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Moderating effects of prior brand usage on visual attention to video advertising and recall: An eye-tracking investigation

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ABSTRACT

For advertisers, attracting attention to video marketing stimuli is paramount to building and refreshing consumers' brand memories and increasing their propensity to purchase. Research has demonstrated brand users are more likely to recall advertising, possibly suggesting a brand's commercials draw more attention from current users than potential new customers. Testing whether prior brand usage moderates the effect of visual attention on recall, infrared eye-tracking collected fixation data from nearly 700 participants across 64 video advertising executions. The results indicate that brand users and non-users can give similar levels of visual attention: what matters is how the effectiveness of this attention differs across the two groups. Prior brand usage moderates the effect of visual attention on recall; light and non-users giving more attention have better recall. However, this effect does not exist for heavier users. These findings highlight the importance of developing advertising to gain visual attention from potential customers.

In the current landscape of fragmented media and information overload, attracting consumer attention is an increasing challenge. A key task for a brand's marketing stimuli is to grab attention, so that it can build or refresh brand-associations and in doing so improve potential customers' propensities to buy the brand. Most brands have many potential customers who are product category users, but not users of the particular brand. Advertising that prompts potential customers to trial a new brand increases the brand's customer base, increasing penetration, market share, sales, and profits (Anschuetz, 2002; Riebe, Wright, Stern, & Sharp, 2014). Advertising expenditure worldwide is estimated at > 2.5% of global gross domestic product (USD$500 billion per annum) (WARC Data, 2018; World Bank, 2016). As advertising is a core marketing tool and a large expense for companies, making it as effective as possible at attracting potential customers is vital for business growth.

Building and refreshing links to a brand in consumers' memories is an important outcome for advertising (Erfgen, Zenker, & Sattler, 2015; Romaniuk, 2009), as there is typically a time lag between advertising exposure and purchase. When advertisers measure the effectiveness of their advertising using memory measures like recall, they generally notice that the brand's users are more likely to recall the brand's advertising than non-users, i.e., potential customers (e.g., Rice & Bennett, 1998; Vaughan, Beal, & Romaniuk, 2016). It has been suggested that this difference in recall could be explained by a difference in attention at the time of viewing the commercial (Harrison, 2013; Vaughan et al., 2016). According to some schools of thought, consumers are assumed to pay attention to advertising for the brands they buy, but little attention to advertising for brands they do not (Ehrenberg, 1974). This might explain why it is difficult for advertising to prompt trial among brand non-users and recruit them as new customers.

At least some attention to a brand's advertising is needed for it to have a chance to influence consumers' memories and eventually nudge their propensities to buy (Bellman et al., 2017; Ehrenberg, Barnard, Kennedy, & Bloom, 2002; Percy & Rossiter, 1992). To work towards developing dynamic advertising that is effective for attracting new customers, there is a need to understand more about how non-users pay attention to a brand's advertising. Visual attention to video advertising is particularly important to understand due to the strong link between visual attention and memory (Pieters, Wedel, & Zhang, 2007). The majority of marketing communication devices act through the eyes. For example, logos, colors, packaging, characters, and fonts all seek visual attention in the hope of improving the consumer's memory for the brand.

To date, a single study has investigated if prior brand usage has an

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effect on visual attention to video advertising (Heath, Nairn, & Bottomley, 2009). It found no difference when brand usage was dichotomized into users and non-users. Given the well-known dangers of dichotomization (Fitzsimons, 2008), the current study investigates whether visual attention varies when prior brand usage is measured across a range of levels. Importantly, the current study examines whether prior brand usage moderates the *effect* of visual attention to video advertising on recall, a common measure of advertising effectiveness.

The authors use eye-tracking technology, a useful proxy for visual attention (Orquin & Holmqvist, 2018), and a large sample of nearly 700 consumers representative of the US population for age and gender. The results reveal that prior brand usage moderates the effect of visual attention on recall; among non and light users, those who give more attention have better recall of the advertised brand. This effect is not seen in heavier brand users. These findings contribute to understanding how potential customers (i.e., non-users) view a brand's advertising and the importance of developing advertising to attract non- and light brand users' attention.

1. Background

Potential customers struggle to remember advertising for brands they do not buy or use (e.g., Vaughan et al., 2016). Customers can be divided into two groups: those who have purchased the brand in the recent past ("brand users") and those who have not ("potential customers"), where the "recent past" is a time period relevant for the product category (Bird, Channon, & Ehrenberg, 1970). To verify and update previous reports of this empirical generalization, the current study's authors collated the results from seven empirical studies of > 8000 brands across a range of product categories (see Table 1). A consistent pattern emerged for 93% of brands (i.e., 7477 brands): brand users were better at recalling the brand's advertising than non-users (Hammer & Riebe, 2006; Harrison, 2013; Rice & Bennett, 1998; Romaniuk & Wight, 2009; Sharp, Beal, & Romaniuk, 2001, 2002; Vaughan et al., 2016). This pattern holds no matter what memory measure is used as the dependent variable: recognition or recall, of the advertising or the brand, as shown by Vaughan et al. (2016).

