positive brand preferences and purchase intentions (Maughan, Gutnikov & Stevens 2007, Yoo 2008, Goodrich 2011). Studies of scene perception have evidenced that eye movement measures are robust in evaluating attention in natural scenes (Henderson 2011). Today, as eye trackers are removable and small enough to be mounted in eye glass frames, they can be placed anywhere to track TV ads and product placement, advertisements in shops

and malls as well as in outdoor environments. Therefore, the flexibility of the method and the easy usability of eye tracking equipment enable data gathering in real-world environments proving a robust ecological validity.

Since Yarbus (1967), it has been widely acknowledged that task instructions have a significant impact on eye paths. This enables efficient task manipulations during the experiments. Tasks typically require participants' full attention and consequently observer's or instructor's influence on participants' attention and task performance is low. In our reading experiment, the task was demanding and engaging. An engaging task supports the participants to overlook the fact that they are sitting in front of an eye tracker (Holmqvist & al. 2011). However, the control of various experimental variables may lead to a lower ecological validity, and it can be questioned whether the selected eye tracking measures and findings can be generalized for other contexts outside test laboratories. In our study, we controlled the number and format of ads, text length and scrolling for instance. Regardless of these required control restrictions, our lab results can be better generalized in real world conditions because we employed real ads and websites instead of artificial ads on mock web pages, and we employed adult samples instead of student samples.

## 4. Main findings and conclusions

### 4.1 Essay 1.

The main purpose of the review was to illuminate the research on online advertising and consumers' perceptions and processing of ads from the launch of the Internet until today. The review expose research trends on consumer perceptions, such as online ad avoidance and emerging trends, such as implicit effects of online advertising. Studies on the effects and interaction between ad characteristics and their influence in online environment show the complexity of consumer processing of online ads. The review also questions whether traditional marketing and advertising models can be directly transferred to web advertising. Even if this question remains open, our summary of articles from 1998 until 2014 shows that the same topics have been debated since the launch of the Internet until now (Appendix 2).

The review also explored eye tracking methodology and revealed several benefits of eye tracking as a promising methodology in visual marketing and advertising research. Eye movements give objective evidence on how ads are processed moment by moment whereas self-reported measures describe effects of advertising after the ad exposure. In addition, consumers' capacity to explain their ad processing is biased because ads are easily avoided and forgotten (Burke & al. 2005). Occasionally different methods may yield to different results being all inappropriate (see Ohme, Matukin & Pacula-Lesniak 2011). Usually eye tracking has been utilized to complement traditional measures by proving more detailed data of the processing of spatiotemporal dynamics. This enables a more integrated view of attention to ads (Wedel & Pieters 2008b). It is especially a reliable and feasible method when used together with auxiliary research methods including both other psychophysiological methods and self-report methods, such as retrospective think aloud. In spite the dynamic nature of the Internet, eye tracking methodology has proved to be a robust method in examining perception of advertising in online environments.

Holmqvist & al. (2011) list around 120 measures for eye movement data. Eye tracking gives rich information on spatial and temporal dimensions which enables building new measures for a variety of research topics. Part of the problem of having many measures available is to select the relevant ones, and interpret them depending on the research context and questions. This review is one of the first attempts to interpret the implications

of some of the most important eye tracking measures in dynamic online advertising context in which most ads are irrelevant to consumers' goals.

Eye tracking studies also raise the question whether advertising processing and behavioral effects take place in hierarchical sequences. So far, there is no solid evidence that hierarchical models are applicable to web-sites (Yoo & al. 2004). Rather, it seems that online ads attract bottom-up attention especially at the beginning of web browsing and only afterwards consumers exert more top down attention control to avoid ads (Stenfors & al. 2003). Depending on the relevancy of ads to the task at hand, attention typically shifts between ads and other locations on a web page. However, top down and bottom up attentional control seem to alternate during browsing when salient stimulus, such as motion in animated ads grabs bottom-up attention. Animation is typically used on cluttered web sites. Perceived clutter, on the other hand, is one of the main reasons why people try to avoid online ads (Cho & Cheon 2004)

Walsh (2010) suggests that ad avoidance is more prevalent on the Internet than in traditional media, but online ads seem to produce more unconscious processing. Unconscious processing has been described as fast and automatic without capacity limitations. Yoo (2008) proposes that consumers experience priming by implicit memory and build more favourable attitude toward the advertised brands independently of the level of attention to these brands. Furthermore, consumers select brands into their consideration set without remembering or explicitly seeing the ads (Yoo 2008). Implicit memory can be defined as non-intentional and unconscious retrieval of information (Duke & Carlson 1994). Implicit memory effects are important, because they do not decay very quickly and can be observable even three months after exposure (Courbet & al. 2014). Since ad avoidance and clutter are dominant on the web, the processing of online ads occurs more unconsciously. The idea that unconscious processing is more common on the Internet sounds logical, but implicit memory effects and their durability for web ads need further evidence (Yoo 2008, Courbet & al. 2014).

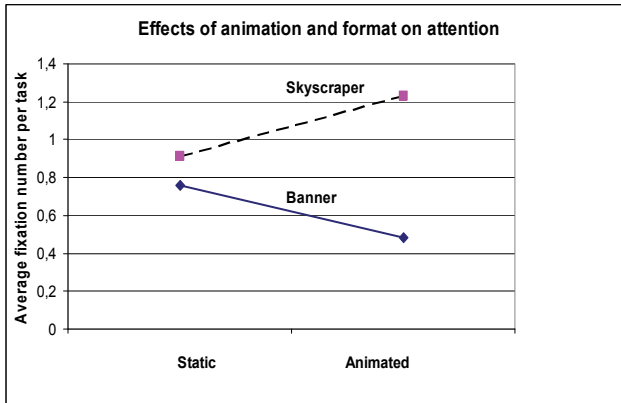
For advertisers the review recommends how to break through advertising clutter, and what impacts a bigger ad surface size, animation, various ad formats have on attention and memory of ads. It provides ideas how advertising effectiveness can be boosted up by ad placement and repetition strategies. In addition, the review suggests a practical interpretation on how to use a variety of eye tracking measures to evaluate online advertising effectiveness. For graphic designers we remind that all exposure is not necessarily a good exposure for the reason that excessive usage of sa-

lient advertising gimmicks may distract and irritate consumers and lead to ad avoidance and deteriorate memory and brand image. According to our review, at least the following factors have to be considered in relation to perception of ads and online advertising effectiveness: 1) web site/page properties: how relevant, congruent, competitive and cluttered the pages are, 2) ad characteristics: size, animation, onsets, format, location, pictorial vs. text dominance, complexity, congruency, ad content gimmicks 3) frequency and strategy of ad repetition, 4) user behaviour: task relevancy, goal orientation, ability and motivation to process, and quality of attention, and 5) advertiser's targets whether building brand image, acquiring sales leads and/or immediate purchase decisions, or exerting market research.

