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Children's Exposure to and Perceptions of Online Advertising[1]

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The popularity of the Internet and marketers' increased investments in Internet advertising have raised some questions concerning a marketer's power to influence children and young people's consumption through new media technology. This article, based on a recent explorative study of 15-year-old Swedish teenagers, aims to discuss their exposure—potential, actual, and perceived—to online advertising. Eye movements of these teenagers were measured while surfing the Internet for 15 minutes. The results suggest that teenagers are exposed to 10% of all the potential advertisements, but they are mainly unaware of this actual exposure. Food advertisements had the highest impact in this study. Our research also indicates substantial gender differences in actual exposure to advertising. Boys are exposed between 30% and 60% more to advertisements in some categories (gambling, ad links, lifestyle, and recreation) than girls.

Introduction

Children's media use has changed dramatically over the last decade, with the increased use of computer games to include digital media, mobile phones, and especially the Internet. It is more common today for young people to have personal mobile phones and computers than a private television set in their bedroom (Medierådet, 2009). The digitization of media use, or the move from traditional media to digital media, has, in some instances, been referred to as a paradigm shift. In Sweden, children (ages 9–14) typically spend an average of 83 minutes daily on the Internet, while the older youth group (15–24 years) spends approximately 140 minutes a day online (NORDICOM-Sweden, 2009).

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The Internet has allowed an expanded reach of advertising by incorporating new ways of targeting young audiences. Studies suggest that 98% of children's Web sites permit advertising, and two-thirds of the sites made for children rely on advertising for their primary revenue (Moore, 2006). Thus, children and young people spend a lot of time in the digital world, a place where commercialization and marketing efforts, in comparison to several other media, have intensified most in the last few years.

Despite several years of financial turmoil, the advertising market recently reached an all-time high in Sweden, according to the Institute for Advertising and Media Statistics (IRM) (2009). Annual investments in market communication in Sweden amount to a total of 64 billion Swedish crowns (SEK), or approximately US$875 million. The earlier extensive development of the Internet as an advertising medium continued in 2008, and advertising investments grew strongly last year (IRM, 2008; IRM, 2009). Between 2006 and 2007, investments in online advertising increased by 35%, from three billion to more than four billion SEK. In 2008, expenditures increased again by more than 18%. The proportion of advertising budget allocated to online advertising in Sweden is now equivalent to the sum spent on television commercials.

Online advertising is often disguised as a form of entertainment, and it can therefore often be hard to identify an ad as promotional. The Internet is an advertising medium that frequently makes use of brand incentives (such as brand mascots, membership in clubs, crafts activities, online games, free samples, extra material for free download or distribution) to influence children to favor the products being promoted. The Internet's capacity to induce high levels of interest and involvement by having consumers actively seek out content and interact with it distinguishes it from a passive medium like television (Moore, 2006). The entertainment format, as well as the use of interactivity, lays the foundation for advertising efficiency and success (Taylor, 2009). This is also why product placement in computer games has been seen as an effective tool for fostering brand recall and positive attitudes toward brands (Mackay, Ewing, Newton, & Windisch, 2009).

It would seem that investors regard the Internet as an effective and attractive advertising medium, and marketers are confident that cyberspace is the place to reach young consumers. Yet young people's attitudes toward modern marketing such as digital advertising (online, e-mail advertising, mobile phone-based SMS and MMS advertising) are more negative than their attitudes toward advertising in traditional media channels—e.g., print, cinema, outdoor advertising and TV (Ekström & Sandberg, 2010). Personal computers and mobile phones are used mostly for private communication and activities (such as taking notes, information search, playing games, etc.) and are thus more personalized media in comparison to TV or other traditional media. Studies suggest that digital advertising that invades the private sphere is considered more irritating and intrusive (Cheng, Blankson, Wang, & Chen, 2009; Ekström & Sandberg, 2010).

Yet, we are witnessing a shift in marketing investments from broadcast and print to online advertising and a move from highly regulated to barely regulated advertising. From the child's viewpoint, the shift is from clearly signaled to unclear or even unfair and deceptive practices of embedded marketing.

The effects of advertising and children's ability to identify, critically scrutinize, and understand commercial messages have been debated and investigated for several decades (Fox, 1996; Furnham, 2000; Institute of Medicine [IOM], 2006; Livingstone & Helsper, 2006). With the rise of levels of childhood obesity (Lobstein, Rigby & Leach, 2005) this debate and field of research have gained new impetus, and questions about food advertising have especially been raised.

Children's eating habits, as well as the increased prevalence of obesity, can't be explained by aggressive marketing and advertising alone. However, there is strong empirical evidence that food advertising and marketing of food in different media affect children's food preferences, food choices, and desires for food purchases (Hastings, Stead, Dermott, Forsyth, MacKintosh et al., 2003; Hastings, McDermott, Angus, & Thomason, 2006; IOM, 2006) as well as excessive consumption of food (Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford, Boyland, & Hughes, 2007; also see Schor, 2006). The studies have so far focused mostly on the influence of television advertising, and we still know little of the nature and the impact of Internet advertising.

Earlier research (Moore, 2006; Ekstrom & Sandberg, 2007; Sandberg, 2008) has indicated that the Internet, in comparison to several other media being surveyed (television, comic books, direct mail advertisements), allocates a large proportion of ads for unhealthful food directed to children. In one study, ads for unhealthful food on the Internet accounted for almost 50% of all the food advertisements being surveyed, on children's as well as on the food industry's Web sites (Ekström & Sandberg, 2007). In a follow-up study two years later, the proportion of unhealthy food advertisements had decreased somewhat, but was still high (35%) (Sandberg, 2008).

Voices have been heard in Sweden lately claiming a need to regulate Internet advertising aimed at children to protect them in their role as consumers, as well as to prevent obesity and promote their health development (von Haartman, 2009). Before arguing for a need for Internet regulation, there is a need for greater understanding of children's and teenagers' potential, actual, and perceived exposure to Internet advertisements, as well as their understanding of online marketing.

Eye-tracking and Advertising Effects

Eye-tracking (ET) is used increasingly in a number of research fields, including usability testing (Goldberg & Kotval, 1999), reading research (Holsanova, Rahm, & Holmqvist, 2006), problem solving (Grant & Spivey, 2003), consumers' decision making (Vikström, 2006), and psycholinguistics (Allopenna, Magnuson, & Tannenhaus, 1998). So far, however, researchers in media and communication studies have rarely used ET.

ET has been influential in international research initiatives since the mid-1900s. One early example is the well-known and important study by Yarbus (1967), which demonstrated, among other things, how eye movements while inspecting a visual stimulus are greatly influenced by personal intention. A large part of Swedish ET research, along with this study, is tied to the Humanities Laboratory at Lund University in Sweden.