This first section will examine theoretical explanations for why brand users may give more attention to a brand's advertising than potential customers (or non-users).

Table 1
Summary of the brand usage studies, comparing the number of brands with higher brand recall by brand users versus non-brand users.

Study[a]	Product category	Higher recall	
		Users	Non-users
		N (brand)	*N* (brand)
Vaughan et al. (2016)	Products & services	51[b]	19
Harrison (2013)	Products & services	7255	546
Romaniuk and Wight (2009)	Categories not specified	7	0
Sharp et al. (2002)	Travel destinations	21	0
Sharp et al. (2001)	Home loan & insurance	17	0
	Total: brands	7351 (93%)	565 (7%)

[a] Brand level data not available for Hammer and Riebe (2006) or Rice and Bennett (1998).

[b] The differences between brand users and non-users were reported as not necessarily statistically significant but all trended in the direction of higher recall for brand users.

1.1. Reducing advertising avoidance

Some authors hypothesize that the positive relationship between prior brand usage and recall might be caused by brand users giving more attention to a brand's advertising (Harrison, 2013; Vaughan et al., 2016). This perspective follows a key assumption of the early brand usage literature that brand usage increases attention by reducing advertising avoidance:

> *"Purchasers of frequently bought goods usually have experience of more than one brand and they mostly ignore advertising for brands they are not already using"* (Ehrenberg, 1974, p. 33).

The expectation that brand usage increases visual attention is plausible since vision is key to the effectiveness of video advertising. For example, visual branding frequency in video advertising, conceptually similar to looking more often at a brand's advertising, has been found to be positively related to recall (Romaniuk, 2009). Vision is one of the dominant sensory modalities for humans, and the visual system is organized to enable efficient processing (Cohen, 2014). Therefore, it is important to investigate how visual attention, and its effects, may be affected by prior brand usage. Visual attention can be influenced by two types of factors, which act in conjunction. Bottom-up factors refer to characteristics of the visual marketing stimulus (such as use of bright colors) (Orquin & Loose, 2013; Wedel & Pieters, 2008). When viewing video advertising there is an overwhelming amount of stimulation for the sensory receptors, often occurring concurrently (e.g., colors, but also camera movements, celebrities, etc.). Top-down factors, on the other hand, refer to traits and states of the consumer (e.g., prior brand usage, but also brand familiarity, and advertising familiarity). It is the influence of the top-down factor, prior brand usage, that will be considered in this paper.

1.2. Motivated processing

Theoretically, another explanation for why brand users would pay greater visual attention to the brand's commercials (Harrison, 2013; Vaughan et al., 2016) is that brand users may have a higher level of motivation to process information from the brand's advertising. This greater motivation to process may reflect brand users' greater involvement with the brand (MacInnis, Moorman, & Jaworski, 1991). Involvement is a state of mental readiness that is thought to influence the allocation of cognitive resources to a decision or action, such as processing advertising (Park & Mittal, 1985). Participants with higher involvement to process advertising have higher levels of recall (Petty, Schumann, Richman, & Strathman, 1993), because they process the advertising content with more effort using a central processing strategy.

This next section will examine the theory around why brand users and potential customers may give similar attention to a brand's advertising.

1.3. Existing memory structures and accessibility for the brand

Delving into the counter argument that brand users may not pay more attention to a brand's advertising, an explanation for why brand users may still have higher recall is that they can more rapidly access relevant memory structures (Gobet & Clarkson, 2004), brand associations (Romaniuk & Nenycz-Thiel, 2013), and attitudes (Fazio, Powell, & Williams, 1989). Potential customers may need to give similar attention to a brand's advertising simply to make sense of the advertising and to understand which brand is responsible for it. However, this similar attention may not lead to similar levels of recall because these potential customers lack the extensive brand knowledge structures that can be gained from brand usage (Alba & Hutchinson, 1987; Campbell & Keller, 2003). Non-users of the brand do not have direct personal experience with the brand, and consequently lack many important brand associations (Romaniuk & Nenycz-Thiel, 2013) and rapidly accessible attitudes

summarizing these associations (Fazio et al., 1989).

The more accessible in memory an attitude is, the stronger is its influence on information processing and behavior (Descheemaeker, Spruyt, Fazio, & Hermans, 2017). If brand users have more accessible favorable attitudes towards the advertised brand, this attitude accessibility may influence information processing to improve encoding and storage of the advertising brand, even if it does not influence the levels of attention. The memory structures explanation likens brand users to experts, who have developed memory structures that act as "templates" for storing new information (Gobet & Clarkson, 2004). For example, when expert and novice chess players are given the same amount of time to memorize positions on a chess board, experts are better at remembering these positions. Experts' memory templates can string together as many as 15 chunks of information referring to board positions that can be recalled later. Novices lack these templates and so are unable to store as many positions for later recall. Similarly, a brand's non-users may lack the highly-developed network of associations to the brand in memory that provides brand users with a template for encoding and storing memory for the brand from a brief period of visual attention (Campbell & Keller, 2003). Any of these memory accessibility explanations might account for why it is more difficult for non-users to process a brand's advertising and remember it later in memory tasks and purchase situations.

