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Where to Place an Online Ad: An Eye-Tracking Experiment

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Abstract
Internet advertising budget exceeds 100 billion $ globally, therefore it is important to see if those money are well spent. The aim of this article is to investigate if Internet users are looking at advertisements and where they are looking at. An eye-tracking experiment was designed to test how much attention- in terms of fixation time and fixation counts - is allocated to advertisements when users are performing different online tasks. Tasks were selected based on complexity – low/high complexity – and involvement – low/high involvement. The results revealed that the longer it takes to accomplish a task, the more the user will look at advertisements. Regardless of task, users pay the most attention to the top advertising area followed by downright advertising area. Even if the study has some limitations, it has also some valuable managerial recommendations.

Keywords: Online Ad, Eye-Tracking, Attention, Advertisement, Internet.

JEL classification: C91, D83, L81, M31, M37.

1. Introduction

Nowadays we live in the so-called attention economy because in this new economy attention is the most precious resource. If for all other resources - capital, information, and labor - the offer is relatively large, attention is limited. Moreover, as the volume of information available increases, the level of attention decreases. Therefore, it is considered that attention will be the currency of future business (Davenport and Völpel, 2001). Thus, the most important factor of success nowadays is to understand and manage attention (Davenport and Beck, 2001).

Attention is the object of interest of many sciences - such as cognitive psychology, education, consumer sciences and marketing (Galloway, 2017) - and one of the most important applications is in the field of advertising. In 2018, the budget allocated to Internet advertising in the US was over $ 100 billion, out of which 76% was allocated to search and banner advertising (IAB, 2019) and in 2019 it is expected that – at global level – Internet advertising will exceed for the first time the budget allocated to traditional media (Enberg, 2019).

At this scale, it is obvious that Internet users are bombarded with numerous advertisements and to ensure that messages are noticed, advertisers have developed various approaches. Initially, demographic and contextual targeting was used, which means that the advertising messages were displayed on relevant websites based on keywords or topics (Google Ads, 2019a). For example, if a user reads sports news, he will be shown advertisements for sports products. To increase efficiency, new approaches were developed such as geolocation targeting - delivering ads based on users' geographic locations (Google Ads, 2019b) and a more refined and complex one, behavioral targeting. This means delivering ads to online users based on their previous browsing behavior (Boerman et al., 2017).

Given recent regulations - the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA) - which prohibit or limit the collection of personal information (such as online activity) without users' consent, behavioral advertising has been affected. Moreover, some consider that even the mechanism of programmatic advertising – automated selling and buying of online ads according to users behavior on the Internet - constitutes a violation of GDPR principles (Bilz, 2018, DecisionMarketing, 2018).

However, regardless of the type of targeting used by advertisers, Internet users learned to avoid advertising - a phenomenon known as advertising avoidance - and to focus on what they have to achieve. Users were actively avoiding looking at advertisements (Drèze and Hussherr, 2003, Wedel, 2015) following a process of habituation – learn to ignore a stimulus which is repeatedly presented. So, the research question is how much do Internet users look at advertisements, when and where exactly are they looking?

2. Literature review

2.1 Visual attention

Attention is not a unitary notion because it describes and explains a variety of psychological concepts - such as visual/auditory/ spatial attention, conscious/unconscious attention, overt and covert attention, divided and alternating attention and so on - and what it means is different in different situations (Styles, 2006). In principle, however, attention is a cognitive process by which we selectively focus on some type of information at the cost of ignoring other competing information (Anderson, 2015).

If we refer to visual attention in marketing, there have been three environments in which it was investigated: field environment (like retail), desktop environment, and nowadays virtual reality (Bigné et al., 2016, Husić-Mehmedović et al., 2017, Meißner et al., 2017). This classification is based more on the instruments used for measuring visual attention, desktop or mobile eye-tracking devices, but a comprehensive classification would be online versus offline activities and simulated versus natural environment.

Regardless of the environment in which it is researched, several theories have been developed that explain how we focus our attention. Since we have a limited ability to process visual information, it is important to allocate these resources efficiently not to waste important information (Woodman and Luck, 2015). Thus, top-down theories have emerged, that argue that attention will be allocated according to the task to be performed, so it depends on the viewer's mental representations. That is why the viewer will focus on the areas in which he considers he can collect the information he needs to fulfill his task (Foulsham, 2015).