The rationale behind ET is the good match demonstrated between the eye's visual focus and the viewer's cognitive attention (Henderson, 2003). ET provides quantitative and objective data that demonstrate what visual and mental attention processes look like (Duchowski, 2002). By measuring teenagers' eye movements as they surf the Internet, we get a good comprehension of their subjective experiences of different Web sites. We measure the extent to which they are looking at advertising, as well as the type of advertising they pay attention to, the time spent on advertising in relation to other media content, the number of advertisements, the category and position of advertisements in relation to their visual attention, etc. All of these measurements are of high relevance when discussing the media's role and the power of advertising to influence our ideas, emotions, and behaviors.

The current body of advertising research is immense and complex, and there is still no consensus about the influence advertising has on children. Advertising effect studies vary greatly with respect to paradigms, perspectives and methodology. Three main dimensions are usually involved when studying the impact of advertising on children: (1) cognitive, (2) affective, and (3) behavioral effects (Valkenburg, 2000).

Cognitive effect studies concentrate on a child's ability to differentiate commercials from other media content and his or her capacity to understand the purpose of advertisements. Affective studies focus on the appeal of commercials and the trust they generate in children, while studies of behavioral effects examine the extent to which the child is persuaded, usually measured by children's preferences for a product or by their requests to buy particular products (Valkenburg, 2000). In all three cases, advertising impact is defined as a product (outcome) measurement and usually measured by the use of survey techniques and interviews. However, impact may also be defined as a process measurement (Holsanova & Holmberg, 2010), answering questions such as: How does the individual visually interact with advertising? What happens during exposure? ET is the most suitable method to study advertising impact as a process. In this study we investigate mainly the processual aspects of online advertising, operationalized as potential and actual exposure. Children's perceived exposure, which is a cognitive effect, is also discussed, however, and investigated by interviewing the individuals shortly after exposure.

As advertising effects are largely based on visual stimuli, visual exposure (potential and actual) to a communication effort is a necessary but not a sufficient condition for a cognitive, attitudinal or behavioral effect to occur. The individual must pay attention to the message, cognitively process the content, and then act on the basis of the evaluation of the message. There are several theories that describe this kind of influence or persuasion process stepwise, e.g., McGuire's Information Processing Theory and Communication-Persuasion Matrix, which deals with 13 steps in the persuasion process from exposure to message through the step when the message is fully embraced. The final step is to get others to think and act according to the sender's intentions (acting as a sort of ambassador or change agent). The process is based on a power hierarchy, which means that each step in the process is dependent on the outcome of the immediately preceding step (McGuire, 2001, also see Rice & Atkin, 1994). Another theoretical framework of some relevance is Petty and Cacioppo's socio-cognitive model, *The Elaboration Likelihood Model of Persuasion* (1986). It explains the process of influence on the basis of two paths to persuasion (a central and a peripheral route). The model describes how individuals who have been exposed to a message process the message in different ways, according to factors embedded in the

message. The peripheral route to persuasion is based on superficial and visual triggers that require little elaboration (such as colors, pictures, celebrity communicators). It seems likely that online advertisements, because of their restricted size and flexible character, rely heavily on peripheral cues for inducing effects. The model was developed in the early 1980s and has since been applied extensively in research on advertising effects, but rarely in research on advertising effects on children (Livingstone & Helsper, 2006). Because the ET study reported here had an explorative purpose and an inductive approach, these theories had a limited role to play in the study. However they present an important connection between the traditional ET research with a strong focus on cognition and media and communication research focusing on persuasion and effects, and thus they deserve to be elaborated further in future testing of hypotheses and research of this kind.

Eye-tracking at Work

How does ET work? With a video-based eye tracker, the eye movements are measured using the pupil and the light reflected in the cornea. The eyes are illuminated with infrared light whilst being filmed in order to localize the centre of the pupil and the reflection in the cornea. This measurement can be used to calculate the eye's movements because the relationship between the pupil and the cornea reflection changes depending on where the person looks.

These recordings make it possible to identify periods of time when the eye is still, called fixations, and the movements between these fixations, called saccades. It is only during the fixations that the eyes can gather information from the scene; during the saccades we are virtually blind. A fixation can last for about 80 milliseconds (ms.) up to a few seconds (sec.). Eighty milliseconds is all it takes to read a word and understand its meaning (Rayner, 1998). The duration of a typical fixation is approximately 200–300 ms., which is barely a quarter of a second (ibid). The movements of the eye are very important because we can see sharply in only a very limited part of the scene, about 2º of the visual field, although studies have shown that experts tend to have a larger functional visual field than novices and a more task-efficient selection of fixation points (Reingold, Charness, Pomplun & Stample, 2001).

In theory, then, it does not take long to influence a person or to trigger mental processing of information. In practice, however, persuasion processes are far more complex and usually involve more than a simple stimulus and response to be considered successful.

Aim and Research Questions

The aim of this study was to deepen and widen previous insights and knowledge of advertising directed to Swedish children. As far as we know, there is still no published study on children's exposure to and visual interaction with advertisements on the Internet. The project was designed to fill this knowledge gap. The research questions are:

RQ1: What kind of advertisements are Swedish children potentially exposed to on their favorite Web sites?

RQ2: Are there any differences between the children's potential and actual exposure to Internet advertisements?

RQ3: If the children look at the advertisements, how do they perceive the exposure?

RQ4: Do food advertisements stand out in any way in online advertising?

This is an observational and explorative study not driven by hypotheses but with the intention to formulate hypotheses for future research. This also implies that inferential statistics have not been undertaken. In total the project consisted of three distinct sub-studies that combine different methodological approaches and measurement techniques: a classroom survey, an eye-tracking study followed by retrospective videotaped interviews, and individual in-depth interviews. The target group for this study was limited to school children, 9th graders, 15 years old. The study presented and discussed in this article is the eye-tracking study focusing on mapping out the advertisement landscape on the Web sites visited by the teenagers, as well as measuring the teenagers' kinds of exposure to and perceptions of advertisements on the Internet.

Methods and Research Design

In our previous studies, younger children (up to 12 years) were described as a particularly attractive consumer group for marketers, but at the same time a group in need of special consideration and care when framing and designing commercial messages. In the project reported here, we have chosen to focus on teenagers, who as a group are less often identified as a priority in media and advertising research (Livingstone & Helsper, 2006), but who use new information and communication technology, in particular the Internet, extensively. Younger teenagers or preteens, also referred to as "tweens" (8–12 years) in the literature, have gained a lot of scholarly attention recently (Siegel, Timothey & Livingstone, 2001; Lindstrom, 2003; Hertzberg Kaare, Bae Brandtzaeg, Heim, & Endestad, 2007). Older teenagers often receive less attention. They are not children or adults and have great freedom in comparison to younger children. They spend a lot of time outside the home and household context among friends and peers, and are soon independent consumers on their own terms. In addition, they have quite a lot of money to spend and often have to make buying decisions and might thus be open to advertising influence. Studies on advertising effects on younger children demonstrate varying results, while studies on teenagers show more clearly the effects of advertising (Livingstone & Helsper, 2006). On the basis of this, the population studied here is limited to boys and girls in grade 9, ages 14–16, according to the Swedish school system.