The following section will examine empirical evidence from eye-tracking studies assessing the effects of the top-down factor, prior brand usage, on visual attention. Examining eye movement using eye-tracking technology is useful as it provides a continuous proxy of visual attention (Orquin & Holmqvist, 2018), a superior method compared to asking respondents to self-report about how much attention they paid to the content (Potter & Bolls, 2012; Ravaja, 2004). Eye-tracking studies typically report measures of visual attention based on where participants' eyes fixate, that is, dwell to take in information, and the count of these fixations (Orquin & Holmqvist, 2018).

1.4. The effect of brand familiarity on visual attention

As limited research exists that investigates prior brand usage and attention using eye-tracking, this literature review was broadened to include articles reporting the effects of brand familiarity on attention. While the two constructs are theoretically distinct, brand usage typically increases brand familiarity. Indeed, consumers can be familiar with (know *of*) a brand without necessarily having any brand usage experience (know *how*) (Alba & Hutchinson, 1987). For example, a car enthusiast may know much about the Ferrari brand without owning one.

A video advertising study measured visual attention in terms of dispersion (variance in where people looked on the screen), with more dispersion indicating a failure to attract most viewers' attention to one location (Teixeira, Wedel, & Pieters, 2010). A high level of attention dispersion (i.e., low attention) was associated with advertising avoidance (pressing the skip button). However, the top-down factor, brand familiarity, had no effect on avoidance after controlling for attention dispersion and the bottom-up factor, branding intensity.

A follow-up study added the effects on advertising avoidance of emotion (joy and surprise). It found that emotional effects had even greater influence on avoidance than low attention (dispersion) (Teixeira, Wedel, & Pieters, 2012). However, unlike the first study (Teixeira et al., 2010), the second study reported the correlation between brand familiarity and dispersion. Brand familiarity improved attention (i.e., it reduced dispersion). That is, one out of these two brand familiarity and eye-tracking studies suggested that more attention is paid to familiar brands, similar to the more usage leads to more attention explanation.

1.5. The effect of prior brand usage on visual attention

Compared with brand familiarity, the construct of prior brand usage incorporates additional learning acquired through direct experience with the brand (Alba & Hutchinson, 1987). This additional learning creates even more extensive memory structures than mere familiarity. As far as the authors are aware, only one study of television advertising has reported on whether brand usage has an effect on visual attention. In that study, a small sample of university students and staff ($N = 31$) viewed a dozen television commercials. The effect of brand usage on visual attention was not statistically significant (Heath et al., 2009). The results of this prior study do not support the more usage leads to more attention explanation but suggest brand users and non-users may give similar attention. However, a sample of this size has only 39% power to detect a significant ($p < .05$) medium correlation ($r = 0.3$) between brand usage and attention (Faul, Erdfelder, Lang, & Buchner, 2007). Before ruling out whether brand usage has no effect on attention, it is necessary to conduct a study such as the present one, with sufficient sample size to detect a managerially relevant, medium-sized effect (Weber & Popova, 2012). It should be noted that Heath et al. (2009) reported a significant negative correlation between advertising familiarity and visual attention. Therefore, advertising familiarity will be included as a control variable in the current study.

The mixed results in the literature on the effect of visual attention suggests that there may be another process underlying the influence of prior brand usage on the relationship between visual attention and recall of a brand's advertising. The current study aims to uncover this underlying process. A moderating effect of the different levels of prior brand usage on the relationship of visual attention on recall might explain the mixed results in the literature as previous studies have not examined visual attention at varying levels of prior brand usage. Therefore, this study tests the following hypothesis:

H1. Prior brand usage moderates the effect of visual attention to the commercial on recall (as depicted in Fig. 1).

Another explanation for brand users' better recall of advertising than non-users' (i.e., potential customers') may be false recall. That is, brand users have such strong memories of the brand's advertising that they falsely attribute their own brand for the advertising they were asked by market researchers to recall. For example, in one experimental study that measured false recall using an unexposed control condition, the level of false recall was 8.9% (Patzer, 1991), which is enough to give a recall advantage to brand users if not controlled for. It is worth ruling out this false positive explanation through controlling exposure to advertising using a laboratory experiment.

In this context, this study tests the following hypothesis:

H2. Prior brand usage increases recall of brands seen during laboratory-controlled television advertising exposure.

