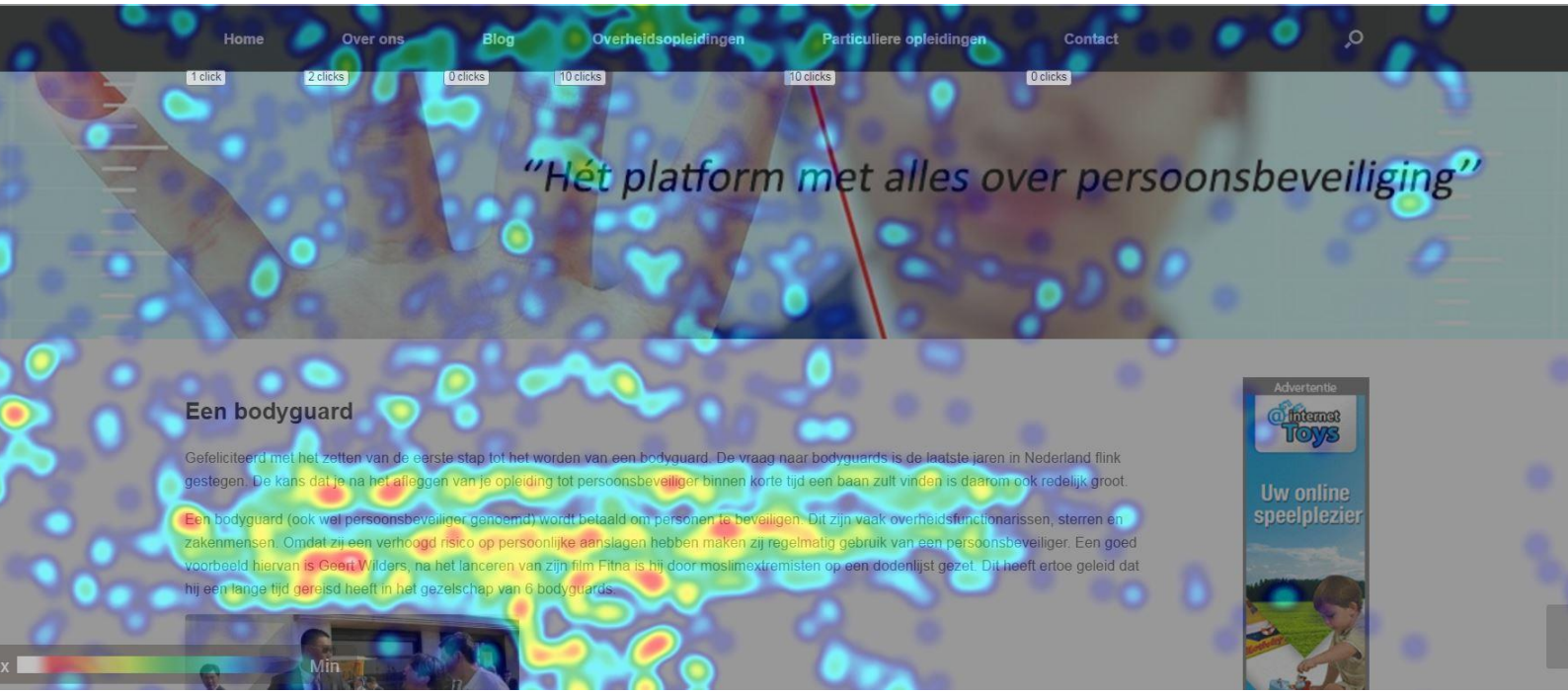
Attention as a Currency for Online Advertising

Making Advertising Publishers Excel Within the New Attention Based Performance Metric



Master Thesis

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ABSTRACT

A natural field experiment was conducted on a live Dutch website. Over the course of 15 weeks the mouse-movements of 450 subjects were tracked. Several tests ascertained the effect of the of animation, size, position, the degree of distinction, the length of exposure and browser usage on the attention that consumers devote to online advertising banners. The study found that consumers are much more likely to pay attention to an advertising banner that is positioned on the left side of the page than to an advertising banner that is positioned on the right side of the webpage. Left positioned banners are also noticed earlier than right positioned banners, as are large banners compared to small banners. Additionally, the likelihood of a consumer paying attention to an advertising banner increases with every second that a consumer spends on a website. An advertising publisher should therefore focus on positioning its advertising banners on the left side of the webpage and on keeping consumers engaged for a longer time.

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MANAGEMENT SUMMARY

Online advertising is a large industry with performance metrics that haven't changed for years. Advertising publishers either get paid for each website visitor who clicks on an advertising banner or for every 1000 impressions. Because these metrics are rather flat, several media organizations have proposed a metric that is better in capturing what advertising is about; attention. In the current economy our attention is a scarce and limited resource, those who can capture more of should be able to charge more for it. Prior research into Yellow Pages and magazines has shown that the attention that consumers devote to advertising banners can be influenced by features like the advertising banner's position, its size and the size of the brand logo and textual content within the advertising banner. This thesis study aims to increase our understanding of how one can effectively use animation, size, positioning and distinction to increase the attention devoted to online advertising banners and thus, generate more revenue within this new attention based metric. A natural field experiment was conducted on a live website that provides its visitors with information about being and becoming a bodyguard. Over the course of 15 weeks, the mouse-movements of 450 subjects were tracked. Eye-movements and mouse movements are known to be highly correlated which means that tracking one's mouse movements can tell provide insight into what consumers devoted their visual attention to. Five slightly different advertising banners were displayed on the website and rotated every week. While keeping all other variables equal, I was able to infer that changes in attention are the causal effect of the differences in the advertising banners. The experiment was able to measure the differences in attention between a static and an animated banner, a small and a large banner, a banner on the right side and a banner on the left side of the page, a banner that contains a grey distinctive border with the headline ''advertising'' above it and a banner that does not contain this border. The mouse-tracking software tracked 3 key variables; the amount of subjects within a group who paid attention to the advertising banner (fixations), the length of the engagement (dwell time) and how long it took before the subjects devoted their attention to the advertising banner (time until the first fixation). Other predictor variables next to the previously mentioned advertising features are the amount of seconds that a subject spent browsing the webpage and the web browser that the subject used during its visit. A binary logistic regression was performed and found that the likelihood that a consumer devotes its attention to an advertising banner is influenced by the position of the advertising banner, by the amount of time that the consumer spent browsing the webpage and whether or not the consumer uses Internet Explorer. When the banner is positioned on the left side of the page, a consumer is 3,69 times more likely to pay attention to an advertising banner than when the banner is positioned on the right side of the page. Additionally, this likelihood increase for every second extra that a consumer spends on the website. Users of Internet Explorer are rather advertising avoidant considering that they are much less likely to pay attention to an advertising banner than users of other web browser. Consumers engage with large banners for longer than small banners and the position and the size of the banner significantly influence the time until the first fixation. A banner on the left side does not only draw more attention; it also catches a consumer's attention earlier than a banner on the right side of the page. Advertising publishers are advised to prefer the left side of the webpage in regard to banner placement and to keep consumers attracted for a longer time by providing quality content.

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1. INTRODUCTION

Online display advertising is a multibillion dollar industry that has experienced a steady growth since the introduction in the late 90's[1]. The global expenditures for 2016 are expected to grow by 4,6% to an estimated amount of 182 billion US dollars[2]. The majority of the websites that publish advertising banners are either paid for each visitor who clicks on an advertising banner (CPC[3]) or for every 1000 impressions (CPM[4]). Both of these pricing models are often criticized for being flawed due to their flat reward structure. The CPC model undervalues a website's visitors who pay a lot of attention to advertising banners but do not click on them and the CPM model overvalues visitors who are exposed to advertising banners but do not pay any attention to them. Next to that, large scale impression fraud has led to a major increase in the supply of advertising impressions[5]. This increase has shifted the equilibrium of supply and demand which has led to lower prices being paid for advertising impressions. Several media organizations like the Financial Times, The Economist and Forbes have decided to drop these metrics. Instead of using clicks and impressions they proposed to start charging their advertising partners for attention. After all, capturing one's attention in order to form or change one's cognitions or affections towards a brand is one of the main objectives of advertising. The proposal to use attention as a currency for online advertising has recently been approved by the Interactive Advertising Bureau, a non-profit organization that sets the standards for digital advertising. The objective of this thesis study is to find out how an advertising publisher can make its advertising banners perform better within this new attention based metric.

In the current economy, attention is the single most important determinant of business success. Nowadays there are so many things that compete for our attention that it has become one of the scarcest resources (Davenport 2001). Attention has a positive influence on brand preference (Pieters & Warlop 1999 and Janiszewski 1998) and brand memory (Janiszewski 1998, Botta et al. 2010, Schmidt et al. 2002). This means that an advertiser who is able to capture more attention is more valuable to a brand than an advertiser who captures less of it. Prior research has shown us that the attention that consumers devote to advertising can be manipulated. Consumers who use Yellow Pages[6] devote more attention to large advertising banners, banners on the left side of the page, banners that contain color and banners that contain images (Lohse et al. 1997). The recent approval of attention as an online advertising metric has created a demand for this knowledge in relation to online advertising. By performing an experiment, I aim to ascertain how an online advertiser can make consumers devote more attention to online advertising banners. I will test the causal effect of certain featuress that are used to display advertising banners such as the size, the position, the presence/absence of animation and how visually distinctive the advertising banner is. The major research question for this thesis study is:

How do different features in online advertising banners affect the attention that consumers devote to an advertising banner?

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[1] Source: https://www.iab.com/wp-content/uploads/2016/04/IAB-Internet-Advertising-Revenue-Report-FY-2015.pdf

[2] Source: http://www.zenithoptimedia.com/wp-content/uploads/2015/12/Adspend-forecasts-December-2015-executive-summary1.pdf

[3] CPC = Cost per Click – an advertising publisher is paid for every visitor who clicks on an ad

[4] CPM = Cost per Mille – an advertising publisher is paid for every 1000 people who visit a page where the advertising banner is displayed

[5] Impression fraud is the practice of letting bots crawl a website to rack up the amount of advertising impressions

[6] Yellow Pages is the U.S. equivalent of de Gouden Gids

Much academic research has been done in an effort to unravel how one can increase the effectiveness of advertising. A few examples of the theories that were constructed from these studies are the use of means-end-chains in TV advertising to link consumer values with product attributes (Walker & Olson 1991); the use of color, imagery, size and position to increase the attention devoted to Yellow Pages advertising (Lohse et al. 1997) and the use of certain ratio's between brand element size, text size and pictorial size in magazine advertising to increase the attention devoted to the advertising banner (Pieters & Wedel 2004). Popular academic journals in this field of study are the Journal of Consumer Research, the Journal of Advertising and the Journal of Advertising Research. The implications of this thesis are expected to fill up a gap in this stream of literature by providing an in-depth analysis of the performance of online advertising in relation to attention. The implications of this thesis are also expected to be of great value for advertising publishers. Advertising publishers, like Forbes, The Economist can use the implications to increase the revenue they generate from advertising.

This thesis experiment will measure the influence of animation, size, position and distinction on the attention that consumers devote to online advertising banners. The remainder of this thesis is as follows. The first section contains a neurological approach of the attentional process, a review of attention research and the hypotheses. The second section contains an explanation of the experimental design and the number of observations. In the third section the methods of data analysis will be explained. This section is followed by the fourth section that contains the data analysis and general discussion. The fifth section contains the conclusions and the managerial implications and is followed by the sixth, last section that contains the managerial implications.

2. THEORY AND HYPOTHESES

This chapter contains a review of literature into attention research. The neurological processes that drive one's attention are explained in the first sub-section. The second sub-section contains a review of prior research into attention and describes the methodology of attention research. The sub-sections that follow contain additional literature regarding attention research that lead to the formulation of the hypotheses and the last sub-section contains an overview of all the literature into attention research.

2.1 A NEUROLOGICAL APPROACH TO ATTENTION

When people observe an image or an environment, they do not pay attention to every object that is present. Paying attention to things and subsequently processing information costs time and cognitive energy. This cognitive energy is known to be a constant and limited resource (Clarke & Sokoloff 1999 and Attwel & Laughlin 2001) which means that it is scarce and that consumers only tend to pay attention to selective parts that they find to be of value to them (Carrasco 2011). The neurological process behind attention has two main components. The first component is a controlled, top down component that shifts a person's attention based on features like orientations, colors or directions of motion and is often described as feature based attention (Maunsell & Treue 2006). The second component of attention is an uncontrolled, bottom-up component that involuntarily directs a person's attention based on salient stimuli within the visual field (Schmidt et al. 2002).