Sample

The study was conducted through the fall of 2008 in a city in southern Sweden. Schools were identified through the local school office and chosen to participate on the basis of municipality data. Two urban schools, out of a total of nine local secondary schools, were selected to take part in the study. One school was a high-status (A) and one was a low-status school (B). The purpose of this sampling procedure

was to secure variation among the subjects, in terms of social background, ethnicity, media use and interests. One class of 9th graders was selected from each of the two schools for the study, with a total of 44 students.

Altogether there was a loss of five students from the total population of 44, so the study included 39 students, 21 from school A, and 18 from school B. There were 20 girls and 19 boys. Parents of two of the students would not permit them to participate, and three dropped out because of illness or because they forgot their appointed times for the test and could not be rescheduled.

According to the classroom survey data compiled a couple of weeks before the ET, all of the students used the Internet. The vast majority of the students (98%) had a computer with Internet access at home. Forty-three percent had computers of their own, and 69% had Internet access in their bedrooms. 77% of the students used the Internet on a daily basis. More than a third of the students used the Internet 1–2 hours on weekdays, a third used it 2–3 hours on weekdays, and 16% between 3 and 6 hours on week days. On the weekend, their Internet use increased overall, with 63% using the Internet more than 3 hours on any given Saturday or Sunday.

In the survey questionnaire we also asked the students to list their favorite Web sites (not more than 10) to map out their everyday environment in cyberspace. One third of the respondents listed a maximum of three sites, 17% reported as many as seven sites, and 14 % used the opportunity to fill in 10 sites. On average, each person indicated five Web sites. In total 98 unique sites were reported as the teenagers' most visited or preferred Web sites. It is noteworthy that none of the chosen sites had to do with food or had any particular connection to the food industry. There were, however, Web addresses to social forums (e.g., LunarStorm, eBuddy), media sites (papers and television networks/channels), search engines (e.g., Wikipedia), services (e.g., Web sites for local transportation, Ticnet, Amazon), and sites reflective of the teenagers' personal interests (e.g., sports, music, fashion, celebrity gossip, environmental issues, theology etc.).

Data Collection and Procedure

To facilitate students' participation, all data collection took place during the daytime in the schools. The technical equipment and the researchers as well as the staff from the Humanities Laboratory moved from the university campus, and a temporary laboratory was set up in the schools. The ET setup, the instructions for the students, and the experiment procedure for the upcoming data collection were tested on individuals from the designated target group in a pilot study, four months ahead of the data collection period and adjusted according to the outcomes of the pilot.

Our ambition was to capture the teenagers' natural behavior online. Thus we wanted to have as few restrictions as possible during the trials in order to increase the ecological validity of the study. The study consisted of two parts, the eye-tracking and the retrospective interview recording, conducted in two rooms adjacent to the students' classrooms.

Each student was welcomed into the room where the eye movement recording took place and was asked to sit in front of the experiment computer. Once in place, the student read a leaflet with some background information and the conditions for taking part in the study. The chair and computer were adjusted so that the teenagers could sit comfortably. A calibration of the equipment was completed before the eye movement recording began. Test instructions were then presented on the screen, and thereafter the student was allowed to ask questions about possible ambiguities before starting.

Instructions

Each student was given 15 minutes to surf the Internet without restraints or particular tasks. To assist, a list of URLs was presented. The list had been developed from the classroom survey data. A selection of 21 of the 98 Web sites made up the list for the ET test (Table 1). If the teenagers did not like any of the stipulated Web sites, they had the option to seek any Web site they wanted through the Google search engine, which was included in the list.

Table 1. *List of Preset Web Sites Presented to the Teenagers during the Eye-tracking**.***

www.google.com	www.hamsterpaj.net	www.posh24.com
www.aftonbladet.com	www.hockeyligan.se	www.pricerunner.se
www.alluc.org	www.ign.com	www.snyggast.se
www.bilddagboken.se	www.kamrat.com	www.spela.se
www.curse.com	www.mediatakeout.com	www.svenskafans.com
www.emocore.se	www.mimersbrunn.se	www.ticnet.se
www.fz.se	www.msn.se	www.ultimate-guitar.com

While students were surfing, they were left alone in the room to create a relaxed unsupervised situation and to encourage the most natural online behavior possible. When 15 minutes had passed, they were asked to complete their activities on the Internet, and a short questionnaire on their activities was completed by the investigator. Questions were asked to estimate the consistency of the surfing activity, e.g., “Have you visited sites you have never been on before?” and “Would you say that your activities reflect your everyday Web activities or diverge in any way?” Students were then asked to go into the other room, where a retrospective interview was conducted.

Recording of Eye-tracking Data

The eye tracker used in this study to measure potential and actual exposure was a remote SMI iView X RED video-based pupil and corneal reflex system, recording data at 60Hz, which means that it measured the eye movements by filming them from a distance and therefore required no physical contact with the person, in order to improve ecological validity. This means that the subject can be at ease and

move relatively freely during the data collection. The eye tracker is attached to a panel below the computer screen and is hard for an untrained eye to detect.

The experimental equipment consisted of a computer, which was used for the students' Internet surfing as well as the recording of their eye movements. For presentation of stimuli (instructions, list of URLs and browser), measurement of eye movements and for the presentation of eye movements during the retrospective interview, *Experiment Suite 360°* from SensoMotoric Instruments was used.

Retrospective Interviews

In order to assess the children's perceived exposure, we set up retrospective interviews based on the eye-movement data. The purpose of the retrospective interview was to reconstruct the trials, making the teenager recall the process, the choices and the decision=making involved in the online activities. Another important purpose was to explore their awareness of the exposure as well as the reasons behind the attention they had paid to some advertisements but not others. During these interviews, we also asked the teenagers to identify and actually point out the advertisements on the Web site. In the retrospective interview, the subject sat on a chair in front of a computer screen on which the eye-tracking data were presented.

The retrospective interview began with questions about how the student had experienced the eye-tracking and the recall of the sites visited. The interviewer had a guide to follow so that a between-subjects comparison could be made of the questions asked at each interview. The interview was filmed for later transcription and analysis. The setup of the video equipment was such that the student remained anonymous and the computer screen where the eye movements were presented was in focus. During the retrospective interview, one researcher conducted the interview and one managed the technology (video recording and uploading of the subject's eye-movement data). Each interview lasted a little less than an hour.

Ethical Issues

Research involving minors generally requires great caution. The researcher must obtain not only participants' consent to take part in the study but also consent of parents or guardians if the participants are under 15 and if the research concerns matters of a very sensitive nature. Because many of the students in grade 9 were 15 at the start of the project or would have their 15th birthday in the project time span, we were able, after consultation with teachers and the school management, to use passive parental consent for student participation. The project leader gave students written information to take home to parents from the project leader. In the written notice, the project and conditions for students' participation were presented, in accordance with the Research Council's Code of Ethics for the Humanities and Social Sciences (www.vr.se) in Sweden.

The teenagers' own consent to participate in the project was collected, orally in connection with the questionnaire survey and in writing in the form of a consent form in the context of the eye-movement measurement. In order to protect the participants, this article does not reveal the city, schools or names

of the people involved. In return for participating in the project, teachers and students received personal cinema checks. The checks were distributed to the students and the teachers after the completion of the eye movement recording.