2. Method

2.1. Participants

A sample of 696 participants from a media panel in the Southwest of the USA was recruited. Gender (51% of the participants were women),

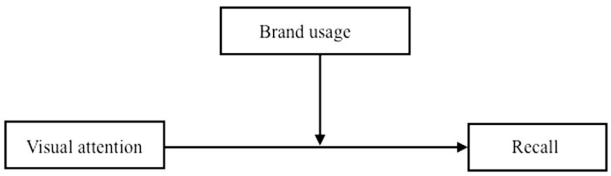

Fig. 1. Conceptual model depicting prior brand usage moderating the effect of visual attention on recall (H1).

ethnicity and age were quota-selected to reflect the adult American population based on Census data (United States Census Bureau, 2014). The average age of participants was 41 years old, with ages ranging from 18 to 78 years. For advertising and eye tracking research, it is important to have a range of ages for external validity as age affects how people's eyes search (Williams, Zacks, & Henderson, 2009) and what they remember (Dubow, 1995). The participants came from a wide range of occupations, with the majority being involved in positions in a service or trade or in managerial or professional roles. Participants' time and travel was compensated with a $25 gift card. In this study, the average sample size per brand ($N = 257$) has 100% power to detect a statistically significant ($p < .05$) medium-sized effect ($r = 0.3$) (Faul et al., 2007).

2.2. Stimuli

To increase external validity, and the likelihood of observing natural levels of attention (Heath et al., 2009), naturalistic stimuli were employed: 30-second commercials for real brands available in the respondents' market. A number of brands, and several executions for each brand, were used to cancel out any unique effects of brand or creative execution (Potter & Bolls, 2012). Specifically, the commercials used were for well-established global brands available in the participants' city, with variance in market share in four low-involvement, packaged goods categories. Overall, the stimuli consisted of 64 English-speaking commercials that had been aired in the last five years.

2.3. Procedure

The study was conducted in a laboratory to allow advertising exposure to be manipulated. The laboratory was equipped to conduct eye tracking studies. For example, it had no windows to prevent interference from infrared sunlight. A trained research assistant greeted and briefed participants, and obtained written informed consent prior to data collection. Participants were seated approximately 70 cm from the 17-inch computer monitor and provided with headphones. The iMotions® *Attention Tool* software was used to create rotations of stimuli, present stimuli to participants, and take screen recordings of what participants viewed. Participants requiring corrected vision were permitted to wear their spectacles. Participants' eye-gaze was calibrated, with usable data determined by participants achieving a score of 'good' or above using the *Attention Tool* calibration algorithm, in conjunction with their gaze hitting ten or more of 12 validation targets.

To increase external validity, participants were briefed that they were evaluating a program, rather than being instructed to watch a reel of commercials (Lloyd & Clancy, 1991). To encourage natural attention to the advertising, participants viewed a 30-minute episode of a television program with professionally edited mid-roll commercial breaks incorporated. Prior to the program starting, participants viewed a relaxing scene of a Japanese stone garden with soothing music for four minutes, to allow them to settle and resting baseline activity to be measured. Each participant chose to view one of three popular programs so that content was interesting to as many participants as possible (i.e., to control for program liking). The participants were randomly allocated to view five of the 64 test commercials. To minimize any primacy and recency effects (Ambler, Ioannides, & Rose, 2000), the test commercials were not shown in the first or last ad spot in any break. The order and identity of the test commercials shown were randomly varied across 30 presentation-order variations. The post-viewing questionnaire began with questions about the program and its particular episode, to provide believability for the cover story around evaluating the program, and to clear short-term memory after viewing, before measuring recall.

2.4. Measures

2.4.1. Operationalizing visual attention

Advertising effectiveness is commonly measured using recall. This is where a respondent is asked what brand they remember seeing advertised, typically using product category for prompted recall. Recall measures have traditionally been used to *both* (1) indicate what attention has been paid to a commercial, and (2) assess whether that commercial has been remembered (Haley & Baldinger, 2000; Heath & Feldwick, 2008). Such an approach is potentially misleading and tautological, because it mixes up the two different processes – attention, and formation (or refreshment) of memories through processing, storage and later recall (Aribarg, Pieters, & Wedel, 2010). Importantly, consumers are innately unaware of their visual attention, and its objectively measurable rapid and jerky eye movements; instead experiencing smooth, uninterrupted viewing (Pieters et al., 2007; Purves et al., 2013). To overcome the limitation associated with using a single measure, recall, to assess two processes – attention and memory – the authors operationalized visual attention by objectively measuring eye movement. That is, the authors were able to objectively capture whether participants attended to the advertising, regardless of whether they could remember the brand's name post-exposure.

Infrared technology was used to capture consumers' eye movements, which consist of saccades (rapid jumps) and eye fixations (where the eye remains relatively still for approx. 200–500 ms) (Wedel & Pieters, 2008). Eye fixations increase memory for the fixated object (Pieters, Warlop, & Wedel, 2002). However, it should be noted that the link between eye movement and attention is not direct or automatic (Orquin & Holmqvist, 2018). That is, registering eye fixation does not necessarily mean that the information fixated on was attended to (and then processed by the brain). These caveats for using eye-tracking as a proxy for visual attention should be considered when interpreting eye-tracking data.

