Consumer Engagement Characteristics in Mobile Advertising

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Abstract: Advertising on mobile devices is becoming increasingly more important as the possibilities regarding their design and context become increasingly more extensive. This research focuses on the characteristics of design and context regarding mobile advertisements, structured according to the CRISP-DM process model. First, we describe their key concepts and relevant theoretical background. Then, we design the Mobile Advertising Effectiveness Framework for Consumer Engagement (MAEF4CE), which relates medium types, creative attributes, ad formats, device specific ads, and brand visibility as mobile advertisement characteristics. Finally, we uncover the combination of characteristics that elicits optimal consumer engagement in mobile advertisements in a real-time bidding dataset.

1 INTRODUCTION

The number of mobile device owners increased to 68% in 2015 for all ages (Deloitte, 2015). The biggest growth in mobile device owners occurred in the age category 55+. This indicates an attractive target group available for the purpose of mobile advertising. The advertising world is using mobile devices to reach their target group by a specific medium: the smartphone. Since mobile devices are personalized in a high degree advertisers are able to reach this target group more efficiently. Another difference between mobile advertising and traditional advertising is the possibility to use the capabilities of the device to specify a target, such as location-based data.

Less is known about the factors that trigger a user's behavior when they get served an advertisement (ad). In the case of mobile advertising we first distinguish two types of behavior. First, the user can or does not interact with the ad. This means that the user performs no action related to the banner and is therefore not engaged with the ad. The second behavior does involve the user performing an action, for example clicking on the ad. This interaction is called an engagement. This research focuses on the second behavior.

In a recent research Grewal, Bart, Spann, & Zubcsek (2016) looked at the broader picture of mobile advertising. Components related to mobile advertising were mapped into the *Mobile Advertising Effectiveness Framework* (MAEF) as separated components influencing the mobile advertising process. In this work we customize and extend MEAF to model the influence of ad design characteristics on ad engagement in mobile advertising: the MAEF4CE framework. The goal of this project is to increase the number of consumer engagements. Which will be measured based on different interaction types. The following research question is formulated:

Which combination of mobile advertisement characteristics can optimally improve consumer engagement?

To answer this question propositions are defined based on the literature and the MAEF. This research is structured according to the CRoss Industry Standard Process for Data Mining (CRISP-DM). CRISP-DM is a very commonly used method for knowledge discovery processes (Spruit et al., 2014). The related work is described in the following section, Section 2. This section also contains the explanation of some definitions that are important for the remainder of the report. Next, a theoretical background is set in Section 3 including the explanation of the MAEF and the introduction of the MAEF4CE. The research approach (Section 4) is structured according to the CRISP-DM phases: Domain Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, and at last the Deployment phase. The results are discussed in Section 5 followed by the conclusion and suggestion of further research in Section 6.

2 KEY CONCEPTS

Consumer Behavior. Generally, *consumer behavior* is based on the consumer's buying behavior. Since the purpose of mobile advertising is not persuading a user to directly buy a product, the approach of this research is focused on user awareness.

Mobile Campaign. An ad is part of a campaign. A *campaign* is a gathering of one of more ads that are used to persuade a target group to engage with a brand, product or service. An advertisement is defined by Flores, Chen & Ross (2014) as "an online advertising space that typically consists of a combination of graphic and textual content and contains an internal link to target ad pages or an external link to the advertiser's website via a click through URL". A mobile application can be added as a medium to display ads for mobile advertising besides websites. An ad that is made viewable in a website or application is called an *impression*. The ads within a campaign can be different. This means that the format, design and layout can differ between the ads of a campaign.

When a user interacts with an ad, such as by clicking or swiping, the user is *engaged* with the ad. The specific engagement is measured and therewith available for further analysis. The engagement measurements say something about the performance of an ad. The *Click-Through-Rate* (CTR) is the measurement that is most used in mobile advertising and indicates the performance by providing a ratio of the number of times the ad is served and the number of times the ad is actually clicked.

Mobile User. A *mobile user* is referred to as a person that owns and uses a mobile device. This research will be mainly focused on smartphone users. These mobile users are able to receive advertisements (ads) during the use of an application and/or mobile Web browser.