Analysis of Eye-tracking and Coding

The huge amount of ET data, corresponding to 9.86 hours of recording, was imported into the software *BeGaze* from SMI for analysis.

The Web content was captured (recorded) at the time of the ET. In order to analyze the amount of and type of advertising content that the teenagers looked at, the advertisements on the Internet during the sessions first had to be identified and coded into product categories. Internet advertising is in this study was restricted to paid advertising space on the Web sites, such as banners (top or bottom), advertisements placed in boxes in the left or right margins, ad links, and "floating" advertisements that usually appear in the middle of the Web site and follow the viewer scrolling down the page. Altogether 5,161 advertisements (also referred to as instances below) were identified and coded. The statistics of the compiled eye-movement data were then exported from BeGaze into a database for further analysis.

Identified advertisements were coded into one of 11 categories (Table 2). Advertisements considered self-promotion for the particular Web site in use were not included in the analysis.

Table 2. *Online Advertisement Categories.*

Advertisement category	Description
Food and drinks	Ads for products to eat or drink, e.g., bread, coffee, hamburgers
Ad links	Ads for other Web sites visualized as a link
Gambling	Ads for poker, games, football betting etc.
Technology	Ads for electronic devices and hardware, e.g., computers, cameras, phones and cars
Entertainment	Ads for movies, DVDs, music, events
Lifestyle and recreation	Ads for fashion, clothes, beauty and travel
Banking	Ads for banks, credit institutions, credit services, loans
Education and employment	Ads for educational institutions, career coaching, job recruitment
PSA/NGO	Ads for public service announcements (PSA) and/or nongovernmental organizations (NGOs)
Diet/weight loss	Ads for slimming methods, pills and products to lose weight
Other	Other (including ads with no identified sender)

Limitations

During the ET, some technical problems unfortunately occurred on Web sites containing online games. The program used for the recording could not handle all of the information in these games and therefore occasionally stopped. We then asked the teenagers not to play these games during the test. They could visit the sites but were asked not to start the games. Despite this, a few did not comply, and their recordings had to be started again, with a little risk of data loss each time. Advertising in online games was therefore not measured in the study.

Our aim in this project was to measure the teenagers' eye movements while they performed their everyday activities on the Web. Initially, we wanted to instruct the students to pretend that they were at home and should carry out whatever they usually do on the Web during the test. They were also informed that their personal codes would not be saved by the equipment. However, the test situation per se is such an unnatural setting for the children that such instruction would seem ridiculous to them; consequently the teenagers were encouraged only to surf unreservedly during the test and do whatever they normally do on the Web.

To compensate for this little remission, some questions were asked in connection of the test to estimate whether the surfing behavior and the Web sites visited were representative of their natural activities and Web environment. As many as 82% of the students responded that during the test, the sites they had visited were sites they already knew of and had visited before. Fewer than a fifth of the teenagers visited one site that was completely new to them. Half of the participants confirmed that during the test, they visited the same Web sites they usually did at home. Those who said they would visit other Web sites if at home mentioned specific game sites and personal blogs as the only alternatives. It is therefore our assessment that the teenagers' surfing activities during the tests are similar to their usual Internet habits and thus the advertising they were exposed to during the test is not unlike their everyday exposure to online advertisements.

Results

The recording session had been set to 15 minutes, but the actual average session time ended at 15.57 minutes. Each recording session was divided into smaller units, or trials. Each time a subject clicked on a link and a Web site was downloaded to the subject's Web browser, a new trial was set up. A trial is thus roughly equivalent to a request.

The result of a subject's visual behavior during a typical trial/request:

- Average duration of fixation 406.88 ms. (SD=101.39)
- Average duration of saccade 31.92 ms. (SD=6.25)
- Average number of saccades/trial 32.4 ms. (SD=23.18)
- Average saccade amplitude 1.98 visual degrees (SD=0.58)

Figure 1. *A Scan Path from Eye-tracking. The picture shows the output of a student's eye-tracking data from a trial, in this case: www.hockeyligan.se. The green line corresponds to the eye-movements during the first second of the trial.*

In Figure 1, a scan path is presented, showing a student's eye movements during a trial. The round spots in the picture represent eye fixations, hence when the eyes are quite still and information is taken in and being processed; the larger the spot, the longer the fixation. The lines between the spots represent the saccades, the very fast eye movements between the fixations when the eye is practically blind.

It is interesting to note that the average duration of fixation for the teenagers in this study is almost 407 ms., which is more than typical mean fixation durations during reading (225 ms.), visual search (275 ms.) and scene perception (330 ms.) (Rayner, 1998). For comparison to fixation duration in reading data, see Figure 2. Long fixation times are often interpreted as an indication of visual information of high density, which requires longer fixation times for the viewer to process the content (Rayner, 1998). This result suggests that the Internet is a visually very demanding medium for students 14-16 years old (grade 9 in the Swedish school system), even though they are very familiar with the Internet environment and use it several hours per day. Advertising in this environment of high information density might require more concentration to identify, and to subsequently decode, than advertisements on less information-rich media channels.

The results from the saccades, when the eye moves across the screen, show that the average saccade duration is 32 ms., which is quite normal (Rayner, 1998) and was expected, because the eye does not collect any visual information during these quick jumps and thus is not affected by the visual information density. An interesting finding is the average saccade amplitude of nearly two visual degrees. This demonstrates that the average distance the eye moves during the students' Internet surfing is about 3 cm on the computer screen. This shows that the individuals have not engaged in a linear reading of the texts, which requires much shorter saccades (approximately 1 cm) and shorter fixation duration (100–200 ms.). These larger saccades suggest instead a scanned and exploratory reading, where subjects integrate visual information actively from different places on the page.

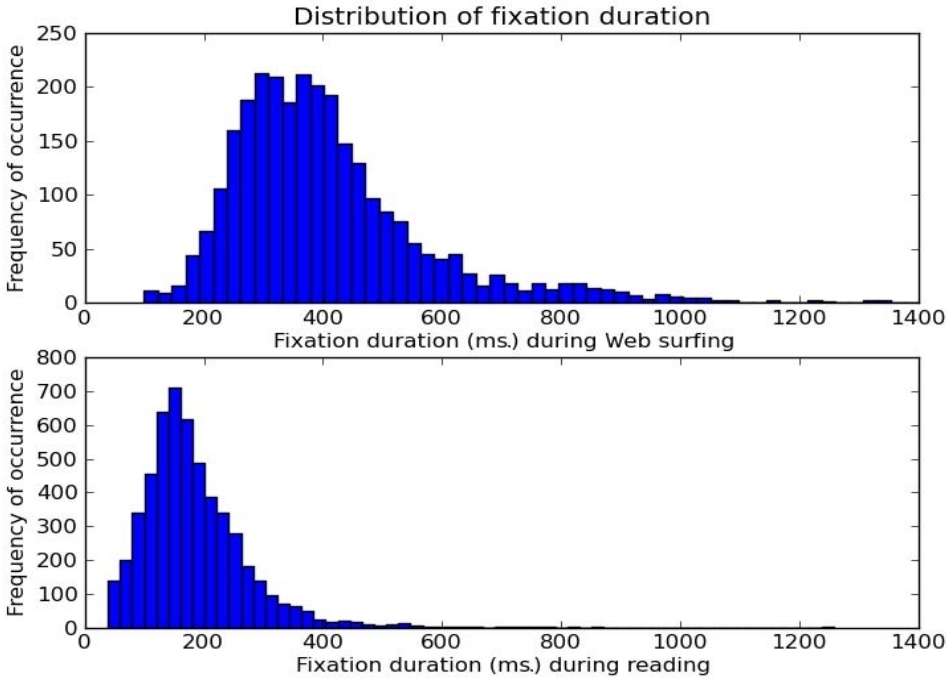

Figure 2. *Distribution of Fixation Duration in Web surfing (top) Compared to n-screen text reading (bottom). In both cases the histograms are skewed to the left, which indicates that shorter fixations are more common. However, Web surfing is characterized by a higher* ***frequency of longer fixation durations.***

