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Divided Attention: The Value of Eye- Tracked High and Low Attention in Consumer Behaviour

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Divided Attention: The Value of Eye-Tracker High and Low Attention in Consumer Behaviour

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STATEMENT OF PUBLICATIONS AND PRESENTATIONS

Doctoral Colloquia

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ABSTRACT

In an expanding digital landscape, a consumer's attention level is a critical predictor of future behaviour. Prior technological constraints necessitated the use of proxy attention metrics insensitive to passive engagement and simultaneously distortive of visual engagement. Since proxy metrics are poor measures of engagement, advertising trading metrics don't reflect true audience exposure and engagement - concerning for advertisers. Advances in non-invasive technology enable research to differentiate levels of visual attention and their relation to brand outcome variables. The purpose of this research is to generate empirical understanding of how consumer behaviour is influenced by levels of natural visual attention.

While scholars have investigated the relationship between selective or 'high' attention and consumer behaviour, little is known about the role of peripheral or 'low' attention on behaviour. This is critical to advertising valuation, as more focused attention to advertising has been shown to increase the likelihood of brand memory creation while more diffuse attention can positively affect brand selection and preference.

This thesis comprises three papers. The first proposes a conceptual framework of visual attention, relating the control and degree of different types of attention to advertising in relation to discreet brand outcomes. It extends attention theory to wider discussions surrounding advertising measurement and monetisation practices.

The second paper empirically tests the role of repetition in digital advertising by investigating differences between high and low attention with single and repeated exposures in the context of brand choice and recall (prompted and unprompted). This research also explores the interacting effects of demographic variables, including gender, age, brand use, on the relationship between visual attention (high and low) and brand choice and recall. The findings

reveal significant differences between the two forms of attention for brand outcomes. High attention predicts more brand choice and recall at first exposure than at second exposure, while low attention predicts more brand choice and recall at second exposure. This study contributes to attention, advertising and marketing literatures by relating two forms of natural audience attention to discreet brand outcomes.

The third paper empirically examines the role of emotion in attention-based advertising appraisal by investigating the moderating effect of two dimensions of emotion – arousal and valence – on the relationship between visual attention (high and low) and brand outcomes. Arousal and valence can affect how consumers perceive advertising and their attention focus (Vanlessen, Rossi, de Raedt, & Pourtois, 2013). Beyond main emotional effects on brand outcomes, this research reveals significant interaction between valence and low attention on brand choice and unprompted recall. This paper contributes to the marketing literature by relating dimensions of emotion to a high/low model of visual attention.

This study generates novel insight contributing to research and practice in attention theory, advertising monetisation practices, and advertising measurement. Advertisers, media owners, and digital platform holders can benefit because the research establishes that the value of attention is nuanced but demonstrable. To generate immediate impact from high attention viewership, advertisers may select high-cost advertising; conversely value remains attainable from lower-cost, low attention advertising more suited to repeated exposures.

STATEMENT OF DECLARATION

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Kellen James Ewens

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CHAPTER 1. INTRODUCTION

1.1. BACKGROUND

The last two decades of consumer research has demonstrated that our attention holds tremendous value to brands, advertisers, and media owners. This value captures the numerous benefits arising from attracting consumer attention, including enhancing preference and memory formation, as well as memory retrieval. These lead to desired advertising organisation outcomes such as sales growth and brand mental availability. For this research, visual attention is of specific interest, defined by the process in which environmental information is visually perceived, filtered and processed. In the context of advertising, attention also encompasses more complex consumption processes, which impact consumers' evaluations, preferences and attitudes, as well as closely predicting future consumption behaviour.

While the extant literature identifies a significant relationship between visual attention and consumer behaviour, it is limited in that its focus is predominantly on focal or selective attention and its effect on advertising appraisal. Conversely, less is known about the impact on consumer behaviour when a viewer's level of attention is low, or incidental in the perception advertising. This is despite a proliferation of low attention styles of viewing, particularly amongst younger media users. However, studies from the incidental exposure literature suggest that advertising can indeed be processed even if viewers are distracted from the content, screen or device (Acar, 2007; Humphrey, Laverie, & Rinaldo, 2017; Sauerland, Felser, & Krajewski, 2012). Furthermore, studies have shown relatively durable and long-lasting positive impacts on preference decisions and memory at low attention, resulting from as little as one exposure to advertising (Yagi & Inoue, 2018). As both forms of attention underlie advertising perception (Barel, 2020; Wedel, Pieters, & Liechty, 2008), this research seeks to understand their relative impact on consumer behaviour.

A conceptual framework for consumer attention will initially be introduced, explicating the role of high and low attention in affecting brand preference decisions and memory strength, before conducting a preliminary empirical investigation of the model using data.

In order to examine the role of high and low attention across single and repeated exposures, as well as in relation to other real-world variables of interest, such as brand use and demographic information, an empirical study is conducted and the process and results of this will be described.

In addition, the role of emotional content in advertising and how it affects consumer attention and behaviour in the context of digital advertising is also investigated empirically.

the context of this research is digital advertising. This context was chosen due to the growing popularity of attention metrics in digital advertising measurement. Additionally, this research sheds new light on particular differences between digital advertising platforms regarding consumer attention, memory and behaviour, among other notable findings. To the author's knowledge, this study is among the first to investigate naturalistic consumer attention across three major digital advertising platforms using large-scale samples, thereby engendering strong generalisability from these findings.

In summary, building on the current attention and advertising literatures, this research provides a critical view of consumer attention to advertising, both high and low, and its relation to consumer behaviour. An empirical investigation is undertaken to relate consumer attention to subsequent preference- and memory-based brand decisions, taking into account viewing platform and demographic characteristics, establishing an integrated view of consumer attention to advertising.

1.2. RESEARCH OBJECTIVES

This research involves 3 main interrelated questions:

- 1) Are different levels of attention to digital advertising associated with unique consumer behaviours?
- 2) How does repetition affect consumer behaviour in relation to digital advertising?
- 3) Does emotion affect high and low attention processing of digital advertising differently?

In order to address these research questions, three studies are conducted. The first study provides a conceptual background to attention metrics, exploring their use, current limitations, and potential for future use of emerging technologies to deliver more evidence-based measurement approaches. It introduces a conceptual framework of visual attention and consumer behaviour based on prior research, tested against a preliminary attention variable set of phone-based facial capture (5 frames per second), recorded in the participants' natural viewing environment. The findings from this research provide initial validation of the use of attention metrics in measuring brand outcomes, such as brand choice and recall, as well as to support prior research into the distinction between 'low' and 'high' attention, particularly within natural viewing conditions and environments.

The second study expands upon the scope of variables included in the research testing, as well as increasing the number of advertising exposures seen by participants (from a single exposure to repeated exposure). Repetition was shown to exert a significant impact on the relationship between attention (high/low) and brand outcomes, as well as highlighting key interactions between attention and other demographic variables.

The third study again expands the research scope by examining the influence of emotional content in advertising, on brand outcomes at single and repeated exposures. Advertisements were categorised by their level of arousal (high/low) and valence (positive or negative). A key

finding from this research is that, to motivate purchase, certain types of advertisements (low arousal, positive valence) may be more appropriate for lower attention audiences than high.