Therefore, the main factors that explain how attention is distributed are task type or task complexity (Betz et al., 2010, Lo et al., 2014, Wang et al., 2014), impulsivity (Huang and Kuo, 2012) and involvement (Behe et al., 2015, Pieters and Warlop, 1999).

Other theories – called bottom-up theories - consider that how attention is allocated depends on the ability of some environmental factors to stand out. For example, in consumer behavior research, factors that attracted attention were related to design features such as shape and contrast (Orth and Crouch, 2014, Uggeldahl et al., 2016), product presentation and seller reputation (Wang et al., 2016), position (Boz et al., 2017), pricing information (Guyader et al., 2017, Menon et al., 2016) and other information display (Guyader et al., 2017), visual / content complexity, familiarity and navigation fluency (Clement et al., 2013, Otterbring et al., 2016, Otterbring et al., 2014).

In the online environment, numerous researches show how attention is allocated based on shape, size, color, and location of ads (Kuisma et al., 2010). This allocation of attention can be represented by so-called scan paths that can be highlighted with the help of eye-tracking devices. Some say that users follow an F pattern while scanning. This means that they focus on the upper and left part of the content area: two horizontal stripes followed by a vertical stripe, like an F shape pattern (Lam et al., 2007, Nielsen, 2006, Pernice, 2017) similar to how we read a text. But there are other viewing patterns - such as - Z pattern, Gutenberg diagram (Heijmans, 2018), layer cake, spotted, marking and bypassing patterns (Pernice, 2017). So, the question is what are the factors that determine these different attention allocation strategies? While some authors consider that attention is distributed based on how the information is organized on the webpage - with or without a clear hierarchy (Babich, 2017), other authors consider that these viewing patterns are task dependent (Betz et al., 2010).

However, most researchers have come to a consensus that the way in which attention is allocated is determined by both bottom-up and top-down factors (Richardson and Gobel, 2015).

2.2 Task complexity

Online users do not access the Internet to look at advertisements but for other purposes: reading news, buying, sharing information, searching for advice, entertainment, etc. Therefore, advertisements constitute distractors that disturb them in carrying out the tasks that they have to accomplish. And these tasks can be extremely varied from simple (a reading task) to complex (a decision or judgment task). The level of complexity of a task is determined by attributes such as multiple pathways to achieve the desired outcome, multiple desired outcomes, conflicting interdependencies among paths and uncertain linkages among paths and outcomes (Campbell, 1988).

For our research, we will test two activities currently performed online: reading about an event and choosing/buying a product. While reading a text is a simple task, choosing between competing brands and deciding which one to buy is a more complex one.

2.3 Involvement

According to Behe et al. (2015) involvement can be defined as an individual's relevance of an item dependent on person’s needs, values, or interests-. It can be evaluated from different points of view, for example, involvement as a participant or as an observer (Greenwald and Leavitt, 1984).

Previous research shows that we can gauge a person’s involvement with various activities (task involvement) or objects (product involvement) using a context free scale (Zaichkowsky, 1985, Zaichkowsky, 1994). Involvement determines how much effort we put and influences our results. For example highly involved buyers give more consideration to the product and its specific information (Behe et al., 2015) and exhibit an active search behavior (Huang and Kuo, 2012). Accordingly, involvement ought to be utilized to check whether it influences how attention is allocated for online activities.

3. Methodology

3.1. Experimentation outline

The purpose of the experiment was to evaluate how much Internet users look at advertisements, when and where are they looking while they are performing different tasks.

Therefore, two distinct Internet pages were created, for two different tasks: one which resembles a news site and another one similar to an online store webpage. The two website pages are divided in two parts – one assigned to the task, called task area and what is left forms the advertising area (see Fig. 1). The task area is where information necessary to execute the task is displayed (1368 x 697 px).