Brand Awareness. In this research *brand awareness* is defined according to the definition of Hoyer & Brown (1990) and is as follows: brand awareness is as a rudimentary level of brand knowledge involving, at least recognition of the brand name.

3 THEORETICAL BACKGROUND

3.1 Persuasive Technology

New technologies are more and more focused on influencing the behavior of consumers, which is generally referred to as persuasive technology (Fogg, 2002). According to Fogg (2002) , the Internet had a great influence on the growth of persuasive technologies. As an example he mentions the example of persuading Webshop visitors by making suggestions to buy more products based on their preferences (i.e. up-selling). The Internet also enables another medium of approaching consumers: advertising. Fogg (2002) states that persuasive technology is more effective when it is interactive. This characteristic distinguishes computer technologies from traditional technologies, such as television commercial and paper advertisements. Computer technology allows its users to interact, and therefore is able to adapt its content to the user. Additionally, computer technology is ubiquitous and versatile, and is able to generate and store lots of data (Fogg, 2002). Lane (2010) states that mobile devices with its sensors can create user profiles for advertising purposes.

Persuasive Advertising. Persuasive Advertising is defined by Armstrong (2010) as advertising that intends to influence other through all types of media. This media includes both traditional as 'new', modern media, like the Internet.

Mobile Advertising. The effectiveness of mobile advertising is measured by Goh, Chu & Wu (2015) by looking at the search behavior and advertising response of people who got served with a mobile ad. Goh et al. (2015) describe the benefits of mobile advertising, compared to the Internet market, as a targeted marketing strategy. Additionally, nowadays a lot of people own a smartphone (Lane et al., 2010). Location targeting and being personal are the main benefits of mobile devices due to the extensive number of sensors in mobile devices (Grewal et al., 2016; Lane et al., 2010). Goh et al. (2016), Wong, Tan, Tan and Ooi (2015) , and Lane (2010) conclude that mobile devices therefore are the most relevant media regarding advertising since it allows the advertiser to serve more tailor made advertisements to their consumers.

3.2 MAEF

As mentioned earlier Grewal et al. (2016) designed the Mobile Advertising Effectiveness Framework (MAEF). The MAEF is a framework that maps the components involved in the setup and design of an advertisement and its purpose is to create a research agenda. The components defined by Grewal et al. (2016) are: context, consumer, ad goal, market factors, ad elements, and outcome metrics.

The following Section (3.3) will first simplify the framework to better fit the more narrow scope of this research. Then, the MAEF is expanded with some additional ad elements and metrics.

3.3 MAEF for Consumer Engagement: MAEF4CE

The MAEF model shown is too extensive and unfocused for our research application. Therefore we first customize it by removing various components that are not applicable to the domain of this research. For example, the 'Market Factors' are being disregarded due to the low impact on the ad goal and the ad elements to limit the scope due to page restrictions.

3.3.1 Context and Consumer

The MAEF includes two components that influence the ad goal directly. First, they split the 'context' of an ad in two types: environmental context and technology context. The *environmental context* contains factors, such as location, time, weather, and events, that described the environment in which the mobile device is located at the moment an ad is, or can be displayed (Grewal et al., 2016). The second type of context is *technology context* and is based on the specifications of the mobile device, such as the size of the screen and the location (website or application) they come from. They found that the context in which an ad is served is very important regarding the behavior of the consumer towards the ad.

The second component 'consumer' contains information about the consumer. Besides the information of the current state of the consumer in the 'customer journey', it also contains information about the history of the consumer and possibly demographic information (Grewal et al., 2016).

The context and consumer components contribute to the determination of the goal. The components allow an advertiser to specify its target based on data that is generated by mobile devices. These components are not further specified in this project, but are mentioned in the model since their influence, provided that they are chosen accurately, can be of great influence on ad performance (see column A of Figure 1).

3.3.2 Ad Goal

The ad goal is what the initiator of a mobile campaign aims for. It determines the target of the campaign. The MAEF mentions multiple ad goals, however several elements are not included in this project. The focus is on the 'engagement goal' and therefore the rest of the outcome metrics are removed from the framework (see column B of Figure 1).