1.3. RESEARCH FRAMEWORK

To investigate the role of attention in consumer behaviour and meet the research objectives set for this research, three separate research papers were developed and submitted for publication. Paper One (Ewens, 2022) provides the conceptual and empirical framework for the research, framing attention theory in the context of the research issue as well as laying the foundation for the subsequent two papers with a preliminary test of a 'high/low' model of attention across three digital advertising platforms. Paper Two (Ewens, 2022) expands on Paper One through empirically examining the role of high and low attention across both single and repeated exposures, as well as alongside other variables such as brand use and demographics. The evidence from Papers One and Two support the relationship between visual attention and consumer behaviour, thus Paper Three (Ewens, 2022) empirically examines the role of emotion in advertising appraisal, specifically investigating emotional arousal and valence as moderators between attention and consumer behaviour.

As the focus of consumer attention research has historically concerned selective attention, where attention is artificially controlled or influenced by the research setting, this present research explores the interaction between natural attention and advertising response. This research adds to the body of knowledge by examining not only how different states of attention affect response in real-time, but also how changes in these states across the course of a view can further affect consumer behaviour. The studies built hypotheses and verified them using binary logistic regression, relating the proportion of correct brand choice or recall responses to viewer's level of attention throughout each branded advertisement exposure.

A short description of each paper is presented below:

Paper one: Second-Generation Attention Metrics for Digital Advertising

This paper investigates the concept of visual attention and its role in measuring advertising performance, proposing a conceptual model to explicate the role of high and low attention in affecting brand choice and recall responses. Specifically, the paper explores the pitfalls of current monetisation metrics of attention, proposing that such attempts lack theoretical foundation and fail to measure real human attention. Additionally, the study extends discussions around attention metrics by conceptualising how an attention metric based on high and low attention could be applied when grading attention, enabling monitoring of attention volume as well as quality. Hence, by adopting an empirical approach to understanding attention, this paper recognises a practical solution to the growing issue of how best to value advertising exposure across different platforms, contexts, and customers.

The objectives of the paper are: 1) To examine the influence of visual attention to advertising on preference formation (i.e., brand choice); 2) To examine the role of visual attention on memory retrieval (i.e., brand recall).

This paper provides an agenda for future research that builds on the research propositions relating to high and low attention as discussed within this study. This conceptual paper thus contributes to marketing theory by extending the involvement and ‘levels-of-processing’ literature by utilising the lens of visual attention to explore the influence of different viewing conditions on consumers’ behaviour. Additionally, paper one provides a preliminary test of this model with real-life consumer data, providing the empirical foundation for papers two and three, as they provide further insight into the relationship between attention and sales across different creative and exposure conditions.

This study was conducted with European consumers recruited by a panel provider (Lucid). Twelve real brands were utilised as a context for this study. The data analysis was conducted using SPSS (version 24), using binary logistic regression with attention and other demographics as predictor variables and brand choice and recall as outcome variables.

Paper two: High Attention, Low Attention, Brand Choice and Recall across Single and Repeated Exposures

Building on the conceptual paper, paper two examines the relationship between attention and consumer behaviour across single and repeated exposures. Specifically, this study investigates whether high and low attention display similar or dissociative effects on brand response after repetition. Additionally, this paper explores the relative effect of attention compared to respondent factors such as brand use and demographics. Hence, this paper demonstrates the underlying role of attention in affecting positive consumer behaviour. These findings provide marketing managers with better insight into the value of viewer attention by associating changes in attention with discrete behavioural outcomes.

The objectives of paper two are: 1) To examine the influence of high vs. low attention on consumer behaviour; 2) To investigate differences between high and low attention across single and repeated exposures; 3) To investigate the role of brand use in the relationship between attention to digital advertising and consumer behaviour; 4) To investigate the role of age and gender in the relationship between attention to digital advertising and consumer behaviour.

The study was conducted with consumers from three European countries recruited by a panel provider (Lucid). Twelve real brands were utilised as a context for this study: with categories ranging from fashion and beauty, food and beverage, to automotive. The data analysis was conducted using SPSS (version 24), estimating a binary logistic regression with attention and

other demographics as predictor variables, and brand choice and recall as outcome variables. In summary, this paper provides an understanding of the role of visual attention in affecting advertising appraisal, building a foundation for theoretical and managerial implications.

Paper three: Is Affective Advertising Effective Across High and Low Attention?

Paper three examines the role of emotional-content-in-advertising on consumers' appraisal. Specifically, it investigates the mediating effect of emotional arousal and valence on the relationship of attention and consumer behaviour in the context of digital advertising. This paper explains how arousal and valence exert dissociative effects on consumer response, and highlights in particular the interaction between low attention and emotional valence. In addition to expanding our understanding of frequency effects, this paper supports and extends the 'low attention/involvement' literature by demonstrating the unique role played by low attention relative to high attention in the context of emotions, echoing earlier assertions by Heath (2001b).

This study was conducted with European consumers recruited by panel providers in two waves (Lucid & GapFish respectively). Twelve real brands were utilised as a context for this study. The data analysis was conducted using SPSS (version 24), using binary logistic regression with attention and other demographics as predictor variables, and brand choice and recall as outcome variables. While emotional arousal and valence exert direct effects on consumer response, as well as moderating the relationship between other variables and brand response, there is only evidence for a moderation effect of valence on attention and brand choice. This paper contributes to the marketing literature by exploring a high/low model of attention in the context of emotional arousal and valence. Managers could benefit from these findings by

aligning the emotional content of creative executions against viewer characteristics, including viewers' projected level of attention.

Overall, these three papers contribute to an in-depth understanding of attention and its role in affecting brand sales by providing a conceptual framework of high and low attention, an empirical study that examines the role of attention across repeated exposures, and an empirical study that investigates the role of advertisements in the emotional arousal and valence of consumers and the role this has on their attention and behaviour.

1.4. RESEARCH CONTEXT

In response to a rapid expansion in digital media, advertisers are increasingly looking for new metrics of advertising performance that are accurate, practical and platform-agnostic. However, issues of entrenched organisational reliance on traditional cost-per-hour (CPH) metrics and limited empirical focus have shaped the advertising economy as a vehicle of volume, rather than of quality. Given the increasing pressure on media owners to be transparent in the sale of advertising space, the importance of an alternative monetisation strategy continues to be relevant. Hence, this research has the potential to be highly valuable, introducing the concept of a metric based on real, verifiable human attention.

The advertising literature in particular has embraced the concept of attention, evidenced by a myriad of hierarchy-of-effects models which position attention as an integral component to sales performance. Previous studies have identified the unique role played by attention in both early- and late-stage perception (Katsuki & Constantinidis, 2014; Lachter, Forster, & Ruthruff, 2004), as well as its influence on consumer reasoning (Florack, Egger, & Hubner, 2020; Grimes & Kitchen, 2007; Machouche, Gharbi, & Elfidha, 2017) and memory (Grybinas, Kantner, & Dobbins, 2019). However, despite the insights gained in such studies, there has been criticism

levelled at ‘hierarchy-of-effects’ models for reflecting an overly deterministic and stochastic view of attention (Krugman, 1965), leaving little conceptual room for natural variation in viewing attention, both due to internal (Heath, 2001a) as well as environmental factors (Wojdnyski & Bang, 2016). Hence, this research highlights the non-stochastic element of attention by consulting a dual model of attention (Heath, 2001), whereby viewers’ attention freely oscillates between states of ‘high attention’ and ‘low attention’.