On average, each student completed 76.89 requests (downloads) during a session, and each request lasted on average 18.45 seconds. The minimum time a person spent on any particular Web site was 0.14 seconds. The maximum time spent on a site was 279.29 seconds, or 4 minutes and 39 seconds. These figures clearly demonstrate the range in time a certain Web site is displayed, and accordingly it also tells us something about the time of display of advertisements on the Web site.

Potential and Actual Exposure

In total, 5,161 advertisement instances were assigned to one of 11 categories. The largest was Ad links (33.8%), then Technology (14.39%), Gambling (11.15%), and Lifestyle and recreation (10.51%) (Table 3). The Food and drinks category was surprisingly rarely present and did not represent more than approximately 2% of all the advertisements on the Web sites visited by the teenagers during the eye movement measurement. Some of the advertisements were for basic food such as bread, coffee, milk,

sausages, and beer, but there were also several instances of fast food e.g., hamburgers. In this study 50% of the advertisements for food and drinks were for products considered less healthful (or junk food).

What can the results from the ET tell us about the teenagers' interaction with the advertisements? Did they actually pay any attention to them? The teenagers visited altogether 121 unique Web sites and 935 unique URLs (pages), and we got a total of 3,042 requests (page downloads) across all subjects in the study. The total number of ads in this material, 5,161, indicates the total number of potential advertising exposures in the study. Not all these advertisements, however, were in fact viewed by the teenagers, and therefore the potential exposures do not correspond to the actual or absolute advertising exposures.

***Table 3**. Online Advertisements: Distribution, proportion (%) and duration of actual exposure per advertisement category (ms.), mean (m) and standard deviation (SD).*

Advertisement category	Frequency (f)	Percentage (%)	Average duration of actual exposure (ms.)	Standard deviation (SD)
Food and drinks	100	1.94	615.44	918.70
Ad links	1746	33.80	4465.14	5585.75
Gambling	576	11.15	3223.49	7799.80
Technology	743	14.39	3880.90	6144.27
Entertainment	363	7.03	1176.88	1230.38
Lifestyle and recreation	543	10.51	2705.07	3763.83
Banking	239	4.63	324.28	577.59
Education and employment	244	4.72	546.45	1094.52
PSA/NGO	178	3.45	924.91	1888.00
Diet/weight loss	66	1.28	849.55	2584.69
Other	363	7.03	681.23	1016.16
N=	**5161**	**99.93**		

We can conclude from looking at the whole session of 15 minutes that a person visited on average 5.85 unique Web sites, and performed 30.44 unique requests. The number of unique requests can be compared with the average total number of requests (download of Web page), which reached 76.89. This shows that most of the downloaded pages were actually "reloads" of previously visited URLs.

Over an entire session, the average number of possible or potential exposures of advertisement measured 132 (SD=130.01), but the number of actual exposures was not more than 13.69 advertisements (SD=11.61). This result means that the teenagers fixated on, and visually paid attention to, about 10% of the potential number of advertising exposures. The total effective (absolute) exposure time for these advertisements, over the entire session, was on average 14.5 seconds per session (SD=15234.1).

For each trial there was an average of 4.65 advertisements on a Web page. The average time for an "advertisement look" was 0.5 seconds, or slightly over 1 fixation of average duration (406.88 ms.), which is more than it takes to decode a very simple message.

We found that the exposure time differed between the different advertisement categories, with some receiving more attention than others. The top three categories: Ad links, Technology and Gambling. The teenagers are most highly exposed to these advertisements (see Table 3, average duration of actual exposure per advertisement category). The Food and drinks category received little attention from the individuals, about 0.7 seconds on average. The maximum dwell time was 2545.83 ms. and the minimum dwell time was 99.5 ms.

The study suggests a substantial difference between girls' and boys' actual exposure to Internet advertising. The average total duration of exposure for all advertisement categories for the teenage boys is 16.5 seconds, while the equivalent value for girls is 12.6 seconds. The graph in Figure 3 shows the average exposure time per advertisement category by gender. The gender differences are most noticeable in the categories Gambling, Ad links and Lifestyle and recreation. The boys are exposed between 30% and 60% more to advertisements in these categories than the girls.

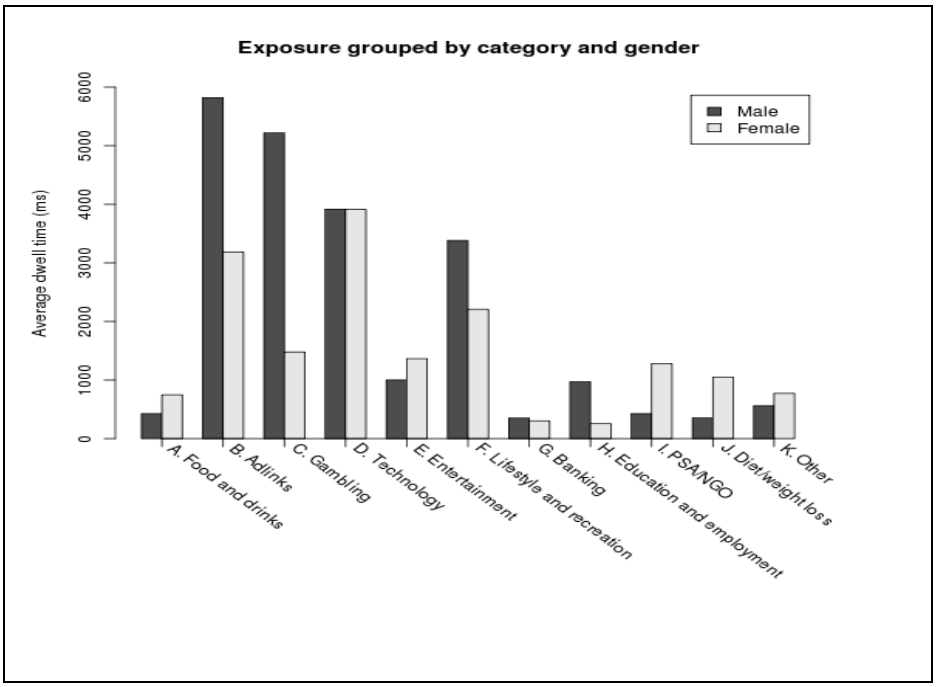

Figure 3. *Gender and Average Advertisement Exposure.*

Advertisement Impact

Eye tracking gives us the possibility of addressing questions about the efficiency or impact of advertising. Some of the advertisement categories occurred frequently in the material but still got a low total dwell time, which could be interpreted as a low impact for those categories. On the other hand, few advertisement instances and longer total dwell time could be interpreted as high impact. One way to operationalize our definition of advertisement impact is to compare absolute exposure to relative exposure, or the average duration of actual exposure with the average time of actual exposure related to the number of advertisement instances (relative exposure). The higher value of relative exposure, the higher the impact for that particular advertisement category.