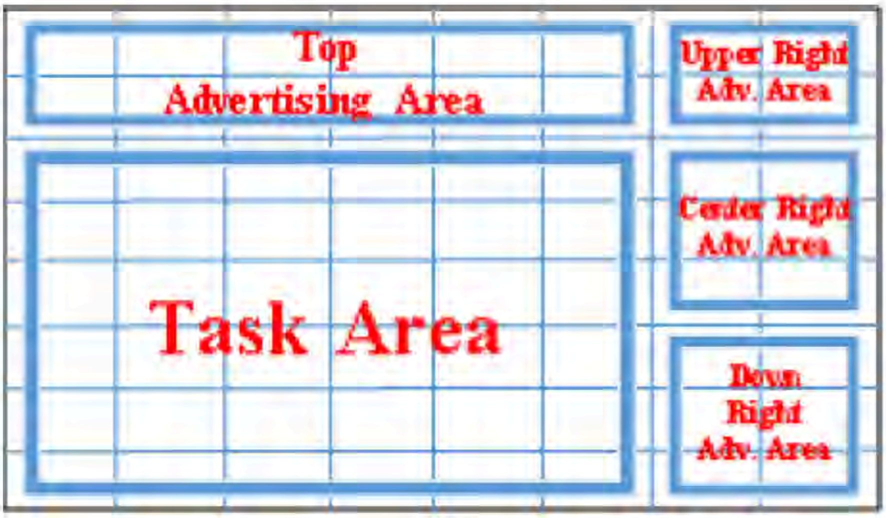

Figure 1. Undertaking and promoting zones on the testing pages

The advertising area is partitioned into four parts, according to Google advertisements guidelines (AdSense, 2017, Statista, 2014): top (970 x 90 px), upper right (300 x 250 px), center right (336 x 280 px) and down right (336 x 280 px) and in each area an ad was placed. The advertising area is divided as follows: 18,75% for top, 6.25% for upper right, 9.37% for center right and 9,37% for down right).

Complexity was controlled by asking participants to carry out an activity: either to read information about an event – on the news webpage - or to compare two products – on the e-commerce webpage. At the start of the experiment, subjects were told that the aim was to assess attention and the test consists of two stages, which were clarified in detail. , The eye-tracking apparatus was presented and the procedure described. Firstly, the participants had to answer to a short survey designed to measure their level of involvement with the activity they have to execute. Secondly, after the calibration of the eye-tracking apparatus, subjects have been instructed to execute a task: those which had to read where presented with the news site webpage while those which had to compare where presented the e-commerce webpage. They were permitted to achieve the assignment they got in their own pace. During the test, the examiner recorded additional information for every subject on an observation form.

3.2. Subjects

Subjects were chosen among students from business and finance faculties from the Bucharest University of Economic Studies and were granted with credit points. The subjects are Romanians attending English-language under graduation program. because ads were in Romanian and English language.

According to specialists (Kuisma et al., 2010, Nielsen and Pernice, 2010), 30 records are needed for each group in order to get stabilized results. Therefore, to get approximately 60 valid record it was needed to test 82 subjects, which were randomly assigned to a group as follows: the first respondent was assigned to group 1, the second one to group 2, the third one again to group 1, the fourth to group 2, etc. Out of 82 records made, we kept 59 records for investigation (29 for the first group and 30 for the second one). As we have previously mentioned, subjects were 19 - 22 years old belonging to Digital Natives, a generation which lives most of its time. on the Internet.

3.3. Measurements

Visual attention is the dependent variable in our experiment, while task complexity and task involvement are independent variables. Visual attention was measured with an eye-tracking apparatus which recorded fixations both in terms of quantity "fixation count" and time "fixation duration total time" for every area. While these indicators are usually utilized in eye-tracking research (Rayner and Well, 1996, Wątróbski et al., 2017, Holmqvist et al., 2011), they are measuring different dimensions. For instance, a higher number of fixations shows that users attempt to comprehend the content viewed (Poole and Ball, 2006), while longer time fixations might indicate a high interest and involvement (Poole and Ball, 2006, Galesic et al., 2008).

Task involvement was measured with a modified Zaichkowski scale (Zaichkowsky, 1994). We calculated for each participant an involvement score based on three dimensions – the importance, the interest and the need.

3.4. Device and software

The eye tracking apparatus utilized was SMI REDn Scientific System from SensoMotoric Instruments (SMI). The recommended manufacturer setting was utilized, SMI workstation and an extra screen, both with 1920 x 1080 HD resolution. The 24-inch size external screen was utilized at 60 Hz and Image Aspect Ratio was set to 16:9. The examiner sat in front of the SMI PC and the subjects in front of the stimulus external screen at a 45 to 84 cm (average 63 cm) distance from the eye-tracking sensor. Supplemental console and mouse were given to participants to use during the investigation. The experiment took place in similar brightness conditions for all participants.

