JOURNAL OF ADVERTISING
2022, VOL. 51, NO. 4, 440–449
https://doi.org/10.1080/00913367.2022.2077266

Interactive Ad Avoidance on Mobile Phones

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ABSTRACT

Ad avoidance (e.g., "blinding out" digital ads) is a substantial problem for advertisers. Avoiding mobile banner ads differs from active ad avoidance in nonmobile (desktop) settings, because mobile phone users interact with ads to avoid them: (1) They classify new content at the bottom of their screens; if they see an ad, they (2) scroll so that it is out of the locus of attention and (3) position it at a peripheral location at the top of the screen while focusing their attention on the (non-ad) content in the screen center. Introducing viewport logging to marketing research, we capture granular ad-viewing patterns from users' screens (i.e., viewports). While mobile users' ad-viewing patterns are concave over the viewport (with more time at the periphery than in the screen center), viewing patterns on desktop computers are convex (most time in the screen center). Consequently, we show that the effect of viewing time on recall depends on the position of an ad in interaction with the device. An eye-tracking study and an experiment show that 43% to 46% of embedded mobile banner ads are likely to suffer from ad avoidance, and that ad recall is 6 to 7 percentage points lower on mobile phones (versus desktop).

Ad avoidance is a critical concern for advertisers, as "banner blindness," or avoiding looking at digital display ads (Benway 1998), is a strong and robust phenomenon (Nielsen Norman Group 2018). Scholars have studied ad avoidance only in desktop settings (e.g., Cho and Cheon 2004; Baek and Morimoto 2012; Seyedghorban, Tahernejad, and Matanda 2016). However, with the growth of mobile advertising, advertisers and academics have called for research on whether and how such ad avoidance occurs on mobile phones (e.g., Liu-Thompkins 2019; Yaniv 2017). Using viewport logging, a method to extract granular path data from consumers' phone screens, we introduce and document a process of interactive ad avoidance specific to mobile phones.

Ad avoidance on mobile phones differs from avoidance behavior in non-mobile settings (along with general differences in ad viewing; Grewal et al. 2016). Because mobile displays are small, consumers cannot actively avoid looking at specific screen areas ("banner blindness"; Resnick and Albert 2014; Duff and Faber 2011); instead, they must interact with the ad to avoid it. Consumers first classify the ads as such; second, they actively move the ads; and third, they position them in a peripheral display location while considering the adjacent non-ad content. We refer to this behavior as *interactive ad avoidance*.

We investigate interactive ad avoidance on mobile phones in an eye-tracking study and an experiment that compares ad avoidance on mobile phones with ad avoidance in desktop settings. In line with the proposed interactive ad avoidance process, we find that the distribution of ad-viewing time on screen differs between mobile phones and desktop computers. While mobile ad avoidance results in a concave ad viewability pattern on users' screens (i.e., ads being viewable at the top and bottom of the screen instead of the center), ad avoidance on desktop computers shows a reversed pattern (i.e., ads being viewable in the screen's center, where they are "blinded out").

Our findings contribute threefold to extant research. First, we introduce interactive ad avoidance on mobile phones, following managerial and academic calls (Liu-Thompkins 2019; Yaniv 2017). Second, we contribute to the debate about mobile ad effectiveness (e.g., Grewal et al. 2016) by comparing ad avoidance

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Supplemental data for this article is available online at at https://doi.org/10.1080/00913367.2022.2077266.

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on mobile phones and desktop computers. Third, we introduce and test viewport logging (Grusky et al. 2017) as a valid, accessible, and scalable alternative to eye tracking.

Literature and Hypotheses

Ad Avoidance

Researchers have extensively studied ad avoidance in non-mobile contexts (Fransen et al. 2015). Viewing display or banner ads is usually a side product of another task (e.g., news reading: Shapiro 1999). Consequently, consumers perceive ads as intrusive and goal impeding (Li, Edwards, and Lee 2002) and often ignore them (Cho and Cheon 2004; Seyedghorban, Tahernejad, and Matanda 2016). In this process, consumers typically blind out (i.e., avoid paying attention to) display regions where ads are most likely located (e.g., top or side, where many desktop banners appear; Resnick and Albert 2014) or by selectively paying attention only to the surrounding content (Duff and Faber 2011; Lee and Ahn 2012). Such an avoidance process is active because consumers intentionally and actively focus on non-ad content (Cho and Cheon 2004; Duff and Faber 2011). Viewers do not interact with ads to avoid them but rather avoid paying attention to ads (in contrast to, e.g., pop-up ads, which have to be actively closed; Edwards, Li, and Lee 2002). Consequently, the presence of a viewable banner ad on a desktop screen is insufficient to prove that users paid attention to it (Lee and Ahn 2012).