Tobii T60 trackers were used to track participants' eye movements remotely and unobtrusively, compared to other methods such as goggles. Binocular recordings were made at the sampling rate of 60 Hz, and an idealized tracking accuracy of 0.5 degrees, as per the user manual. Eye movement was measured using fixation count, as recommended by Orquin and Holmqvist (2018), when the eye fixation was inside the area of interest. Fixation count measures the number of times the eye is involved in detailed visual processing (Rayner, 1998). The area of interest for H1 was the whole screen for the duration of each commercial, as is typical for studies of dynamic media (Venkatraman et al., 2015). Using the whole screen as the area of interest allowed all aspects of the commercial's content, including all visual branding elements (such as, logos, packaging, distinctive colors, and fonts) to be captured by the participants' eye tracking. Fixation count inside the area of interest was automatically counted by the *Attention Tool* software. See Tables 2 and

Table 2
Summary statistics for category-prompted recall and fixation count by brand, in order of market penetration (from left to right).

Variable mean (SE)	Brand 1	Brand 2	Brand 3	Brand 4	Brand 5	Brand 6	Brand 7	Brand 8	Brand 9	Brand 10	Brand 11
Prompted recall	0.48	0.59	0.49	0.47	0.64	0.31	0.42	0.47	0.40	0.35	0.40
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.05)	(0.03)
Fixation count	21.39	16.80	17.45	11.44	16.34	15.06	18.60	15.25	11.41	14.82	17.13
	(0.86)	(0.71)	(0.92)	(0.76)	(0.93)	(0.83)	(1.01)	(0.72)	(0.76)	(1.05)	(0.74)

Table 3
Summary statistics for category-prompted recall and fixation count by brand usage level.

Variable mean (SE)	Non-usage[a]	Light usage	Moderate usage	Moderately heavy usage	Heavy usage
Prompted recall	0.42 (0.01)	0.47 (0.02)	0.50 (0.02)	0.48 (0.03)	0.50 (0.02)
Fixation count	16.90 (0.69)	16.55 (0.76)	16.43 (0.81)	15.93 (0.88)	16.40 (0.77)

[a] Non-usage is estimated by brand usage = 0, Light usage is estimated by brand usage = 1, Moderate usage is estimated by brand usage = 2, Moderate-heavy usage is estimated by brand usage = 3, Heavy usage is estimated by brand usage ≥4. Repeated measures have been accounted for.

3 for summary statistics for fixation count by brand and prior brand usage level, respectively.

2.4.2. Visual avoidance

The authors assessed rates of cognitive advertising avoidance (ignoring the ad) (Speck & Elliott, 1997) and looked at how comfortable the participants were with the laboratory setting through measures that assessed whether in-laboratory behavior resembled typical at-home viewing behavior. The cognitive avoidance rates observed in the laboratory during the current study were comparable to benchmarks reported for advertising avoidance studies in the home (as reviewed by Bellman, Schweda, & Varan, 2010). Some commercials were almost totally ignored: 8% of commercials were viewed for < 1% of their duration, and 73% of commercials were viewed for less than half of their duration. Among other activities, participants were seen turning their head away and looking around the room during commercial breaks, as they would do at home, indicating the conditions in which the study was conducted allowed for relaxed realistic viewing. Although the observed rates of avoidance were comparable to rates in the home, the avoidance rate did not differ between brand users and non-users.

A post-viewing questionnaire asked about recall of the advertised brand, advertising familiarity, prior brand usage, and demographic information.

2.4.3. Memory metrics

Memory measures of advertising effectiveness continue to be used in advertising tracking assessments and decisions to change or cancel campaigns, despite critiques of the use of such intermediary metrics (Newstead, Taylor, Kennedy, & Sharp, 2009). Participants were asked about their recall of advertising viewed with a prompt (e.g., "Which brands of chocolate do you remember viewing advertising for?"; i.e., category-prompted recall). Correct branding (miss-spelling allowed) was coded 1, otherwise 0. See Tables 2 and 3 for summary statistics for prompted recall by brand and prior brand usage level, respectively. The category-prompted recall questions came before any questions that mentioned brand names (e.g., the brand usage questions) to ensure that preceding measures would not artificially inflate subsequent scores (Darley & Murdock, 1971).

2.4.4. Advertising familiarity

Participants were asked whether they had seen the commercials before their viewing session. Exposure to the commercial ("How often have you seen this ad before your viewing session today?") was assessed via a 5-point scale of exposure ('never' to '5+ times') using three stills to identify each advertising execution the participant viewed (Crosby & Stephens, 1987).

2.4.5. Prior brand usage

For external validity, and in line with prior research (e.g., Heath et al., 2009), brand usage was measured rather than manipulated. This approach had the added advantage that the results were directly comparable to the prior field studies (e.g., Vaughan et al., 2016), which also used pre-existing brand usage levels. Frequency of prior brand usage and category usage for the regularly purchased categories tested in this study were measured via self-reported 6-point scales of use ('none' to '5+ times') over the past three months (Ludwichowska, Romaniuk, & Nenycz-Thiel, 2017). Non-users of the brand's product category were excluded from the sample for each brand.