## **4.2 Essay 2**

In Study 2 we predicted that animated ads attract more attention than static ads, and that skyscraper format gets more attention than banner format. We detected that skyscrapers attracted significantly more attention when they were animated but noticed a reverse effect when banners were animated. The interaction of animation and ad format on attention was an interesting and unexpected finding depicted in Figure 4. The superiority of animated skyscrapers over animated banners in attracting attention can be partly explained by location. Skyscrapers are located in the proximity of the task area but banners were placed more in periphery on the top of the page as depicted in Figure 1 and Appendix 3. The combination of ads where the skyscraper was animated and the banner was a static ad drew more attention than other combinations of ads. We expected that participants would allocate maximum attention to ads when the both ads were simultaneously animated. Apparently too much animation on the page increased also clutter, which resulted in more determined ad avoidance by participants.

In a similar manner we also predicted that animation reinforces memory effects of the both ad formats. Thus, the finding that higher attention level does not necessarily reinforce memory was unexpected. We found that animation improved the recognition memory for banners but had no effect on memorization of skyscrapers. Correcting participants' guessing strategies by the two-high-threshold-model (Snodgrass & Corwin 1988) did not alter the results of the recognition memory test.



**Figure 4.** Effects of animation and format on attention

The control (or distractor) ads shown in the recognition test were identified more accurately than the ads presented during the reading task. This may be partially explained by the new object account as new objects attract attention earlier and more frequently with longer fixation durations (e.g. Loftus & Mackworth 1978). As expected, the results on recall showed that participants could spontaneously recall only a few ads out of 32 ads in total. Finally, we found no correlation between the short-term visual memory capacity of the participants and the recognition of ads but only a weak indication that ads distracted less those viewers with lower visual short-term capacity.

### 4.3 Essay 3

In Essay 3 we investigated the impacts of repetition on recognition memory with two experiments in which we varied the number of ad exposures and assumed that the higher number of exposures (four exposures instead of two) during task performance will improve recognition and spontaneous recall of ads. In addition, we postulated that skyscrapers are more accurately recognized than banners, and that animation enhances recognition accuracy of both ad formats. Our results suggested that recognition of ads was significantly higher when the frequency of exposure was raised from two up to four exposures per ad. The impact of repetition concerned both animated and static ads; they were more accurately recognized when the number of exposures was higher.

The spontaneous recall results showed a similar trend when recall was measured immediately after the experiment. Participants could recall around 3 ad contents in the high-exposure experiment whereas they recalled on average only 1.7 ad contents after the low-exposure experiment. Recall rates were low compared to recognition rate. The rationale is that in recall task participants were required to reproduce the information that was previously presented, whereas in the recognition task participants simply had to identify stimuli as seen before. Our results of spontaneous recall support prior studies that recall of ads decays quickly, even though the same ad contents had been presented several times in two formats and in animated and static modes. Decay typically increases when consumers are highly involved in performing a task, and our task was also demanding deteriorating memory performance even further.

Moreover, we noticed that the effect of animation interacted with repetition suggesting that static ads were more accurately recognized after higher-exposure than after the lower-exposure. Although we did not observe any difference in recognition between banners and skyscrapers, we found that the response times for skyscrapers were significantly shorter than that for banner ads. This may indicate that the participants felt more confident when responding seeing vertical skyscrapers than seeing horizontal banner ads. Repetition had no significant effect on response times. We also found a positive correlation between eye fixations and recognition suggesting that deepened attention to ads enhanced the recognition accuracy of ads.

#### **4.4 Essay 4**

In Essay 4 consisting of four experiments, we investigated how consumers allocate their attention to ads during reading versus free browsing, and whether salient ad properties and abrupt onsets of ads distract reading by capturing overt and/or covert attention. Overt attentional shifts relate to eye movements toward an object that grabs users' attention and is fixated whereas covert attentional shifts do not involve eye movements to objects in periphery (Pasqualotti & Baccino 2014). In other words, we manipulated the combination of static and animated ads appearing on the screen already at the beginning of trial or appearing abruptly after a delay. In addition, ads were presented simultaneously in the proximity of task area or in the periphery and participants' tasks were either to read for comprehension or just to browse the pages freely.

A summary of the main results first suggests that the ads were primarily overtly and not only covertly attended independent of task. According to eye tracking measures and participants' retrospective verbal reports ads grabbed attention even during an engaging task (reading for comprehension). Second, animation distracted reading performance most when a combination of a static and an animated ad was exposed during the reading task compared with conditions where both ads were either static or animated. Third, abrupt onsets captured attention but the effect was moderated by ad location and task. Abrupt onset of a banner ad above the text did not capture attention when web viewers were involved in the reading task but a skyscraper appearing along the right of the text captured attention. When participants freely browsed the web pages according to their own interest, abrupt onsets of the both ads captured attention. Fourth, ads attracted more attention during a free browsing than during a reading task. Over 80% of participants reported paying attention to ads after free browsing, whereas only around 50% of participants performing the reading task reported paying attention to ads. This result was anticipated because in the free browsing situation the rigorous task instructions were omitted and therefore top down attention control was less compulsory. Fifth, skyscraper ads located immediately to the right of the text region produced a greater attentional capture than ads positioned isolated above the text region. Due to the proximity of the task area within the perceptual span and the western reading habit to read from left to right, the direction of gaze tends to be more focused on to the right than left (Rayner 2009). An overview of the results of Essays 1-4 is summarized in Table 1.

## **4.5 Conclusions**

Consumers' daily visual environment is cluttered with advertisements and visual attention to ads is critical for effectiveness of advertising. Our review of literature and experiments explored how various ad characteristics, repetition and consumers' tasks affect advertising processing. The results put emphasis on the importance on interactions between several variables, such as ad format and animation. Attention to ads is highly contingent on the nature of task users have at hand when they are exposed to ads. An ad can retain attention or simply be avoided depending on its relevancy to users' task, and ads typically attract more attention when users' task is less complex and stringent. Investigating visual processing of advertisements by eye tracking measures has greatly supplemented the



results of self-reported retrospective methods. In addition, we propose that interpretations for the conventional eye tracking measures have to be interpreted a bit differently in online advertising context than in print advertising or usability contexts.

Advertising research has long suffered from the limitations of using self-reported indirect measures, and data gathering on consumers' perceptions of ads has taken place only after advertising exposure and not during advertising processing. This study provides information of the process itself. It also suggests that there is a need to re-evaluate hierarchy of effects models in online contexts. These models begin with the assumption that consumers are exposed to ads but do not explain how they are exposed. Researchers also criticize that there is little empirical evidence that consumers' ad processing follows a strict hierarchy (Peters & Wedel 2008), and that these models over-all lack empirical evidence of temporal sequences (Vakratsas & Ambler 1999). Neither, there is evidence that hierarchy of effects models are functioning on websites with animated ads (Yoo & al. 2004), and these models have become insufficient in online advertising (Barreto 2013). In general, our review of literature suggests that processing of ads is probably far more complicated than hierarchical perception models describe, and that a considerable amount of advertising processing takes place on lower levels of attention generating implicit visual representations and implicit memory effects (Henderson & Castelano 2005, Yoo 2008).