3.3.3 Ad Elements

The Ad Elements in the MAEF are elements that characterize the look and feel of an ad and from now on referred to as design characteristics. The characteristics given by Grewal et al. (2016) are the ad medium, media type, pull versus push, interactive versus static, and promotional elements.

Ad Medium. Grewal et al. (2016) mentions that a mobile device can function as different ad medium. First, the mobile device can be the only screen the consumer is working with, but can also be the second screen besides, for example, a television. In this project we assume that the mobile device serves the purpose of the first and only screen and therefore ad medium is removed from the MAEF.

Pull/Push. In the MAEF distinction is made between pull and push methods for advertising. With the pull-based method the consumers pull the advertisement by opening a specific mobile website or application (Grewal et al., 2016). The second method is the push-based method, and relies on the delivery methods such as SMS. This project is only focused on the pull-based methods and therefore the pull/push element is removed from the MAEF.

Promotional Element. An ad might contain a promotional element. This means that an ad can contain discount offers for the consumer (Grewal et al., 2016). This element is not taken into account in this project since the purpose of the ads are more often to create traffic to the website of the client.

The ad elements described below are included in the framework, as shown in column C of Figure 1.

Medium Type. The medium type is the channel through which the ad is served to a consumer. The types can be a mobile Webpage (site) or a mobile application (app). Both are opened by the consumer itself. The content of the Webpage or application can influence the perception of an ad (Grewal et al., 2016). Since the content of an app is more personalized, the user installed the app itself (Grewal et al., 2016), we expect that the ad is more personalized and therefore more likely to be interacted with.

Proposition 1. *An ad that is served in an app elicits better consumer engagement than an ad served on a site.*

Creative Attributes. Grewal et al. (2016) distinguishes four types of creative attributes (IAB Nederland, 2014) in mobile ad: static, dynamic, interactive, and ads containing a video. In the MAEF the creative attributes are indicated as interactive / static. The type of creative in an ad can be important regarding how inviting the ad is for interaction (IAB Nederland, 2014). According to de Sa, Navalpakkam, &
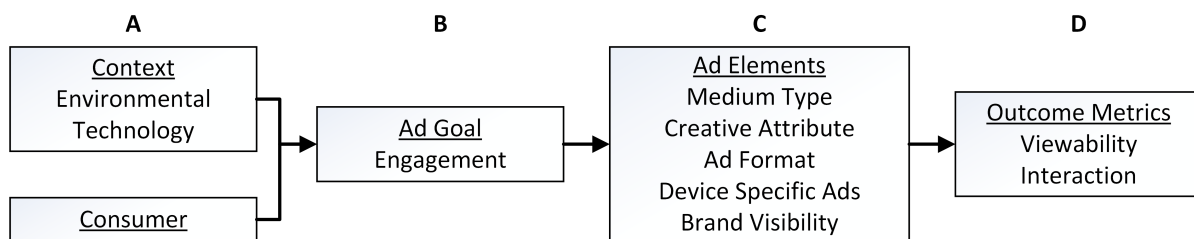
Figure 1: MAEF4CE: Mobile Advertising Effectiveness Framework for Customer Engagement.

Churchill (2013) an in-ad animation leads to a negative impact on user experience than ads that are not animated. Based on Sa et al. (2013) we expect that a static ad will elicit the highest consumer engagement compared to a interactive, dynamic, or video ad due to the possible negative impact of animated ads.

Proposition 2. *A static ad will elicit better consumer engagement compared to a dynamic ad.*

Ad Format. According to a study performed by de Sa et al. (2013) is an smaller ad preferred over a larger ad. We expect that large ad sizes elicit better consumer engagement since a large banner size is completely filling up the device screen.

Proposition 3. *A 'large' medium type will elicit better consumer engagement compared to the other medium types.*

Device Specific Ads. The size of the mobile device limits down the space for mobile ads (Grewal et al., 2016). Since there are major differences in screen size of mobile devices it can be useful to create ads that are specific for certain screen sizes.