While the attention literature has focused largely on instances of high attention (Florack, Martin, & Ronald, 2020; Janiszewski, Kuo, & Tavassoli, 2013; Washaw, 1978), low attention viewing styles are quickly growing in popularity (Nelson-Field, 2020), evidenced by new research into the topic (Acar, 2007; Humphrey et al., 2017; Santoso, Wright, Trinh, & Avis, 2020). Yet, low attention has rarely been considered as a focal object of attention research. Therefore, this research offers important theoretical and managerial implications as it expands upon the advertising and in particular, attention literature, shaping new insights for the marketing field.

1.5. RESEARCH CONTRIBUTIONS

This research makes a valuable contribution to the existing literature on consumer behaviour by expanding the concept of visual attention in advertising and applying it to the prediction of consumer behaviour. This thesis thus provides a conceptual framework on how two forms of visual attention – high attention and low attention – affect consumers’ preference formation and retention of brands in memory. Drawing on existing attention literature surrounding low- and pre-attentive processing (Heath, 2001a, 2001b; Janiszewski et al., 2013), this research is the first to comprehensively explore the role of natural consumer attention.

Examining purported sales impact when viewer attention is free to vary is critical to gauging real-world advertising performance, as consumers frequently oscillate between different viewing modes across a typical view session (Nelson-Field, 2020). Specifically, introducing the concept of ‘high attention’, ‘low attention’ and ‘non-attention’, the research suggests that the differences between the forms of attention are meaningful in terms of consumer behaviour, as well as how they react to certain conditions such as content type, exposure conditions, and platform. These insights contribute new understandings to the marketing and attention literatures, as they explain the differential impact of high and low attention on consumer behaviour. Marketers may focus on tailoring advertisement executions to the different forms of attention as described in this research, as well as aligning specific campaign goals (i.e., to establish brand memory) with the relevant form of attention.

Another significant contribution of this research lies in its empirical investigation of consumer attention under naturalistic testing conditions. Drawing from earlier conceptual frameworks (Heath, 2001b), this research empirically examines the notion that studies of consumer attention may differ between highly-unnatural laboratory settings and those more natural to research populations, such as their home or office. Specifically, the research builds on extant knowledge of incidental exposure and implicit perception as facilitators of advertising impact (Sauerland et al., 2012; Shapiro, Macinnis, & Heckler, 1997; Wang & Teo, 2012). It significantly contributes to both attention and marketing literatures by explaining attention from an oscillatory, rather than stochastic perspective, enabled using naturalistic testing environments and a non-invasive research methodology. This research adds to a growing body of research addressing the importance of non-invasive attention measurement; demonstrated here in the context of advertising measurement.

Furthermore, building on the findings of the role of attention in advertising appraisal, this research is the first to empirically examine the relationships between ‘high’ and ‘low attention’

and sales impact across three major digital media platforms, including Facebook, YouTube and Television. Specifically, it reveals that while both high and low attention relate to consumer outcomes, they do so in different magnitudes. Additionally, the present findings support the notion that these forms of attention are distinct, evidenced by their unique interactions with other demographic variables across consumer responses. These findings contribute to the marketing literature by establishing common relationships between attention and sales across platforms, while also identifying unique effects of high and low attention across platform.

1.6. THESIS OVERVIEW

This introductory Chapter 1 has provided a detailed overview of the research, including an explanation of its overall purpose and the research context. This chapter has also summarised each of the 3 research papers that have been prepared for publication and are presented here as valuable contributions to the literature and the basis of this research study.

The following Chapters 2, 3 and 4 represent the body of this thesis, with each of these chapters outlining one of the three research papers presented here. Chapter 5 concludes this thesis, presenting the overall research contributions, managerial implications, the limitations of the research and suggestions for future research directions

**CHAPTER 2. A SECOND-GENERATION ATTENTION
METRIC ON HUMAN ATTENTION**

Kellen Ewens, Steven Goodman and Karen Nelson-Field

Statement of Authorship

Title of Paper	A Second-Generation Attention Metric On Human Attention
Publication Status	☐ Published ☐ Accepted for Publication ☒ Submitted for Publication ☐ Unpublished and Unsubmitted work written in manuscript style
Publication Details	Journal of Consumer Research

Principal Author

Name of Principal Author (Candidate)	Kellen James Ewens
Contribution to the Paper	Developed conceptual paper and data analysis, wrote manuscript and revised manuscript
Overall percentage (%)	80
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.
Signature	Date 26/06/22

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- the candidate's stated contribution to the publication is accurate (as detailed above);
- permission is granted for the candidate to include the publication in the thesis; and
- the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

Name of Co-Author	Steven Goodman
Contribution to the Paper	Supervised and contributed to the conceptual development and writing of the paper. Edited manuscript, revised/edited manuscript.
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Name of Co-Author	Karen Nelson-Field
Contribution to the Paper	Contributed to the conceptual development of the paper.
Signature	Date 26/06/22

Please cut and paste additional co-author panels here as required.

ABSTRACT

Many popular advertising metrics fail to properly inform advertisers of the true value of their media spends. Though attention data has attracted interest in the neuromarketing literature as a promising means by which to measure brand processing, considerably less research has focused on implementing attention as a metric for quantifying advertising performance. This is in part due to the lack of a graded taxonomy of audience attention, the like of which is presented in this paper. Such a taxonomy offers advertisers and researchers alike a rigorous framework to value consumer attention. A study was conducted to examine two forms of visual attention – high and low – on consumer responses. Both forms of attention were related to brand choice and recall responses, although with differences in magnitude. These data provide initial empirical support for the use of a metric based on high and low attention to measure advertising value, alongside or in preference to existing advertising metrics. In application, an attention metric based on human attention could render the buying and selling of media more robust, transparent, and evidence-based for media owners and advertisers alike; and as technology develops, possibly result in real time reward and pricing.

Keywords: visual attention, eye-tracking, naturalistic testing, high attention, low attention.

2.1. A SECOND-GENERATION ATTENTION METRIC ON HUMAN ATTENTION

The digital age catalysed a revolution in how advertisers reach consumers, yet there has been comparatively little change in how we measure advertising for the purposes of ad trading; given the multi-platform and channel competition for attention, this is problematic. Year-on-year, advertising metrics underpin the transactions of ever-swelling media spends, where the supply of audience attention becomes increasingly rare and consequently, increasingly valuable. These metrics are used on the assumption that they provide an accurate depiction of audience behaviour, yet this belief has long been questioned by research citing low accuracy and reliability of these measures, particularly across diverse viewing contexts (Heath & Nairn, 2005). Although these issues are recognised amongst researchers as responsible for wasted ad spend, it is when such wastage has begun to occur at scale that the issues associated with Cost per Mille (CPM) volume metrics have become evident to industry. This paper presents a way forward for advertisers and media channel owners alike.

The prominence of CPM metrics means that advertisers are forced to engage with volume metrics if they wish to remain competitive (Sanghvi, 2015). However, the CPM model does not consider the quality of user activity, merely its quantity, which can often mislead advertisers as to the true nature of exposure. In turn, advertisers often pay for their ads to be displayed in low visibility environments, reducing the effective value of their media spend.