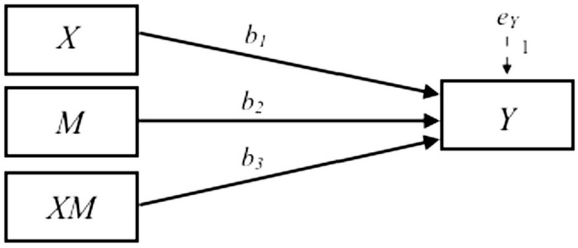

Fig. 2. Statistical diagram depicting the interaction effect of prior brand usage (M) and fixation count (X) on brand recall (Y).

2.5. Analysis

The authors estimated the classic regression equations for moderation as outlined by Baron and Kenny (Fig. 2 and Equation) (Baron & Kenny, 1986). The test for moderation is the significance of the two-way interaction between the independent variable (X) and the potential moderator (M), i.e., the significance of the path b_3 in Fig. 2.

To assess moderation, the authors estimated generalized linear mixed-effects regression models, using SPSS (version 24). A generalized linear regression model assuming a binomial distribution was used for the binary dependent variable (correct category-prompted recall = 1 or 0), with a logit link function. A mixed-effects regression considers the non-independence of observations from the same participant inherent in the eye movement data (Barr, 2008), as well as the five test commercials viewed by each participant, and the potential for missing data. An autoregressive structure (AR1) was used as the within-subject correlation model to account for adjacent observations showing greater correlation that those that are more distant. All participants included in the analyses were users of at least one category (to match the qualification procedure used in telephone surveys of recall), with missing data for categories they did not use. Participant ID was included as a random effect in the model to account for these systematic sources of variance, allowing them to be explained rather than included in the error term. A number of covariates were included in the regression equation as fixed effects, as represented by the equation below:

$$Y = b_0 + b_1X + b_2M + b_3(XM) + W_j + Z_k + e_Y$$

where Y represents the dependent variable, category-prompted recall; X is the independent variable, visual attention measured using fixation count as a proxy; M is the proposed moderator, level of prior brand usage; XM is the interaction between prior brand usage and fixation count; b_0 is the random intercept to control for the five repeated measures from each participant viewing five commercials; W_j is the effect of the j^{th} serial-position order of each stimulus (0 to 4); Z_k is the effect of the k^{th} exposure of the commercial (a measure of advertising familiarity; 0 to 5 times previously seen); and e_Y represents the auto-correlated error on repeated measures with variance σ^2_e.

3. Results

Hypothesis 1 predicted that participants' prior brand usage moderates the effect of their visual fixations on recall. To test for this moderation effect, the researchers first assessed the main effects on recall of fixation count (b_1 in Fig. 2) and prior brand usage (b_2 in Fig. 2). The

Table 4
Coefficients from the mixed-effects regression model for H1, using category-prompted recall as the recall measure.

	Non-usage[a]	Light usage	Moderate usage	Moderately heavy usage	Heavy usage
	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
Intercept	−0.708	−0.288	0.044	−0.545 *	−1.736
	(0.430)	(0.404)	(0.203)	(0.243)	(1.22)
Fixation count	0.011 ***	0.016 ***	0.008	−0.003	0.088
	(0.003)	(0.005)	(0.005)	(0.006)	(0.049)
Order	0.046	−0.004	−0.039	−0.120 *	−0.064 *
	(0.025)	(0.037)	(0.041)	(0.050)	(0.032)
Ad familiarity	−0.078	−0.081	−0.007	−0.590	−0.740
	(0.043)	(0.055)	(0.060)	(0.070)	(0.042)

*p < .05, ** < .01, *** < .001.
[a] Non-usage is estimated by brand usage = 0, Light usage is estimated by brand usage = 1, Moderate usage is estimated by brand usage = 2, Moderate-heavy usage is estimated by brand usage = 3, Heavy usage is estimated by brand usage ≥4.

main effect of fixation count – which also represents the face validity of the eye movement data –was significant and positive ($b_1 = 0.012$, $p < .001$; Table 4). As expected, memory was associated with visual attention as measured by fixation count (Pieters et al., 2007). Prior brand usage was positively associated with recall ($b = 0.148$, $p < .001$). Additionally, while advertising familiarity had a significant and negative association ($b = -0.059$, $p < .01$), the effect of stimulus order was not significant ($b = -0.016$, $p > .050$).