Extant research focuses on identifying ad- and personality-related antecedents of desktop ad avoidance through surveys (see the Supplemental Online Appendix, Table 1); few studies investigate behavioral consequences through (eye-tracking) experiments. To the best of our knowledge, there is no research on ad avoidance behavior on mobile phones, nor a comparison of ad-viewing patterns across devices. Rau and colleagues (2013) use mobile phones to study antecedents of ad avoidance (e.g., intrusiveness), but not to study avoidance behavior.

Interactive Ad Avoidance on Mobile Phones

We assume that consumers are equally likely to engage in ad avoidance on mobile phones, as antecedents for ad avoidance behavior are consistent between desktop and mobile settings (e.g., ads are equally goal irrelevant; Cho and Cheon 2004; Rau, Liao, and Chen 2013). However, due to the characteristics of mobile phones, we suggest that the ad avoidance process is more interactive when it occurs on mobile phones. Because mobile displays are small, consumers cannot selectively pay attention to surrounding focus content, as they can on desktop computers (Duff and Faber 2011). Instead, they have to interact with their mobile devices to navigate irrelevant content out of the primary field of vision. This context requires an interactive three-step ad avoidance process involving cognitive and behavioral ad avoidance (Li, Edwards, and Lee 2002; Cho and Cheon 2004).

First, consumers must actively classify content as an ad (see Figure 1, Panel A). This classification involves at least a brief interaction as active fixation. If an ad is recognized, consumers will likely avoid paying attention to it to focus on relevant website content.

Second, consumers must directly interact with the ad to move it out of the center of attention. This process involves vision and movement (i.e., eye-hand coordination): consumers fixate on a particular position on the screen (e.g., the ad) and decide on the navigation of that position by scrolling (Johansson et al. 2001). This behavior is different in desktop settings, where an ad's fixation is often unnecessary to avoid it because the screen is large enough that irrelevant content can be actively blinded out.

Third, consumers typically place ads in peripheral screen locations while focusing their attention at the center of the screen (e.g., for news reading). Most mobile ads are embedded within relevant content (Grewal et al. 2016). They will remain peripheral while the actual website content is viewed in the central area (see Figure 1, Panel B).

Because both attention and avoidance involve consumer interaction (classification and eye-hand movement), we refer to the process of ad avoidance on mobile phones as interactive ad avoidance. Although ad avoidance on desktop screens may also involve active components, usually by scrolling (Cho and Cheon 2004), desktop ad avoidance remains less interactive than ad avoidance on mobile phones because (1) scrolling is only one of the avoidance strategies, as blinding out ad content is much easier on large desktop screens (Duff and Faber 2011; Lee and Ahn 2012; Resnick and Albert 2014), (2) scrolling does not necessitate a direct interaction with the ad, as it happens through a mouse or a bar on the side, and (3) scrolling does not involve a direct touch of the screen and ad.

Mobile screen time and actual attention correspond to the interactive active ad avoidance process: After briefly screening ads to classify them as such, users scroll