Our results support earlier studies that overall attention to online ads is low and that ads are easily forgotten (e.g. Drèze & Hussherr 2003, Burke & al. 2005). Based on our findings it seems that salient ad characteristics, such as animation are not effective in all circumstances. In our experiments animation resulted in reduced attention to banners, but animation improved banners' recognition correctness, whereas animation increased attention to skyscrapers but had no effect on recognizing them. These somewhat surprising interrelationships between attention and memory may indicate that animation and format interact in a different way during the processing of a web page and ads. The control ads shown only in the recognition test in our experiments were identified more correctly than the test ads presented during reading. Correcting participants' guessing strategies did not alter the results. Participants were more certain about which ads they have not seen than about which ads they have seen. This may be explained by the fact that new and incongruent objects grab attention and improve recognition of these objects (Berlyne 1970, Loftus & Mackworth 1978, Brockmole & Henderson 2005). We presented ads iso-

lated from the web page setting, and it is possible that the contents of our distractor ads were not enough in line with tele operator services and thus participants perceived them incongruent and recognized them better.

It is a widely acknowledged that repetition is an important strategy to improve advertising effectiveness. Our experiments on the impacts of repetition, online ad type and attention on recognition support earlier findings that repetition functions also in online environments. The results indicated that recognition of ads increased already when the frequency of exposure of ads was only slightly elevated from two up to four exposures (also Yaveroglu & Donthu 2008). When investigating effects of animation and format on memory, we found that both horizontal and vertical animated ads were more accurately recognized than static forms of the same ads supporting a few earlier findings on animation effects (Sundar & Kalyanaraman 2004, Yoo & Kim 2005, Goodrich 2010). Especially static ads were more accurately recognized after the higher-exposure experiment than after the low-exposure experiment. Moreover, we did not observe any difference in memory performance between horizontal banner ads and vertical skyscraper ads, but found that the response times for vertical ads were significantly shorter than for horizontal ads. This indicates that the participants felt more confident in recognizing vertical ads than horizontal ads.

Previous studies have suggested that the nature of the task affects the number of correctly recognized ads, and that goal-oriented consumers recognize fewer ads than those who are only surfing on web pages (Chatterjee 2005, Pagendam & Schaumburg 2001). Our experiments on the impacts of task oriented reading versus free browsing generated similar results. Obviously, browsers are exposed less frequently to the same ads on the web compared with conventional media, and therefore the repetition effects on memory are weaker in online media. Drèze & Hussherr (2003) have reported that a web browser's probability of seeing an ad on a website is approximately 50% while in print and TV, the respective probabilities are around 90% (Lohse 1997, Siddarth 2002). Our last experiments investigated how ads affect attention during reading for comprehension. Across the experiments the results propose that ads were attended mainly by direct fixations (overtly) than seen peripherally (covertly) contrasting the results proposed in some earlier studies (Burke & al. 2005, Day & al. 2006, Drèze & Hussherr 2003). The fact that participants' self-reports on experienced attention to ads were consistent with their eye movements supports the results. Manipulations of animated and static formats had only a minor effect on eye movements during reading. Ad characteristics and combinations did not affect much eye movements during reading.

However, our experiments showed that the most salient ad condition was a combination of animated ad and a static ad. It is possible that when two animated and task-irrelevant ads compete simultaneously for readers' attentional resources both have to be ignored by top down attention control to allocate enough resources to task. When only one ad is animated, more attentional resources are available to look at it as the total clutter on a page decreases.

A new finding was that abrupt onsets of ads attract attention immediately also during a reading task, especially when they were skyscrapers appearing along the right side of the text on the screen. Again, this may be due to the proximity of the ad and the task area, and that a vertical skyscraper is bigger in surface size than banners, whereas horizontal banners are smaller and peripherally located. However, the number of fixations and ad entries to banners also increased when they appeared abruptly, which demonstrates increased attention. Peripheral abrupt onsets of banners also seemed to improve text comprehension compared to the condition when the ads were visible all the time through the trial. A few prior studies have suggested that flashed items in periphery may increase participants' arousal and increase allocation of processing resources to primary task (Day & al. 2006, Hong & al. 2004). The nature of task affects the extent of attention to ads. The eye movement results of our study showed that ads attracted more attention during free browsing than during task performance. The results were confirmed by participants' self-reports. This is in line with earlier studies of Chatterjee (2005) and Pagendam & Schaumburg (2001). Finally, our experiments measured also reading performance in the base line condition when ads were not present at all. Interestingly, participants' reading performance was not improved by the absence of ads. This proposes that presence of ads *per se* did not hinder reading, and the distraction by ads seems to occur primarily through overt attention to ads rather than covert processing.

## **5 General discussion**

### **5.1 Attention as an antecedent of online advertising effectiveness**

The Internet has become a pervasive channel for marketing and advertising, information search and social communication. Our eye tracking investigations illustrate that the continuously growing amount of information on the Internet and the multiplicity of dynamic advertising have increased ad avoidance and clutter on the Web. A new challenge for advertisers is how to attract consumers' attention in an affirmative manner to improve advertising effectiveness. Traditionally, attention to ads has been considered a main antecedent of effective advertising. An effective ad is supposed not only to attract attention but also to hold attention and remain in memory (Radach & al. 2003). Referring to social media, Barreto (2013) adds that effective advertising is able to change attitudes based on trust and cause action not only in relation to buying behavior but also as regards of social engagement. Literature on online advertising effectiveness has extensively discussed why online ads are avoided by viewers (Benway & Lane 1998, Pagendarm & Schaumburg, 2001, Drèze & Hussherr 2003, Burke & al. 2005, McCoy & al. 2007, Hervet & al. 2011). Attention to ads has typically referred to overt attention and awareness of advertising exposure but online research has also discussed implicit visual representations and pre-attentive processing of ads (Van Rompay, De Vries & Van Venrooij 2010, Ryu & al. 2007). We propose that overt visual attention and conscious awareness of ads are the most effective antecedents of online advertising effectiveness. Yet, implicit unconscious advertising effects can supplement the explicit impacts. Attention to ads can be both enhanced by manipulating ad characteristics and the techniques of ad appearance and repetition, but involuntary attention to ads can also deteriorate advertising effectiveness. These issues are discussed next in more detail.

### **5.2 Effects of ad characteristics, onsets and repetition**

Manipulating ad characteristics appears to produce diverse outcomes. Increasing saliency of ads may yield to greater attention and memory for ads, but in some cases increased attention may not improve recognition of ads.