Figure 4 presents a diagram of the impact of different online advertisement categories. It suggests that Food and drinks is the advertisement category that gives rise to the highest impact of the online advertisement categories in this study (with the exception of the category Diet/weight loss). The extreme relative value of the category Diet/weight loss is an outlier effect from one single individual who spent quite a while (9.77 seconds) looking at advertisements for diet products.

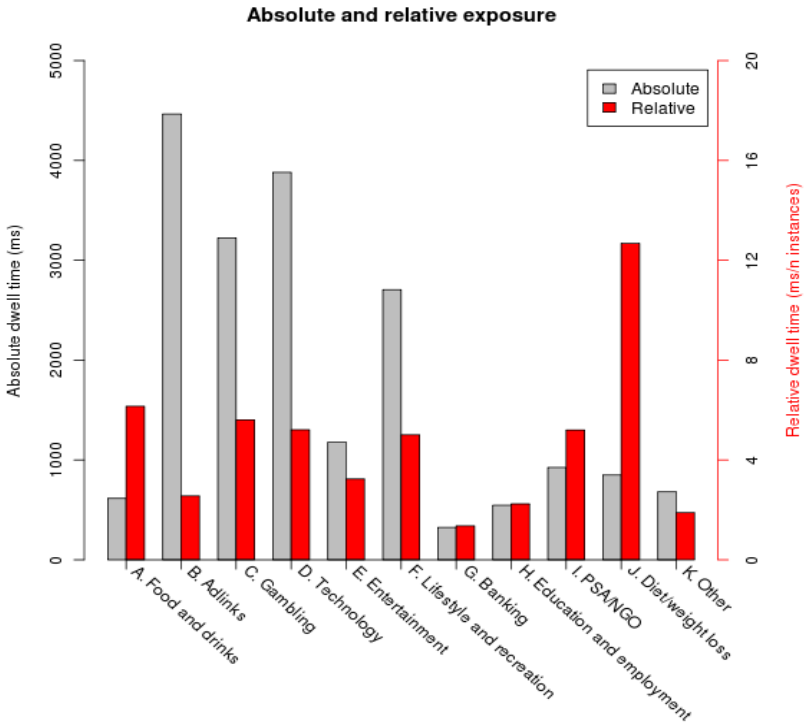

Figure 4. *Online advertising impact.*

We also found that the advertising attention varied between the teenage boys and girls (Table 4). Thus, girls paid more attention to the Food and drink category (average relative exposure 14.95 ms.) than did the boys (average relative exposure 8.52 ms.), while Lifestyle and recreation was the advertisement category that reached the boys (average relative exposure 22.70 ms.) most of all categories. The average relative exposure for this category among the girls was not more than 5.60 ms. The teenage boys' much higher attention to this category might be explained by the fact that some of the advertisements in this category contained female fashion models dressed in very little clothing or nothing but their underwear. The category for PSA/NGOs had a high impact on both girls and boys in Sweden.

Table 4. *Gender and Advertising Impact.*

Advertisement category	Relative exposure Boys (ms.)	Advertisement category	Relative exposure Girls (ms.)
Lifestyle and recreation	22.70547	Diet/weight loss	34.93883
PSA/NGO	19.34709	Food and drinks	14.95752
Gambling	18.50422	PSA/NGO	8.21492
Technology	16.59225	Technology	7.71480
Diet/weight loss	9.80563	Entertainment	6.43664
Food and drinks	8.52477	Lifestyle and recreation	5.60366
Education and employment	7.02300	Gambling	5.02765
Entertainment	6.63313	Ad links	3.79279
Ad links	6.42338	Other	3.76586
Banking	3.70592	Education and employment	2.41340
Other	3.54561	Banking	2.10359

Perceived Exposure

The interview transcripts presented below consist of a representative sample of the rich data collected (about 16 hours of video recording) and aims to describe teenagers' perceptions, experience, and awareness of the online advertising on the visited Web sites at a deeper level. In all of the quotes, the letter I represents the Interviewer and R represents the person being interviewed, the respondent.

The ET results presented above suggest that teenagers seem to avoid Internet advertisements efficiently. The retrospective interviews revealed that the students were fairly aware of where advertising is most often placed on the Web sites. At the same time, however, they seemed to be unable to distinguish advertising content from nonadvertising content. In several cases, they also found it difficult to identify the source of the advertisement and the product being promoted. The following quotations will show how this came out in the interviews.

Example 1 (R1 boy, school B)

I: Is there any advertising on this site? (www.sydsvenskan.se)
R: Yes.
I: Mm, where is it then?
R: Eh, there, everywhere sort of, there and there (pointing to advertisements on the screen)
I: There and there. Aha. Is this advertising then?
R: Yes.

I: What is being advertised?
R: I don't know, maybe cars? (advertising for credit loans)
[silence]
I: Is this an advertisement? (www.youtube.com)
R: Eh, yes.
I: Where? Can you point it out?
R: IQ test, there. (pointing to an advertisement on the screen showing a cartoon picture of Albert Einstein, a professor in white laboratory coat with a white chalk in his hand)
I: Oh, yeah, what is it advertising?
R: Eh, how one is, uh well, or how much IQ you have . . . ?
I: Mmm, who is the advertiser here?
R: Eh, Albert, Albert, eh, yes.
I: Albert?
R: Eh, yes, it says so.

Figure 5. *Online Ad with an Ambiguous Sender and Product. Several of the teenagers had a hard time understanding the ad. The text says: "How smart are you? Let Albert calculate your IQ. IQ-test. On blackboard: 'Click here.'"*

Example 2 (R2 boy, school A)
I: Is there any advertising on this Hockey League site? (www.hockeyligan.se)
R: Mm. . . .
I: There is? Where is it? Can you identify it?
R: At the far end of. . . . (pointing at the screen, at the top of the Web site)
I: There you go. Are there any others?
R: Up here too. (pointing at the screen, at the top of the page)
I: There you go, okay, hm. Are there advertisements in more places than at the top and bottom?
R: In the middle also, and here (pointing to an advertisement on the screen)
[silence]
I: How do you know that it is advertising?
R: It is, there is usually, advertising tends to be up there.
I: Okay, so it's the placement that you go for?
R: Mmm.
I: What is this advertisement for? (points to an instance on the Web site www.hockeyligan.se)
R: No idea. . . .