The test of path b_3, for whether prior brand usage was acting as a moderator was the significance of the two-way interaction between prior brand usage and fixation count ($b = -0.002$, $p = .050$). The authors carried out planned comparisons within each of the levels of prior brand usage to test Hypothesis 1. The moderating effect of brand usage was demonstrated by differences in the significance of the effect of attention on recall as brand usage increased. Visual attention (fixation count) had a significant effect on recall for a brand's non-users ($b = 0.011$, $p < .001$) and light users ($b = 0.016$, $p < .001$). However, at higher levels of brand usage (i.e. brand usage ≥2), attention had no significant effect on recall. That is, the link between fixation count and recall is stronger for those with lower levels of brand usage (potential customers and light customers). These results help to explain why it is more difficult for non-users and light users to recall a brand, compared with heavier users. Non-users and light users can recall the brand if they give the brand's advertising more attention. Yet, moderate and heavy users can recall the brand's advertising equally well whether they give a little or a lot of attention.

Further, an effect of stimulus order was seen for the moderately heavy ($b = -0.120$, $p < .05$) and heavy brand users ($b = -0.064$, $p < .05$). As heavier users progress further through the commercial break, their memory for the advertising brand deteriorates. That is, a bottom-up primacy effect is seen where a commercial viewed earlier in the viewing session is easier for heavier users to recall.

Hypothesis 2 predicted that prior brand usage increases recall of brands seen during laboratory-controlled exposure to advertising. This hypothesis was supported by the significant and positive effect of prior brand usage on category-prompted recall, path b_2 in Fig. 2, ($b = 0.148$, $p < .001$; Table 4). To match the format of results of prior field studies, which frequently compare brand users with non-users, the prior brand usage levels were dichotomized to separate brand users (those who had used the brand once or more in the relevant buying period, i.e., 3 months) from non-users (category-prompted recall for brand users versus non-users: 50% versus 37%; $p < .01$), despite the well-known issues with dichotomization (Fitzsimons, 2008). This result demonstrates that the effect of brand usage on recall mainly found in field studies in the literature can also be found when advertising exposure is controlled in the laboratory. However, in this repeated-measures study it was difficult to control for false recall. Participants could have recalled the correct brand but potentially not from the brand's advertising that they saw in the experiment. The 13.0% gap in recall between users and non-users is larger than the 8.9% false recall rate reported by a prior study (Patzer, 1991); this difference in our study being larger than that reported for false recall suggests that the effect of brand usage on recall is also observable when exposure is controlled in a laboratory setting.

4. Discussion

First, the authors empirically examined whether prior brand usage was acting as a top-down factor moderating the effect of visual attention on recall of the advertising brand (H1). This study detected visual attention objectively using a proxy measure via infrared eye-tracking software, fixation count. The results indicate that different amounts of visual attention do not affect whether moderate to heavy brand users recall the brand. This suggests that greater usage does not result in higher attention, in line with the previous results reported by Heath et al. (2009). As such, the findings do not show support for the assertion emerging from the previous brand usage literature (Ehrenberg, 1974; Harrison, 2013; Vaughan et al., 2016) that brand users have higher recall because they pay greater attention to the brand's advertising. Consequently, these results do not provide evidence that brand users are more motivated to process the brand's advertising (MacInnis et al., 1991), or less likely to avoid the brand's advertising (Ehrenberg, 1974).

On the other hand, the moderation analysis indicated that for non-users and light users of the brand, greater visual attention to the commercial increased recall of the advertised brand. This result fits with findings in the literature that visual fixations increase memory for the fixated object (Pieters et al., 2002). However, this positive effect of attention on memory was not displayed at the higher levels of brand usage. This finding may be explained by the concepts of accessible brand associations (Romaniuk & Nenycz-Thiel, 2013) and memory structures (Gobet & Clarkson, 2004), and attitude accessibility (Fazio et al., 1989). If brand users have more accessible favorable attitudes towards the advertised brand, this attitude accessibility may influence information processing to improve encoding and storage of the advertising brand, even at low levels of visual attention. Similarly, if prior brand usage builds extensive memory structures, including templates for rapidly encoding information, these templates could be quickly updated from commercials (e.g., noting which brand was advertised) with little visual attention. For these reasons, heavier brand users could recall the advertised brand, without necessarily paying more attention to the brand's advertising. Overall, these results suggest that visual attention has a more important influence on recall for non-users and light users of the brand.

Further, a primacy effect was seen in heavier brand users where a commercial viewed earlier in the viewing session was easier for them to recall. A primacy effect like this is often explained by competitive interference, but competitive interference is thought to have less of an effect on consumers who have greater familiarity with a brand (Kent &

Allen, 1994). However, over the viewing session there were often multiple brands advertised from one product category to cancel out any unique brand effects, which may have resulted in participants being able to recall only the first few commercials they saw for brands they used.

Lastly, recall was assessed to determine whether the brand usage effect reported in the prior studies, using telephone or online surveys, was also observed in a laboratory setting (H2). Confirming the results of prior studies, recall was, on average, better for brand users than non-users. Quantitatively, the proportion of brand users to non-users recalling advertising was similar to the proportion reported in a previous study that verified advertising exposure and measured advertising memory after a short interval (Hammer & Riebe, 2006). In this previous study, respondents had viewed advertising and completed the memory survey at home. The current study extends the empirical generalization that brand users recall advertising better than non-users to the laboratory setting where advertising exposure can be carefully controlled and observed. However, it is possible that some of the gap between users and non-users in the present study may be due to false recall (Patzer, 1991). A future study using an unexposed control condition to measure and control for false recall could eliminate this as an explanation. The brand usage effect extending to laboratory settings suggest that prior brand usage needs to be measured when testing advertising exposure in the laboratory, to make sure there has been no failure in randomly assigning participants to groups. If groups differ in brand usage that would provide an alternative explanation for the effects of experimental manipulations on recall).