When a person executes a search query on Google, he or she does this to find information about a certain subject. While doing this, a person engages in a visual search task. The consumer might not know the exact location of what he or she is looking for but often has knowledge of, or has expectations about, one or more features of what he or she is looking for (Carrasco 2011). This person will then scan the environment and the controlled component directs this person's attention to objects that possess these features. It is very similar to losing a friend in the crowd during a concert. You might not know exactly where in the crowd your friend is but you do know some of his physical features such as his red hair and above average height. When searching for your friend you will look over the crowd and rapidly scan for every tall guy with red hair while you simultaneously dismiss the presence of every person that does not fit these criteria. However, certain events that are salient, like a loud noise, a colored sign or a sudden unexpected movement can disturb this visual search task and involuntarily draw one's attention to this event. This is the second component of attention that is capable of involuntarily shifting a person's attention to a salient object or event (Folk & Peterson 2001, Nakayama & Mackeben 1989 and Carrasco 2011). Within this second component of attention, salient stimuli are picked up by peripheral vision which is followed by the brain involuntarily guiding the eyes towards this stimulus. A salient stimulus is an object or event that stands out due to a contrast between this stimulus and its environment. An example of this is a red square between a lot of blue squares or a loud noise in a quiet hall (Underwood & Foulsham 2006). Salient objects are picked up earlier than less salient objects. For example, a red square amongst a lot of green squares is easier and faster to find than a red square amongst a lot of squares that are a slightly darker shade of red, just like the tall red haired friend would be easier to find in a crowd than a dark haired friend who has an average height. Visual salience, thus, depends not only on the object itself but it depends on the relationship between the object and its environment. All other objects in the environment are

possible competitors for a consumers' attention. If all competing objects in an image are, from a theoretical point of view, more salient, then paradoxically they are all less salient at the same time.

(Visual) salience is often used in marketing to draw the attention of a consumer to a specific object. Examples are flashy store signs, large highway billboards and extraordinarily loud TV commercials that make you wonder if you accidentally sat down on the volume button of your TV remote. The concept of visual salience has been broadly studied, features like color, orientation, size, spatial distance or a conjunction of these features influence the degree of visual salience (Treisman & Gelade 1980, Itti & Koch 2000 and Carrasco 2011). How visually salient objects are, also has important implications for marketing and advertising. More salient objects are easier retrieved from memory than less salient objects (Pooresmaeili et al. 2014, Fine et al. 2009). For advertising banners this implies that increasing a banner's degree of salience will improve brand recall.

2.2 EYE TRACKING METHODOLOGY AND RESEARCH APPLICATIONS

Attention is measured by tracking a consumers' eye movement patterns. While scanning an environment or an image, the eyes make rapid scan movements, saccades, that are separated by fixations. Saccades are short, fast movements that guide the eyes from fixation point to fixation point that range in duration from 10 to 200 milliseconds. Saccades are so fast that people are temporarily blind during a saccade and therefore do not process the objects that the eyes pass (Shebilske & Fisher 1983). A fixation occurs when the retina stays stable and focused on an object for more than 200 milliseconds. The duration of this fixation is called the dwell time. A fixation is an indicator of cognitive load. When someone fixates on an object he or she starts to process it and sends information to the brain. Devoting more or longer fixations to a region means that more cognitive effort is being exerted on that region (Duchowski 2007). When reading an academic text, consumers showed longer fixations for infrequent words and words that contained a lot of vowels which implies that processing complex things require longer fixations (Just & Carpenter 1980).

Eye tracking is often used for several economical and psychological research applications. In 1997, a group of researchers tracked consumers' eye movement patterns when browsing for a supplier in Yellow Pages (Lohse et al. 1997). This study tried to ascertain which advertising features cause people to notice an advertising banner, whether people follow a particular order while scanning the advertising banners and how these advertising features influence the dwell time. A different study tracked consumers' eye-movements while browsing the magazines Allerhande and Cosmopolitan (Pieters & Wedel 2004). This study tried to ascertain the effects of brand logo size, pictorial size and text size on the attention devoted to advertising banners in the magazines. A third study tracked the attention that adolescents devoted to warning messages on beer and cigarette advertising banners (Fox et al. 1998). This study tried to determine whether adolescents look at beer and cigarette advertising warnings and if there are differences between both. Next to these applications, eye tracking has been used to measure the attention devoted to NASCAR vehicle advertising[7], brands on a supermarket product shelf (Pieters & Warlop 1999) and words in an academic text (Just & Carpenter 1980).

7 A study executed by Clemson University students – mentioned by Duchowski in his book Eye Tracking Methodology (Duchowski 2007).

2.3 MOUSE TRACKING AS A PROXY FOR EYE-TRACKING

A major downside of eye-tracking is that the experiments have to be executed in the lab and that the equipment is very expensive. To conduct an experiment, the equipment needs to be bought or leased, subjects need to be invited to the lab and the equipment needs to be calibrated. One can conclude that eye-tracking studies are therefore very difficult to execute at large scale. This is clearly visible when one assesses the amount of subjects in the eye-tracking studies that were mentioned in the previous sub-section. The study into Yellow Pages by Lohse et al. was done with 28 subjects, the study into magazine advertising by Pieters & Wedel was done with 33 subjects and the study with words in an academic text was done with only 14 subjects. Additionally, it is technologically impossible to track the real life eye-movements of a random consumer who browses the internet. Therefore, eye-tracking is not suitable to serve as a measuring method for online advertising performance.

The online research equivalent of eye-tracking is mouse-tracking. Mouse movements serve as a proxy for interest because they are highly correlated with eye-movements. Several studies that attempted to determine the correlation between eye-movements and mouse-movements found correlation coefficients ranging from 0,64 to 0,92 (Chen et al. 2002, Johnson et al. 2012, Rodden & Fu 2007). The mouse visits around 84% of the regions that are also visited by the eye (Chen et al. 2002). Despite mouse tracking being relatively novel, it has been used before to measure attention devoted to advertising banners in emails (Goldstein et al. 2014) and user experience in web-content (Navalpakkam & Churchill 2012).

Eye-movements and mouse-movements are not perfectly correlated. This lack of perfect correlation can be attributed to a small portion of consumers who browse a website without moving the mouse. These consumers have a tendency of placing the mouse on an empty space and merely use their eyes to scan the content while using the mouse wheel to scroll up and down (Rodden & Fu 2007). Nevertheless, mouse-tracking does provide one with the opportunity to execute large scale experiments in an online environment. In online research, mouse tracking brings us another step closer to a more comprehensive and accurate measure of advertising effectiveness. Mouse tracking will also be used as a data gathering method in this thesis experiment.

2.4 ANIMATION IN ADVERTISING BANNERS

Animation in advertising banners is often employed to grab a consumer's attention by appealing to the salience sensitive component of attention. The flashing images, often aided by bright colors are a strong salient stimulus in a static environment such as a website. Someone who creates an animated advertising banner can determine both the amount of images within one loop and the speed of the images following up on each other. In emails, animated advertising banners draw significantly more attention than static advertising banners. Animated banners are fixated on more often and for a longer duration (Goldstein et al. 2014). I expect that these research results will also hold up for animated banners on web pages. I expect that their high degree of saliency will cause them to be noticed earlier and by more consumers than a static advertising banner, hence the hypotheses:

H1a: *An animated advertising banner will receive more attention than a static advertising banner*

H1b: *An animated advertising banner will receive attention earlier than a static advertising banner*

I also expect that consumers will dwell over the animated banner longer than the static banner. Essentially, an animated banner consists of multiple static banners that follow up on each other rapidly. Because each image contains a new piece of text the animated banner contains more textual content than the static banner.

The static banner that is used for this experiment only contains one image with the text:

- Uw online speelplezier

whereas each animated banner contains 3 images where the text changes with each image:

- Uw online speelplezier (image 1)
- Altijd de scherpste prijzen (image 2)
- Enorm aanbod en snelle levering (image 3)

Consumers who pay attention to the animated advertising banner have more textual content to process than the static banner. As the image below shows, consumers dwell on nearly all the words while processing textual content (Just & Carpenter 1980). It is therefore undisputable that processing the three slogans of the animated banner takes a consumer longer than processing the single slogan of the static advertising banner. Therefore, I expect that the dwell time for the animated banner is longer than the dwell time for the static advertising banner, hence the hypothesis:

H1c: *The length of attention spent on an animated advertising banner is longer than for a static advertising banner*

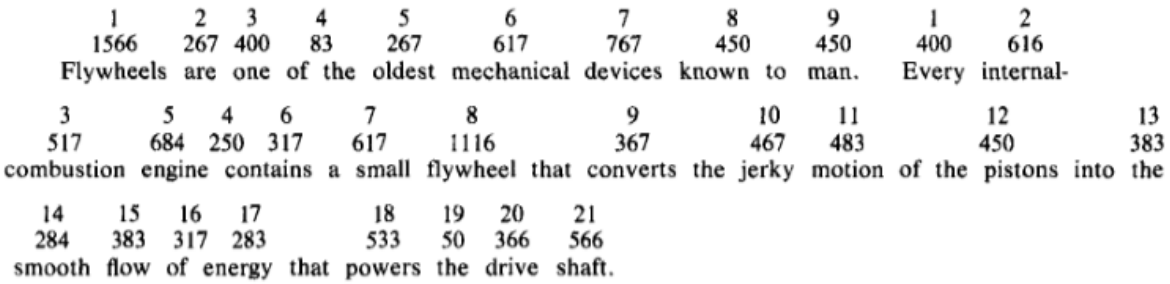


Figure 1 The mean dwell time in milliseconds for each word in an academic phrase – an experiment conducted among 14 students by Just & Carpenter in 1980

2.4 SIZE AND ATTENTION

When browsing Yellow Pages, significantly more consumers devote their attention to large advertising banners than to small advertising banners (Lohse et al. 1997). Size is also known to be a positive determinant of visual salience (Treisman & Gelade 1980, Itti & Koch 2000 and Carrasco 2011). This implies that large advertising banners will be noticed by more consumers and that they will be noticed earlier than small advertising banners, hence the hypotheses:

H2a*: A large advertising banner will receive more attention than a small advertising banner*

H2b: *A large advertising banner will receive attention earlier than a small advertising banner*

A larger advertising banner also means that the eyes need to cover more surface in order to retrieve information to be processed. Logically, this would imply that an increase in banner size leads to an increase in the length of attention. The study into Yellow Pages found that advertising banner size was a determinant of advertising viewing time (Lohse et al. 1997). However, the researchers also noticed that their subjects spent equal time viewing each page. The presence of a larger advertising banner means that there is less space left for other ads which, in turn, means that the viewing time per page can be distributed over less ads, resulting in a higher viewing time per advertising banner. Thus, one can conclude that viewing time is influenced by a combination of advertising size and the amount of advertising banners per page. Based on these findings, I expect that a larger banner size leads to an increase in the length of attention necessary to cover and process the information.

H2c: *The length of attention spent on a large advertising banner will be longer than for a small advertising banner*

2.5 THE INFLUENCE OF POSITION ON ATTENTION

Consumers are known to browse Yellow Pages in alphabetical order. Advertising banners on the left side in Yellow Pages page draw more attention than advertising banners on the right side (Lohse et al. 1997). This effect does not only occur in Yellow Pages but has also been found in magazine advertising (Pieters & Wedel 2004).

Additionally, in 2006, the Nielsen Norman Group measured how consumers allocate their attention on the Google Search results page (Nielsen Norman Group 2006). This study found a clear F-shaped scan pattern on the Google search results page. As the heat map image below shows, consumers devote far more attention to content on the left side of the search results page than to content on the right side of the page.

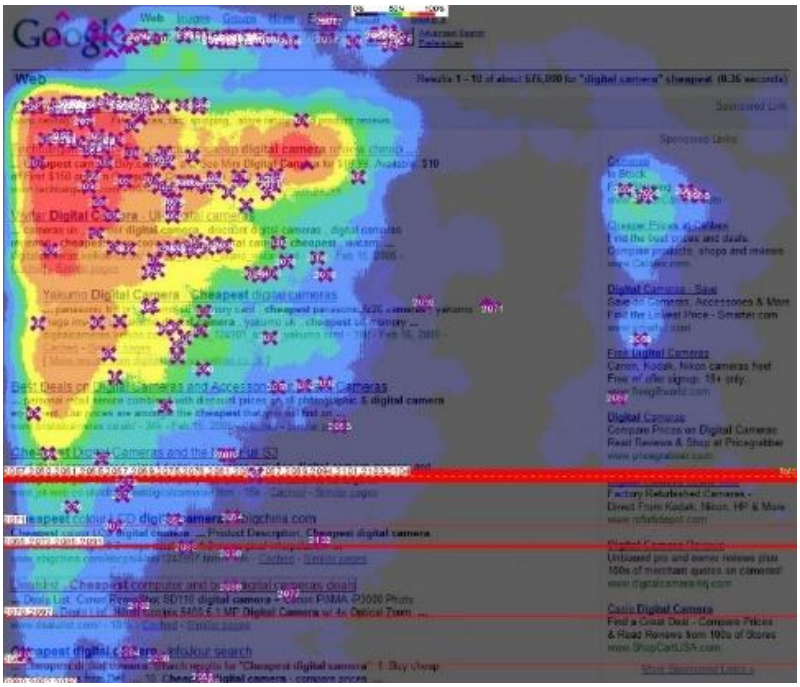


Figure 2. The F shaped pattern of visual attention on the Google's search results page – a study by the Nielsen Norman Group in 2006

This repeatedly occurring effect is often attributed to reading habits in western languages. People in western languages are used to read from left to right. Therefore, when opening a webpage, a Yellow Pages catalog or a magazine the focus of one's attention will be biased to the left side. Objects on the left side are therefore noticed earlier and more often than objects on the right side.