According to Zhang, Wedel, and Pieters (2009, p. 670), “the amount of attention consumers pay to feature advertisements can affect sales outcomes of the featured products”. If this is so, metrics based on human attention may be a more effective measure for advertising impact than existing CPM or volume-based metrics; today’s technology allows this to be feasible, if an

agreement on worth can be identified. Although metrics based on estimated user attention are already in use within the advertising industry (Merritt, 2017), they do not show a sufficiently strong relationship to real human attention and therefore fall short of their true-north potential as a currency for ad trading.

The development of a human attention metric has been historically limited by expensive and unwieldy measurement technologies. However, increasing cost-efficiency of attention-monitoring hardware enables more researchers to access attention data. Similarly, such technologies are becoming more flexible in application, providing additional opportunities to collect attention data within realistic consumer environments without the need for an unnatural laboratory setting. This paper presents a conceptual framework of consumer attention theory, underpinned by an empirical study, leading to a number of applications of attention data to a proposed attention metric.

2.2. THEORETICAL BACKGROUND

As the digital advertising industry developed, it became clear that unique solutions would be required to regulate it compared with traditional formats. The potential for significantly increased ad exposure on online platforms heralded the development of website monetisation centred around sheer quantity of exposure over quality (Sanghvi, 2015). The subsequent pursuit of increased revenue yields via simplified impression measures like page views or ad clicks (Traphagen, 2019), led to a number of practices responsible for increased clutter and competition within online environments; confusing ad spend return and decreasing the quality of the user experience. Several well-known examples of these practices include pop-up ads, ‘click-bait’, disguising ads as editorial content, and manipulating page loads to artificially

inflate impressions numbers (Drott, 2020), though the scope of the issue is far greater than these considerations.

In order to remain competitive with reduced visibility, advertisers are forced to engage with poor impression metrics and simply wear the financial consequences of wasted ad spend (Edelman, 2014). However, scaled media owners who tend to receive high levels of traffic regardless will continue to experience success indefinitely while smaller players will become dwarfed within a wholly-impression-based economy (Sanghvi, 2015). To overcome such challenges, many in the advertising industry now advocate for a Digital Attention Economy (Merritt, 2017; Sanghvi, 2015; Smith & Fischer, 2020), where human attention is recognised as a limited consumable resource (Goldhaber, 2006) with which advertising space can be traded (Merritt, 2017). With this, it is anticipated that an attention currency can usher in a pricing system which better reflects actual return on ad spend for advertisers, is reflective of the human element of advertising appraisal, and which does not establish value on simple volume metrics alone (Sanghvi, 2015). Thus, attention metrics have the potential to enable greater stability and transparency in the trading of advertising space between media owner and advertiser.

2.2.1. THE NEED FOR ATTENTION METRICS

Digital advertising metrics underpin the trading of billions of dollars each year in advertising space (Sanghvi, 2015). They provide a means to quantify the relative value of advertising exposure by ascribing increased cost to high exposure opportunities and decreased cost to low-exposure opportunities (Fulgoni & Lipsman, 2017). An assumption held by those who use digital advertising metrics is that they provide a true and accurate reflection of advertising performance, however, mounting evidence suggests that many popular performance metrics

may overestimate the true extent and quality of advertising exposure, which tend to be brief and fleeting (Heath & Feldwick, 2008; Nelson-Field, 2020). Industry standard exposure benchmarks show that up to 54% of delivered ads are simply not seen by audiences (*comScore*, 2013); according to Sanghvi (2015, p. 4), “just because an ad has been served, it does not mean that it has been viewed”.

If this is the case, the implications for media budget allocations as well as factors such as ad pricing are significant. Given the billions of dollars invested annually in digital ad metrics (Merritt, 2017), any overestimation of performance could result in advertisers losing hundreds of thousands of dollars and upwards in wasted media spend. Similarly, fluctuating performance metrics make it difficult for media owners to establish reliable pricing structures across media platforms. Though the term digital advertising metrics refers to a number of different performance figures, they tend to share a common approach, valuing ad performance based on exposure potential rather than actual exposure.

Potential advertising exposure does not equate to actual advertising exposure. It is easy to understand why many digital metrics have reached the level of widespread usage they have. Compared with traditional approaches to measuring ad performance such as complex analysis of market data or qualitative interviews, digital metrics such as ‘clicks’ and ‘likes’ provide significantly fewer obstacles to understanding advertising performance. They are cheaper to obtain than previous methods, easier to understand and have good face validity (Edelman, 2014). However, while capable of addressing certain limitations of earlier methods, digital ad metrics ultimately fall short of their accuracy by conflating potential for exposure with actual exposure. This problem is addressed by the research presented in this paper.

This difference between the potential and actual exposure is particularly distinct on digital platforms. According to Merritt (2017, p. 4), “the vast majority of users who visit a webpage simply don’t spend much time looking at it”. To this end, page views are a poor predictor of advertising success if viewers are not meaningfully exposed to its content (Fulgoni & Lipsman, 2017), despite this, clicks, page views and other volume metrics continue to dominate the ad trading industry (Merritt, 2017; Sanghvi, 2015), and thus demonstrate the need for a new metric.

The issues associated with digital ad metrics can be traced back to the long-term use of rudimentary web analytic systems. Recognising the growing need for e-commerce on the online platform but facing technological limitations, early players such as Google and Adobe established their own analytics platforms based on the number of webpage visits, or ‘hits’ (Merritt, 2017). Limited iteration of this approach over time meant that digital ad metrics assumed a comfortable niche within page views, impressions and clicks. However, given that issues associated with these measures do not appear to be going away any time soon, it is critical that media trading moves past simple metrics of volume towards metrics of quality. One step towards achieving a metric of quality is via a metric of attention, as will be demonstrated in this paper.

The Emergence of First-Generation Attention Metrics. The premise behind adopting a metric of attention is that audience volume is a poor measure of ad impact if users do not actually spend time looking at the ads being sold, and as the literature demonstrates, a significant amount of advertising is not seen by viewers (*comScore*, 2013; Exposito-Ventura, Ruiperez-Valiente, Parra-Arnau, & Forne, 2021; Uhl, Nabout, & Miller, 2020). For advertisers, attention metrics can help to illuminate user preferences in identifying what type of content keeps people engaged while online (Merritt, 2017).

Initial discussion surrounding attention metrics began in the early 2010s at the hands of several digital publishers, most notably *Medium* when, to better gauge viewer interest in online editorial content, they introduced their own performance metric known as Total Time Reading (TTR) (Ingram, 2014; Davies, 2013). Through measuring user's digital footprints on their page over time, achieved by tracking cursor movements, keystrokes, and scrolling behaviour, *Medium* was able to achieve a superior measure of user engagement compared to traditional audience measures (Davies, 2013). A comparable service was implemented in 2014 by *Upworthy* another digital publisher (Ingram, 2014), however unlike TTR, attention minutes are comprised of both 'Total Attention on Site' (per day, week, month, etc.) as well as 'Total Attention per Piece' (Rose, 2014). Aggregating user attention in this manner enabled *Upworthy* greater insight into the quality and extent of their content exposure, achieving similar benefits to TTR.