Example 3 (R4 girl, school B)
I: Haribo, what is that? (points to an advertisement on www.skaneboll.se)
R: It is one of those brands, the football team or something.
I: What?

R: You usually have it, eh, I've been on like that training camp and then have it on my shirt there.
I: Okay, do you know what is being advertised (aiming at Haribo)? Did you say it was a football team?
R: Nah, we have it as a logo.
I: You have it as a logo? Do you know what Haribo sells?
R: [silence]
I: They make candy.

Most of the students experienced the advertising online as a nuisance. They were irritated, annoyed and some also upset about it for various reasons. Internet advertising was of no interest to them. There was also some skepticism and distrust of advertising online. We recognize these attitudes from the previous surveys and from the in-depth interviews in this project as well. This can be an important reason why the teenagers deliberately avoid advertising as much as they can. In the interviews, the teenagers also described strategies they used to escape the advertisements online, e.g., they consistently look away, deliberately try to stay alert and avoid being seduced by concentrating on the task, and they hold their hands and arms up blocking the screen to avoid seeing the advertisements. Others declared that they immediately click to a new link or simply close down the advertisements that are obtrusive. Seventy-six percent of the respondents reported in the survey that they avoid advertising on the Internet (Ekström & Sandberg, 2010). It is clear that there is huge resistance to Internet advertising among teenagers.

Example 1 (R2 boy, school A))

I: There is quite a lot of advertising on this page (www.hockeyligan.se). Have you ever thought about it, when you're on this site?
R: Nah, I notice mostly the bigger ones out there in the margin.
I: Mm, they don't bother you?
R: Well sometimes . . . yes
I: In what way do they bother you?
R: Eh, you know when reading and there are pictures moving about. . . .
I: Mm.
R: So, you can't keep your eyes still.

Example 2 (R5 girl, school A)

I: How come you don't look at this advertising? This . . . yet it is so big? (points to an advertisement for www.bilddagboken.se) How come?
R: You know I am not interested, and there are more important things like friends and things far more important than advertising.
I: Aha.

Example 3 (R3 girl, school A)

I: Do you click on the advertisements?
R: No way, I will not click on advertising, a lot of windows and stuff just open, it gets on your nerves, like.

I: Do you actually think when you access a Web site that you will pay no attention to the advertising; is it something that you intentionally do?
R: Eh, you know for me it's just advertising, eh, like a bunch of lies.
I: Yeah?
R: If I see an offer, buy three for one, then I know that, then if I buy three for one, and then later there will come one every month, higher price, it just keeps coming and it gets worse and worse, so there's no point, that's the way it is.

Example 4 (R6 boy, school A)
I: Have you thought about it, that this here is also like an ad, a little box with sponsored links?
R: Nah, not . . . well, not really. . . .
I: Yes. It does not happen to you that you click here on this type of advertising?
R: I never click on that kind of thing . . .
I: You don't. Why don't you?
R: I guess I've gotten used to it and that this is just sort of rubbish.

Although the teenagers are somewhat aware of advertising placement and although they have negative attitudes about it, the results of the eye movement recording evidenced that they actually look at advertising to a certain extent. The amount of advertising online is very large in relation to how much the teenagers actually note (about 10%). The Internet offers a very competitive advertising environment, and with so much competition from different advertisers as well as other simultaneous media content, it will of course be important to be the advertisement that gets attention. The retrospective interviews showed that the teenagers are not fully aware of the advertisements they actually view. Several subjects could not at all recall looking at a particular advertisement shortly after exposure.

Example 1 (R4 girl, school B)
I: What is that in the middle? (pointing to a McDonald's advertisement at www.aftonbladet.se)
R: I don't know.
I: Do you remember that you looked at the picture?
R: Maybe.
I: It's an advertisement for food. Do you know what kind of food?
R: [silence]
I: Hamburgers.
R: Mm . . . .
I: McDonald's, I believe. You don't remember watching it?
R: [silence]
I: What made you pay attention to it? Did anything move in there somehow?
R: I don't know, maybe. . . .

Example 2 (R6 boy, school A)
I: Do you look at advertising here?
R: Yes, I do, a bit on the side.

I: Here you see that your eyes have actually moved out and looked at it. Do you remember that you watched this advertisement?
R: Yes, now that I see it I remember it, but otherwise I would probably not recall it.

Example 3 (R7 girl, school B)
I: What is this up here? Are there any advertisements?
R: Well yes that's true. There, I really didn't notice. I didn't even think about it.
I: Yes. But you've also looked at it.
R: It's possible, but I haven't seen . . . not been thinking about it, sort of.

Example 4 (R3 girl, school A)
I: We can see here that you actually looked at the advertisements. . . .
R: Oh really, I don't care much about advertising, eh, you know, I haven't read it, you know, maybe just had a glance at it.
I: Here, you see, in this case you have looked four times at this advertisement, or you looked four times but in different places. Do you remember this?
R: You know I don't look at advertising, so it's a bit, nah . . . I don't know.
I: And you do not remember now, when looking at it sort of, if there was something special that captured your interest or anything?
R: Nah.

The retrospective protocols revealed that there was a substantial difference between the children's actual and perceived exposure to advertisements. First, the children proved to be uncertain about what Web material contained commercial messages. Second, the children perceived the advertisements as disturbing, not interesting, and not to be trusted. Third, the retrospective protocols revealed that the children were not aware of their actual exposure, as recorded by the eye-tracking equipment. A conclusion from the analysis of the retrospective interviews is that even though the teenagers efficiently try to escape the advertisements on the Internet, they do not manage to escape them all, and the ones to which they evidently pay attention are not always recalled. To put it briefly, the teenagers in this study seem to be unaware of their exposure to advertising on the Internet.

Discussion

The aim of this analysis was to discuss teenagers' exposure to and perceptions of Internet advertising with a particular focus on food advertisements. In order to capture the potential as well as actual exposure to online advertising, teenagers' eye movements were measured while they surfed the Internet. Retrospective interviews have also been carried through with the intention of getting a deeper understanding of the teenagers' awareness of online advertising.

Even though we are dealing here with people who take the Internet for granted, and who are experienced Internet users, our study suggests that the Internet is a demanding environment for the teenagers to maneuver. The average duration of a fixation on the Internet was estimated at more than 400 ms. The Internet is a tricky environment for teenagers to the degree that it takes time and energy to

sort out the good information from the bad, and to identify and distinguish what might be considered to be "rubbish" (e.g., advertisements) from the media texts of interest to them.