For the examination the Software "Experiment Center ™" was utilized together with the online research platform "Lime Survey". To analyze the collected data "SMI BeGaze ™" and "IBM-SPSS ™" software was used. When designing the test pages, the researchers paid attention that every area of interest (both task and advertising area) fits into the standard gridded AOI of the "SMI BeGaze ™" analysis software of 8 x 8 automatic AOI's. To match this design, the advertising areas were included in the first two horizontal rows and the last three vertical columns. What was left represents the content area. Also, the automatic gridded 8 x 8 AOI helped us to partition the screen into 64 equal AOI that gave a reasonable delimitation between the task zone and the advertising zone. Since the AOI's were bigger than the visual stimuli researched (Wang et al., 2018), the participants could clearly perceive them. For analysis, information recorded by the right eye was utilized as past investigations (Niehorster et al., 2018) consider that the right eye sees the data in a uniform way, regardless if it is placed on the left or right half of the focal position. Moreover, SMI eye-tracking device gathers by default the data for the right eye. Information collected for each AOI was processed according to each sub-area: content: top, upper right, center right and down right. All the tests were performed and the statistical significance of the observed variations was checked using "SPSS™". For statistical significance test, a series of independent samples T-tests were used at a significance level set at 95%.

4. Results

Using the 64 automatic AOI's facility from the "SMI BeGaze ™" software, in Figure 2 it could be observed the area of interest most viewed in both scenarios – reading group and comparing group. Starting from red intense color (most viewed areas), thru orange, yellow, light green, dark green, light blue and dark blue (least viewed areas), it could be distinguished a colored map of attention distribution during the task performed.

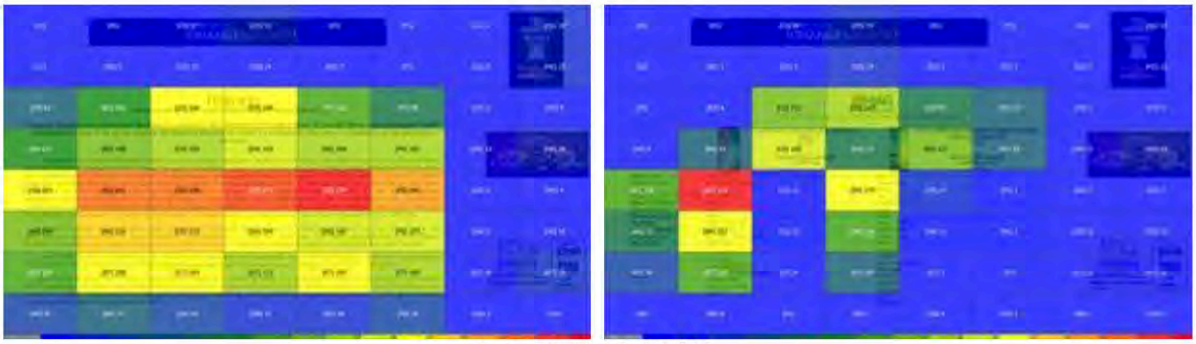

Figure 2. Grided AOI's
Reading group versus Comparing group

For reading group, the focus was more on the areas where the text was displayed. The map is more colorful, because in order to understand the text the subjects read line by line and needed a longer viewing time than the comparing group. Subjects in the comparing group quickly looked - back and forth - at the main features, of the two brands of mobile phones. Using focus map, it could be clearly seen the "F shape" distribution of attention in the reading task and the "I shape" in the comparing task (see Figure 3).