While these digital outlets initially sought to employ user attention to improve the quality of editorial measurement, a number of legacy publishers quickly recognised the value of online attention-based ad trading. Prominent among them was *The Financial Times* which, frustrated by ad success standards that often do not correlate to quality (International News Media Association [INMA], 2016), began operationalising attention as the basis for a new ad pricing infrastructure. In 2015, *The Financial Times* announced the launch of 'cost-per-hour' (CPH), a time-based currency of user attention (Sanghvi, 2015). Compared with traditional CPM metrics which value all ad impressions equally, CPH provides a pricing model based on the quality of user attention during ad time-in-view (Sanghvi, 2015). This was one of the first measures of attention to guarantee only impressions which met the 100% viewability threshold (i.e., at least 50% of the ad on screen for at least five seconds) would be charged to advertisers (Merritt, 2017). The CPH model, along with a series of other real-time attention analytic metrics, began to realise the potential for using attention for advertising purposes. By

permitting the measurement of user's attention through inferences of their online activity, attention metrics helped establish a sustainable, attention-driven economic model of ad sales.

The rise of attention metrics provides several advantages to advertisers over traditional volume-based impression metrics; by providing a closer view of user attention, advertisers can access up-to-the-minute measurement data across a range of online platforms. However, what the advertising landscape presently lacks is a framework of consumer attention against which advertising exposure can be valued. Such a framework should be based principally on empirical research but remain applicable to a variety of real-world viewing circumstances; a feat not yet achieved within existing attention measurement approaches.

Conceptual Obstacles to the Uptake of First-Generation Attention Metrics. Against a backdrop of misleading, impression-based digital ad metrics, the emergence of attention metrics appears to offer advertisers and publishers a suitable means by which to accurately measure audience engagement. If that is the case, then why do traditional CPM's based on quantity and volume continue to dwarf the use of attention metrics (such as CPH) year-on-year in the advertising marketplace? Alongside practical factors such as limited awareness of attention metrics (Feeley, 2017) and entrenched organisational reliance on traditional CPMs, one compelling reason for limited uptake of attention metrics is that existing attention metrics are incapable of tangibly measuring users' actual attention, so instead rely only on a digital estimate of their attention.

Using digital estimates of attention over measured attention is problematic due to the fact that such measures (i.e., TTR, attention minutes or CPH) assume that the location of a user's website behaviour, such as cursor movement, clicks or scrolls, reflects perfectly where they are looking at that time. This assumption contrasts with recent research showing extensive visual

exploration over webpages, distinct from a user's cursor activity or location. Indeed, by using inferred measures of attention, media owners may either be under or over-selling to advertisers the true extent of their exposures, forcing them to spend unnecessarily to reach desired targets.

Likewise, using measures of ad time-in-view (i.e., how long viewers watch) to represent attention may also be a flawed measure, given that time-in-view can equally represent distraction as it does attention. According to Nelson-Field (2020), despite the introductions of media viewability standards (50% of the ad on screen must be in view for at least five seconds) (Media Rating Council, 2015), more than half of time-in-view impressions continue to elude human eyes but are charged to advertisers irrespectively (*comScore*, 2013).

Though these metrics may bring ad exposure closer to the reality of user attention than previously, their inability to determine whether users are paying attention to the screen - much less where on-screen this attention is directed - signals critical limitations for this so-called metric of attention. Given the sheer magnitude of money spent on advertising space each year, an inference of attention is simply not enough and highlights the need for a metric of attention that delivers what it infers it is delivering.

2.2.2. Second-Generation Attention Metrics – The Need to More Effectively Measure Attention

The successful design and implementation of an attention metric relies on the appropriate measurement of real – not estimated – human attention. Human attention offers substantial value to advertising measurement beyond simply improving opportunity-to-see (i.e., whether or not viewers are present and looking at an ad), it is also capable of revealing both explicit

and implicit modes of advertising processing (Heath & Nairn, 2005), which is in line with how humans actually observe what they see. Current impression measures as well as existing attention metrics do not consider variance in audience attention. The fact that they treat this as a singular entity is a significant downfall in the measuring, charging and paying for advertising, and thus necessitates a new metric.

It is important to investigate how advertising creates impact under different perceptual conditions because consumer attention is naturally highly variable and capable of fluctuating greatly even within a manner of seconds (Chun, Golumb, & Turk-Browne, 2011; Esterman & Rothlein, 2019). Thus, it is imperative that a metric of attention incorporates consideration of the quality and extent of viewer attention (Heath, 2001a, 2001b). In addition, this information can be used to provide a closer view of attention over time, rather than time-in-view measure, which can conflate attention with distraction (Nelson-Field, 2020). Through measuring attention effectively, advertisers can maximise the efficiency of their media spend. In an attention economy, it might be that low-level, low-quality attention amidst cluttered media environments may be worth a fraction of the value of high-level, high-quality attention. The ability to discriminate attention based on level and quality could enable the use of clear and defined cost-per-view values specifically calibrated for human attention data. To achieve this, a robust framework of attention is required to achieve the transparency and reliability expected of a tradable currency. It may be that a breakthrough in our understanding of consumer attention can revolutionise the digital Attention Economy, enabling – for the first time – a true economy of attention.

2.2.3. Operationalising High and Low attention for a New Attention Metric

Before any further discussion it is first necessary to clearly define attention, as its interpretation often varies with context; further complicating the issue of measurement and value. The term ‘attention’ broadly refers to a process of heightened mental activity and focus on discrete stimuli for the purpose of mental evaluation (Eysenck & Keane, 2015). Attention is also further defined by the mode of perception, for instance sound, touch or vision. Each of these follows a similar process of relaying sensorial information to the brain, activates the relevant neural areas, and motivates subsequent action. For the purposes of this research, visual attention is of specific interest.

Attention is also not a stochastic process, it is highly variable and can differ depending on the situation (Heath, 2007). Different stimuli and processing activities tend to exhibit different perceptual demands; some may be non-complex and therefore easier to process, while other objects may be more detailed and thus take more effort to evaluate. To suit our changing perceptual needs, our attention changes. ‘Levels’ or ‘types of attention’ – defined as the amount of cognitive resources being deployed (Macinnis & Jaworski, 1989) – incorporates this notion through distinct categories of attention, according each a number of representative mental activities and processes, as well as specific visual search behaviour. This ‘levels of attention’ theory is particularly critical to a new attention metric, as such a metric must be capable of detecting focal as well as peripheral viewing behaviour.