Considering that this effect is repeatedly found in academic studies, I expect that the reading habits will also bias a consumer's attention on web pages to the left side. I therefore expect that an advertising banner on the left side of the page will both be noticed earlier and by a higher amount of people than an advertising banner on the right side of the page.

H3a: *An advertising banner on the left side of the page will receive more attention than an advertising banner on the right side of the page*

H3b: *An advertising banner on the left side of the page will receive attention earlier than an advertising banner on the right side of the page*

2.6 ADVERTISING DISTINCTION AND ADVERTISING AVOIDANCE

Recently, the most popular ad blocking software named Adblock Plus (hereafter referred to as ''ABP'') launched an acceptable ads program. ABP does not consider each advertising banner equally intrusive and wants to contribute to making the internet a better place altogether. Therefore, they will allow certain non-intrusive advertising banners[8]. To be accepted in this program, one's ads need to comply with several demands. Animation, pop-up effects, attention grabbing colors and other rich media effects are not allowed. One of the other demands is that the advertising banner needs to be distinctively marked as an advertising banner by a surrounding border headlined with the word ''advertising'', as explained in the image below.

Figure 3. ABP requires advertising banners to be highly distinctive from the main content that can be done by creating a border around the advertising banner (left). Making the advertising banner blend in with the main content by removing this border is forbidden (right)

[8] Adblock Plus Acceptable Ads Program - https://adblockplus.org/acceptable-ads

It is widely known that some advertising publishers engage in a grey-hat performance tactic called ‘’click baiting’’. Click baiting is the practice of tricking visitors into clicking on an advertising banner by removing the previously mentioned border and headline that makes the advertising banner distinctive and/or by placing the advertising banner in the middle of the content. By removing the distinction, it becomes less clear whether a piece of content is an advertising banner or a part of the website’s content. This border becomes even vaguer when the advertised product and the style of the advertising banner is congruent with the website’s theme and style. This practice is especially tempting for advertising publishers that use the CPC model as that they are rewarded for every click regardless of whether the consumer was aware that he or she clicked on an advertising banner or not.

The influence of advertising distinction on attention hasn’t been tested in academic research yet. Nevertheless, it has been determined that consumers cognitively avoid the presence of advertising banners (Li et al. 2002) and that this phenomenon is usually referred to as ‘’banner blindness’’. Consumers combine their knowledge of website structures with peripheral vision to avoid paying attention to positions that usually contain advertising banners or to avoid paying attention to objects that look like advertising banners (Hervet et al. 2011). The image below is from an exploratory study into visual attention on web pages by the Nielsen Norman Group. The image shows that consumers tend to pay attention to nearly everything on the webpage except for the advertising banners.

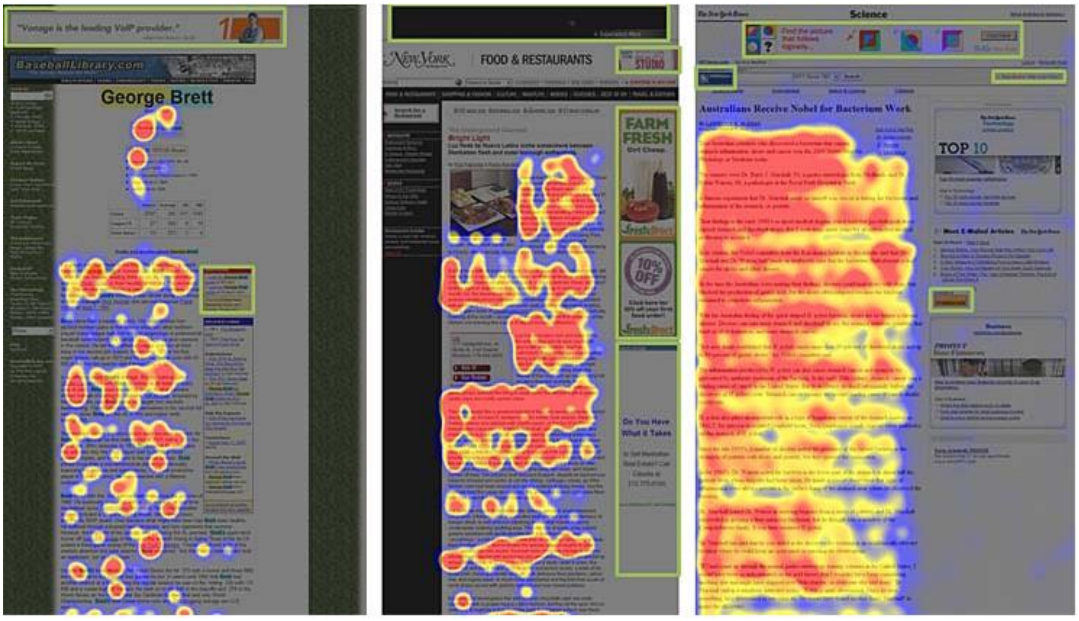


Figure 4. The patterns of visual attention on web pages clearly display that consumers hardly pay attention to the advertising banners that are marked by the yellow borders – an exploratory study conducted by the Nielsen Norman Group in 2006

Based on the findings by the Nielsen Norman Group and the frequent use of click baiting, I expect that removing the distinction of an advertising banner increases the attention. By making it more difficult for consumers to identify the advertising banner as a piece of advertising one makes it more difficult for consumers to cognitively avoid advertising. This leads to more consumers devoting attention to the advertising banner.

***H4**: An advertising banner that is not distinctively marked as advertising will receive more attention than an advertising banner that is distinctively marked as advertising*

2.7 THE INFLUENCE OF EXPOSURE ON ATTENTION

As mentioned in the first sub-section, neurological research into attention has determined that attention is a scarce and limited resource (Clarke & Sokoloff 1999 and Attwel & Laughlin 2001). Considering the scarcity of this resource, it is unlikely that a consumer will waste it by devoting its attention over and over again on the same piece of content that has already been processed. Therefore, a consumer who spends more time on a website has the opportunity to pay attention to more content on the website. If more content is processed, this means that less content will be left to be processed. The probability that a consumer pays attention to the advertising banner should therefore increase proportionally to the amount content on the website that a consumer has already processed.

On the other hand, consumers tend to find advertising intrusive and interfering with their objectives (Chaong-Hoan & Hongsik 2004). Next to that, consumers use knowledge about website structures combined with peripheral vision to avoid paying attention to anything that looks like an advertising banner (Hervet et al. 2011). One can argue that if an advertising banner isn't salient enough to disturb the visual search task early it is likely to be avoided for the entire browsing session.

I am rather curious to find out whether the length of exposure has a significant influence on the probability that a consumer fixates on the advertising banner. No prior research has been done into the effect of exposure on attention but I expect that there is a significant positive relationship between the two, hence the hypothesis:

H5*: The longer a consumer browses, the more likely it is that he or she will fixate on the advertising banner at least once*

2.8 THE INFLUENCE OF WEB BROWSER USAGE ON ATTENTION

On the internet there are a lot of stereotypes regarding the users of different web browsers. Firefox, with its open source capabilities is often associated with IT tech savvy people and nerds. Chrome is associated with hipsters who like speed and efficiency and Internet Explorer is associated with old fashioned people who do not know that there is anything better out there. So far no academic research has been done into the user profiles of different web browsers. The descriptions above are merely stereotypes that are commonly used on the internet. However, personally I do believe that there is some truth in these stereotypes. I believe that the majority of web browser users can be segmented based on demographic, psychographics and product usage criteria. This raises the question if these underlying user profiles can also lead to differences in the attention devoted to advertising banners. For example, it is rather likely that a group of people who use a browser that is associated with IT tech savvy people are more advertising avoidant. Take the usage statistics of ad blocking software for example. Its usage shows that around 2% of the Internet Explorer users employ an ad blocker against an astonishing 37% for Firefox users. Next to that, these same statistics show that ads are most often blocked on gaming, tech and social networking websites[9]. This implies that there might be a relationship between the propensity to avoid advertising and characteristics such as age, technological knowledge and education.

[9] Adobe Pagefair 2015 Ad Blocking Report - https://pagefair.com/blog/2015/ad-blocking-report/

This makes me very curious if, for example, users of Internet Explorer are more likely to pay attention to advertising than users of Google Chrome or Firefox. To keep the hypothesis simple, I will assume that there are no differences and use the results to explore whether there are differences between the different web browsers.

***H6**: The attention devoted to online advertising is equal for all web browsers*

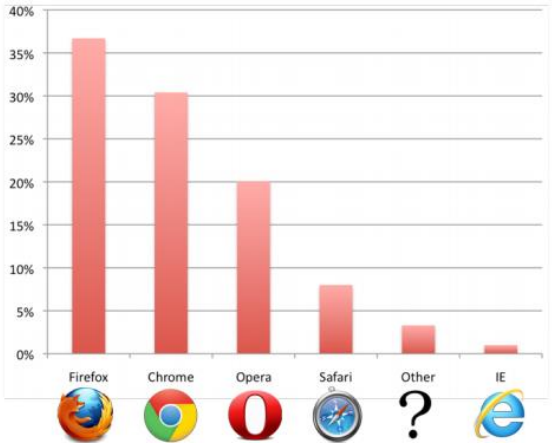


Figure 5. The percentage of adblocker users for each web browser – Adobe Pagefair adblocking report 2015

2.9 DEPENDENT VARIABLES

In academic research, attention is always measured with 3 dependent variables. The most important variable is the amount of fixations. A fixation occurs when the mouse stays focused on the advertising banner for at least 200 milliseconds. The outcome of this variable is binary; either a consumer fixates on the advertising banner at least once or not at all. Fixations as a dependent variable has been used before in several academic studies:

- The attention allocated to Yellow Pages ads (Lohse et al. 1997)
- The attention allocated to animated and static ads (Goldstein et al. 2014)
- The attention allocated to cigarette and beer product warnings (Fox et al. 1998)
- The attention allocated to brand-, pictorial-, and text-sizes in magazine ads (Pieters & Wedel 2004)

The second variable is the dwell time. The dwell time is an indicator of cognitive load; longer dwell time means that more cognitive load is being exerted onto a region (Duchowski 2007). This variable is a continuous variable that will be measured in seconds and can take on any value between 200 milliseconds and infinity. It has been used before in the following studies:s

- The attention allocated to Yellow Pages ads (Lohse et al. 1997)
- The attention allocated to animated and static ads (Goldstein et al. 2014)
- The attention allocated to cigarette and beer product warnings (Fox et al. 1998)
- The attention allocated to brand-, pictorial-, and text-sizes in magazine ads (Pieters & Wedel 2004)
- The attention allocated to words in an academic text (Just & Carpenter 1980)

The third variable that is measured is the time until the first fixation. This variable is often used in experiments to quantify the degree of visual salience. In these experiments, respondents are told that they need to find a certain object that has an odd shape, orientation or color compared to the distractors it is surrounded with.

Examples are a triangle within a lot of squares or a red circle within a lot of green circles. Their reaction time, the time until they have found the object is measured. A lower reaction time means that the object is more salient. The time until the first fixation is a continuous variable that can take on any positive value. It has been used as a dependent variable in several studies:

- The attention allocated to animated and static ads (Goldstein et al. 2014)
- The effect of color and orientation on visual salience (Carrasco et al. 1995)
- The influence of shape and color on visual salience (Treisman & Gelade 1980

The study into Yellow Pages (Lohse et al. 1997) uses a variable that is related to the time until the first fixation. Rather than measuring the time until the first fixation the experiment measures the order of the banners that are fixated. Because Yellow Pages are filled with nothing but advertising banners, measuring the order of fixation is a more accurate measure than the amount of seconds. For this study however, the time until the first fixation is a more accurate measure considering that the advertising banner only competes with the other content on the webpage. If for example, multiple advertising banners were to be used, the order of fixation might have been a suitable variable.