The Internet is flooded with advertising. In the 39 15-minute sessions of Internet activity we identified a total of 5,161 Internet advertisements. A third of these advertisements were Ad links promoting other sites on the Web, but other important categories were advertisements for Technology (electronic devices and hardware), Gambling, and Lifestyle and recreation. Food and drinks came out as a rather small category in relation to the total number of advertisements. However, approximately half of the food and drink advertisements that appeared on the Web during the ET recordings were for unhealthful food such as sweets, soda drinks and hamburgers, in line with other research. Yet, what is more fundamental is that our ET data suggest that it was the Food and drink advertisements that, according to our definition, captured most of the teenagers' visual attention. Subsequently, even though the instances of food and drinks advertisements were few, the ones that were identified received a lot of attention from the teenagers, relatively speaking. This was an unexpected result but an important one to consider in relation to public health and in the ongoing policy debate about advertising/marketing regulations and childhood obesity. The question remains as to why these advertisements had the highest impact, particularly considering their infrequency. One reason, a simple one, might be rarity. The very fact that food and drinks advertisements are infrequent in comparison to some of the other advertising categories makes them stand out in the flow of advertisements. The high impact might also be explained by the fact that the teenagers are more familiar with food than with some of the other categories, and by the fact that food is more relevant to them than banking, education, and employment, for instance. In addition, these teenagers buy food and drinks on a regular basis with their own pocket money but they spend money less often on computer hardware, cameras, cars and travel. So the teenagers' presumed better knowledge of, and interest in the category of food and drinks could in part explain their attention to it, and consequently also the high impact.

Our results suggest that the teenagers have developed strategies to efficiently avoid Internet advertisements. This was indicated by both the retrospective interviews about perceived exposure and the eye-tracking measurement of actual exposure. The large majority of the online advertisements never received any attention from the teenagers. The ET study indicates that during the 15-minute session of free surfing, the average teenager faced 132 potential exposures to advertisements. The number of actual exposures was slightly fewer than 14. The teenagers were exposed to approximately 10% of the online advertisements, with an effective exposure time of 14.5 seconds on average. Compared to the time spent on non-advertising content, this represents only 1.6% of the total time for the session (15 minutes), which strongly suggests that teenagers use avoidance strategies.

The use of avoidance strategies could be explained by the teenagers' Internet surfing expertise and their use of parafoveal vision. The classroom survey data show that the teenagers are highly skilled Internet users spending several hours on the Internet each day. With that amount of Internet usage, it is likely that they have developed a mental representation of the structure of Web sites and know where to expect advertisements to appear in this structure (Drèze & Hussherr, 2003). This is also suggested by the retrospective interviews. Such expertise in a specific activity is also known to increase the viewers'

functional visual field, thus the ability to make use of parafoveal vision (Reingold et al., 2001). The extended parafoveal vision and the salient visual features of advertisements would enable the teenagers to recognize advertisements without looking at them directly. The underlying cognitive and visual processes of avoidance strategies should be the subject of future research.

It is difficult to say whether this amount of actual exposure is substantial or not. It is also hard or even impossible to determine whether the exposure time is high or low, because we have no equivalent data yet for comparison. The figures for actual exposure might be considered high, in view of the high information density on the Internet. Coming across in such an information-rich media is not easy, as the teenagers' negative attitudes toward advertising in general and online SMS ads, in particular, (Ekström & Sandberg, 2010) make it increasingly difficult for advertisers to connect with the assumed target group.

The average attention paid to an advertisement was estimated at 0.5 seconds. This is considered to be a fairly long time in ET research, since it takes less than 0.1 seconds to take in and process basic information (e.g., a word), which is the first crucial step in any persuasion process. Given that, the probability of the teenagers being influenced by online advertising to which they attend is high. Precisely the fact that they have visually paid attention to advertisements during a certain amount of time, measured and demonstrated in our study, confirms that the teenagers have been influenced in some way. Our research design does not allow us to make any conclusions about the sort of influence. Advertising effects should not erroneously be understood as positive attitudes to a certain brand, nor as higher brand recognition or intention to buy the product. Advertisement exposure might trigger desired as well as unwanted effects. What makes the situation more complex is the fact that the teenagers in this study reported in the retrospective interviews modest recall of the advertisements to which they had been exposed. They demonstrated a low awareness of the actual exposure.

Denial of advertising exposure is not unusual. Most people do not admit to looking at advertising or being influenced by advertising. However they are often eager to talk about friends or acquaintances who enjoy watching commercials and are seduced by offers and products for sale. This was also true for our teenagers. In the literature, this is referred to as a third-person effect (Grusell, 2008). This theory identifies a considerable distinction that we make between ourselves and others, and it becomes particularly evident in the characteristics that are seen as not being good for one's self-image. It also holds for media content that is perceived as unacceptable or questionable (e.g., extreme political views, violence, and pornography). The distinction between self and others is then often reinforced. In the retrospective interviews, the teenagers had a hard time admitting or realizing that they paid attention to advertisements online, even when faced with the evidence from the ET recording. For some of the teenagers, this came as a revelation. They were largely unaware that they were exposed to advertisements online, a topic they had hardly reflected upon before participating in the study. Some of the teenagers who regarded themselves as critical had a hard time accepting what the data revealed to them, as attending to advertising was simply not in line with their self-identity. In the classroom survey (Ekström & Sandberg, 2010) we asked the teenagers some weeks before the ET study if they could remember having seen advertisements on the Internet and if so, what kind of advertisements. We were surprised by the concordance of the data reported in the survey and the findings in the ET study. Twenty

percent of the students remembered online advertisements and the examples mentioned in the survey (e.g., mobile phone subscriptions, insurances, cheap travel, computer games, Coke, ringtones, cosmetics, Web sites, weight-loss pills, Party-poker and BET365 gambling, movies, casinos and so on) all fitted neatly into the advertising categories we had identified on the sites visited by the teenagers during the ET sessions. No conclusions can really be drawn from this, but it seems as if the Internet advertising makes an imprint on the teenagers no matter how negative they are toward it.

Our eye-tracking study also identified another important result concerning differences between boys' and girls' advertising exposure. Boys are exposed to between 30% and 60% more advertisements in some categories than girls. The discrepancy in the total effective exposure time could be explained in at least two ways. Either the girls tended more to visit Web sites that contain less advertising or they have developed more effective strategies to avoid advertising. We strongly suggest a future ET study with a special focus on this issue. We know that boys' and girls' access to computers differs. It is more common for boys to have computers of their own (Medierådet, 2009; NORDICOM-Sweden, 2009). It is also more common for boys' Internet usage to be unrestricted or unsupervised by parents, while girls frequently report having different regulations. Girls' usage time is also often restricted, which might actually cause the girls to become more efficient Web users. One's activities performed on the computer will probably become more focused and efficient if one has only limited access to the computer. There is simply no time for the girls to explore new Web sites, clicking on whatever pops up. Consequently, they develop strategies to avoid online advertising, which only distracts them from what they set out to do. The boys, on the other hand, might be more exposed to advertising because of a more exploratory and more audacious use of the Web than the girls. The boys are perhaps not encouraged to be careful on the Web, as are girls, but are rather encouraged to explore and try things out, particularly as they also have more access to computer technology and Internet time at home. The boys in our study take more risks online, they explore new Web sites and do not hesitate as much as the girls to click on a new link. However, the girls report being more careful and stick to familiar sites and the ones that have been agreed upon by their parents. This is reported in the classroom survey as well as in the in-depth interviews (Ekström & Sandberg, 2010).

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