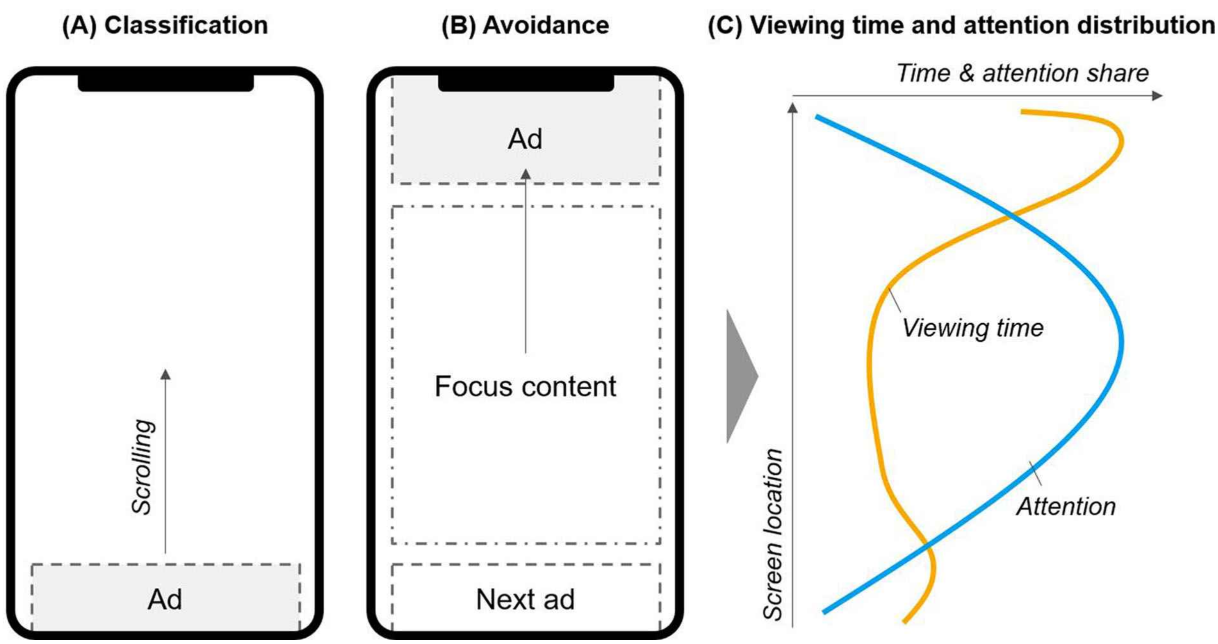

Figure 1. The interactive ad avoidance process. *Note*. Vertical screen position as in 90% of all mobile websites (ScientiaMobile 2018).

their screens to move ads and locate them at the top of the screen without attentively viewing them. Consequently, we expect differing patterns of screen time (concave: high at the screen periphery, low in the center of the screen: Figure 1, Panel C, yellow) and attention (convex: low at the screen periphery, high at the center of the screen: Figure 1, Panel C, blue) across the screen. Formally, we propose:

> **H1(a):** Consumers actively avoid mobile phone ads by scrolling them to peripheral locations that receive less attention.

> **H1(b):** Ad-viewing patterns on mobile phones differ from desktop devices, resulting in different areas where ads are viewable.

Incidental ad exposure research shows that active attention is not necessary for ad effectiveness (e.g., Shapiro 1999), but "mere exposure" to an ad is sufficient to achieve desired downstream consequences (e.g., recall, attitude; Schmidt and Eisend 2015). As ad avoidance patterns differ between devices, however, it will matter where ads are located when they are actively avoided: On desktop devices, ads will be actively avoided by selectively paying attention to surrounding content (Duff and Faber 2011). We suggest that ads are actively placed in peripheral locations on mobile devices while active attention is paid to the center of the screen, per hypothesis 1(a). Consequently, we suggest that for ad effectiveness, it matters (a) where on the screen the ad is displayed, and for how long, and (b) that the most effective regions will differ between devices (mobile versus desktop). Formally, we propose:

> **H2:** The effect of the time an ad is viewable on recall **(a)** depends on the location of the ad on a user's display and **(b)** interacts with the device on which the ad is viewed.

It is not evident from extant research whether ad avoidance on mobile or desktop devices will lead to differences in ad effectiveness, such as recall. On one hand, because the ads are located at the periphery of mobile displays, we could expect that incidental ad exposure effect is weaker. In addition, smaller display sizes might lead to shorter viewing times. On the other hand, the small mobile screen size implies that the human field of vision encompasses the entire mobile phone screen (Dagnelie 2011), including the peripherally located ad. The "mere exposure" effect might, thus, be more substantial. Because we do not have a clear theoretical indication for the direction of the difference in recall between devices under ad avoidance, we ask the following research question:

> **RQ:** Given different patterns of ad avoidance, on which device (mobile or desktop) are ads recalled more frequently?

Method

We employ two methods to measure users' attention distribution and interaction with mobile display ads across the screen.

Eye Tracking

Eye tracking is a pivotal technique for assessing ad attention (e.g., Meißner, Musalem, and Huber 2016). Although eye tracking is highly predictive of many marketing phenomena, it is very resource intensive and thus often impractical (Grusky et al. 2017). Despite recent decreases in equipment costs (Wedel and Pieters 2008), eye tracking still requires a controlled environment and time for researchers to map the gaze time to the tested material. We use eye tracking as a well-established baseline for capturing attention (Wedel and Pieters 2008).

Viewport Logging

Recently, studies have suggested viewport logging to assess users' attention on mobile phones at scale (Lagun et al. 2014). The viewport can be characterized as the "portion of the web page that is visible on the phone's screen at a given point in time" (Lagun et al. 2014, p. 2). The viewport changes and reveals previously hidden parts as the user interacts with the website (e.g., by scrolling the page), resulting in path data of the time that website elements (e.g., a search result, an ad) are visible to the user (e.g., Lagun et al. 2014). Research has successfully employed viewport data for studying active information retrieval in goal attainment (e.g., news articles; Grusky et al. 2017). We use viewport data to measure the movement (i.e., scrolling position) and timing of mobile banner ads across users' mobile phone displays.