2.10 OVERVIEW OF LITERATURE

Table 1. An overview of literature used in the theoretical framework

Paper	Implication(s)
Clarke & Sokoloff 1999	The amount of cognitive energy in the brain is a limited resource
Attwel & Laughlin 2001	The amount of cognitive energy in the brain is a limited resource
Carrasco 2011	Attention is a selective process
Maunsell & Treue	Consumers use knowledge of features in visual search to find an object
Schmidt et al. 2002	Attention has two components and there is a positive relationship between salience and memory
Folk & Peterson 2001	The allocation of attention partially depends on salient stimuli
Underwood & Foulsham 2006	Visual salience depends on the object in relation to its environment
Treisman & Gelade 1980	Visual salience is measured by the reaction times of consumers in goal directed search
Itti & Koch 2000	Visual salience works with a "winner-takes-all" mechanism
Pooresmaeli et al. 2014	Objects that are more salient are remembered more often
Fine et al. 2009	Objects that are more salient are remembered more often
Shebilske & Fisher 1983	People do not processs content during a saccade
Duchowski 2007	A fixation is an indication of cognitive effort being exerted onto an object or region
Just & Carpenter 1980	Fixations on complex content last longer
Lohse et al. 1997	Studied attention allocated to Yellow Pages ads
Fox et al. 1998	Studied attention allocated to product warnings on beer and cigarette packages
Pieters & Warlop 1999	Studied attention allocated to different brands on a supermarket product shelf
Pieters & Wedel 2004	Studied attention allocated to brand-, pictorial- and text-sizes in magazine ads
Chen et al. 2002	Found a .84 correlation between eye-movements and mouse-movements
Johnson et al. 2012	Found a .92 correlation between eye-movements and mouse-movements
Rodden & Fu 2007	Found a .76 correlation between eye-movements and mouse-movements
Nielsen Norman Group 2006	Consumers browse web content from left to right
Goldstein et al. 2014	Softly explored that consumers allocated more attention to animated banners than static banners
Hervet et al. 2011	Consumers avoid banner ads by pattern recognition and peripheral vision scanning
Chang-Hoan & Hongsik 2004	Consumers avoid banner ads because they interfere with their objectives
Adobe Pagefair 2015	Ad blocking is highest for gaming, tech, social and educational sites

3. EXPERIMENTAL DESIGN

In this section, the experimental design will be explained. The first sub-section contains an explanation of the type of experiment that is conducted and how the data is gathered. The second sub-section explains which measures were taken to increase the experiment's reliability and validity. The third sub-section explains how the treatments for the experiment were chosen and the fourth sub-section explains how the advertising banners that were used in the experiment were chosen.

3.1 COURSE OF INVESTIGATION

A natural field experiment was conducted on the website www.bodyguardworden.nl. This website is a Dutch informational platform about being and becoming a bodyguard that was created in October 2014. The website receives around 7500 unique visitors per year and it is equipped with a premium version of Mouseflow. Mouseflow is software that tracks, records and saves the website visitors' mouse movement patterns and secondary information like the duration of their visit, their web browser and their operating system. Mouseflow is currently the most comprehensive and user-friendly mouse tracking software available, some of their largest customers are Deloitte, Accenture, Nike, Microsoft and Philips.

The experiment has recorded the mouse movements of 450 visitors between the 4th of April and the 10th of July 2016. Within those 15 weeks, 5 different advertising banners were rotated on the website. The experiment started with a control banner that has its name due to the similarity of a control group in medical experiments. This control banner is used as a reference banner to measure the causal effect of different isolated treatments. In the first treatment, the banner's image was changed from static to animated. In the second treatment, the size of the advertising banner was doubled. In the third treatment, the banner's position was changed from the right to the left side of the page. In the last treatment the advertising banner's grey border was removed. All treatments were implemented isolated from each other and were done in relation to the control banner. This means that the second treatment is not a follow-up on the first treatment and that there were no conjunctions of treatments. This experimental design has much similarity to a medical experiment. Suppose a doctor invites 150 ill patients into a clinic and then divides these patients into 5 groups of 30 patients. The first group is given no medication (control group), the second group is given medication A, the third group medication B, the fourth group medication C and the fifth group is given medication D. The doctor then measures the causal effect of each medication by comparing the results of each group of patients after the medication (treatment groups) to the results of the group of patients who did not receive any medication (control group). As a doctor would not put a patient on multiple medications, in this experiment there were no conjunctions of treatments either. The table and the images on the next page show what the control banner and the treatments look like on the website that was used for the experiment. The next page contains a table with descriptions and screenshots of what the control banner and each of the treatment banners look like on the website that was used to conduct the experiment.

The table below shows a description of all the advertising banners and which feature was manipulated in each treatment. Below the table are 4 screenshots of the control banner and the 4 treatment banners placed on the website during the experiment. The first image is a screenshot of the control banner and the animated banner. The control banner and animated banner both have the same size and it is obviously not possible to capture animation in a screenshot. An overview of the different images in the animated banner can be found in appendix 1. The second image shows the advertising banner after the size was doubled. The third image shows the advertising banner after its position was changed to the left side of the webpage and the fourth image shows the advertising banner after the distinctive border was removed.

Table 2. An overview of the control banner, the 4 treatment banners with the features of the control banner and which feature was manipulated for each treatment

Treatment	What was done	Image
Control banner	A small, static banner on the right side of the page with a clear distinctive border was placed	1
Treatment 1. Animation	The static banner was changed for an animated one	1
Treatment 2. Size	The banner's size was doubled	2
Treatment 3. Position	The banner's position was changed from the right side to the left side of the page	3
Treatment 4. Distinction	The grey distinctive border around the advertising banner was removed	4

Figure 6. The control banner and the animation treatment banner

Figure 7. The size treatment banner

Figure 8. The distinction treatment banner

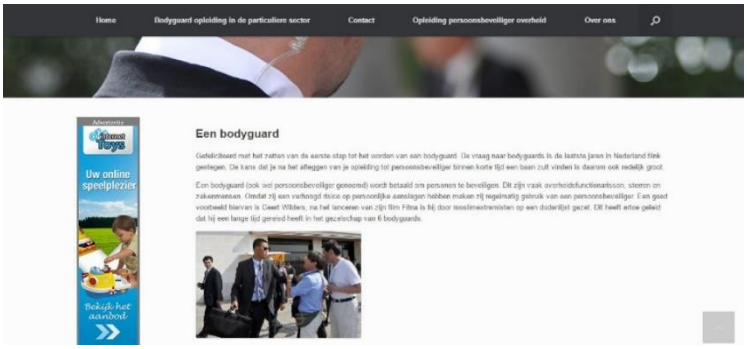


Figure 9. The position treatment banner

3.2 INCREASING THE RELIABILITY AND VALIDITY OF THE DESIGN

While designing the experiment, a few measures were taken to increase its reliability and validity. First, the decision was taken to only analyze the mouse-movements of consumers on the homepage who also landed on the homepage. Due to the presence of various other pages among the Google search results around 33% of the visitors land on a different page of the website. The advertising banners were also present on these pages and it is likely that the subjects ended up navigating to the homepage. Nevertheless, these subjects are not included in the data analysis because the differences in page layout might influence the allocation of attention and hence reduce the reliability of the experiment.

Second, the Mouseflow JavaScript source code was edited to exclude the recording of phone visitors, tablet visitors, non-Dutch visitors and returning visitors. Phone and tablet visitors obviously do not possess a mouse and are therefore excluded. Next to that, 99% of the visitors are Dutch visitors. Non-Dutch visitors are often from shady countries like Nigeria or India that land on the website via shady referral websites. They are not considered to be visitors who use the website to gain information about being or becoming a bodyguard and are therefore excluded as well. Returning visitors have knowledge about the website and the website's structure. This knowledge is known to aid in advertising avoidance (Hervet et al. 2011). It is therefore essential that all visitors have no prior knowledge of the website's structure. Due to this reason returning visitors are excluded as well.

Third, partial randomization of the manipulations was implemented to control for heterogeneity issues. Complete randomization of the advertising banner that is displayed, unfortunately requires HTML coding that is difficult for me to implement in the website's content management system. Therefore, complete subject randomization is not possible within my current coding expertise. However, it must be noted that, prior to the experiment and during the experiment, the Google Analytics reports showed no significant fluctuations in age, gender, location, interests and browser usage. This implies that the visitor base remains homogeneous over time which means that heterogeneity is no issue for this experiment. The partial randomization was only implemented as a safety precaution and additional luxury.

Table 3. The treatment rotation schedule, 15 weeks, 1 control group, 4 different treatments and 1 treatment each week – executed between the 4th of April and the 10th of July 2016

Treatment ↓ Week →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Control banner	x					x					x				
Treatment 1. Animation		x					x					x			
Treatment 2. Size			x					x					x		
Treatment 3. Position				x					x					x	
Treatment 4. Distinction					x					x					x

3.3 NUMBER OF OBSERVATIONS AND NUMBER OF TREATMENTS

The website that is used for the experiment receives around 650 unique visitors each month. After eliminating non-Dutch visitors, visitors that do not land on the homepage, returning visitors and visitors that use a mobile device or tablet this leaves around 30 visitors per week that meet the requirements to be a subject for the experiment. With a predetermined timeframe of 15 weeks the focus was set on observing 450 visitors.

This maximum amount of subjects, together with the relevancy and consistency of the possible advertising features were used to assess the amount of manipulations to be tested in the experiment. Next to position, distinction, size and animation there are more possible manipulations such as color, use of imagery and advertising banner functionalities like pop-up ads, pop-under ads, video ads and hover enlargement ads. First, the decision was made to restrict the experiment to on-page banner advertising because on-page banner advertising is by far the most commonly encountered ads on websites. Implications on how to improve on-page banner advertising could aid the vast majority of advertising publishers whereas this is not the case for video-advertising, pop-ups and pop-unders that are less common. Next to that, pop-up advertising and video advertising are an entirely different advertising concept on their own, that, within itself have performance determining features as well. Examples of these are static vs. animated pop-up advertising, the timing when the pop-up appears, the length of the video advertising, whether the video advertising automatically plays or not and if the video advertising includes sound or not. After this, the decision was made to exclude color and use of imagery as possible manipulations. Color and use of imagery were both tested in the experiment into Yellow Pages (Lohse et al. 1997). Color and use of imagery was only relevant for Yellow Pages because in the 90's, publishing color and image advertising in Yellow Pages was more expensive than displaying plain black & white text advertising. The implications by the Yellow Pages paper allow an advertising publisher to consider the benefits of color and imagery against the extra costs associated with them. Images and color are currently very common in online advertising and are therefore not relevant for this experiment. This leaves display banner advertising as the category of advertising that will be studied. With 5 different advertising concepts to test and 15 weeks, this means that the control banner and every treatment has 90 subject each.

3.4 ADVERTISING BANNER SELECTION

The advertising banner that was displayed on the website was chosen out of the Tradetracker affiliate database. Tradetracker is an affiliate marketing platform with over a thousand affiliate partners that all provide advertising material. First, the decision was taken to look for a banner of a product or service that is incongruent with the topic of the website and the use of colors within the website. This decision for incongruence was made to reduce the underlying familiarity and interests of the website's visitors in regard to the advertising banner. Nearly all the website traffic is provided by Google organic search results. These visitors reach the website by Google search queries like ''how to become a bodyguard'', ''bodyguard education'' and other related search queries. If the website were to display an advertising banner for bodyguard education for example, this underlying interest rather than the advertising features might shift a consumer's attention towards the advertising banner. I tried to eliminate this result by using an advertising banner for children's toys. Several suppliers were assessed in trying to find a supplier that provided a large animated banner. A large animated banner can be used to produce all the necessary other banner formats for the experiment. It can be used to create a small static banner, a small animated banner and a large static banner. The border with the ''advertising'' headline to create the distinction was made in Adobe Photoshop CS6. The different advertising banners that were placed on the website can be found in appendix 1.

4. METHODS AND VARIABLES

This section contains an in depth explanation of the independent variables and the methods that were used for the data analysis. The first sub-section contains an overview of all the independent variables, their nature and their expected relationship with the dependent variables. After this, there is a sub section for each of the dependent variables; fixations, dwell time and time until the first fixation. In these sub-sections, the nature of the dependent variables is explained which is followed by the statistical tests that will be used to measure the relationship between the predictor variables and the independent variables[10].

4.1 INDEPENDENT VARIABLES

There is one independent variable for each of the advertising features animation, size, position and distinction and there are subject specific variables such as the length of a subject's website visit and the underlying characteristics of consumers that manifests itself in the preference of a certain web browser.

Animation is a nominal variable with 2 levels, static and animated. I expect that an animated advertising banner will receive more fixations than the static advertising banner and that the mean dwell time will be significantly higher. I also expect that the time until the first fixation for the animated banner will be significantly lower due to the higher degree of salience grabbing the subject's attention earlier than the static banner.