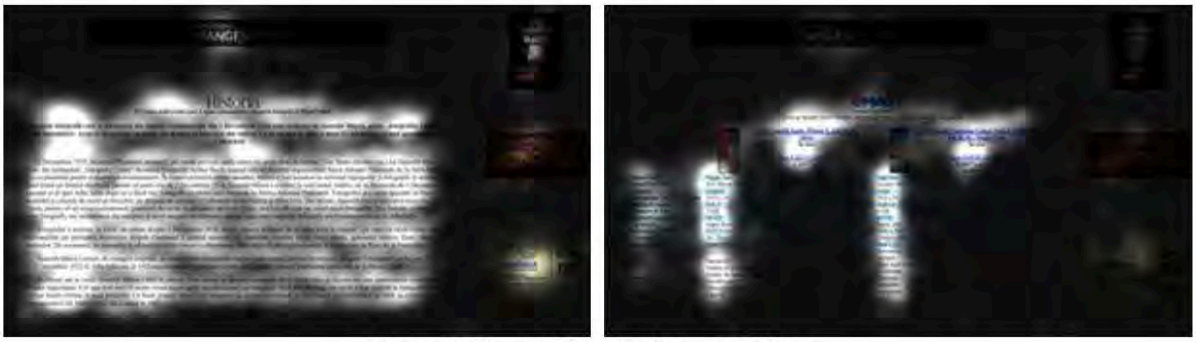

Figure 3. Focus Map: F shape vs I shape
Reading group versus Comparing group

While performing the task, participants have looked sporadically to the advertisements displayed on the webpage(see Figure 4). Still, there are differences considering the viewing patterns of the two analyzed groups. Reading group subjects looked and looked again more often at the top and down right advertisements as somehow these points define the boundaries of the page from where the readers start and stop visualizing the page. On the comparing task, as there is no need of starting and ending points, the participants has looked in a more uniform way to all the advertising areas on the page.

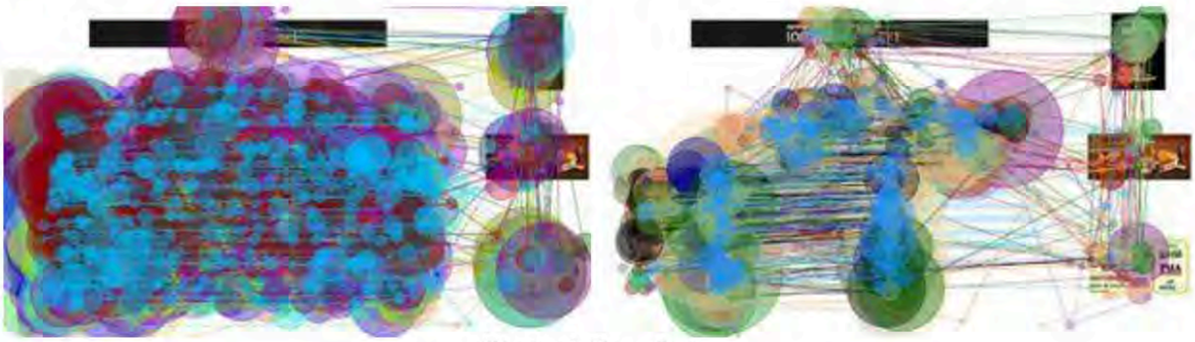

Figure 4. Scan Path
Reading group versus Comparing group

Based on "fixation count" and "fixation duration total time" recorded by the eye-tracking device for all AOI, we calculated attention indicators for the task area and the four advertising areas of the webpages. The values were analyzed in SPSS™ using t-test for independent samples to identify if the differences are statistically significant. In Figure 5 and 6 the values are presented both as nominal values and as percentages to better understand how attention is distributed. The values highlighted in green color (either Total time [T] in ms. or Fixation count [F]) are statistically significant different for the reading and comparing tasks.