Study 1

Design

Using eye-tracking data as a baseline, Study 1 compares users' attention to ads' viewport time. Participants ($N = 37$, $M_{age} = 24.3$ years, $M_{gender} = 13\%$ female) were told they were participating in a website usability study. Before a calibration procedure, they were fitted with a pair of Tobii Pro Glasses 2 (all participants had normal or corrected-to-normal vision). Participants were handed a mobile phone (Samsung Galaxy S6, OS: Android; browser: Google Chrome; screen size: 360×640 pixels) and were instructed to hold the mobile phone vertically at a viewing distance of about 19.6 in. (50 cm) and browse four news articles according to their interests and pace "as they would typically do" (i.e., self-paced).

We randomly sampled the presented articles from a more extensive set of seven articles (e.g., about music, food; mean word count = 709). Depending on its length, each article included at least two mobile display ads (medium rectangle; 300×250 pixels) randomly sampled from a more extensive set of 25 ads (e.g., for sports shoes; available upon request) from five industries. In line with marketing practice, the ads were embedded between paragraphs of approximately 275 words. Thus, participants saw at least eight ads. After they finished browsing the websites and reading the articles, we asked them to indicate unaided (open text) and aided (multiple choice from all ads) ad recall.

Throughout the browsing session, we recorded participants' gaze using eye tracking and viewport logging, including the position, time, and share of display advertisement visible to the participant. We calculated participants' raw gaze and mapped these calculations to the screen using a computer vision approach to measure attention. We aggregated viewport metrics by unique position (i.e., pixel) along the screen's vertical axis (or offset) and normalized it to the unit interval [0, 1] by dividing it through the screen's size. We excluded six participants due to technical problems with the eye tracker or with viewport logging.

Results

Model-Free Evidence

Participants recalled 48.6% of the ads (unaided: 16.9%). Their attention (i.e., gaze time) was mainly distributed across the upper half of the screen (see Figure 2, Panel A), with a mode at .24 vertical offset of the screen and approximately 50% of gaze distributed across the first third of the screen (median = .34). Thus, attention was approximately normally distributed across mobile screens ($\mu = .376$, $\sigma = .196$). Users' fixations concentrated on the left of the horizontal screen dimension (see Figure 2, Panel B).

The distribution of viewport time (i.e., the time a display advertisement has spent at a given position on the screen) descriptively confirms our hypothesized process (see Figure 2, Panel A). Specifically, ads spend the most time on the bottom of the screen (where they are classified as ads) and at the top (where they are positioned to be avoided). Consequently, viewport time has a bimodal distribution that peaks at the top (vertical offset mode = .06) and bottom of the screen (vertical offset mode = .92). As a result, the attention and viewport time distributions are largely disjointed, which implies that display advertisements have a high likelihood of spending time at screen positions with a low probability of receiving attention. This notion aligns with the interactive ad avoidance process, as suggested