We detected that skyscrapers attracted significantly more attention when they were animated but noticed a reverse effect when banners were animated. In addition, animation improved recognition for banners but not for skyscrapers. When we increased the saliency of banners by animation, we noticed that banners attracted fewer fixations in animated mode than in static mode independent of our research conditions. Also Lee & Ahn (2012) propose that animated banner ads attract less attention than static ads and thus reduce the positive effect of attention on memory, but animated banner ads were unconsciously processed and had influence on brand attitudes. Compulsory attention to ads typically leads to negative responses of online audiences. Occasionally, ads may have no effect at all. Our experiments demonstrate that removing ads during the reading task did not convey any improvement in reading performance. In other words, the mere presence of ads does not necessarily interfere with task performance.

As suggested by our findings, abrupt ad onsets capture attention depending on the location of the ad. Consumers are more likely to ignore abrupt stimulus onsets in the periphery but not in the proximity of the main task area, when engaged in a task. The result is interesting as one might expect that abruptly appearing stimulus would attract attention by peripheral vision which is sensitive to motion. However, onsets of banners appeared in typical and predictable location on the upper side of the page, and users quickly develop schemas of location and learn to avoid them (Bernard 2001). Our study suggests that ad effectiveness would be strengthened by countering ad avoidance strategies by choosing more liked and less compulsory ad formats and varying placement of ads.

Repetition strategies of ads vary depending on the ad environment. We studied the impact of repetition on recognition and recall. We noticed that recognition of ads was significantly improved with higher frequency of exposure. The spontaneous recall results showed a similar trend as recognition results. In this respect our results were a bit different from those of Lee & Sundar (2002) who found a positive effect between ad repetition and recall, but they found no effects between repetition and recognition. Depending on advertising environment, various repetition strategies may be applied. Single ad strategy proposes that repeating the same ad format and message in the same location may facilitate ad familiarity, and thus an ad is sooner liked by viewers, and liking typically facilitates advertising effectiveness. Our results suggest that already a moderate increase in the frequency of repetition improves memory performance, when exploiting single ad repetition strategy. However, this strategy may also lead to ignorance, irritation or boredom, even though consumers seem to tolerate

higher repetition frequencies in online environments (Campbell & Keller 2003). Fang & al. (2007) found no wear-out effects after 22 exposures of online ads. Variation strategy suggests changing ad contents, formats and placement on web pages regularly to attract and hold viewers' attention in order to increase advertising effectiveness. Yaverogly and Donthu (2008) propose that in competitive environment single ad repetition strategy improves brand recall and intention to click better than variation strategy, but in non-competitive environments variation strategy is more effective. Further impacts of ad environment, such as clutter are discussed next.

### **5.3 Online advertising environmental characteristics**

Online advertising clutter can be defined as a high number of salient ads in various formats and locations placed on a single web page that disturb media consumption process (Cho & Cheon 2004). It is widely agreed that perceived advertising clutter on a web page is related to lower memory performance for ads and leads to ad avoidance (Ha & McCann 2008, Cho & Cheon 2004, Lee & Sundar 2002). Advertisers typically utilize salient ads on cluttered web pages to compete for consumers' attention (Nielsen 2000, Chatterjee 2005), which consequently increases ad clutter and deteriorates memory for ads even further.

Animation typically increases clutter on web pages. In our experiments the most effective condition for attracting attention emerged when skyscrapers were animated and banners were static. Burns & Lutz (2008) have proposed that a skyscraper format is rated more entertaining and informative than a banner format, and liking may have influenced our results too. Altogether, our experiments suggest that a slight increase in experienced clutter may trigger ad avoidance. Regardless of somewhat inconclusive results of ad clutter effects on advertising efficiency in online surroundings, the literature mainly suggests that "less is more" (e.g. Sundar & Kalyanaraman 2004), and that excessive attempts to compete for consumers limited attentional and cognitive resources by conspicuous and irrelevant ads can deteriorate recall and recognition of brands, weaken trust, liking and harm attitudes towards ads, websites and brands (Ha & McCann 2008). On the other hand, congruency and relevance of ads can enhance advertising effectiveness, and these topics are discussed in the following.

## 5.4 Congruency of ads and relevancy to consumer goals

From the literature we have noticed that ad-website or ad-editorial congruence is one of the typical advertising strategies for persuasion, although we controlled the effects of congruency in our lab experiments. In other words, there was no thematic connection between the banner subjects and the text topics. Earlier studies have emphasized that incongruent ads cause negative effects for the website (Newman, Stem & Sprott 2004), incongruent ads grab attention, but congruent ads produce more positive attitudes (Moore & al. 2005). Incongruent ads increase users' efforts and irritation (McCoy & al. 2007). Web site-ad content relevancy, on the other hand, enhances brand name recall and intention to click (Yaveroglu & Donthu 2008). Hervet & al. (2011) showed that even though congruency had no effect on attention to online ads, congruent ads were better memorized than incongruent ads, whereas Porta, Ravarelli & Spaghi (2013) found that thematic connection between banner theme and related online newspaper article topic affected attention but not memory. This apparent discrepancy in results is probably rather due on different stimuli, test instructions and web page surroundings than by congruence itself.

Consumers' goals lead information search and allocation of attention on web sites. Our experiments showed that ads were attended significantly more during free browsing than during the reading task performance (also e.g. Chatterjee 2005). Ads could be thus considered as more effective when users are in a free browsing mental condition. So, in order to create effective ads, marketers have to consider consumer browsing behavior in relationship to a particular website on which ads appear. Additionally, our evidence of eye movement measures and participants' self-reports support this view. Attention to ads was higher during free browsing both during abrupt onsets of ads and when ads were permanently visible from the beginning of browsing. These observations strongly suggest that goal oriented users are able to exert top down attention control and keep their attention in task accomplishment. Goal-orientation seems to be the most significant antecedent of online ad avoidance and stronger impediment for advertising effectiveness than clutter or prior negative experiences (Cho & Cheon 2004). Moreover, banner blindness is strongest for goal-directed tasks (Resnick & Albert 2014). Tasks, such as reading for comprehension require high cognitive resources (Pasqualotti & Baccino 2014) leaving less cognitive resources to process ads (Duff & Faber 2011). Though we did not measure memory for ads during browsing, the literature logically suggests that the memory for ads is higher during free browsing than performing a task (e.g. Pagendam & Schaumburg 2001).

## 5.5 Summary of theoretical contribution

The present study has demonstrated that theories of visual attention and saliency (Itti & Koch, 2000), bottom-up vs. top-down control of attention (Theeuwes & Burger, 1998) the principles of the central capacity theory (Kahneman, 1973) and the research related to abrupt stimulus onsets (e.g. Theeuwes 1994, Yantis & Jonides, 1984) can be successfully applied also to the web environment. This thesis draws researchers' attention on experiments with dynamic online stimuli. Advertisements can go beyond the topics of real-word scenes and present episodes and objects that do not happen or exist in reality, which makes the research of advertising perception challenging (Rayner & Castelhana 2008). Online environment presents more complex objects and interactions than mere singletons for example. Therefore it provides researchers a promising dynamic environment to investigate consumer perception by applying theories of reading, scene perception and visual search.