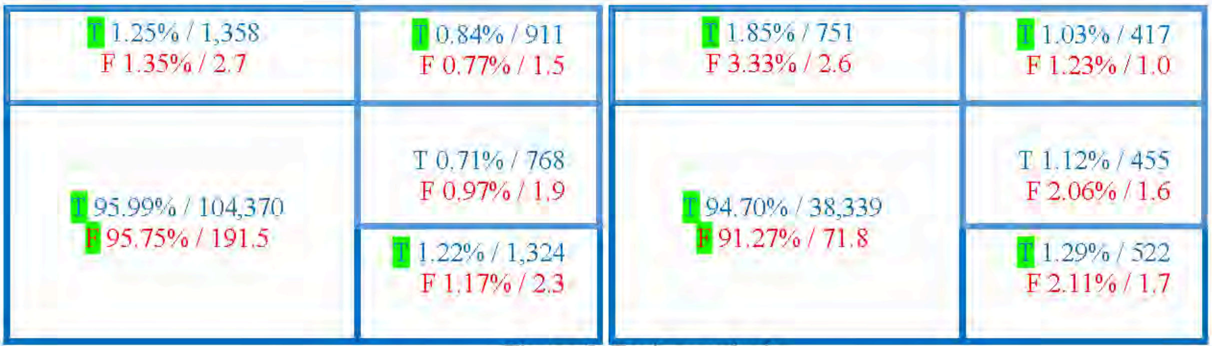

Figure 5. Task complexity

a) Reading *b) Comparing*

Total time (T) ms., Fixation count (F).

Analyzing from the task complexity point of view for "Task area" could be observed that reading depletes more visual attention than comparing – both in fixation time (+172%) and fixation count (+167%). We must mention that both total fixation time [F (14.643) = 8.278, p < 0.001, df = 57] and fixation count [F (19.184) = 6.612, p < 0.001, df = 57] are statistically significant different for the reading and comparing tasks. A "simple" task seems to consume more attentional resources, which means that task complexity is not as important as visual complexity, in the way in which information is presented.

For "Advertising area" statistically significant differences are only in terms of total fixation time [F (7.887) = 3.123, p < 0.005, df = 57]. "Comparing" group allocates more attention to the advertising area (>5%) while "reading" group less (<5%). If the task needs more attentional resources, the viewer will also allocate more attention on advertisments.

The differences between the tasks and the four advertising areas are statistically significant only in terms of total fixation time for "Top advertising area" [F (3.089) = 2.618, p < 0.05, df = 57], "Upper right advertising area" [F (22.689) = 2.922, p < 0.005, df = 57] and "Down right advertising area" [F (12.080) = 2.648, p < 0.05, df = 57]. Regardless of task, "Top advertising area" and "Down right advertising area" are the mostly viewed zones.

If we consider the degree of task involvement , the results differ from the general situation presented above. As we mentioned previously, task involvement was measured on a scale from 1 to 7, and at the sample level the average was 4.73 and the median was 4.66. Regardless of the task performed, we have divided the respondents into two groups - high involvement and low involvement - , considering value 5 as separation point. Since value 4 signifies the middle of the scale - a "neutral" point, so to say - , everything which exceeds this value can be safely named as high involvement.

Considering the value 5 as a threshold 28 subjects are part of the "High involvement" group and 31 subjects form the "Low involvement" group. There are significant differences between the "High involvement" group and "Low involvement" group on the "Center right advertising area" based on total fixation time [F (12.864) = -2.364, p < 0.05, df = 57] and on the "Down right advertising area" based on fixation count [F (6.178) = -1.984, p < 0.05, df =

57]. Another result is that there are no more significant differences on the main task area considering the number of fixations, while considering the total fixation time the differences are still significant [F (3.672) = -2.674, $p < 0.05$, df = 57], see Figure 6.

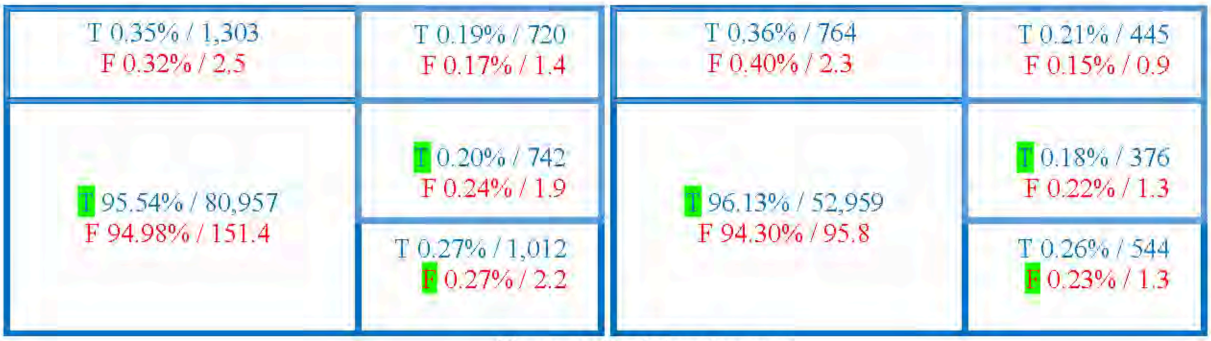

Figure 6. Task involvement

a) Low involvement ***b) High involvement***

Total Time (T) ms., Fixation count (F).