Proposition 4. *An ad that is screen specific will result in a higher consumer engagement than an ad that is not screen specific.*

Brand Visibility. Ghose & Todri (2015) concluded that advertising contributes to an increased interest in a brand. This ad element researches if the presence of a brand logo contributes to the recognition of a brand. According to Flores et al. (2014) does an ad containing images of the brand of the product positively influenced attitude towards the brand.

Proposition 5. *A visible logo within an ad results in a higher consumer engagement than an ad without a logo.*

3.3.4 Outcome Metrics

The outcome metrics are used to determine the result of serving a viewable ad to consumers. The metrics are explained below and shown in column D of Figure 1.

Viewability. This outcome metric is not described in the MAEF. Viewability is whether the ad is directly viewable, without performing an action by the consumer, or is viewable as a result of the consumer scrolling down. In this project all the ads used for analysis are viewable. This means that the ad is viewable the moment the consumer opens an application or site. As a result of the guaranteed viewability we can assume that the ad is seen by the consumer, because the ad was visible on a consumer's screen area (Ghose and Todri, 2015). An ad is considered to be viewable when at least 50% of the ad is visible for at least 1 second, according to the Media Ratings Council (MRC) (Ghose and Todri, 2015; IAB Nederland, 2015).

Interaction. Here, an interaction is considered as a measurable type of engagement. When an ad is actually visible to users.

The ratio is a composition of multiple interaction types. The interactions measured in this research are: i) installs, ii) clicks, and iii) events.

Installs. An install is an engagement in the form of an application installation as a result of an interaction with an ad. When the application is actually installed an 'install' event is registered.

Clicks. Clicks are the simplest form of interaction of the user and a served ad. When a user clicks on the ad a click event is registered. This 'click through' event often results in the navigation to another (web) page of the advertiser. In this project a click is categorized as an engagement.

Events. Besides install and click events other interactions can be elicited, such as dragging and swiping.

4 RESEARCH APPROACH

Quantitative research design is used to determine the relationship between advertisement characteristics and consumer engagement. Multiple statistical tests are performed to determine this relationships. The structure of the methodology, as described in the Introduction, is according to CRISP-DM. The follow-

ing order is used for the research approach description: Domain Understanding, Data Understanding, Data Preparation, Modeling, and Results (evaluation). The last, deployment, phase of the CRISP-DM will be absent as this paper is an exploitative research without an implementation.

4.1 Domain Understanding

Two parties can be distinguished in the process of serving an ad in a mobile device context (see Figure 2). First the one which provides the ad, the advertiser, and second, the party that offers an ad space in an application or site, the publisher. However, between the advertiser and the publisher are two service parties that make sure the ad is served in the right space, the bidding service and the auction service.

When an advertiser is going to use mobile advertising, the ad needs to be served in mobile contexts. Before a mobile ad, or impression, is served in a mobile application or mobile website, a Real-Time Bidding (RTB) process is performed. The Interactive Advertising Bureau (IAB) creates and maintains standards and specifications in order to improve the ad network landscape and describes RTB as bidding for individual impressions in real-time (IAB Nederland, 2014).

The advertiser is not directly involved in the auction, but is outsourcing the bidding process to a service on the Demand-Side Platform (DSP). Companies on the DSP compete in auctions to obtain an unique impression. This means that the advertiser is waiting until the auction for one unique banner is finished in order to serve an ad (IAB Nederland, 2014). The auction is finished when the highest bidder is determined. The decisions made regarding the participation in the auction and its result is based on computer algorithms, so there is no direct human input required (Yuan et al., 2013).

On the other hand, opposite to the advertiser and the DSP, are the publisher that offers the impressions, and the Supply-Side Platform (SSP) that conducts an auction among bidders on the DSP per impression.

4.2 Data Understanding

The data used in the research is made available by a company operating in the Dutch mobile advertising landscape, Mobile Professionals (MobPro). MobPro has build its own bidding server in order to participate in the RTB process. MobPro is mostly operating on a DSP. The data that is needed for this research is a result of three types of information: i) bid request information, ii) design characteristics, and iii) engagement information.