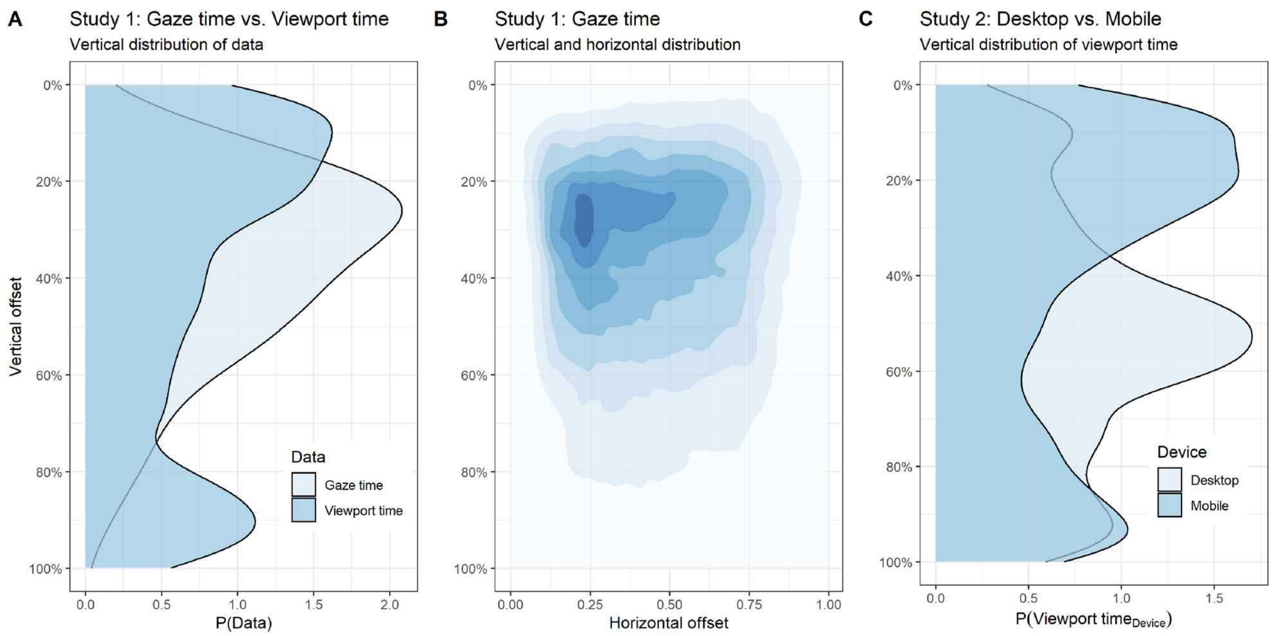

Figure 2. Empirical findings in Study 1 and 2.

in hypothesis 1(a): Mobile ads are not actively blinded out (as would be done in desktop settings; Resnick and Albert 2014), but users interact with the website to position ads on the screen's periphery.

Models

We separate unique screen positions into five equal regions of 20% vertical offset to test our hypotheses. We then aggregate the data by regions and include the regions as dummy variables in linear models on eye-tracking gaze time and viewport time. We estimate the linear models using ordinary least squares (OLS) with advertisement fixed effects to control for differences across ads.

The formal models replicate the model-free evidence of a convex attention pattern (see Table 1): Attention increases from the first to the second and third regions of the screen ($\beta_{Region\ 2} = 493.960$, $p < .001$; $\beta_{Region\ 3} = 101.974$, $p < .001$) and decreases from the first to the fourth and fifth regions ($\beta_{Region\ 4} = -313.472$, $p < .001$; $\beta_{Region\ 5} = -474.777$, $p < .001$).

In support of hypothesis 1(a), we find that viewport time follows a contrasting pattern and steadily decreases from the first region to the fourth region (Region 2 versus Region 1: $\beta = -1{,}390.821$, $p < .001$; Region 3 versus Region 1: $\beta = -2{,}744.617$, $p < .001$; Region 4 versus Region 1: $\beta = -4{,}196.786$, $p < .001$) and then slightly increases again relative to region four (Region 5 versus Region 1: $\beta = -3{,}184.890$, $p < .001$). In summary, the dynamics of attention and display advertisement position follow different patterns, in line with our proposed ad avoidance pattern, in which users actively scroll ads to locations where they receive limited attention.

We next assess whether the viewability of an ad affects recall. We estimate a series of logistic regression models (i.e., binomial link function) on aided (see Table 2, models 1–3) and unaided recall (see Table 2, models 4–6) with the raw gaze mapped to each ad (i.e., using the

Table 1. Model results for Study 1: fixations and viewport time.

	Dependent Variable	
IV	Fixation Time (in ms) (1)	Viewport Time (in ms) (2)
Region 2 (20%–40% of screen)	493.960*** (13.321)	−1,390.821*** (312.036)
Region 3 (40%–60%)	101.974*** (13.321)	−2,744.617*** (312.036)
Region 4 (60%–80%)	−313.472*** (13.386)	−4,196.786*** (312.036)
Region 5 (80%–100%)	−474.777*** (14.533)	−3,184.890*** (312.036)
Constant	601.032*** (9.774)	5,013.428*** (220.643)
Observations	18,590	1,450
R^2	.251	.132
Adjusted R^2	.251	.130

†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

Table 2. Model results for Study 1: aided and unaided recall.

	Dependent Variable					
	Aided Recall			Unaided Recall		
IV	(1)	(2)	(3)	(4)	(5)	(6)
Fixation count	.034*** (.008)			.015* (.006)		
Viewport logging (in μs)		.006† (.003)			.004† (.002)	
Region 1 (0%–20% of screen)			.013* (.006)			.009* (.004)
Region 2 (20%–40%)			.007 (.008)			.007 (.006)
Region 3 (40%–60%)			−.0003 (.011)			−.002 (.008)
Region 4 (60%–80%)			.002 (.025)			−.018 (.018)
Region 5 (80%–100%)			−.011 (.009)			−.004 (.006)
Constant	−.588*** (.121)	−.617*** (.129)	−.616*** (.130)	−.417*** (.089)	−.413*** (.093)	−.417*** (.094)
Ad fixed effects	✓	✓	✓	✓	✓	✓
Observations	290	290	290	290	290	290
Log likelihood	−188.094	−195.039	−191.965	−98.757	−100.670	−97.627
AIC	428.189	442.078	443.929	249.514	253.340	255.253

Note. AIC = Akaike information criterion.
†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