Consumers are surrounded by a vast amount of advertising daily, but they scarcely allocate their attention to ads they are exposed to. In this respect it is a remarkable shortcoming that most of the traditional advertising literature has focused on implications that happen after direct attention to the ad itself (Duff & Faber 2011). The theoretical contribution of this study for marketing and advertising is based on the examination of the nature of both ad exposure with the emphasis on direct methods and accompanied by consumers' retrospective self-reported measures. The study indicates that hierarchy of effects and advertising persuasion models need to be supplemented by a more detailed description of the quality of attention to ads. Research on temporal sequences of online ad processing has only recently started (Köster, Rüth, Hamborg & Kaspar 2014). Although beyond our experimental hypotheses, the results give an indication that pre-attentive processing and mere exposure effects take place in online environment as well (Ryu & al. 2007, Duff & Faber 2011), and we cannot rule implicit memory effects out of discussion either (Yoo 2008, Courbet & al. 2014). It is quite possible that attention from early stages of an exposure, such as a first gist of an ad, generates more far-reaching impressions of ads that are encoded in implicit memory. Consumers are able to recognize a gist of a complex visual scene within a few milliseconds, independently of the quantity of objects in the image, and this enhances object recognition in cluttered scenes (Oliva & Torralba 2006). In this respect, complexity of online ads should not hinder attention to ads but generate elaboration likewise complex ads do in print media (Pieters, Wedel & Batra 2010).



## 5.6 Managerial contribution

The Internet is alluring wider audiences and growing marketing budgets every day. This study provides several suggestions for online advertisers, graphic designers and online media firms on how to improve online advertising effectiveness. In practice, advertisers typically have to decide on which sites their ads will best reach their target audiences and then consider the message and placement strategies of ads. When advertisers assess creative designs of ads, they must consider how salient their ads should look like to attract enough attention but not too much distraction. This dilemma is related to the web site characteristics, such as web-page-ad congruence and clutter. High attention to incongruent ads on a web page may attract more attention, but ads in congruent online context generate more favourable memory effects and attitudes towards ads (Moore & al. 2005, Hervet & al. 2011). The effect of less salient ads can be strengthened by increasing the number exposures or applying variation repetition strategy, i.e. changing repeatedly ad design and format and location on a web page (Yaveroglu & Donthu 2008). Less salient objects may also benefit when placed in expected locations which facilitates positive user experience as well (Roth, Tuch, Mekler, Bargas-Avila, & Opwis 2013). This strategy can be applied when ads are congruent and relevant.

In general, our review of literature and the results of our experiments suggest that attention to ads can be enhanced by the following means: moderate animation, larger ad surface size, liked ad format, proximity to task area and location on lower visual field, congruent ad-web site design, repetition and conspicuous ad content such as human faces, personalization and picture-text balance in relation to ad placement on a web page (Ryu & al. 2007). Depending on web page characteristics, increased attention to ads most often improves memory for ads as well. The following ad properties typically evoke irritation and ad avoidance especially among goal oriented users: excessive animation, compulsory ad formats, incongruence and irrelevancy of ads located within task area or very close to task area. Our research establishes that these ad characteristics typically have a negative influence on memory for ads. However, the effects of these ad characteristics are contingent on ad environment and the interactions between ad features (e.g. animation-format). These interactions, at least partly, explain why some research results on online advertising effectiveness have been inconclusive. Unfortunately, at present only a few studies have considered several interaction effects simultaneously in applied experiments.

Commercial web sites are typically competitive and cluttered because online media sales companies aim to maximize their sales and profits. This often imposes advertisers to utilize highly conspicuous ad formats and designs to break through the clutter depending on their goals which vary across brand categories and product life cycles. So, when advertisers launch a new product, they may benefit from increased attention and saliency provided by distinctive ads and incongruent ad content at the beginning of a campaign. This effect may not last in the long term because incongruent salient ads may harm liking the ad and harm the attitudes toward a whole web site and brand (Newman & al. 2004). Our review suggests that an alternative approach to choose less intrusive advertising approach in congruent web context better ensures that the brand is liked and stored in consumers' memory and consideration set.

Our experimental results suggest that excessive motion, such as many animated ads presented simultaneously, seems to expedite users' ad avoidance. For media firms this means offering advertisers less cluttered environments. Less demanding and more user friendly environments would assist all online users in faster information search result in improved user experience on web sites. Online marketing budgets are growing, and it is highly recommended that advertisers test their ads in real environments by eye tracking and other methods before launching any extensive online campaigns. Otherwise, negative responses from consumers and a waste of marketing budgets is a potential outcome. For designers who pretest their ads, we recommend that ad layouts should not be evaluated on their own. Rather, they should be tested embedded on web pages on which they are meant to be placed in order to check the interactions between ad characteristics and web page characteristics.

## **5.7 Limitations**

There are a few general limitations that need to be mentioned. First, the results of the numerous studies reviewed on attention and memory for online ads have been difficult to compare. Similar experimental research conditions are rare for the reason that advertising stimuli have varied from simple mock ads to real ads, and experiments have been completed in different environments with different tasks, measures and equipment. Furthermore, samples, research designs, experimental conditions and instructions cannot be compared across studies, which also may explain some contradictory results. Yet, inconclusive results give opportunities to

replicate many earlier studies. Second, compared with the history and literature of eye movements in reading, scene perception and visual search, the eye tracking research in advertising is still in its infancy (Higgins & al. 2014), and even more so concerning online advertising. Third, perception psychology has mostly employed rather simple stimuli, such as singletons, and therefore the results of these studies do not necessarily fully explain the perception of all dynamic combinations of online ads. Fourth, the terminology within cognitive psychology and marketing seems to be somewhat different, making the interpretation and evaluation of research results difficult between both scientists of different disciplines and practitioners (Higgins & al. 2014).

Although our experimental procedures were carefully pretested, the “lab” circumstances typically generate participants some extra pressure to perform well in task completion in spite of the fact that our instructions emphasized the insignificance of performance results. Our test platform was real tele operator web site, which raises a question whether some participants had seen some of the ads before and could retrieve them from memory for that reason. However, none of participants mentioned seeing ads before as the ads had not been online during the last 2 years before our experiments. We did not measure implicit memory, so unconscious memory traces of ads cannot be totally excluded, and on the Internet sites unconscious processing is common (Yoo 2008). Moreover, we manipulated only two ad formats in static and animated modes, a banner and a skyscraper and kept their position stable. Therefore, as participants obviously learned the locations quickly, this may have facilitated ad avoidance. Nevertheless, our ads and their locations were real-life examples and ads were tested by average adult people. These experimental arrangements increase the ecological validity of our experiments compared with those earlier studies employing mock web pages and ads and employing student samples.