Size is a nominal variable with two levels, small and large. After assessment of the website dimensions, the decision was taken to go for 420x114 pixels (height x width) and 840 x 228 pixels. Much consideration has been given whether to treat size as a continuous or a dichotomous variable. Treating size as a continuous variable measured in square pixels could provide useful implications regarding the ideal amount of square pixels to use for an advertising banner. A major issue however, is that the experiment observes consumers in their natural environment. Contrary to lab experiments, the test subjects view the website that is used to conduct the experiment on their own PC screens that all have different aspect ratios. Next to that, internet browsers provide users with the opportunity to zoom in on the webpages they visit. This implies that treating size as a continuous variable is of no use because the relative size of a certain amount of square pixels is different for every test subject. Size will therefore; be treated as a dichotomous variable with two levels, small and large. I expect that a large advertising banner will receive more fixations than a small advertising banner and that the mean dwell time will be significantly higher. I also expect that the time until the first fixation for the large banner will be significantly lower due to the higher degree of salience grabbing the subject's attention earlier than the small banner.

The third variable that will be measured is position. Position is a nominal variable with two levels; right and left. The right and left side of the content are usual positions to show advertising banners and provide excellent opportunity to test the theory and hypothesis regarding position. The choice has been made not to test ''center'' as a position. The main reason for this is because it would make no sense to display a vertical advertising banner exactly in the center of the page. Doing this would spoil the content structure and have a severe negative impact on the website's design. It is extremely unlikely that any website owner will sacrifice this much aesthetics just to display a vertical advertising banner in the center of the webpage. Most website owners who display an

[10] The 20th edition of IBM's SPSS will be used to analyze the data

advertising banner in the center of the page do this by changing the banner's orientation to horizontal. By changing the orientation, the ability to infer the causal effect of position will be lost. I expect that an advertising banner on the left side will receive more fixations than an advertising banner on the right side and I also expect that the time until the first fixation for the left positioned banner will be significantly lower due to the consumer's habit of reading from left to right biasing the consumer to the left. Distinction is a nominal variable with two levels. Distinction is a rather subjective concept. An advertising publisher can reduce distinction in many ways. One can, for example, make the colors of the advertising banner more congruent with the colors of the webpage or advertise products that are more congruent with the website's purpose. Adblock Plus states that distinction can be made clear by providing the advertising banner with a grey border and an ''advertising'' headline on top of this border. For this experiment, I will test the influence of the presence and absence of this border on the attention devoted to the advertising banner. I expect that removing the border will lead to an increase in the amount of fixations.

The length of exposure is a continuous variable measured in seconds. It represents the amount of time within one visit that a subject spends on the homepage. I expect that there is a positive relationship between the length of exposure and the likelihood of subject fixating on the advertising banner.

Web browser usage is a dichotomous variable with 5 possibilities: Internet Explorer, Google Chrome, Mozilla Firefox, Apple Safari and Opera. There are no expectations in regard to the influence of browser usage on attention but its influence will be explored.

4.2 ANALYZING THE AMOUNT OF FIXATIONS

The amount of fixations is a dichotomous variable with two levels and is measured at a group level. When a consumer lands on the website he or she either pays attention to the advertising banner by fixating on it at least once or he does not pay attention to the advertising banner at all[11]. The probability that a certain consumer pays attention to the advertising banner is expected to be causally influenced by the display features of the advertising banner, the length of exposure and the latent characteristics of the consumer that manifest itself in the preference for a certain web browser.

The binary logistic regression is a binary response model that expresses the odds of an event happening over the odds of this event not happening. In this case, the model describes the odds of a consumer paying attention to the advertising banner over the odds of this consumer not paying attention to the advertising banner. The binary logistic regression model uses the cumulative logistic distribution function to predict the probability that the consumer will fixate pay attention to the advertising banner. In the data analysis, this probability is expressed as P while the probability of a consumer not paying attention to the advertising banner is expressed at P-1.

[11] Prior exploration shows that subjects hardly fixate on the advertising banner multiple times so treating fixations as a continuous variable holds no additional value.

The output of the binary logistic regression analysis provides the logistic odds coefficients. After computing these coefficients with the levels of the predicator variables, the logistic odds ratios can be transformed to derive the non-logistic odds ratios with the following equation:

$$Odds\ ratio\ =\ e^{\beta_0\ +\ \beta_1 X_1\ +\ldots \beta_k X_k}$$

β_0 = the intercept at the Y-axis
β_1 until β_k = the logistic odds coefficients of the predictor variables
X_1 until X_k = the predictor variables (position, distinction, length of exposure etc…)

The odds ratio describes the odds of a consumer paying attention to the advertising banner at least once over the odds of this consumer not paying attention to the advertising banner. If the odds for example are 2 to 1, the odds of a consumer paying attention to the advertising banner at least once is twice as large as the odds of this consumer not paying attention to the advertising banner.

Additionally, odds ratios can be transformed to probabilities. In dichotomous models with more than two outcome categories this probability can be derived by constructing an algebraic equation. When the outcome variable consists of two categories the probability of an event happening can be calculated by the following equation:

$$P(Y = y_i) = \frac{Odds\ ratio}{1+odds\ ratio} \qquad y_i = \begin{cases} 1 & If\ the\ i'th\ subject\ fixates\ on\ the\ banner\ ad\ at\ least\ once \\ 0 & If\ the\ i'th\ subject\ doesn'tfixate\ on\ the\ banner\ ad\ at\ all \end{cases}$$

P = the probability of Y taking a value of y_i

If we combine both equations, we get the final logistic regression equation:

$$P(Y = y_i) = \frac{e^{\beta_0\ +\ \beta_1 X_1\ +\ldots \beta_k X_k}}{1\ +\ e^{\beta_0\ +\ \beta_1 X_1\ +\ \ldots\ \beta_k X_k}} \qquad y_i = \begin{cases} 1 & If\ the\ i^{'}th\ subject\ fixates\ on\ the\ banner\ ad\ at\ least\ once \\ 0 & If\ the\ i^{'}th\ subject\ doesn^{'}tfixate\ on\ the\ banner\ ad\ at\ all \end{cases}$$

P = the probability of Y taking a value of y_i
e = the natural logarithmic base
β_0 = the intercept at the Y-axis
β_1 until β_k = the coefficients of the predictor variables
X_1 until X_k = the predictor variables (position, distinction, length of exposure etc…)

4.3 ANALYZING THE DWELL TIME

The dwell time is a continuous variable measured in milliseconds. When a consumer fixates on the advertising banner, the length of this fixation is the dwell time. Considering that the threshold of a fixation is 200 milliseconds, the dwell time can theoretically take on any value from 200ms to infinity. The dwell time is expected to be influenced by the presence of animation in an advertising banner and by the size of the advertising banner.

The study into Yellow Pages advertising (Lohse et al. 1997) used multiple ANOVA's to test for significant differences between the different advertising banners and the study into magazine advertising (Pieters & Wedel 2004) used a log transformed regression analysis to analyze the dwell time. For this experiment, a multiple linear regression analysis will be used to model the relationship between the predictor variables and the dwell time. Contrary to the ANOVA, a multiple regression provides the possibility to include the length of exposure as a continuous predictor. A log transformation of the variables is however not necessary, the study by Pieters & Wedel (2004) only used this to be able to build a complete logistic attention model with several other logistic predictors. The multiple regression analysis models a linear relationship between the predictor variable and the independent variable that uses the linear equation below:

$$Y = \beta_0 + \beta_1 X_1 + \ldots \beta_k X_k$$

Where:
Y = the dwell time in milliseconds
β_0 = the intercept at the Y-axis
β_1 until β_k = the coefficients of the predictor variables
X_1 until X_k = the predictor variables

Additionally, the multiple regression analysis will also be used to measure possible interactions between the predictor variables. Even though there is no scientific substantiation, it is for example not unlikely that the dwell time for some advertising banners is longer in specific web browsers.

4.4 ANALYZING THE TIME UNTIL THE FIRST FIXATION

The time until the first fixation is a continuous variable measured in seconds. This variable can take on any value from 1 to infinity. My expectation is that a banner on the left side of the page will be the subject of one's attention earlier than a banner on the right side of the page. This is expected to be the same for an animated banner versus a static banner and for a large banner versus a small banner. A multiple regression analysis will be used to gain a better understanding of how the variables position, distinction, size, animation, exposure time and browser influence the time until the first fixation.

The time until the first fixation will be expressed as the dependent variable that is linearly influenced by the explanatory variables position, distinction, size, animation, exposure time and browser. The output of the regression analysis can be translated to the following equation:

$$Y = \beta_0 + \beta_1 X_1 + \ldots \beta_k X_k$$

Where:

Y = The time until the first fixation in seconds

β_0 = The intercept at the Y-axis

β_1 until β_k = The coefficients of the predictor variables

X_1 until X_k = The predictor variables

5. DATA ANALYSIS AND RESULTS

In this section, the data that was gathered during the 15 weeks of mouse-tracking will be analyzed. The first sub-section contains descriptive statistics of the variables. After this, there is a sub-section for each of the dependent variables. In each of these sub sections the data analysis process is explained and the results of the data analysis is discussed.

5.1 COURSE OF INVESTIGATION AND DESCRIPTIVE STATISTICS

Over the course of 15 weeks, the mouse movements of 450 subjects were recorded. These 450 subjects were divided in 5 groups of 90 subjects for each advertising banner. Of those 450 subjects, 110 fixated on the advertising banner at least once and 340 didn't focus on the advertising banner at all resulting in an overall fixation rate of 24,4%. The table below shows how the amount of fixations and nonfixations are divided for the control group and each of the treatment groups. The control group received 18 fixations and has a slightly below average fixation rate of 20%. A change of position from right to left and removing the distinctive border resulted in a higher amount of fixations. Increasing the banner's size and changing the static banner to an animated one resulted in a lower amount of fixations.

Table 4. The distribution of subjects who fixated at and didn't fixate on the advertising banner at all for the control group and each treatment

Treatment	Paid attention	Percentage	Paid no attention	Percentage	Total subjects
Control banner	18	20%	72	80%	90
Treatment 1. Animation	10	11,10%	80	88,90%	90
Treatment 2. Size	14	15,60%	76	84,40%	90
Treatment 3. Position	44	48,90%	46	51,10%	90
Treatment 4. Distinction	24	26,70%	66	73,30%	90
Total	**110**		**340**		**450**

The table below shows that, on average, the subjects spent two minutes browsing the website. The length of exposure is highly skewed to the right and has a high standard deviation. A histogram plot (appendix 2) shows that the majority of the visitors remained on the website for a very short time and that a small minority stayed for a very long time. This small minority significantly lifted the mean which resulted in a high standard deviation and a skewed distribution. The table also shows that the mean dwell time is 349 milliseconds and that the mean time until the first fixation is 10,18 seconds. Both variables are slightly skewed to the left and have a slight negative kurtosis.

Table 5 Descriptive statistics for the continuous variables dwell time, the time until first fixation and the length of exposure

Variable	Minimum	Maximum	Mean	Std. Dev	Variance	Skewness	Kurtosis
Dwell time (milliseconds)	200	545	349,09	78	6079	0,314	-0,262
Time until first fixation (seconds)	2	21	10,18	4	16	0,075	-0,523
Length of exposure (seconds)	5	600	120,8	129	16675	1,965	3,855

A test of normality was performed to assess if the 3 variables dwell time, time until the first fixation and the length of exposure are normally distributed. Both the Kolmogorov-Smirnov and Shapiro-Wilk tests conclude that the variables dwell time and the seconds until the first fixation are normally distributed. The exposure time is not normally distributed as one could expect considering the high skewness and kurtosis. The results of these tests were double checked by creating histograms and QQ-plots of the variables that verified their distributions. The normality tests, the histograms and the QQ-plots can be found in appendix 2.