Tobii Pro Lab I-VT Fixation algorithm; Olsen 2012; eye tracking) and aggregate viewport time (viewport logging) as well as viewport time by display regions as predictor variables. As expected, eye-tracking fixations (models 1 and 4) explain both aided ($\beta_{\text{Fixation count}} = .034$, $p < .001$) and unaided ($\beta_{\text{Fixation count}} = .015$, $p < .05$) ad recall. Viewport time (models 2 and 5), in comparison, increased aided ad recall ($\beta_{\text{Viewport time}} = .006$, $p = .059$) and unaided ad recall ($\beta_{\text{Viewport time}} = .004$, $p = .089$) only at a significance level of $p < .10$. This result follows expectations per hypothesis 2(a), given our hypothesized interaction of ad viewability with the display region for which we find support in the data: When looking at the breakdown of viewport times across five equally sized regions of the screen (models 3 and 6), we find that time in Region 1 (i.e., top 20% of the screen, where ads are placed in the avoidance process) increases both aided ($\beta_{\text{Region 1}} = .013$, $p < .05$) and unaided ad recall ($\beta_{\text{Region 1}} = .009$, $p < .05$).

Study 2

Study 2 contrasts ad avoidance on mobile phones and desktop computers per hypotheses 1(b) and 2 and serves as proof of the concept of interactive ad avoidance per hypothesis 1(a) beyond laboratory settings (e.g., with different devices and environments).

Design

We recruited participants from an online consumer panel that allowed us to limit access to the experiment by the device (mobile versus desktop). Specifically, users could see the mobile (desktop) version of the experiment only if they used the mobile (desktop) version of the panel provider's website/app. Participants were instructed to browse three news articles. They saw articles in a randomized order with nine slots for display ads, populated by five target advertisements (available upon request). Articles and ads were selected in a prestudy ($N = 31$) based on consistent perceptions of pleasantness, arousal, and offensiveness.

As in Study 1, all ads were of medium rectangle format (300 × 250 pixels), consistent across devices to rule out confounding by the ad's size. While other ad formats are also available on desktop devices (e.g., top or side banners; Resnick and Albert 2014), medium rectangle ads are highly popular and considered the best-performing ad format (Sabharwal 2022). We randomized ads and repetitions and randomly allocated filler ads to the remaining free slots. Effectively, each participant saw between two and five unique ads centered horizontally on both devices and embedded in paragraphs of approximately 170 words. The article font size was held constant at 16 pixels.

To increase external validity and introduce variability in ad viewing, we placed a "continue" button at a fixed position at the bottom of participants' viewports. Consequently, participants could go to the next page without navigating to the bottom of an article. After participants had browsed all three articles at their own pace, we asked for their unaided and aided recall of the ads.

For Study 2, 375 participants ($M_{\text{age}} = 39.6$ years, $M_{\text{gender}} = 43\%$ female) completed the experiment. As in Study 1, we logged the viewport position and timing of the display advertisements. We excluded 87 participants (23%) who had technical problems (viewport logging did not work due to, e.g., deactivated JavaScript or ad blocker), resulting in a final sample size of 288 with 1,176 unique ads shown. Screen sizes on desktops (mobile phones) were on average 1,642 (381) pixels wide and 950 (794) pixels in height.

Results

Model-Free Evidence

Participants correctly remembered 65% of the ads with aided recall (mobile: 61%; desktop: 67%) and 26% with unaided recall (mobile: 21%; desktop: 28%). The viewport time of advertisements across the screen varies by device, in line with hypothesis 1(b), and is substantially shorter on mobile phones (median for mobile: 25.1 seconds versus desktop: 73.3 seconds). While the trajectories on mobile phones fit our proposed interactive ad avoidance process of classification (bottom), navigation, and positioning at the periphery, the trajectories on desktop computers follow a reversed pattern (see Figure 2, Panel C). Furthermore, distribution of viewport positions on mobile phones closely mirrors the bimodal distribution in Study 1 (see Figure 2, Panel A). Distribution peaked in the top 20% and bottom 40% of the mobile phone screen, with modes at .06 and .82 vertical offset. Consequently, the most unlikely position for display advertisements on mobile phones is the center of the screen (i.e., 40% to 60% of the screen's pixels). In contrast, this position is the most likely on desktop computers.

Models

We again estimate a linear model of (binned) screen position on aggregate viewport time, including a dummy for the device and its interaction with screen position. In support of hypothesis 1(b), we find that the time spent in each screen region is contingent on the participants' device (i.e., mobile phone versus desktop). In particular, the viewport time of advertisements on mobile devices is shorter ($\beta_{Mobile} = -8{,}325.108$, $p < .001$) than on desktop devices. For desktop devices, the viewport time is highest at the center ($\beta_{Region\ 3} = 3{,}625.667$, $p < .01$) and lowest at the bottom of the screen ($\beta_{Region\ 5} = -4{,}142.186$, $p < .01$). In these regions, ads' viewability is significantly lower (higher) for mobile devices (desktop devices) ($\beta_{Region\ 3\ \times\ Mobile} = -6{,}271.613$, $p < .01$; $\beta_{Region\ 5\ \times\ Mobile} = 6{,}605.176$, $p < .01$). The effect persists when controlling for repetitions.