## **5.8 Future research**

Our experiments investigated abrupt onsets in online environment for the first time as far as we know. In future studies, there is a need to know more of the perception of other ad formats and their abrupt onsets appearing in multiple, less predictable locations. On many web pages ads appear on the screen first before the actual page content starts to load and are thus compulsorily attended. Yet, we do not know if this sudden appearance of ads at first creates positive or negative impression on consumers. Motion

and animation have typically been studied within the “borders” of ads. We know close to nothing about how consumers perceive ads that actually move around the screen, like virtual agents do.

The present study has concentrated mainly on external ad features, such as ad formats and locations but ad contents and layout features are little researched. Even though usability researchers have extensively examined attention to menus, buttons, various colors and font types among other graphic features, additional research on ad contents is needed for advertising purposes. Recent research suggests that content features, such as, human faces seem to draw attention effectively probably in a bottom-up manner because they attract attention independently of task (Cerf, Frady & Koch 2009). The finding that direction of human gaze in an ad strongly guides the gaze of the viewer of the ad as well (Sajjacholapunt & Ball 2014) is useful for online advertisers and graphic designers.

Analyses of serial processing of online ad contents are also scarce. Köster & al. (2014) make a promising effort by analyzing temporal sequences of banner ad processing, suggesting that exploration of banners proceeds from picture to logo and finally to slogan. The preliminary findings suggest that pictorial features in online ads attract attention first during the beginning of ad processing. However, these results are highly contingent on consumers’ goals and task. Further research should find out how advertising persuasion process actually works from attention to action in online environments.

Evaluating individual differences in online behavior or between genres was mostly beyond our study objectives. Earlier research (e.g. Bayliss, di Pellegrino & Tipper 2005) suggests that there are dissimilarities in navigation and visual search patterns between male and female viewers but the topic is little investigated. Our observations on how ads were perceived did not reveal any major differences between genders across the experiments. Similarly, Barreto’s (2013), investigations on banner ads on Facebook did not find any dissimilarity between females and males on how ads were seen or clicked.

Psychophysiological methods offer promising possibilities in many areas of visual marketing. Eye tracking technology has developed extremely fast with declining operational costs. Nowadays the usage of this methodology is available for small research units and even for individual researchers. In future, combining neuromarketing research and eye movement methods with traditional self-reported data acquisition methods will also provide researchers and marketers an opportunity to form a more holistic view of online consumer behavior and visual marketing in the midst of growing advertising clutter and information overflow.

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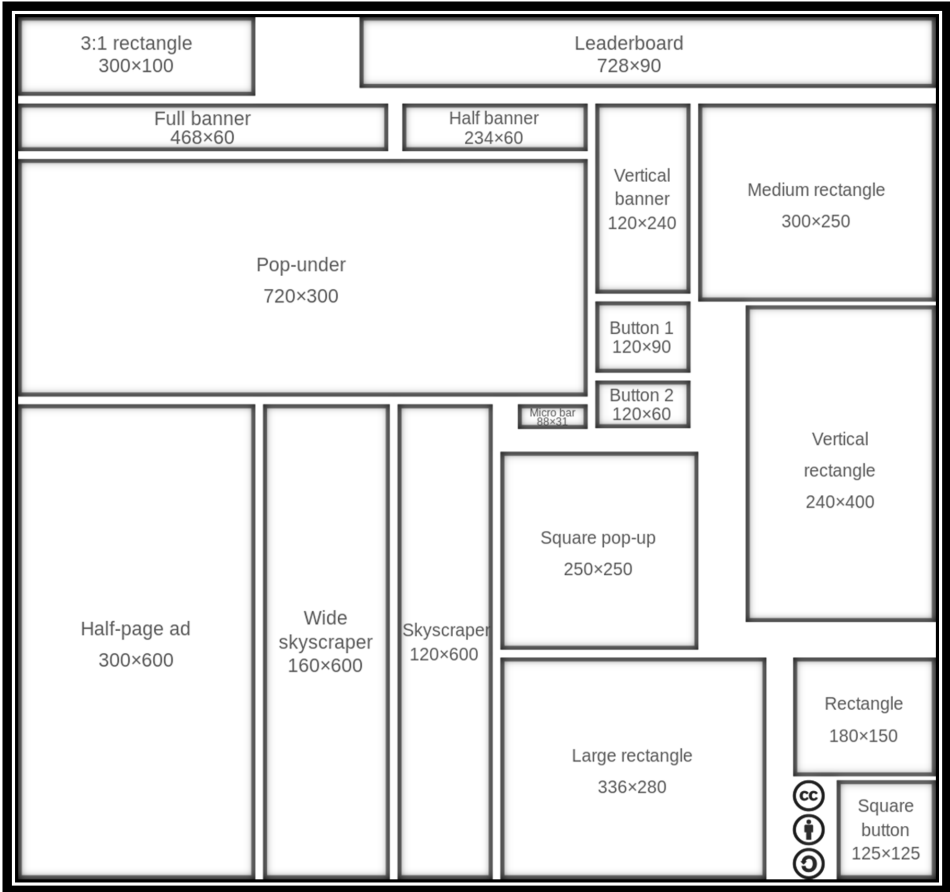
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# Appendices

## Appendix 1

Standard formats of online display advertising (IAB Display Advertising Guidelines)



## Appendix 2

### Relevant literature on online advertising research

Authors	Animation	Format/size	Location	Repetition	Memory	Emotions	Action/behavior	Task relevancy	Other/Remarks
Briggs, R., & Hollis, N. (1997)						X			Banner ads have a positive influence on advertised product assessments.
Bachofer, M. (1998)					X				Effects of graphic design and images affect memory.
Benway, P. J., & Lane, D. M. (1998)	X	X	X		X				Users avoid looking not only at ads but also noncommercial info that looks like an ad. Animation has no effect.
Cho, C.-H. (1999)	X	X					X	X	Saliency of ads matters in low-involvement situation. Relevancy of products advertised and web site content enhance click through rate.
Bayles, M. (2000)	X				X				Recognition of banners high (74 %). Animation enhances recognition. Recall rates lower (below 50 %)
Diaper, D., & Waelend, P. (2000)	X								Web users are not distracted by surrounding graphics
Nielsen, J. (2000)	X								Irrelevant animated ads irritate users.
Bernard, M. L. (2001)			X						Users develop schemas of location of common web objects.
Pagendarm, M., & Schaumburg, H. (2001)	X				X			X	Memory for banners is better during free browsing than performing a task