First, each impression has information that was generated during the RTB process consisting of information about the context of the prospective impression, such as the location of the user and device specifications. This information is stored in the (1) 'auction' table in Google BigQuery. BigQuery enables us to perform SQL-queries for data analyses. Second, some visual information is available of the ad that is shown during the impression, (2) the 'view' table. These are the design characteristics. The ad is only considered an impression when the design characteristics, specified by the advertiser and the designer, meet the specifications of the request. It is only possible that a certain design is shown to a user if the design fits the available ad space. Finally, data that is generated during the impression is stored in the (3) 'click' or 'event' table. This is the actual data about how the ad is perceived by the user and contains information about an engagement. The first two categories are constructing the independent variables, the last one forms the dependent variables.

4.3 Data Preparation

MobPro uses a system to store information about all the incoming bid requests. A bid request is the call from the bidding servers that an ad space is available. The data used in this research is only containing won bid requests, since only the bids that are won can be filled with an ad. This means that an incoming bid request is accepted, bid on, and the bid is won according to the highest bid respectively. This process takes place in the RTB process explained earlier.

Due to the large amount of data the dataset is that is used is reduced to limit number of bid request. First, we are using the auction data table (the incoming bid requests) of one day (2017-01-26). Since we are only interested in the ads that were actually viewable to users, the auction table is combined with the table containing the views. Joining the auction table and the view table results in a table with 3.16 million won bids on that day. In this step, for ad format and medium type, the design characteristics are directly filtered from the auction table. This means that the total numbers of views can differ per dataset for each hypotheses. Overall, the number of viewable ads was more than one million.

In the next step a distinction was made between the characteristics. For the creative attributes and brand visibility a list with campaigns was manually checked to assign the right value for each ad ($N = 151$). This means that each ad was checked and categorized for with the right characteristic. Since each
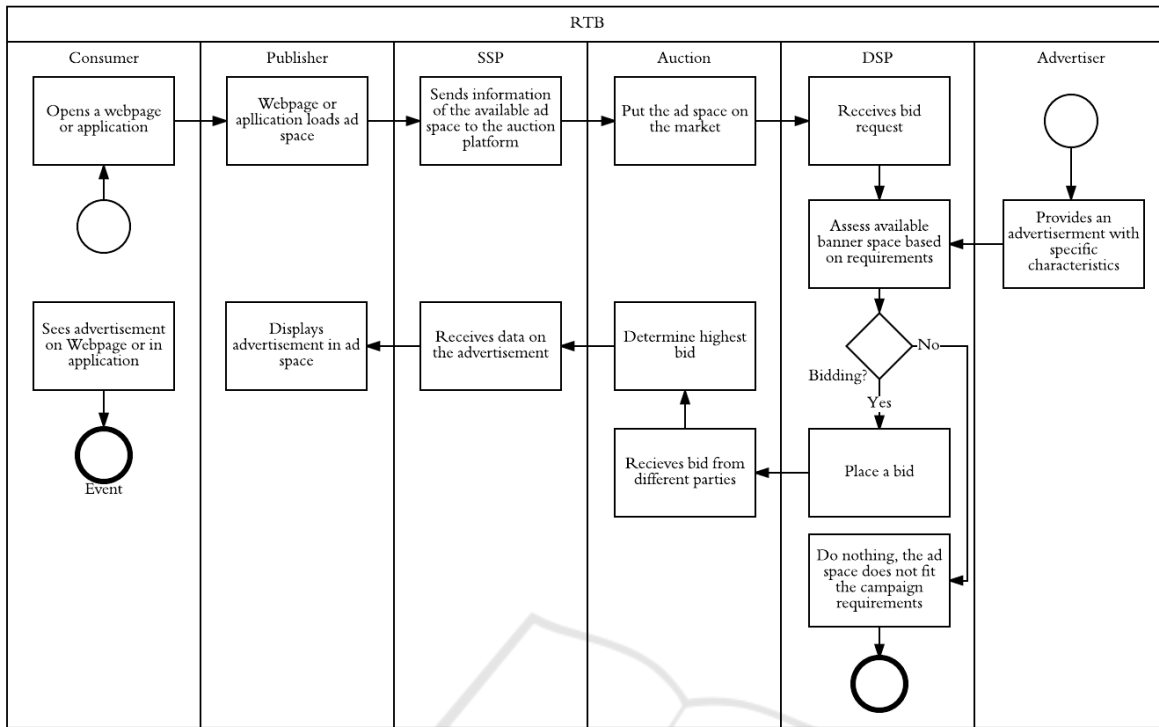
Figure 2: Summary of the Real-Time Bidding process and the involved parties.

ad in the dataset contained a logo or other brand indication, a distinction was made between whether a logo was visible more than 90% of the time ('long') or less than 50% of the time ('short').