Defining Attention – High and Low. Levels of attention represent the type and amount of mental processing undertaken in response to a stimulus (Macinnis & Jaworski, 1989). Across a variety of attention models, attention has been fundamentally by ‘focal’ or ‘non-focal’ forms of visual behaviour (Greenwald & Leavitt, 1984; Heath, 2001b; Macinnis & Jaworski, 1989). One of the first models to formally explore this notion was introduced by Greenwald

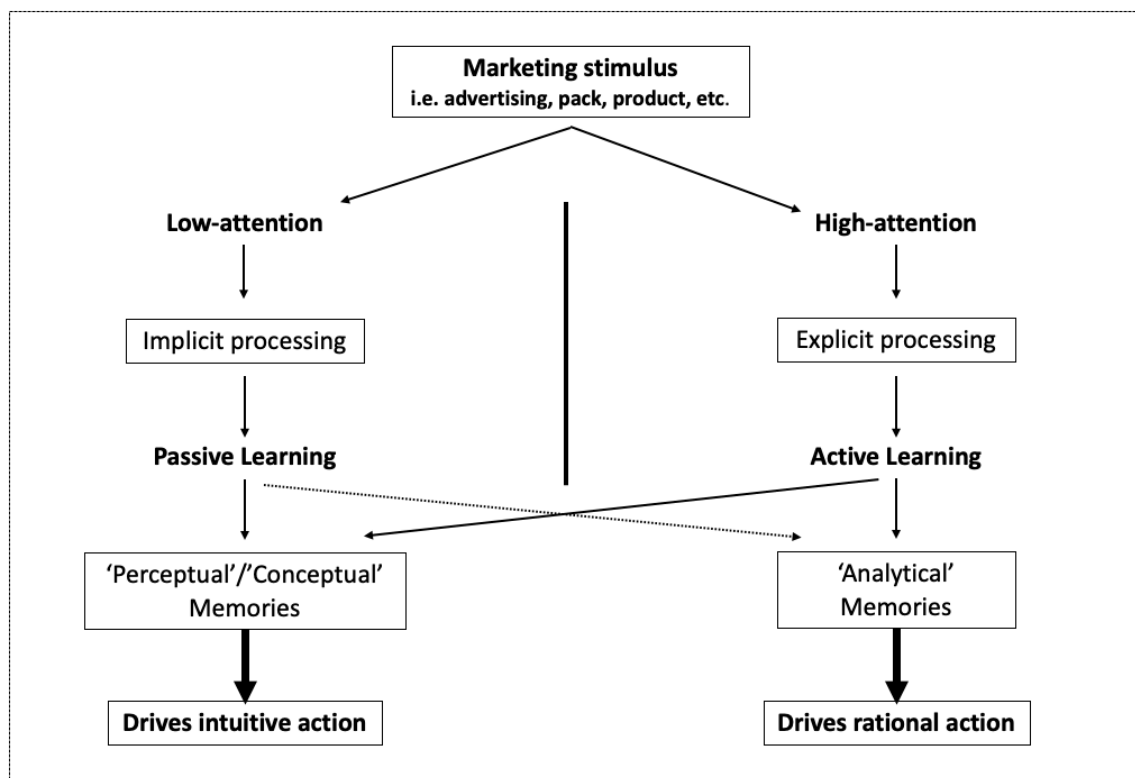
and Leavitt (1984). Their model describes four levels of viewer engagement, according to increased visual focus and processing to each level of processing. Lower levels are defined by more diffuse visual processing, while higher levels see visual focus tightening towards the advertising stimulus in isolation. Subsequent models (Macinnis & Jaworski, 1989) provide a similar perspective on viewers' attentive focus tightening or broadening depending on their engagement. While useful for understanding the typical progression of consumer processing and behaviour, such models are also impractical for applied use; for example, an implicit assumption of these models is that consumer processing follows a serial path, from visual identification to semantic evaluation, and ends with an extrapolation of message (Greenwald & Leavitt, 1984). Such perceptual processes typically occur within a split-second (De Brigard & Prinz, 2009), suggesting that several distinct stages are of little diagnostic value for an advertiser. Such a progression may be true only for an initial exposure as repeated exposures may activate pre-existing stimulus traces in physical and perceptual memory (Posner & Snyder, 2004), potentially affecting the viewers' behaviour. Hence, stage-like models of attention may be inappropriate as they do not reflect the true variability of attention (Heath & Nairn, 2005).

In contrast, a promising approach that does not rely on a stage-like system but rather uses a dual-process explanation, is Heath's (2001a, 2001b) Low Involvement Processing Model (later referred to as Low Attention Processing Model). According to Heath (2001b), consumers process advertising differently depending on the level of attention they devote to it. At high attention, consumers process visual information deliberately and specifically, often on the basis of goals or motivations (Heath, 2012). For this reason, high attention is most commonly associated with top-down modes of processing (Katsuki & Constantinidis, 2014), as well as a general narrowing of attentional focus (Sawaki & Katayama, 2008). However, it is also the

case that high attention may emerge in response to salient bottom-up stimuli (Sawaki & Katayama, 2008).

At high attention, the creation of explicit, analytical forms of memory occurs because of active learning processes. Active Learning makes use of working memory to “analyse, reinterpret and then store information in long-term memory”, which assists in creating high resolution memory, though its durability is limited (Heath, 2001b). Typically, such memories may also be accessible to the individual, helping to encourage rational consumer action in line with viewers’ specific goals or motivations in processing.

Figure 1. The Low Involvement Processing Model



SOURCE: Adapted from Heath (2001b).

Low attention, in contrast, refers to attentive behaviour which is more automatic and effortless than high attention. A primary characteristic of low attention is enhanced peripheral focus,

where processing of non-central stimuli takes place outside of the perceiver's awareness (Rosenholtz, 2020). For this reason, low attention is seen to predominantly reflect bottom-up appraisal, where processing is driven by the demands of external stimuli (Eysenck & Keane, 2015).

Both high and low attention have a role to play in visual information processing. High attention, while strong in resolution, is a mentally taxing process and so cannot be sustained for extended durations (Kahneman, 1973). As such, it is advantageous in situations where highly directed processing towards specific stimuli or events is beneficial. However, not all situations require focused mental energy. In such instances, we can often make do with lower levels of attention without significantly sacrificing our efficiency (Jensen & Jepsen, 2007). Indeed, the majority of our waking hours are spent in a state of low attention, which allows us to react to all stimuli more easily in our immediate environments while conserving cognitive resources (Heath, 2001b, 2012).

Together, this information has several implications for advertisement viewing. For one, high attention viewing is often sustained amongst consumers for much shorter periods than low attention. Similarly, viewers adopting either viewing style are likely to perceive advertising differently, due to a heightened focus on either central versus peripheral components of a scene. Consequently, we expect differences in the relationship between attention and sales impact for high and low attention, and this opens the door for the model presented within this paper by explicating the different consumer response pathways associated with each type of attention.

2.3.4. The Relationship Between Attention and Sales Impact.

Attention is recognised as a gatekeeper of mental impact (Tallon-Baudry, 2011) and so precedes memory, intention and action. In other words, attention is the mechanism through which advertising information is processed by consumers. As such, attention acts as an enabling factor for advertising impact - in lieu of any attention; advertising cannot exert influence on consumers' purchase behaviours. The mechanisms that underlie the role that attention plays in preference formation are still relatively unknown, although several studies propose that the very act of paying attention to advertising may render enhanced consumer response (Florack, Egger, & Hübner, 2020; Janiszewski, Kuo, & Tavassoli, 2013). According to Krajbich, Armel, and Antonio (2010), attention to specific objects allows more information to be accumulated about it. In turn, the more evidence a person accumulates for a particular alternative, the more "likely this alternative is to surpass a cutoff for choice" (Mormann, Towal, & Koch, 2013, p. 389). An implication of this finding is that attention to advertising is beneficial for establishing brand preference information necessary for activation at a later point of purchase.