Authors	Animation	Format/size	Location	Repetition	Memory	Emotions	Action/behavior	Task relevancy	Other/Remarks
Goldsmith R.E. & Lafferty, B.A. (2002)					X				TV and magazine ads more liked than internet ads.
Lee, S. Y., & Sundar, S. S. (2002)				X	X		X		A positive effect of advertising frequency on recall but not on recognition. Ad clutter has a negative impact on recognition.
Drèze, X., & Hussherr, F.-X. (2003)	X	X	X	X	X				50% ads are seen. Weak support for vertical shape saliency. No support for animation or ad size effects but the message matters.
Stenfors, I., Morén, J., & Balkenius, C. (2003)								X	Processing modes fluctuate. Bottom up ad processing typically occurs at the beginning of browsing.
Cho C.-H., & Cheon, J. H. (2004)								X	Clutter reduces advertising efficiency. Goal-orientation mediates ad avoidance.
Hong W., Thong, J.Y.L & Tam K.Y. (2004)	X				X	X			Animation has negative effects on attention and attitudes. Arousal facilitates visual search.
Newman, E.J., Stem, D.E., & Sprott, D.E. (2004)						X			Incongruent banners may cause negative effects for the whole website.
Sundar, S. S., & Kalyanaraman, S. (2004)	X				X	X			Fast animation elicits more arousal but does not improve memory and may be a negative cue in impression formation.
Yoo, C.T., Kim, K., & Stout, P.A. (2004)	X				X	X	X		Animated banners attract more attention, generate higher recall and more favorable attitude.



Authors	Animation	Format/size	Location	Repetition	Memory	Emotions	Action/behavior	Task relevancy	Other/Remarks
Burke, M., Hornof, A., Nilsen, E., & Gorman, N. (2005)	X				X				Low recognition rates (hit rate 20%). Static ads recognized better than animated. Ads decrease visual search speed.
Chatterjee, P. (2005)	X			X	X			X	More clicks on banners during browsing vs. goal-directed visual search. A higher number of exposures improved memory results expect during explanatory browsing.
Moore, R. S., Stammerjohan, C. A., & Coulter, R. A. (2005)						X			Incongruence grabs attention but congruency produces more positive attitudes.
Yoo, C. Y., & Kim, K. (2005)	X				X	X			Animation grabs attention and increases arousal but weakens attitude towards ads. Arousal inhibited recognition performance.
Burns, K. S., & Lutz, R. J. (2006)		X				X	X		Online ad format is a significant characteristic that influence advertising effectiveness.
Day, R.-F., Shyi, G. C.-W., & Wang, J.-C. (2006)	X					X	X		Flash banners elevate arousal and speed up online decisions.
McCoy, S., Everard A., Polak, P., & Dennis F. Galletta (2007)		X			X	X		X	Pop-ups more intrusive than in-line ads. Incongruence of ads increases users' efforts.
Robinson, H., Wysoka, A., & Hand, C. (2007)	X	X							Larger size and long messages are associated with higher click through rates. Animation is ineffective to improve click through rate.

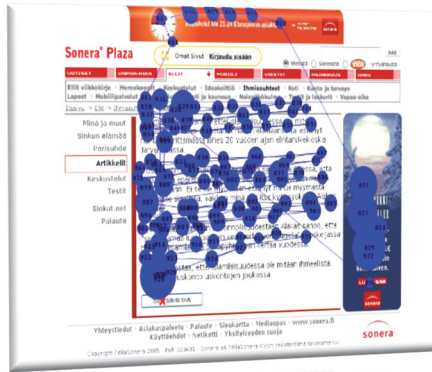
Authors	Animation	Format/size	Location	Repetition	Memory	Emotions	Action/behavior	Task relevancy	Other/Remarks
Ryu, G., Lim, E. A. C., Tan, L. T. L., & Han, Y. J. (2007)			X			X			Pictorial banner ads are evaluated more positively when placed on left side of web page as the pattern is opposite or textual banners.
Yoon, H.-S., & Lee, D.-H. (2007)					X				Implicit memory remains constant regardless of effort level of ad processing.
Burns, K. S., & Lutz, R. J. (2008)		X				X			Skyscraper and banner formats are evaluated most favorably, pop-ups significantly less favorable than other ad formats.
Ha, L., & McCann, K. (2008)					X	X			Ad avoidance and memory deterioration for ads occur in high level of advertising clutter.
Yaveroglu, I., & Donthu, N. (2008)			X	X	X		X	X	Repetition enhances brand memory and intention to click. Repetition strategy is contingent of competing ads and ad-content relevancy.
Yoo, C. Y. (2008)					X	X	X		Greater attention to web ads improves both explicit and implicit memory performance.
Chtourou M. S., & Abida F.C. (2010).	X					X			The nature of animated element, animation speed and type of animation affect cognitive and emotional reactions of users.
Goodrich, K. (2010)		X	X			X			Lower visual field attracts more attention. Ad format affects attention, memory and brand attitude.

Authors	Animation	Format/size	Location	Repetition	Memory	Emotions	Action/behavior	Task relevancy	Other/Remarks
Kuisma, J., Simola, J., Uusitalo, L., & Öörni, A. (2010)	X	X	X		X				Animation improved memory for banners but not for the skyscraper format. Interaction between animation and format.
Kuisma, J., Simola, J., & Öörni, A. (2010)	X	X	X	X					Repetition and increased attention enhanced recognition. Effects of format less significant.
Bahr, G. S., & Ford, R. A. (2011)		X						X	Pop-ups are annoying and users dismiss them.
Duff, B.L., & Faber, R.J. (2011)			X		X	X			Distractor ads, visually similar to target content and close to task area generate particularly negative attitudes.
Goodrich, K. (2011)			X		X	X	X		Attention to ads is positively related to purchase intentions.
Hervet, G., Guérard, K., Tremblay, S., & Chtourou, M. S. (2011)					X				Congruent ads are better memorized.
Simola, J., Kuisma, J., Öörni, A., Uusitalo, L., & Hyönä, J. (2011)	X	X	X					X	Salient ads close to task region disrupt reading, Ads are viewed more often and longer time during free browsing.
Lee, J., & Ahn, J.-H. (2012)	X				X				Animation reduces attention and brand recognition.
Yao, M.Z., Ho, J., & Xu, M. (2012)	X								Article length affects reading depending on animated and static banner conditions.
Porta, M., Ravarelli, A., & Spaghi, F. (2013)					X				Thematic connection between banner subject and article theme affect attention but not memory.

Authors	Animation	Format/size	Location	Repetition	Memory	Emotions	Action/behavior	Task relevancy	Other/Remarks
Roth, S. P., Tuch, A. N., Mekler, E. D., Bargas-Avila, J. A., & Opwis, K. (2013)			X						Placing (target) web objects in expected locations is beneficial for search, first impressions and user experience.
Courbet D., Fourquet-Courbet, M.-P., Kazan, R., Intartaglia, J. (2014).		X		X	X				An image is superior over words concerning brand attitudes and purchase intentions. Positive effects of implicit memory still found after 3 months.
Köster, M., Rüth, M., Hamborg, K.-I., & Kaspar K. (2014)					X				Personalization enhanced recognition for the content of banners. Attention to banners proceeds from picture to logo and slogan.
Pasqualotti, L., & Baccino, T. (2014)	X		X						Ads close to text slow down information processing. Highest negative impacts when high cognitive resources are required (e.g. reading for comprehension).
Resnick, M., & Albert, W. (2014)			X					X	Banner blindness is strongest for banners on the right side and for goal-directed tasks.
Sajjacholapunt, P., & Ball, L.J. (2014)					X				Faces with averted gaze increased attention to banners and enhanced memory for the brand and advertising message.