For medium type and ad format the following approach was used. A new table was created for each for each possible value of a category while combining the views with the engagement data based on ad ID. Staying with the example of the ad format, three tables were created for each ad size and for each ad size an extra column was added with a '1' or '0' for indicating the an engagement or not.

Unfortunately, the data for the device specific ads could not be gathered from the available resources due unavailability of data and time limit. As a result that proposition 4 can not be tested.

4.4 Data Modeling

Both independent variables (clicking) and dependent variables (ad characteristics) are categorical data. First, to test the propositions defined in Section 3.3 null hypotheses and alternative hypothesis are formulated for each proposition. To analyze the hypotheses the significance level is 0.05 is used. Using the sample data, we will conduct a chi-square test for independence. The statistics are calculated using Python packages. The following packages are used: `pandas`

for data preparation and visualization, `numpy` for processing calculations, `scipy` as statistics library, and `matplotlib` for visualization of the results.

5 RESULTS

In this section the evaluation phase of the CRISP-DM is described by examine the stated propositions by applying the previous explained statistics.

Medium Type

The following hypotheses are formulated to test if medium type has an influence on consumer engagement (see Proposition 1):

H_0. *Consumer engagement and medium type are independent.*

H_a. *Consumer engagement and medium are not independent.*

The number of degrees of freedom is 4 which gives critical value of 9.49 at 95% significance level. The chi square statistic of 373.8271 ($n = 1016988$) exceeds the critical value and the $P - value$ (0.0) less than the significance level (0.05), we reject the first hypothesis. Thus, we conclude that there is a relationship between medium type and clicking.

Figure 3 shows the relative frequency of the two medium types. The 'site' medium is clicked more often compared to the 'app' medium (see Figure 3).
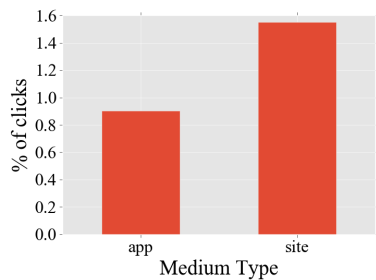

Figure 3: The distribution of medium type in app and site.

Creative Attribute

The following hypotheses are formulated to test if the type of creative attribute has an influence on consumer engagement (see Proposition 2):

H_0. *Consumer engagement and type of creative attribute are independent.*

H_a. *Consumer engagement and type of creative attribute are not independent.*

The number of degrees of freedom is 6 which gives critical value of 12.59 at 95% significance level. The chi square statistic of 42.9243 ($n = 306450$) exceeds the critical value and the $P - value$ (0.0) less than the significance level (0.05), we reject the first hypothesis. Thus, we conclude that there is a relationship between creative attribute and clicking.

Figure 4 shows the relative frequency of the three types creative attributes. The 'interactive' advertisement is slightly clicked more often compared to the 'video' and 'dynamic' ads (see Figure 4).
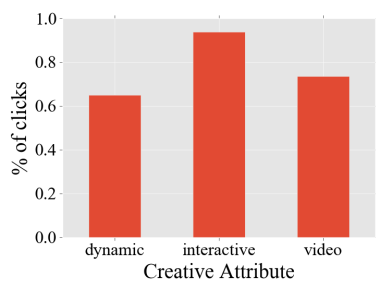

Figure 4: The distribution of creative attribute in dynamic, interactive, and video.

Advertising Format

The following hypotheses are formulated to test if advertising format has an influence on consumer engagement (see Proposition 3):

H_0. *Consumer engagement and advertising format are independent.*

H_a. *Consumer engagement and advertising format are not independent.*

The critical value is 12.59 at 95% significance level when number of degrees of freedom is 6. Calculating the chi-square distribution for $P(X^2 > 2554,77) = 0$ ($n = 1321890$). The chi-square exceeds the critical value and the $P - value$ (0.0) less than the significance level (0.05), we reject the first hypothesis. We conclude that there is a relationship between advertising format and consumer engagement.