Only one research study to the authors' knowledge has investigated whether preference formation from advertising remains observable when the amount of attention paid to advertising changes. Florack, Egger and Hubner (2020) provide initial evidence that high attention exposure biases choice more significantly and positively than does passive attention exposure. Additionally, this effect is shown as consistent across time spent viewing (Florack, Egger, et al., 2020). These findings are yet to be replicated in the context of naturalistic exposure, as laboratory-based search tasks may provide a poor indication of consumers' real

attentive behaviours, particularly in regard to implicit forms of processing such as low attention (Heath, 2001b).

Research does distinguish between the role of memory in high vs. low attention processing. Besides choice, the relationship between attention and memory is an important one because advertising operates in a two-stage manner (Buttner, Florack, & Serfas, 2013), beginning with exposure and ending at a future point in time when a purchase decision is reached. According to Peters and Leshner (2013), memory can be distinguished in terms of an explicit and implicit memory system. Explicit memory refers to memory which is easily and consciously accessible (Goode, 2007). Commonly operationalised as ‘recall’, the creation of explicit memory is most closely associated with high attention (Heath, 2012). However, the durability of explicit memory is quite limited – often fading within a matter of days (Heath & Feldwick, 2008).

In contrast, low attention appears to rely more predominantly on implicit memory (Goode, 2007). Unlike explicit memory, implicit memory is largely unconscious, meaning it is typically inaccessible to a conscious search through memory (Grimes & Kitchen, 2007). In addition, implicit memory is typically of lower resolution than explicit, meaning detail is often sacrificed for the sake of gist. However, it is also the case that information held in implicit memory is often more robust and remembered for longer periods than information in explicit memory (Heath, 2012). Furthermore, recent studies demonstrate a positive association between brand recall and low attention (Simmonds, Bellman, Kennedy, Nenycz-Thiel, & Bogomolova, 2020).

Altogether, there is preliminary evidence of a strong, positive relationship between attention and several measures of sales impact. This relationship could theoretically inform a model of attention and consumer behaviour derived from Heath’s (2001a, 2001b) Low attention model,

which could be leveraged within a new metric of attention. However, additional validation of this theory, particularly in applied contexts, is critical before considering it as a potential basis for a metric of attention. Although several preliminary studies have noted associations between high attention and preference formation (Florack, Egger, et al., 2020; Janiszewski et al., 2013), and low attention with recall memory (Simmonds et al., 2020), future research is necessary to directly compare each attention in response to different advertisements and viewing conditions. This will then allow evaluation of the impacts of different attentive conditions on subsequent consumer behaviour. To this end, a study was designed to explore the effects of high and low attention on brand choice and recall, with viewing in situ across three media platforms - Television, Facebook and YouTube. The following section outlines this study.

2.4. MATERIALS AND METHODS

2.4.1. Design and Participants

A cross-sectional, observational research design was used to explore attention and consumer behaviour across three digital media platforms, including free-to-air television, Facebook and YouTube. Respondents from three European countries (Germany, Switzerland and Austria) were sampled from the online labour sourcing service *Lucid*, in exchange for X EUD. This sample consisted of 466 participants, 380 of whom were sampled from Germany, 38 from Austria, and 48 from Switzerland. All respondents were fluent in the German language. Furthermore, in order to participate in this study, respondents on mobile platforms were required to own and use an Apple iPhone 6s (or subsequent iOS device), while television respondents were sent a package containing an iPhone 6s.

Table 1. Characteristics of the Respondents.

Characteristic	TV		Facebook		YouTube	
	Frequency	%	Frequency	%	Frequency	%
Country						
Germany	137	81.5	109	81.3	134	81.7
Austria	16	9.5	12	8.9	10	6.1
Switzerland	15	8.9	13	9.7	20	12.2
Age (years)						
(18-35)	60	37.5	75	58.6	101	63.9
(36-45)	35	21.9	28	20.9	30	19.0
(45-54)	29	18.1	16	12.5	21	13.3
(55-64)	25	15.6	6	4.7	6	3.8
(65-74)	11	6.9	3	2.3		
Gender						
M	82	48.8	71	53.0	91	55.5
F	86	51.2	63	47.0	71	43.3

Note: ($n = 466$)

2.4.2. Stimuli

Stimuli selected for the viewing session were twelve branded advertisements, covering a range of product categories. These advertisements were for real brands from categories including fast food, chewing gum, rice, cat food, soft drink, men's fragrance, women's deodorant, shampoo, sneakers, cars and washing machines, and were reflected across both the test brand and other

category-consistent brands. After completing the viewing session, participants were asked to complete a 72-item survey questionnaire which consisted of questions exploring participants' choice (36 items) and recall (36 items) responses to the twelve categories of consumer brands.

2.4.3. Hardware and software

In order to understand the impact of viewing attention to advertising on consumer behaviour, participants' eye movements were recorded while viewing advertising on one of the three research platforms.

Depending on the platform, participants were either provided with a Wi-Fi only Apple iPhone 6s device preloaded with a custom research application (television group) or required to own at least an iPhone 6s and download the application from the App Store (Facebook & YouTube groups). Additionally, the television group were given a device charger and tripod stand for mounting the device horizontally beneath the lower bezel of the participants' televisions.

2.4.4. Eye-Tracking and Data Preparation Procedure.

A proprietary gaze prediction system was used to monitor participants' head, facial and eye features while viewing advertisements on a television screen. This system relies on a custom regression model to map (120D) vectors to a predicted location on the device screen. This relationship depends on the positioning and rotation of participants' heads in relation to the camera and screen (Papoutsaki, Laskey, & Huang, 2017). Prior research into such systems has demonstrated relative congruence between such technologies and specialised eye-tracking interfaces (Papoutsaki, 2015), lending credibility to their use in the present research.

Synchronising gaze to a location on screen required a mapping of the position and rotation of a participant's head in 3D space. To achieve this, specific participant facial features, including brow, nose and eye position were recorded by a webcam, at a rate of five frames per second and processed through a custom neural network, thereby deriving five gaze locations on screen per-second.

Once the five gaze locations were calculated an aggregated per-second attention score was generated in reference to the location of the advertisement on-screen. The range of attention scores was between 0 (if 0% of the gaze location and bounds are outside of the screen) to 100 (if 100% of the gaze location and bounds are within the screen). High attention was defined as any gaze point on-screen (and where applicable, on-advertisement), while low attention was defined as any gaze point occurring near-screen, assuming an industry-standard range of 15 points of Euclidean error. Instances of non-attention (i.e., where no visual attention of any kind was detected) were excluded from the present analysis.

2.4.5. Procedure

The present research study was advertised on the online labour sourcing website *Lucid*. The purpose of the study was described as measuring audience reactions to advertising. Prior to starting, participants were informed that in accordance with local and international privacy regulations (i.e., *Privacy [Market and Social Research] Code 2014*), no personal data (i.e., passwords, searches, activity) from their personal media accounts would be collected or stored for the purpose of the study. Furthermore, participants were informed that facial recording would take place but that such images would be processed by visual algorithms, meaning researchers had access only to simple numeric values denoting visual attention.

With their own or study-provided iOS device, study participants were then directed to navigate to the Apple *App Store*, where they were instructed to download a proprietary attention-tracking application. Once logged into this application, participants were required to enable permissions allowing the app to intercept and replicate their live ad feeds on television, Facebook and YouTube. Participants were then presented with a normal log-in page pertaining to their research platform.