Answering our research question, we found that ad recall is less likely on mobile phones (aided: $\beta_{Mobile} = -.405$, $p < .01$; model 1; unaided: $\beta_{Mobile} = -.624$, $p < .001$; model 4). This finding is likely a result of the shorter viewability of an ad. To investigate whether the display region where an ad is viewable explains aided and unaided advertisement recall per hypothesis 2(a), we ran a logistic regression, controlling for the number of repetitions, screen height, and advertisements shown. In line with Study 1 and in contrast to hypothesis 2(a), we find that ad recall does not increase when ads are viewable for a longer time at any position of screen (all $p > .05$ except for Region 3 and the unaided recall task [$\beta_{Region\ 3} = .002$, $p < .10$]; models 2 and 5).

We ran another logistic regression to test whether ad effectiveness interacts with display region and device per hypothesis 2(b) (Table 3). Explaining our findings on hypothesis 2(a), we find that the impact of ad viewability in a specific region interacts with the

Table 3. Model results for Study 2.

	Dependent Variable					
	Aided Recall			Unaided Recall		
IV	(1)	(2)	(3)	(4)	(5)	(6)
Mobile (vs. desktop)	−.405** (.154)	−.383* (.161)	−.488** (.184)	−.624*** (.166)	−.592*** (.172)	−.682*** (.200)
Repetitions	.508*** (.063)	.521*** (.071)	.506*** (.072)	.270*** (.055)	.230*** (.062)	.210*** (.063)
Viewport time (in μs)						
Region 1		−.002 (.002)	−.001 (.002)		−.001 (.002)	−.001 (.002)
Region 2		.004 (.003)	.003 (.003)		.0001 (.001)	−.002 (.001)
Region 3		.002 (.002)	.002 (.002)		.002† (.001)	.002 (.001)
Region 4		−.004 (.003)	−.004 (.003)		.001 (.003)	.000 (.003)
Region 5		−.002 (.003)	−.004 (.003)		.001 (.003)	.003 (.003)
Viewport time × Mobile						
Region 1			−.007 (.007)			−.008 (.009)
Region 2			.028†(.017)			.032** (.012)
Region 3			−.0002 (.012)			.006 (.009)
Region 4			−.001 (.008)			.003 (.007)
Region 5			.006 (.006)			−.007 (.007)
Screen height	−.001† (.0004)	−.001* (.0004)	−.001* (.0004)	−.001** (.0005)	−.001** (.0005)	−.001** (.0005)
Constant	−.003 (.450)	.062 (.454)	.105 (.462)	−.626 (.475)	−.519 (.484)	−.503 (.493)
Ad fixed effects	✓	✓	✓	✓	✓	✓
Observations	1,176	1,176	1,176	1,176	1,176	1,176
Log likelihood	−705.438	−702.432	−699.713	−647.974	−645.435	−640.496
AIC	1,426.876	1,430.865	1,435.427	1,311.948	1,316.870	1,316.992

Note. AIC = Akaike information criterion.
†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

device type and display region: models 3 and 6 show that for mobile devices, time at the top of the screen increases the likelihood of an ad being recalled compared to desktop devices in the unaided ($\beta_{Region\ 2\ \times\ Mobile} = .032$, $p < .01$) and with $p < .10$ in the aided recall task ($\beta_{Region\ 2\ \times\ Mobile} = .028$). We, therefore, find partial support for hypothesis 2(b).

In summary, Study 2 replicates both the distribution of ad viewport time, confirming hypothesis 1(a), and highlights the difference in ad-viewing patterns between mobile phone and desktop devices, per hypothesis 1(b), providing evidence that the effectiveness of ad viewport time on recall differs by screen regions and device, per hypothesis 2(b). Further, ads are less likely to be recalled if viewed on mobile versus on desktop devices (per our research question).