Figure 5 shows the relative frequency of the three ad formats. The 'large' ad format is clicked more often compared to a 'small' and 'medium' ad.
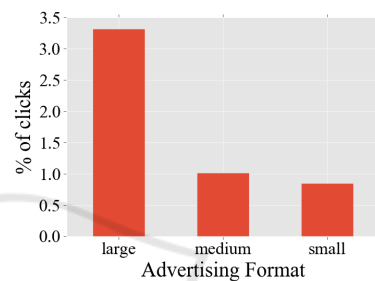

Figure 5: The relative frequency of the three banner formats.

Brand Visibility

The following hypotheses are formulated to test if brand visibility has an influence on consumer engagement (see Proposition 5):

H_0. *Consumer engagement and brand visibility are independent.*

H_a. *Consumer engagement and brand visibility are not independent.*

The number of degrees of freedom is 4 which gives critical value of 9.49 at 95% significance level. Since the chi square statistic of 77.04 ($n = 306.450$) exceeds the critical value we reject the first hypothesis. We conclude that there is a relationship between brand visibility and consumer engagement.

Figure 6 shows the relative frequency of the 'long' or 'short' visibility of a brand. This means that the figure shows the percentages of clicks compared to the total number of views for each specific brand visibility option.

The ads where the brand is shown less than 50% of the time are clicked more often compared to the ads where the brand was visible almost the whole time the ad was served (see Figure 6).
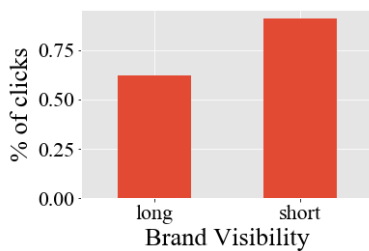
Figure 6: The clicks in percentages for on (non-)visibility of a recognizable brand in an advertisement.

6 CONCLUSION

All characteristics are not independent with consumer engagement, which means that they have a relationship with consumer engagement.

Proposition 1 stated that an ad in an app will elicit better consumer engagement, however, according to the results advertisements on a mobile site did generate more clicks. This proposition turned out to be false. In Proposition 2 we assumed that a static ad would be clicked more often. However, no static adds were found on in the data selection. Interactive ads did elicit the best consumer engagement. It turned out that an ad with a short brand visibility generated more consumer engagement compared to being the brand always visible (Proposition 5). Proposition 3 turned out the be true. The large ads elicits, compared to small and medium formats, more consumer engagement. At last, short brand visibility receives more clicks than long brand visibility. Proposition 5 can not be answered as true or false since all ads did show a logo.

7 DISCUSSION

Two of the four tested propositions (1 and 2) were stated incorrect. First, an ad in a mobile site is more clicked than an app. So while an app is considered to be more personal (e.g. having an app is the consumer its own choice), its use is goal oriented since it will fit the purpose of the app. Therefore, an ad opposed to browsing on a site, its content might vary more and ads are thus only additional varying content. Secondly, since no 'static' ads were included in the evaluation, another creative attribute elicited more consumer engagement: 'interactive' ads. Since the purpose of interactive ads is to engage interaction this output seems valid. Additionally, an interactive ad is relative newly creative type which can result in a limited coverage of the type in the literature.

7.1 Limitations

The data is only based on one day due to process limitations. So, different days of the week are not taken into account.

No information is available of the actions of the consumer after the click-out. This means, that we could not state anything on how effective the advertisement was regarding the engagement with the advertiser outside the advertisement.

Additionally, influences of other advertising media for the same campaign at the same time is not taken into account. For example, when a campaign for a certain brand is served on both mobile and television, brand awareness can be influenced by multiple channels.

7.2 Further Research

The 'context' and 'consumer' components of the MAEF are not tested in this project, but are highly interesting within this scope. An additional study could be the combination of the context or consumer characteristics regarding ad performance.

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