4.1. Contributions and implications

The main theoretical contribution of this study is in identifying the process that underlies the mixed results in prior studies investigating the effects on recall, of visual attention and prior brand usage or familiarity. This is the first study to test whether visual attention varies across levels of prior brand usage, rather than exclusively comparing some brand usage versus no usage. It finds that prior brand usage does indeed act as a moderator for the effect of visual attention on recall. The link between fixation count and recall is stronger for potential and light customers. Visual attention does not affect moderate to heavier brand users' capacity to recall an advertising brand, which is consistent with their more accessible brand associations (Romaniuk & Nenycz-Thiel, 2013), memory structures (Gobet & Clarkson, 2004), and attitudes (Fazio et al., 1989). The present findings showing that prior brand usage acts as a moderator for the effect of visual attention on recall adds clarity to previous mixed results in the literature (Heath et al., 2009; Teixeira et al., 2010; Teixeira et al., 2012). The findings further our understanding of how potential customers and light customers view advertising; that some do give greater attention, and when they do, their recall improves.

This study has important implications for marketing practitioners. Brand non-users and light users are an important pathway to increasing a brand's penetration and market share (Anschuetz, 2002; Riebe et al., 2014), and advertising (increasing consumer mental availability for the brand) is an effective way to reach these potential and light customers. These results suggest that when potential and light customers give more attention to the brand's advertising, they are capable of brand identification and recall. It is therefore important for brands to create advertising that attracts and draws attention from non-users and light users. Advertising to these potential customers provides an opportunity to build memory structures that will eventually improve recall and may increase their propensity of purchasing the brand. Prior research (Romaniuk, 2009) suggests that the branding in advertising to potential and light customers needs to be as clear and consistent as possible, because these customers lack the brand-related memory structures they need to rapidly learn and remember the advertising brand. That is, practitioners should not assume any prior knowledge when creating a commercial for potential and light customers. It is important then that brand non-users should be included in testing and tracking studies to assess the advertising's effectiveness for potential customers. Overall these results suggest that visual attention plays a key role for non-users and light users of a brand in their capacity to recall the brand's advertising.

4.2. Limitations and possible future directions

Future research could consider how advertisers can build relevant brand memories for non-users to enable them to better process the brand's advertising. It may be possible to design commercials so that non-users can recall them as well as brand users. Existing research on frequency of branding and distinctive branding assets in advertising executions provides some useful foundations for this future research (Romaniuk, 2009, 2016; Teixeira et al., 2010).

A limitation with eye-tracking measurement is that if participants move their heads too much, the eye-tracking device can lose its calibration. This lack of natural movement, and being in a laboratory setting, can remind participants that they are taking part in a study. However, the use of advertising embedded in popular television programs disguised the purpose of the study and encouraged attention to the advertising similar to viewing at home, which increased the validity of the experience compared with just showing the commercials in isolation (Heath et al., 2009). Another limitation of the laboratory setting, however, is the lack of real-world distractions, such as chatting to family members or using a second screen, which provide opportunities for behavioral advertising avoidance. As mentioned earlier, the authors found that rates of cognitive advertising avoidance (ignoring the commercials) were comparable to benchmarks reported for naturalistic settings (as reviewed by Bellman et al., 2010). Participants were observed carrying out usual at-home behaviors in the laboratory (e.g., sleeping or resting their eyes during the commercial breaks), indicating the conditions in which the study was conducted allowed for realistically relaxed viewing. Future research should allow co-viewing in the laboratory or viewing in the home to permit opportunities for behavioral and also mechanical ad avoidance. In the home, visual attention could by measured using web cams or eye-tracking glasses.

A future research direction could be to also assess attention to auditory branding cues. A consumer who is not paying visual attention to the screen may still attend to the soundtrack of a commercial. This would enable that consumer to obtain brand information from audio cues, even though this study recorded them as paying no visual attention. Future studies could use additional objective, continuous neurophysiological measures of attention that can identify audio as well as visual attention. For example, heart rate (Lang, 1990; Lang, Schwartz, & Mayell, 2015) can measure autonomic attention to both visual and auditory stimuli (Potter & Bolls, 2012). This stream of research could test whether consumers substitute attention to audio branding when their visual attention is diverted.

Incorporating other sets of commercials would be useful to further test prior brand usage acting as a moderator. For example, it would be useful to test with informational and transformational advertising, for high- as well as low-involvement product categories, and for mature as well as less well-known brands, in different markets.

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Declaration of interest

The authors have no competing interests to declare.

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