It seems that a low involvement task consumes more visual attention than a high involvement task, considering fixation time (+52%), which means that a highly involved viewer executes the task faster. On the other hand, in the advertising area there are differences in terms of total fixation time and fixation counts between high and low involvement groups. If the task needs more attentional resources (low involvement), the viewer will also allocate more attentional resources on ads. Regardless of task, again, "Top advertising area" and "Down right adv area" are the most viewed.

Conclusions

As we mentioned previously, the aim of this study was to identify how much do Internet users look at ads, when and where exactly are they looking.

Considering how attention is allocated on a website, we found out that, no matter what type of task is performed, the advertising area captures 4-6% of attention in terms of fixation time and 4-8% of attention in terms of fixation counts.

Nevertheless, there are differences in the way in which attention is allocated, depending on the complexity of the task. Based on our experimental data, we found that when the user reads (s)he will pay more attention (as a %) to the task and less attention to the ads than when (s)he performs a more complex task such as a comparison.

Although it seems counter-intuitive – because we assumed that a simple task will consume less attentional resources – there could be another explanatory factor, namely visual complexity, that is the way in which the information it displayed on a webpage. Thus, reading is a simpler cognitive task than comparing/decision making, but the fact that information is presented as text, sequentially and with a higher density, increases the visual complexity and implicitly the attention given to the task. And this will influence also the attention given to advertisements.

However, if we analyze the attention indicators (fixation time and fixation count) in absolute values – not as % - we find that when the task requires more attention, the user will pay also more attention to advertisements.

The same result was found in the case of the low involvement - high involvement task analysis. Because a low involvement task requires more time to complete, the attention paid to the advertisements will be higher. Simply put, the more attention a user allocates to a task, the more attention will be paid to distractors.

Considering the attractiveness of advertising areas, regardless of task type (low/high complexity and low/high involvement) the "golden" areas are “Top advertising area” - which attracts the highest number of fixations and the highest fixation time - followed by “Down right advertising area”. Thus, from a managerial point of view, the main recommendation is to place the ads on websites that consume more attention (such as news websites) and on the golden areas, such as “Top advertising area” or “Down right advertising area”. Unfortunately, it is difficult to make recommendations based on task involvement, because we cannot estimate the individual level of involvement of a user.

Beyond all these analyses, we must not forget that less than 5% of visual attention is allocated to online banner ads. Given the fact that global online advertising budget exceeds $ 100 billion, we wonder if this advertising model is efficient anymore. Additionally, current and future regulations limit the effectiveness of targeting strategies which will also affect online advertising efficiency.

Therefore, it is necessary to develop a new online advertising model, in which the advertisements will provide value-added to the user and not perceived anymore as distractors. To do so, some authors suggest adapting them according to user mood (Charlesworth, 2018). Thus, if the user is in information-seeking mood (search engine sites) he will be more open to ads containing details / characteristics of a brand, if he is in entertainment seeking mood (video-sharing platforms) the ad should be funny, if he is in advice mood (review site) the ad should provide recommendations from specialists, in a buying mood (e-commerce sites), the ad could provide information on deals, prices etc.

However, our research has some limitations. First of all, the participants in the experiment were students. Even if they are part of the digital natives - a generation of interest for advertisers - there are also other important generations of users who can exhibit different online behaviors that are worth studying.

Another limitation comes from the way in which we designed the task to be performed on a single webpage. However, when they have to accomplish something, users are not limited to just one page, but navigate back and forth, scroll, click on other pages etc. Additionally, we tested only display ads, not rich media ads which could be perceived as more appealing and we used demographic targeting which is less relevant than behavioral targeting.

A future research direction would be to test the memory. It is possible that users which didn’t look at an advertising area to “see” it through peripheral vision and remember it, while those which looked at it could not remember it. This research was conceived as an initial part of a larger study on attention in the online environment. New independent variables should be investigated- such as type of advertisements or type of websites - and their effect should be tested on both attention and memory.

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