General Discussion

Through an eye-tracking study on mobile phones and an experiment that compared ad avoidance across devices (mobile versus desktop), our research shows that mobile users interact with websites to avoid seeing ads in a three-step pattern (interactive ad avoidance): They (1) classify new content that emerges at the bottom of the screen, then (2) actively scroll the ad to position it (3) at a peripheral location at the top of the screen and focus on the actual website content at the center (e.g., the news). Between 46% (Study 1) and 43% (Study 2, mobile) of the advertisements shown were actively avoided following a concave pattern (i.e., time spent in the peripheral was 40% higher than time spent in the central 60%) and 30% to 41% of participants showed such interactive ad avoidance behavior on mobile phones in most cases. This pattern deviates from active ad avoidance on desktop devices, where ad viewability peaks at the center of the screen. Mobile ad viewing time is 66% shorter, and recall is 6 to 7 percentage points lower. Despite interactive ad avoidance on mobile phones, the time an ad is viewable on display still explains ad recall—contingent on its display location.

Theoretical Implications

First, we show that due to the characteristics of mobile phones (e.g., small screens, navigation through eye-hand movement, embedded ads), mobile ad avoidance differs from ad avoidance in desktop settings. Specifically, mobile users are not only actively trying to avoid looking at regions where (fixed) ads are usually placed (banner blindness; Cho and Cheon 2004; Duff and Faber 2011), but also interact with their device to actively move (embedded) mobile ads out of their focus of attention to a peripheral location. This finding highlights that ad avoidance behavior is not only context, personality, and ad specific but also depends on the device.

Second, our findings contribute to the debate about the effectiveness of mobile marketing (Grewal et al. 2016). Specifically, our results indicate that consumers find mobile ads just as intrusive as desktop ads (Seyedghorban, Tahernejad, and Matanda 2016). This finding contradicts initial hopes about the greater effectiveness of mobile advertising (Peters, Amato, and Hollenbeck 2007). In contrast, our results provide early evidence that mobile ads might be less effective (i.e., lower recall).

Third, methodologically, our research highlights the opportunities that lie in viewport path data for the study of advertising. Our eye-tracking study highlights that the predictive power of viewport path data is on par with eye tracking but at considerably less effort. Further, the granular time series of observational data can be used to investigate consumer behavior (besides clickstreams and binary viewability; Grewal et al. 2016). We provide the JavaScript code to implement viewport logging in the Supplemental Online Appendix.

Managerial Implications

First, the peripheral ad viewability on mobile phones (versus central on desktop screens) implies that ad managers need to embed their ads carefully in the surrounding context so that the ad cannot be moved out of the display while reading the content (e.g., reducing the number of words in the text between the ads). In addition, ads should also be designed to account for the fact that only part of the ad may be visible (e.g., the company's logo at the bottom or the top of the ad).

Second, the different ad avoidance pattern on mobile phones (versus desktops) yields positive and negative news for ad managers regarding ad effectiveness, specifically recall. On one hand, we show that peripheral ad viewability is sufficient to predict recall on mobile phones. Thus, advertisers should not be concerned that their ads are moved to the screen's periphery but trust in the effect of incidental ad exposure. On the other hand, our data indicate that ad recall on mobile phones is lower than in desktop settings. This finding could result from the ads' peripheral (versus central) location and lower viewport time on mobile versus desktop devices. Thus, interactive ad avoidance on mobile phones seems more critical from an advertiser's viewpoint than ad avoidance on desktop devices, justifying lower prices for mobile (versus desktop) banner ads.

Finally, the heterogeneity in viewability patterns and the fact that recall effectiveness depends on the ad location on the screen calls into doubt the viewability policy model for ad payment (50% of the ad visible for more than one second; Media Rating Council 2014) for tracking and paying for ad exposure.

Limitations and Future Research

First, Study 1 shows that viewport logging performs on par with eye tracking for studying ad avoidance in mobile settings. As Study 2 does not include eye tracking, we cannot generalize this finding beyond the mobile context. Further, although ad avoidance research on desktop screens has already established ad avoidance through blinding out ads in eye-tracking studies (Lee and Ahn 2012; Resnick and Albert 2014), to the best of our knowledge, no research to date has collected eye-tracking data for embedded banner ads (versus ads on the top or the side of the desktop screen). We did not collect eye-tracking data in Study 2, which is a limitation that offers an opportunity for future research.

Second, our research focused on documenting the interactive ad avoidance process on mobile phones (versus desktop devices), ignoring potential moderators of mobile ad avoidance. Some moderators are likely consistent with non-mobile ad avoidance (e.g., task orientation; Cho and Cheon 2004), while others are likely specific to mobile phones (e.g., usage context; Liu-Thompkins 2019).

Finally, it would be worthwhile to study how consumers' ad avoidance strategies evolve. For instance, consumers might perceive a trade-off between (active) ad avoidance and ad blocking (e.g., Söllner and Dost 2019). Further, ad avoidance patterns might change over time, as adverse reactions to personalized mobile ads (Bernritter, Ketelaar, and Sotgiu 2021) might decline with increasing data protection.

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