5.2 ANALYSIS OF THE AMOUNT OF FIXATIONS

A binary logistic regression was performed to ascertain the effects of position, distinction, size, animation, exposure time and browser usage on the likelihood that a consumer pays attention to the advertising banner at least once. All the variables were entered into the analysis simultaneously. The Omnibus test of model coefficients shows that the model that includes the predictor variables is a significant improvement over the baseline model (χ^2 52,354 df =8). The Hosmer and Lemeshow test shows that the data is a good fit for the model (sig. 0,465), the model explains a fair amount of the variance in the dependent variable (Nagelkerke R^2 = 0,164). The Wald statistics in the output table show that the treatments have the highest influence on the dependent variable (Wald = 33,839), followed by the constant (Wald = 23,941), the length of exposure (Wald = 5,98) and browser usage (Wald = 5,675). The output table of the binary logistic regression shows that the coefficient of the constant is negative (-1,484). This implies that, in the baseline, the likelihood that a consumer does not paying attention to the advertising banner is higher than the likelihood that a consumer pays attention to the advertising banner. If we solve the equation for the constant parameter this gives us a probability value of 0,184. This means that, in a baseline scenario the probability that a consumer fixates on the advertising banner is only 18,4% and the probability that a consumer does not pay attention to the advertising banner is 81,6%.

$$P(Y = Fixation) = \frac{e^{-1,484}}{1+e^{-1,484}} = 0,184$$

Second, the output table also shows that only one of the treatments, the treatment of position, significantly influences the likelihood of a consumer paying attention to the advertising banner. The exponential beta coefficient of position (3,697) shows that a consumer is almost 3,7 times more likely to pay attention to a banner on the left side of the page than a banner on the right side of the page. If we incorporate the coefficient of position into the equation, the probability that a consumer pays attention to the advertising banner increase to 45%.

$$P(Y = Fixation) = \frac{e^{-1,484+1,307Position}}{1+e^{-1,484+1,307Position}} = 0,455$$

Third, the output table shows that the length of exposure is significantly influences the likelihood of a fixation occurring in a positive direction. The coefficient of length of exposure is 0,002 meaning that the log-likelihood of a fixation increase by 0,002 for every second that a consumer spends browsing. The descriptive statistics show that the mean exposure time is 120 seconds. If one incorporates this coefficient in the equation and we assume the length of exposure of an average consumer, the probability of this consumer paying attention to the advertising banner is 51,5%.

$$P(Y = Fixation) = \frac{e^{-1,484+1,307Position+0,002Exposure}}{1+e^{-1,484+1,307Position+0,002Exposure}} = 0,51$$

If the treatment position were to be excluded from the model, one can derive how long a consumer needs to browse to reach an equal likelihood for paying attention to the advertising banner and not paying attention to the advertising banner, which essentially means a probability of exactly 50%. This is done by dividing the coefficient of the constant by the coefficient of the length of exposure which gives us: 1,484/0,002 = 742 seconds. Cross validating with the equation gives the result:

$$P(Y = Fixation) = \frac{e^{-1,484+0,002*742}}{1+e^{-1,484+0,002*742}} = 0,5$$

Ergo, when the advertising banner is positioned on the right side of the page, a consumer who browses for at least 12 minutes and 22 seconds has a probability of 50% or higher to pay attention to the advertising banner at least once. At last, after including the variables browser usage the output table shows that there is a negative significant relationship between Internet Explorer users and the likelihood of a consumer paying attention to the advertising banner. Including Internet Explorer users into the equation leads to the final model:

$$P(Y = Fixation) = \frac{e^{-1,484\ +1,307Position\ +\ 0,002Exposure\ -\ 0,729InternetExplorer}}{1 + e^{-1,484+\ 1,307Position\ +\ 0,002Exposure\ -\ 0,729InternetExplorer}}$$

Essentially, the model shows that the constant has the highest coefficient which implies that in general the likelihood that a consumer pays no attention to the advertising banner is higher than the likelihood that a consumer does pay attention to the advertising banner. After this, the treatment of position has a large positive influence that is nearly capable of tossing the odds in favor of a consumer paying attention to the advertising banner. The output table also shows that size and distinction are far from being a significant influence and that animation is somewhat close to being significant at a <0,1 level. This implies that consumers are not very favorable towards animated advertising banners and that the effect is in the opposite direction of what was expected.

Additionally, the classification plot (appendix 4) shows that there are quite a few yes-cases under the 0,5 probability range and very little no cases above the 0,5 probability range. This implies that the model is pretty accurate in predicting when a consumer will not pay attention to the advertising banner but it is fairly bad at predicting when a consumer will pay attention to the advertising banner.

Table 6. The binary logistic regression coefficients with the likelihood of fixation as the dependent variable. The effect of position, length of exposure and Internet Explorer are statistically significant.

							95% C.I. for Exp. Beta	
Variable	Beta	Std. Error	Wald	df	Sig.	Exp. Beta	Lower	Upper
Control banner (dummy baseline)			33,839	4	0,000			
Treatment 1. Animation	-0,682	0,432	2,496	1	0,114	0,506	0,217	1,178
Treatment 2. Size	-0,192	0,399	0,233	1	0,629	0,825	0,378	1,802
Treatment 3. Position	1,307	0,345	14,359	1	0,000	3,697	1,880	7,270
Treatment 4. Distinction	0,334	0,364	0,845	1	0,358	1,397	0,685	2,849
Chrome (dummy baseline)			5,675	3	0,129			
Firefox	0,002	0,363	0,000	1	0,996	1,002	0,491	2,042
Internet Explorer	-0,729	0,336	4,709	1	0,030	0,483	0,250	-0,932
Safari	-0,526	0,468	1,26	1	0,262	0,591	0,236	1,480
Length of exposure (seconds)	0,002	0,001	5,98	1	0,014	1,002	1,000	1,004
Constant	-1,484	0,303	23,941	1	0,000	0,227		

Next to the main effects, the interaction effects were included in the analysis. The interaction effects of treatment x browser usage, treatment x length of exposure and browser usage x length of exposure were included. Including these interaction effects did increase the amount of variance explained in the dependent variable to 22,5% but none of the interaction effects were significant. The classification plot (appendix 5) however shows that the model that includes the interaction effects is more reliable in predicting when a consumer will or will not pay attention to the advertising banner. There are fewer yes-cases under the 0,5 probability range and no no-cases above the 0,5 probability range.

Summarized, of all treatments, only the change in position resulted in a significantly higher amount of fixations. The influence of distinction is in the expected direction but not statistically significant. The influence of size and animation are not statistically significant either but it is surprising that the result is in the opposite direction of what was expected. This implies that large advertising banners and animated advertising banners might not lead to more attention but lead to more advertising avoidance. The effect of the length of exposure however is statistically significant and in the expected direction. The probability of a consumer paying attention to the advertising increases for every second that this consumer spends on the website. Internet Explorer users seem to be rather advertising avoidant. An Internet Explorer user is less likely to pay attention to an advertising banner than a user of Chrome, Firefox or Safari.

5.3 ANALYSIS OF THE DWELL TIME

The descriptive statistics show that the mean dwell time for the control banner is 339 milliseconds. The treatments animation, size and position resulted in a higher mean dwell time (resp. 366ms, 357ms and 358ms) and the treatment distinction resulted in a lower mean dwell time (326ms).

Table 7. The mean dwell time for the control banner and each treatment banner in milliseconds

Treatment	Mean dwell time (milliseconds)
Control banner	339,17
Treatment 1. Animation	366,00
Treatment 2. Size	357,86
Treatment 3. Position	358,86
Treatment 4. Distinction	326,46

A multiple linear regression analysis was performed with the treatments, length of exposure and browser usage as predictor variables. The treatments and browser usage were included as dummy variables with the control banner as baseline for the treatments and Chrome as baseline for browser usage. The R^2 value (0,062) shows that only a tiny bit of the variance in the dwell time is explained by the predictor variables which implies that the model is a bad fit. Additionally, the regression coefficients show that none of the predictor variables has a significant influence on the dwell time. The effects for animation and size are in the expected direction but they are not statistically significant.

Table 8. The multiple linear regression output with dwell time as a continuous dependent variable. None of the predictors are statistically significant.

	Unstandardized		Standardized			Correlations		
Variable	Beta	Std. Error	Beta	t	Sig.	Zero order	Partial	Part
Constant	340,231	18,167		18,728	0,000			
Animation (dummy)	24,84	31,421	0,092	0,791	0,431	0,069	0,078	0,076
Size (dummy)	17,596	28,202	0,076	0,624	0,534	0,043	0,062	0,060
Position (dummy)	16,76	22,358	0,106	0,75	0,455	0,103	0,074	0,072
Distinction (dummy)	16,744	24,727	0,089	0,677	0,500	0,154	0,067	0,065
Firefox (dummy)	-19,479	23,017	-0,084	-0,846	0,399	-0,050	-0,084	-0,082
Internet Explorer (dummy)	-13,222	24,183	-0,057	-0,547	0,586	-0,054	-0,054	-0,053
Safari (Dummy)	-30,754	31,227	-0,097	-0,985	0,327	-0,069	-0,098	-0,095
Length of exposure (seconds)	-0,063	0,052	-0,118	-1,199	0,233	-0,115	-0,118	-0,116

Next to the main effects, the interactions between the treatments and the length of exposure was included in the model. The analysis shows that the effect of size interacting with the length of exposure is significant (sig. 0,047). This means that, in the cases where a large advertising banner was displayed, the length of exposure does significantly influence the dwell time (appendix 6). For every second that the consumer browses, the dwell time devoted to the large advertising banner increases by 0,387 milliseconds.

Summarized, none of the main effects significantly influences the dwell time. Animation and size are in the predicted direction but not statistically significant. The interaction effects show that the length of exposure has a positive significant influence on the dwell time but only for a large advertising banner.

5.4 ANALYSIS OF THE TIME UNTIL THE FIRST FIXATION

The descriptive statistics show that the mean time until the first fixation is 12,39 seconds for the control group. All the treatments resulted in a lower mean time until the first fixation with size being the lowest at 7,93 seconds.

Table 9. The mean time until the first fixation for the control banner and each treatment in seconds

Treatment	Mean time until the first fixation (seconds)
Control banner	12,39
Treatment 1. Animation	10,70
Treatment 2. Size	7,93
Treatment 3. Position	9,50
Treatment 4. Distinction	10,88

A multiple linear regression analysis was performed to ascertain the influence of the treatments, the length of exposure and browser usage on the time until the first fixation. The R Square statistic shows that the model explains around 13% of the variance in the time until the first fixation. Next to that, the output table shows that the beta value for the constant is 10,64 which means that in the baseline, a consumer notices the presence of an advertising banner after 10,64 seconds. Additionally, both size and position have a significant influence on the time until the first fixation. The coefficients show that both variables have a statistically negative influence which is essentially a good thing because it implies that the treatments size and position cause a banner to be noticed earlier. A large banner is noticed earlier than a small advertising banner and a banner on the left side of the webpage is noticed earlier than an advertising banner on the right side of the webpage. Of these two variables, size is the largest predictor with a coefficient of -4,632. This means that a large banner, on average, is noticed 4,6 seconds earlier than a small banner whereas a left positioned banner is noticed 2,6 seconds earlier than a banner on the right side of the webpage. The effect of an animated banner is in the expected direction but not strong enough to be statistically significant.

Table 10. The multiple linear regression output with seconds until the first fixation as a continuous dependent variable. The effect of size and position are statistically significant.

	Unstandardized		Standardized			Correlations		
Variable	Beta	Std. Error	Beta	t	Sig.	Zero order	Partial	Part
Constant	10,647	0,906		11,75	0,000			
Animation (dummy)	-1,322	1,567	-0,094	-0,844	0,401	0,041	-0,084	-0,078
Size (dummy)	-4,632	1,407	-0,384	-3,293	0,001	-0,214	-0,311	-0,305
Position (dummy)	-2,677	1,115	-0,326	-2,401	0,018	-0,138	-0,232	-0,223
Distinction (dummy)	1,259	1,233	0,129	1,021	0,310	-0,091	-0,101	0,095
Firefox (dummy)	0,506	1,148	0,042	0,441	0,660	-0,017	-0,044	0,041
Internet Explorer (dummy)	1,831	1,206	0,152	1,518	0,132	-0,105	-0,149	0,141
Safari (Dummy)	1,021	1,557	0,062	0,655	0,514	-0,053	-0,065	0,061
Length of exposure (seconds)	0,000	0,003	-0,008	-0,081	0,935	-0,022	-0,008	-0,008

The interactions effects of treatment x length of exposure and browser usage x length of exposure were included in the model as well. However, none of the interactions has a statistically significant influence on the time until the first fixation. Based on the coefficients one can construct the following linear equation.

$$Seconds\ until\ the\ first\ fixation = 10{,}647 - 4{,}632Size - 2{,}677Position$$

This equation can be used to derive the amount of seconds that it takes a consumer to notice an advertising banner. If the banner size is large (820x228 pixels) then it takes the consumer on average 10,64 – 4,63 = 6,01 seconds to notice the advertising banner. If the banner is positioned on the left side of the page, then it takes the consumer on average 10,64 – 2,67 = 7,97 seconds to notice the advertising banner. Additionally, if an advertising banner were to be large and positioned on the left side of the webpage it would take a consumer 10,64 – 4,63 – 2,67 = 3,34 seconds to notice the advertising banner. However, one must be cautious with the interpretation of this analysis. Even though, mathematically one can take the sum of both effects, this does not necessarily mean that this effect is that strong when put into practice.

Summarized, as expected, the effects of size and position cause the advertising banners to be noticed earlier. The effect of animation is in the expected direction but not statistically significant. Additionally, none of the interactions between the predictor variables have a significant influence on the time until the first fixation.

6. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

The objective of this experiment was to find out how the four different advertising features, the length of exposure and the underlying characteristics of a consumer that manifests itself in the preference for a certain web browser influence the attention that consumers allocate to an advertising banner. In this chapter, conclusions will be drawn from the data analysis and implications will be given as to how an advertising publisher can make its advertising banners perform better within the attention based metric. The section ends with an overview of the hypotheses.