# Appendix 3

Examples of banner and skyscraper ads employed across the experiments.  
 The upper picture of a web page shows a fixation pattern of one test participant.



This screenshot shows the Sonera Plaza website with a skyscraper advertisement. The ad is titled 'Häloinen joka suuntaan' and features a red background with white text. It promotes a service where users can call a number to get help with various issues. The ad is positioned on the right side of the page, partially overlapping the main content area. The website layout includes a header with the Sonera logo and navigation menus, and a footer with copyright information.

This screenshot shows the Sonera Plaza website with a skyscraper advertisement. The ad is titled 'Anna nyt myös' and features a white background with red and black text. It promotes a service where users can call a number to get help with various issues. The ad is positioned on the right side of the page, partially overlapping the main content area. The website layout includes a header with the Sonera logo and navigation menus, and a footer with copyright information.

This screenshot shows the Sonera Plaza website with a skyscraper advertisement. The ad is titled 'Autetaan lapsia yhdessä!' and features a yellow background with black text. It promotes a service where users can call a number to get help with various issues. The ad is positioned on the right side of the page, partially overlapping the main content area. The website layout includes a header with the Sonera logo and navigation menus, and a footer with copyright information.

This screenshot shows the Sonera Plaza website with a skyscraper advertisement. The ad is titled 'Miten muropaketti mahtuu puhelimeen?' and features a white background with red and black text. It promotes a service where users can call a number to get help with various issues. The ad is positioned on the right side of the page, partially overlapping the main content area. The website layout includes a header with the Sonera logo and navigation menus, and a footer with copyright information.

## Appendix 4

### Examples of instructions of Essay 2.

#### *Phase I: Reading task*

1. Welcoming and introducing test environment (quiet office room) to volunteered participants. Asking participants to test the computer, check their email or just to surf in order to feel comfortable and relaxed with the equipment before test instructions.

2. Ethical pre-briefing: During this experiment you will see several web pages and complete tasks. During the experiment your eye movements are recorded. Recording is done by infrared eye camera that is harmless to your eyes and measurements are made without any skin conductance. However, we can tell you the purpose of this experiment only after you have completed the whole experiment because otherwise the knowledge of the purpose would influence the results. Finally, we will show your eye movements on the screen if you wish. Your identity and all information are meant only for our research purposes explained to you later. No personal information of your background connected to eye movements and test results will be stored into our database; only a two digit number relates the data. In addition, the data we gather is of no use to anyone else and the test does not measure any individual characteristics, such as intelligence, but only visual attention in general. Finally, if you have doubts, you can interrupt the experiment whenever you feel like and all your data will be deleted from the database. If you accept to go through the test we will sign a written agreement that we can use your test data for our study and for that purpose only, and the researchers guarantee that none of your personal information is distributed to any third parties. You will be rewarded by lunch coupon of 7 € whether you decide to complete the experiment or not.

3. Calibration: Next, we have to calibrate the eye tracker to match your eyes as all eyes individually different. This goes quickly and simply. You just look at the (nine) spots appearing one after another on the screen.

4. Task briefing: Next you'll be exposed to 32 web pages. All of them have text of various topics which we ask you to read and after each page comes multiple-choice questions about the text of page. However, we want to point out that reading speed and correctness of your answers is insignif-

icant, more important is that you go through the pages accordingly your own interests as you might browse them at home. You may also “think aloud” about what you read and see during the test and ask the researcher any further instructions you may need. However, please keep your gaze on the screen all the time and the distance to screen the same as showed to you during the calibration. Though, minor head or body movements do not affect your test results.

### ***Phase II: Recognition test***

In phase 2 participants went through a recognition memory test in which 32 single ads were shown to them one by one and participants were asked to evaluate, whether they had seen the ads or not. Out of 32 advertisements, 16 ads were taken from the first test phase mixed with 16 distractor ads that had not been presented during the reading tasks. Distractor ads were designed in the same style and logos as the original test ads but with different content. After each ad, participants indicated whether they had seen the ad or not by clicking the corresponding box on the screen. All these ads were presented in random order and under the same four experimental conditions as in the reading test. Eye movements were recorded also during the recognition process but not any longer during the following phases of the experiment. Instructions of phase I and II were also given to participants in writing to reduce their memory load.

### ***Phase III***

During the experiments we recorded subjects’ voluntary “think aloud” with a web cam to collect participants’ comments on how they perceived ads. Web cam also recorded participants’ body language and facial reactions. In addition to normal observation routines, a semi-structured questionnaire was used to measure recall and distraction effects of advertisements. Spontaneous free recall was tested by asking participants to memorize and mention the ads or some features of the ads that they might have seen during reading. The experienced general interference of advertisements was measured by multiple-choice questions on a five point Likert scale with 1 indicating no distraction at all and 5 indicating a strong distraction of ads throughout the reading task. Memory tests came as a surprise because otherwise participants’ normal viewing behavior might have been influenced.

#### ***Phase IV***

The computerized Corsi task version (E-Prime, Psychology Software Tools, 2002) was chosen as a measurement of short-term visual memory capacity of participants. During the task subjects saw seven dots popping-up randomly onto the screen at various screen locations. The dots appeared and created random patterns on the screen and then disappeared. Immediately after each screen, the subjects were asked to click the locations on the screen in the same order in which the dots had been displayed. Participants were not allowed to use any other aids to memorize the dot patterns except the visual image in their memory. Every second participant saw the dot patterns in reverse order. During phases III and IV no eye tracking data was collected which was told to participants in advance.

#### ***Phase V***

Immediately after all experiments, a video clip of participants' eye movements during the test were shown to them and they could comment their viewing behavior. This qualitative feedback was documented for future research purposes. While participants were looking their eye movements on video, the purposes of the experiment were explained to them. At the end of the session, participants received their lunch coupons and contact information in case they wanted to comment or know more about the results later.



Please, note.

The essays/articles related with this publication have been omitted due to issues related with copyright.

This thesis examines consumers' attention and responses to online display advertisements, such as banners and skyscrapers among other online ad formats. Visual attention to ads is a dominant antecedent when evaluating online advertising effectiveness. The study describes and employs eye tracking method and measures to assess the quality of attention to ads in combination with consumers' self-reported measures for memory and emotions.

The study concludes that excessive use of salient ad properties can disturb web page processing and deteriorate memory for ads and brands. However, several variables affect and mediate attention, memory and final user experience. In addition, repetition strategies improve attention and memory for online ads. The results of this study provide several practical guidelines for marketers and graphic designers on how to attract attention prudently in the midst of growing advertising clutter and information overflow.



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