6.1 PREDICTORS OF FIXATIONS

Changing the advertising banner's position from right to left resulted in a significant increase in the amount of fixations. Prior research has shown that this effect is equal for consumers who use Yellow Pages (Lohse et al. 1997). It is very likely that reading habits bias the visual focus of a consumer to the left side of the webpage. This means that an advertising publisher should therefore prefer the left side of the webpage over the right side when deciding to position an advertising banner. Contrary to the results found in Yellow Pages, large advertising banners do not capture more fixations on web pages. The study by into magazine advertising found that increasing the size of the text leads to more allocation for the advertising banner itself (Pieters & Wedel 2004). This effect was however measured by increasing the relative size of the text, contrary to this experiment where the entire banner was doubled in size while keeping the aspect ratio of the text, brand and pictorial equal. It is clear that large advertising banners do not draw more attention on web pages. Additional research would be necessary to determine whether increasing the relative size of the text within the advertising banner influences Despite the influence of animation and size not being significant it is surprising that the direction of the effect was in the opposite direction of what was expected. Rather than attracting more attention, consumers might be more advertising avoidant towards animated and large advertising banners. Advertising publishers are therefore advised to be cautious with animated advertising banners and large advertising banners. Additionally, prior research has proven that animated banners negatively influence a consumer's willingness to reuse a website (Goldstein et al. 2014). The conclusion of the researchers was that animated banners should at least be $1 to $1,50 per thousand impressions more profitable than a static advertising banner to make up for these negative consequences. Considering that this study shows that animated banners are counterproductive within the attention metric, advertising publishers are advised to refrain from using animated advertising banners. A very novel result brought forward by this experiment is the influence of exposure on attention. The likelihood that a consumer fixates on the advertising banner increases for every second that a consumer spends browsing the website. This means that an advertising publisher benefits from providing its consumer with quality content in order to make the consumer spend more time on the website. Considering this finding, in hindsight it is not such a surprise that the first organizations to propose and implement the attention based metric are media websites that tend to keep consumers engaged for a long time. It is also remarkable to see that Internet Explorer users are far less likely to pay attention to an advertising banner than users of other web browsers. Even though, Internet Explorer users are often criticized of being old fashioned people, they seem to be rather advertising avoidant. It is rather mysterious what caused this effect. If we look back at sub-section 2.8 we see that only 4% of the Internet Explorer users use adblocking software against more than 35% of the Chrome users. It might be possible

that these old-fashioned Internet Explorer users are so advertising avoidant because they do not use ad blockers but additional research would be required to determine the exact cause of this effect.

6.2 PREDICTORS OF DWELL TIME

Surprisingly, none of the banner features has a significant influence on the dwell time when isolated. The dwell time however, increases significantly for every second that a person browses the web page when a large advertising banner is displayed. The study results imply that, in general, consumers are capable of processing large banners as fast as small banner and animated banners as fast as static banners. Considering the short mean dwell times (326ms to 366ms) and the absence of significant differences, one can conclude that consumers only take notice of the advertising banner shortly and do not pay much attention to its content. Advertising publishers are therefore advised to use their advertising space efficiently. Considering that large banners do not lead to more fixations or longer fixations it might be wise not to waste precious space by placing an excessively large banner.

6.3 PREDICTORS OF THE TIME UNTIL THE FIRST FIXATION

Both the size and the position of the banner have a significant influence on the time until the first fixation. As with the amount of attention, the early fixations towards the left positioned banner are probably caused by the reading habits resulting in the left biased focal point of consumers rather than the degree of visual salience. However, as mentioned in the theoretical framework, size is known the be positively correlated with a higher degree of salience and faster response times in search tasks (Treisman & Gelade 1980, Itti & Koch 2000 and Carrasco 2011). It is therefore no surprise that the large advertising banner was noticed significantly earlier than the small advertising banner. Advertising publishers who want their message to be noticed early, for example in a situation where multiple banners compete with each other could use this technique to their advantage. This implication has however more value in a medium like Yellow Pages than it has on the internet. Additionally, despite the effect of size on attention not being significant, it is likely that large advertising banners negatively affect the attention devoted to them. A banner getting noticed earlier is of no use when it gets noticed by fewer consumers. Advertising publishers are therefore advised to prioritize the left side of the webpage in regard to positioning but to take caution with large advertising banners.

6.4 HYPOTHESIS REVIEW

In the theoretical framework, several hypotheses were made about the influence of animation, size, position, distinction, the length of exposure and browser usage on the attention that consumers devote to advertising banners. Some of these hypotheses turned out to be true and some were rejected. Below is a list of all the hypotheses and whether they are supported or rejected.

Table 11. The overview of hypotheses with a description if they are supported or rejected including the significance level of their effect

Supported hypotheses
H2b: A large advertising banner will receive attention earlier than a small advertising banner
This hypothesis is supported (sig. < 0,001)
H2c: The length of attention spent on a large advertising banner will be longer than for a small advertising banner
This hypothesis is supported (sig. < 0,05)
H3a: An advertising banner on the left side of the page will receive more attention than an advertising banner on the right side of the page
This hypothesis is supported (sig < 0,001)
H3b: An advertising banner on the left side of the page will receive attention earlier than an advertising banner on the right side of the page
This hypothesis is supported (sig. < 0,05)
H4: An advertising banner that is not distinctively marked as advertising will receive more attention than an advertising banner that is distinctively marked as advertising
This hypothesis is not supported; the effect is in the expected direction but not significant (sig.
H5: The longer a consumer browses, the more likely it is that he or she will fixate on the advertising banner at least once
This hypothesis is supported (sig. < 0,05)
Rejected hypotheses
H1a: An animated advertising banner will receive more attention than a static advertising banner
This hypothesis is not supported; the effect is in the opposite direction of what was expected and not significant (sig. 0,114)
H1b: An animated advertising banner will receive attention earlier than a static advertising banner
This hypothesis is not supported; the effect is in the expected direction but not significant (sig. 0,401)
H1c: The length of attention spent on an animated advertising banner is longer than for a static advertising banner
This hypothesis is not supported; the effect is in the expected direction of what was expected and not significant (sig. 0,431)
H2a: A large advertising banner will receive more attention than a small advertising banner
This hypothesis is not supported, the effect is in the opposite direction of what was expected and not significant (sig. 0,629)
H6: The attention devoted to online advertising is equal for all web browsers
This hypothesis is not supported, however, the formulation of this hypothesis was done because, besides a strong feeling there was no scientific substantiation for specific hypothesis formulation regarding browser usage

7. LIMITATIONS AND FURTHER RESEARCH

It is important to note several limitations of this research. First, even though the control banner and each treatment banner have 90 subjects, the sample size is still rather small compared to the possibilities of online research. If a likewise experiment was to be done for a website with a higher visitor count, one could easily obtain thousands of subjects per day which would lead to more reliable results. This would also provide the opportunity to test more advertising features and to test conjunctions of features such as animation X size. Next to that, the website's visitor pool consists of people who are interested in becoming a bodyguard. This is a profession that is rather appealing for men at a younger age. The Google Analytics report shows that the majority of the website's visitors are men between 18 and 34 years old. It is safe to say that this group does not accurately represent the Dutch population and that the behavior of these subjects is not representative for the entire Dutch population.

Second, the experiment tracked the subjects without them being aware of it. Conducting a natural field experiment has some benefits in regard to lab experiments but one major downside is that all the subjects used their own PC's to visit the website. All these PC's have different screen sizes and the screen size determines the portion of content that is visible above the fold[12]. Therefore, when opening the website, not all consumers see the same portion of content. Conducting this experiment in a lab setting would mean the all consumers use the same PC screen and see the same portion of content above the fold. The relative size of specific objects is then fixed rather than arbitrary which also provides the opportunity to treat size as a continuous variable rather than a nominal one. It must however be noted that one major downside of conducting this experiment in the lab is that it is very time consuming and expensive to gather a large pool of subjects.

At last, as mentioned before, several studies have shown that eye movements and mouse movements are highly correlated. However, because they are not fully correlated it is possible that a respondent focuses its eyes on an advertising banner but does not fixate his/her mouse on it. This is a practical limitation of the metric that cannot be overcome. Limitations like this exist for every online advertising metric. The attention based metric is, considering the capabilities of the current technology the closest that one can get to measure the true effectiveness of online advertising.

[12] ''Above the fold'' is what web programmers call the amount of content that is visible when someone opens a website and doesn't scroll down. The portion of content above the fold varies based on the screen size and whether a person has zoomed in or out on the webpage.

APPENDICES

Appendix 1. The advertising banners that were shown on the website

1 2

3

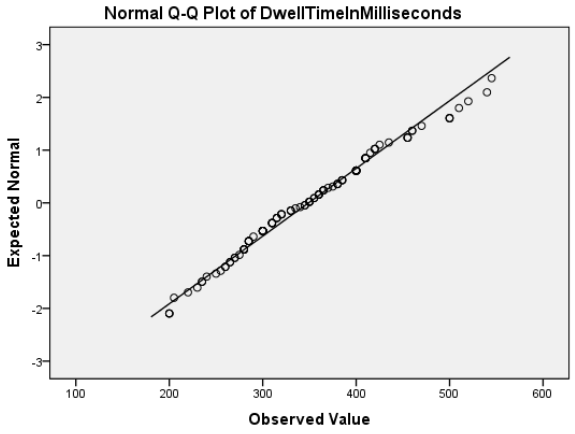
1 = Static small with distinction border
2 = Static small without distinction border
3 = Animated small with distinction border
4 = Static large with distinction border

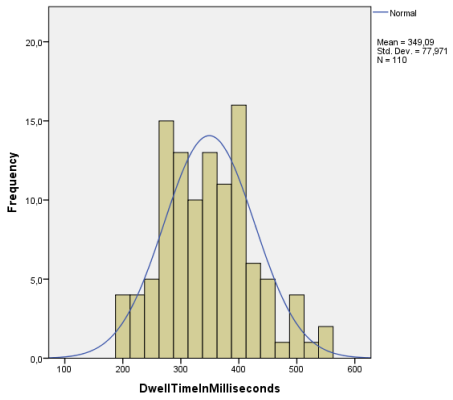
*Due to the small A4 paper size the advertising banners above are not in the actual size as they were on the website.

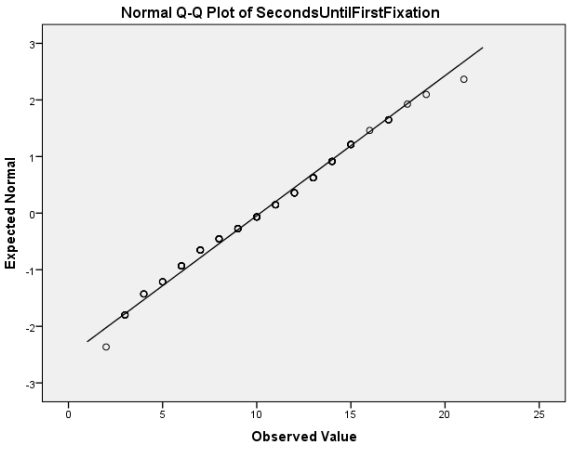
4

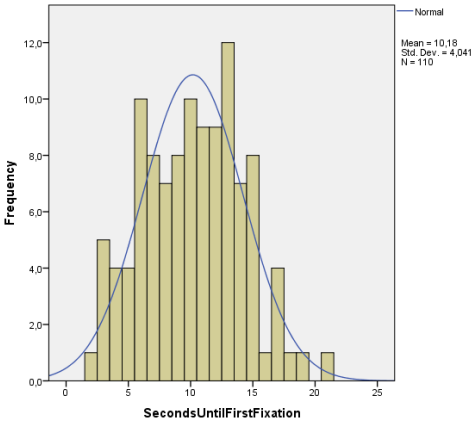
Appendix 2. Normality test, QQ-plots and histograms of the dwell time, time until the first exposure and the length of exposure

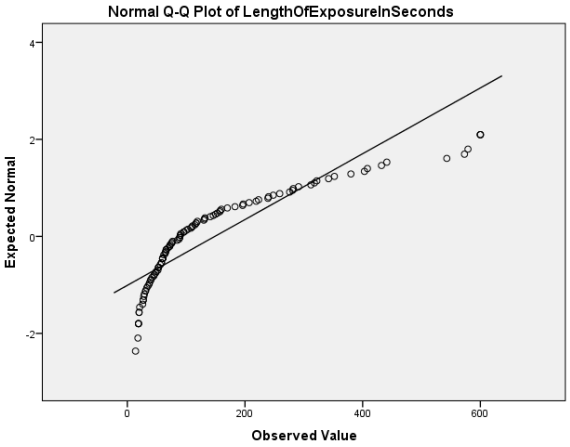
	Kolmogorov-Smirnov test			Shapiro-Wilk test		
Variable	Statistic	df	Sig.	Statistic	df	Sig.
Dwell time (milliseconds)	0,073	110	0,200	0,981	110	0,124
Time until the first fixation (seconds)	0,075	110	0,156	0,983	110	0,173
Length of exposure (seconds)	0,208	110	0,000	0,781	110	0,000

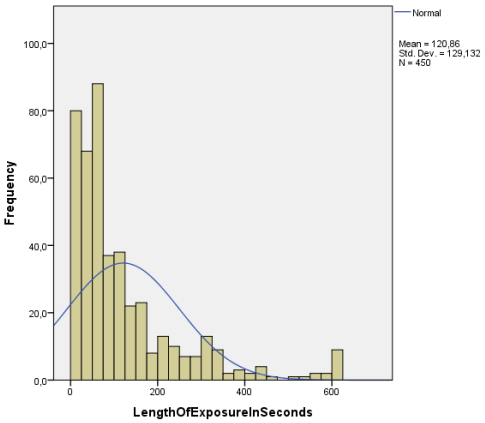












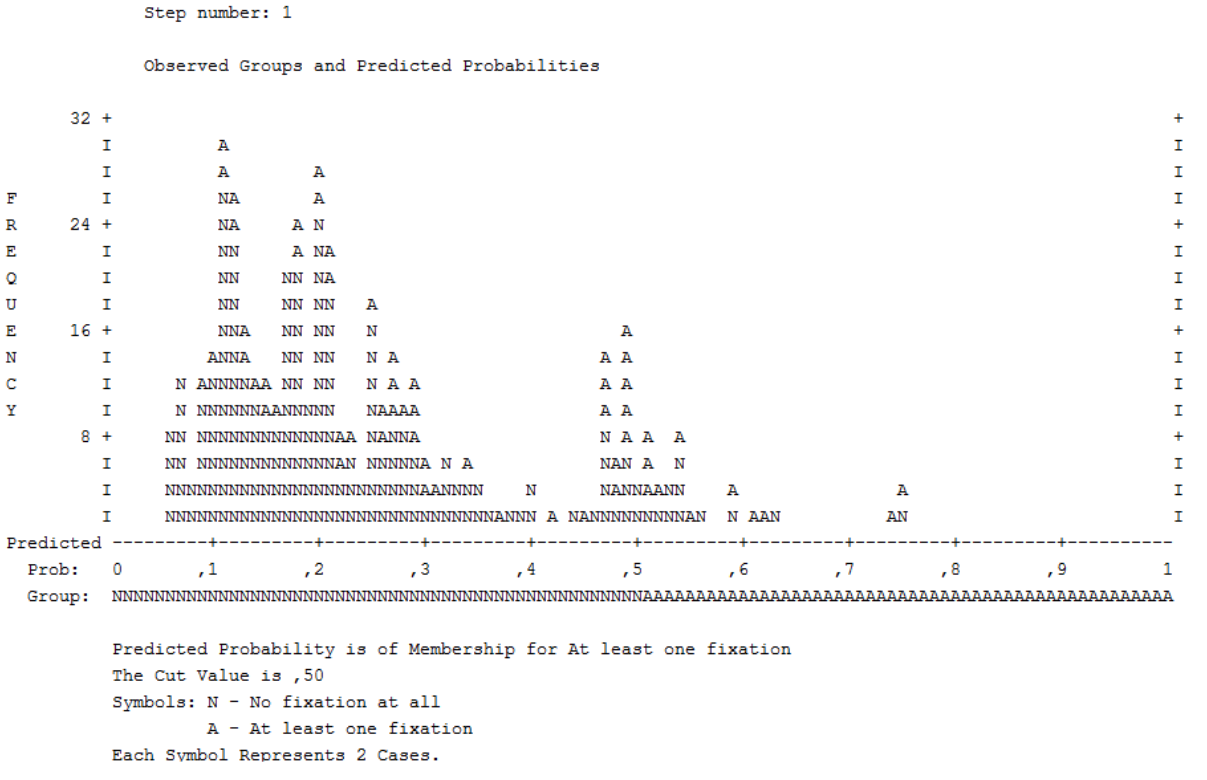
Appendix 3. Binary logistic regression with fixation as a dependent variable

Step	-2 log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	448,18	0,11	0,164

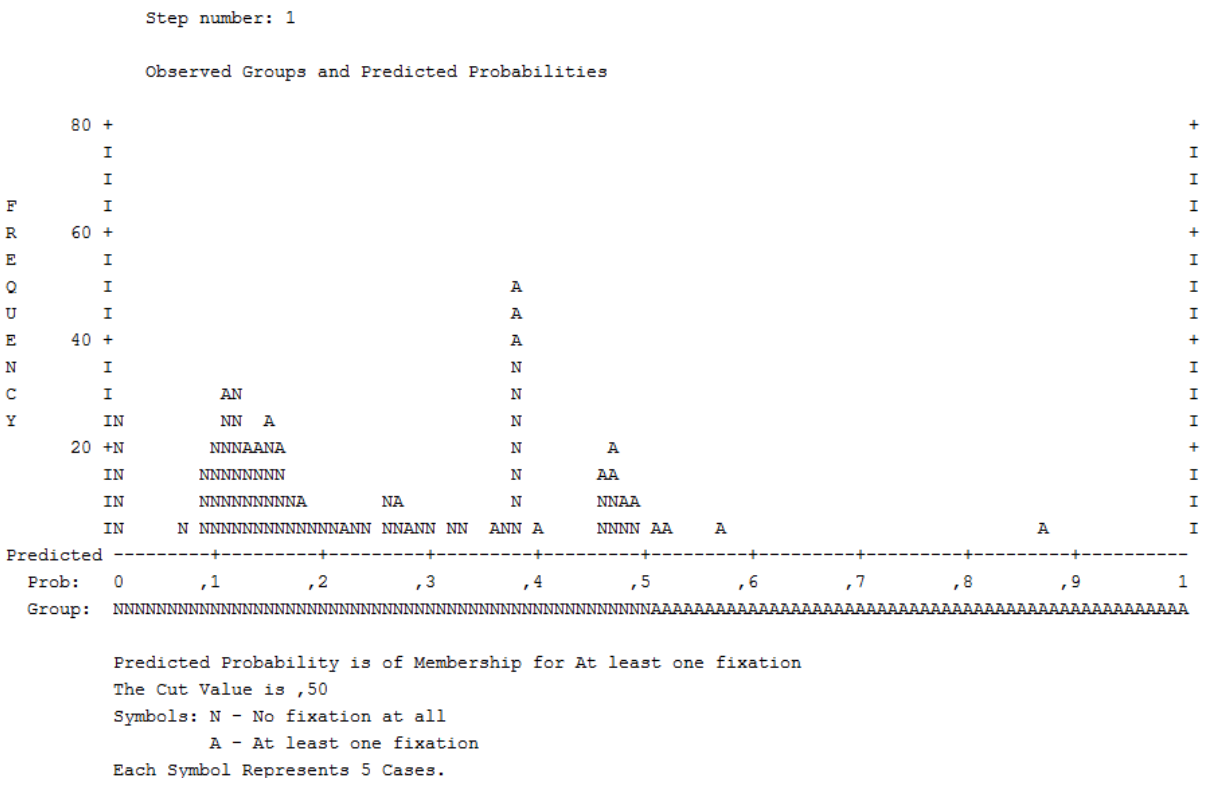
Observed		Predicted		
		Fixation		
		No fixation at all	At least one fixation	Percentage Correct
Step 1.	No fixation at all	321	19	94,4
	At least one fixation	92	18	16,4
Overall percentage				75,3

							95% C.I. for Exp. Beta	
Variable	Beta	Std. Error	Wald	df	Sig.	Exp. Beta	Lower	Upper
Control banner (dummy baseline)			33,839	4	0,000			
Treatment 1. Animation	-0,682	0,432	2,496	1	0,114	0,506	0,217	1,178
Treatment 2. Size	-0,192	0,399	0,233	1	0,629	0,825	0,378	1,802
Treatment 3. Position	1,307	0,345	14,359	1	0,000	3,697	1,880	7,270
Treatment 4. Distinction	0,334	0,364	0,845	1	0,358	1,397	0,685	2,849
Chrome (dummy baseline)			5,675	3	0,129			
Firefox	0,002	0,363	0,000	1	0,996	1,002	0,491	2,042
Internet Explorer	-0,729	0,336	4,709	1	0,030	0,483	0,250	-0,932
Safari	-0,526	0,468	1,26	1	0,262	0,591	0,236	1,480
Length of exposure (seconds)	0,002	0,001	5,98	1	0,014	1,002	1,000	1,004
Constant	-1,484	0,303	23,941	1	0,000	0,227		

Appendix 4. The classification plot of the binary logistic regression without interaction effects



Appendix 5. The classification plot of the binary logistic regression with interaction effects



Appendix 6. Multiple linear regression with dwell time as the dependent variable

Model	R	R square	Adjusted R square	Std. Error of the estimate
1	0,248	0,062	-0,013	78,46

	Unstandardized		Standardized			Correlations		
Variable	Beta	Std. Error	Beta	t	Sig.	Zero order	Partial	Part
Constant	340,231	18,167		18,728	0,000			
Animation (dummy)	24,84	31,421	0,092	0,791	0,431	0,069	0,078	0,076
Size (dummy)	17,596	28,202	0,076	0,624	0,534	0,043	0,062	0,060
Position (dummy)	16,76	22,358	0,106	0,75	0,455	0,103	0,074	0,072
Distinction (dummy)	16,744	24,727	0,089	0,677	0,500	0,154	0,067	0,065
Firefox (dummy)	-19,479	23,017	-0,084	-0,846	0,399	-0,050	-0,084	-0,082
Internet Explorer (dummy)	-13,222	24,183	-0,057	-0,547	0,586	-0,054	-0,054	-0,053
Safari (Dummy)	-30,754	31,227	-0,097	-0,985	0,327	-0,069	-0,098	-0,095
Length of exposure (seconds)	-0,063	0,052	-0,118	-1,199	0,233	-0,115	-0,118	-0,116

	Unstandardized		Standardized			Correlations		
Variable	Beta	Std. Error	Beta	t	Sig.	Zero order	Partial	Part
Constant	-374,85	24,496		15,302	0,000			
Animation (dummy)	-4,12	43,746	-0,015	-0,094	0,925	0,069	-0,010	-0,009
Size (dummy)	-14,71	42,693	-0,205	-1,118	0,267	0,043	-0,112	-0,107
Position (dummy)	-1,775	28,419	-0,011	-0,062	0,950	0,103	-0,006	-0,006
Distinction (dummy)	-20,822	24,686	-0,111	-0,843	0,401	-0,154	-0,085	-0,081
Length of exposure	-0,154	0,082	-0,291	-1,875	0,064	-0,115	-0,186	-0,180
Firefox (Dummy)	-19,299	22,909	-0,083	-0,842	0,402	-0,050	-0,085	-0,081
Internet Explorer (Dummy)	-20,807	24,372	-0,089	-0,854	0,395	-0,054	-0,086	-0,082
Safari (Dummy)	-33,688	31,096	-0,106	-1,083	0,281	-0,069	-0,109	-0,104
Animation x Length of exposure	0,157	0,177	0,139	0,886	0,378	0,052	-0,089	0,085
Size x Length of exposure	0,387	0,192	0,356	2,02	0,046	0,109	-0,200	-0,193
Position x Length of exposure	0,102	0,115	0,149	0,893	0,374	0,000	-0,090	0,085

Appendix 7. Multiple linear regression time until the first fixation as a dependent variable

Model	R	R square	Adjusted R square	Std. Error of the estimate
1	0,362	0,131	0,062	3,913

	Unstandardized		Standardized			Correlations		
Variable	Beta	Std. Error	Beta	t	Sig.	Zero order	Partial	Part
Constant	10,647	0,906		11,75	0,000			
Animation (dummy)	-1,322	1,567	-0,094	-0,844	0,401	0,041	-0,084	-0,078
Size (dummy)	-4,632	1,407	-0,384	-3,293	0,001	-0,214	-0,311	-0,305
Position (dummy)	-2,677	1,115	-0,326	-2,401	0,018	-0,138	-0,232	-0,223
Distinction (dummy)	1,259	1,233	0,129	1,021	0,310	-0,091	-0,101	0,095
Firefox (dummy)	0,506	1,148	0,042	0,441	0,660	-0,017	-0,044	0,041
Internet Explorer (dummy)	1,831	1,206	0,152	1,518	0,132	-0,105	-0,149	0,141
Safari (Dummy)	1,021	1,557	0,062	0,655	0,514	-0,053	-0,065	0,061
Length of exposure (seconds)	0,000	0,003	-0,008	-0,081	0,935	-0,022	-0,008	-0,008

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