Once logged into the platform, participants were free to browse through photo, video and text content (as each platform allows) at their leisure for a period of 30 minutes on Television and 10-20 minutes on the digital platforms (YouTube & Facebook). While browsing, participants' eye movements were recorded, assessing variables such as position and duration of attention on- and off-screen. After the respective viewing times were reached, the viewing session concluded and participants were automatically re-directed to a URL-based Qualtrics survey assessing the behavioural component of exposure. Here, participants were asked to view and choose, out of several unexposed brands and one exposed test brand for each product category, which one they would purchase if price and need were irrelevant. Additionally, participants were also asked to recall which brand they saw during initial exposure.

Once the survey was completed, participants were thanked for their participation and provided with a unique identifier to be used within *Lucid* for remuneration purposes.

2.5. RESULTS

The values of the regression coefficients and their statistical significance obtained by 'Enter logistical regression' method are included in Table 2. This table also provides

information as to the impact of the independent variables on brand choice and recall (see odds ratio [Exp B]). An odds ratio value above 1 indicates a positive association between the predictor and outcome variable, whereas values below 1 reveal a negative association.

High attention – Main Effect. A simple main effect of high attention on choice was revealed ($b = .021, p = .00$), indicating that the probability of a respondent choosing an advertised brand was higher among those who spent more time watching on-screen than non-attention. The odds ratio for the predictor indicates that the odds of a respondent choosing brand change by a factor of 1.021 with each raw score increment in time (seconds) spent on-screen (i.e., high attention). This was also the case for prompted brand recall ($b = .036, p = .00$), as well as unprompted brand recall ($b = .038, p = .00$), demonstrating that the likelihood of correct brand recall was greater among those who spent more time watching on-screen. The odds ratio for the predictor indicates that the odds of a respondent recalling a brand change by a factor of 1.037 for prompted recall and 1.038 for unprompted recall, with each raw score increment in time spent on-screen.

Low attention – Main Effect. Regarding brand choice, the regression slope for low attention ($b = .012, p = .025$) is positive and statistically significant, indicating that the probability of a respondent choosing an advertised brand was higher among those who spent more time-watching near-screen than non-attention. The odds ratio for the predictor indicates that the odds of a respondent choosing a brand change by a factor of 1.013 with each raw score increment in time (seconds) spent near-screen (i.e., low attention).

Simple main effects of low attention on brand recall were also observed. For prompted brand recall ($b = .027, p = .00$), the regression slope is positive and statistically significant, indicating

that the probability of a respondent recalling a brand with prompting was higher among those who spent more time watching near-screen than non-attention. Analysis of odds ratios demonstrates that the likelihood of correct prompted recall occurring change by a factor of 1.027 with each raw score increment in time (seconds) spent on-screen (i.e., low attention). Likewise, the regression slope for unprompted brand recall ($b = .033, p = .00$) is positive and statistically significant, indicating that the probability of correct unprompted recall was higher among those watching near-screen than non-attention. The odds ratio for the predictor indicates that the odds of a respondent recalling a brand change by a factor of 1.034 with each raw score increment in time spent near-screen.

Table 2. Parameters Estimation Results of Three Binary Logistic Models (Choice, Prompted Recall & Unprompted Recall).

	Choice					Prompted Recall					Unprompted Recall				
Model summary	X ² = 15.693, df = 2, <i>p</i> = .000					X ² = 45.517, df = 2, <i>p</i> = .000					X ² = 44.422, df = 2, <i>p</i> = .000				
Nagelkerke <i>R</i>²	.006					.019					.020				
Overall accuracy	73.3%					79.9%					85.1%				
Main effects	B	S.E	Wald	<i>p</i> Value	Exp (B)	B	S.E.	Wald	<i>p</i> Value	Exp (B)	B	S.E.	Wald	<i>p</i> Value	Exp (B)
constant	-1.140	.051	503.263	.000	.320	-1.636	.058	789.849	.000	.195	-2.036	.067	929.785	.000	.131
high attention (base = 0)	.021	.006	13.890	.000	1.021	.036	.006	37.817	.000	1.037	.038	.007	32.766	.000	1.038
low attention (base = 0)	.012	.006	5.026	.025	1.013	.027	.006	19.784	.000	1.027	.033	.007	25.317	.000	1.034

Note: (*n* = 466)

2.6. DISCUSSION

The present study examined the effects of viewing attention – high and low – to advertising on consumer responses across three digital media platforms, in the process establishing a framework which associates changes in attention with changes in value for advertisers. Of particular interest to this research was the differences between high and low attention across brand choice and recall, as well as any differences across platforms; and any observations which provide a view of the value of attention across contexts.

An important finding from this analysis concerns the magnitude of effect on consumer responses resulting from attention. Across all individual tested platforms, which comprised Facebook, YouTube and television, it was revealed that attention did not significantly contribute to brand choice or recall responses. However, when the research sample was expanded to include all platforms, a number of significant relationships with consumer responses were observed across both high and low attention. Although this finding may reflect only a small overall effect of consumer attention on memory and behavioural responses, it remains one that exerts a significant impact over non-attention at scale. This is an important consideration, as such effects are likely to be both significant and large in magnitude when audience sizes are expanded to include national or international markets. To further explore this proposition, subsequent empirical research could further investigate the effects of attention across larger samples, or in response to longer-duration or repeated exposures to advertising.

In support of the attention literature (Florack, Egger, et al., 2020; Janiszewski et al., 2013), several relationships between attention and consumer responses were noted. Based on prior work, it was not surprising to observe a positive association between high attention and preference (Orquin & Loose, 2013), nor explicit memory (Sorum, 2018). In addition, a positive relationship between low attention and choice is also in line with results from prior work (Humphrey, Laverie, & Rinaldo, 2017), as presented in Figure 1 above. In contrast, few studies have shown a relationship between low attention and brand recall, a component of explicit memory. The present finding expands on and supports a recent finding by Simmonds et al. (2020), who show a close positive relationship between time spent at low attention and prompted brand recall success. That low attention relates positively to brand recall is also indicated by the Low Involvement Processing Model (Heath, 2001b). Hence, the present results

provide further validation of that proposition; challenging the notion that high attention and low attention relate solely to individual explicit and implicit memory stores, respectively.

Returning to Heath (2001b), it should be further noted that high and low attention, while both positive for effecting consumer responses, do exhibit differences in terms of consumer response, factors which could be used to ascribe financial values to the two forms of viewing. For instance, across all brand choices and recall responses, the likelihood of positive action occurring is relatively greater for high than low attention. Although these differences are small in magnitude, they corroborate the notion that high attention is of more value to advertisers than low attention, but that even distracted viewers should be seen as important for impacting brand success; this is of significant importance in a multi-media, distracted world in which consumers operate.

These results have obvious implications for the wider use of attention data in advertising performance evaluation. It has been demonstrated that passive, non-invasive attention-monitoring techniques, such as those used in this research, are sensitive enough to distinguish two forms of attention, as well as uncover trends in their buying data relating to the type of attention they had paid to that advertisement. Such promising results highlight the potential for operationalising high and low attention for the purposes of valuing advertising exposure, through the creation of a metric of attention.

A formalised metric of attention has the potential to address and overcome the limitations of existing opaque advertising metrics, including impression-based measures as well as first-generation attention metrics. In addition, a metric based on human attention is capable of enhancing the quality of audience analytics by expanding the scope of consumer measurement

to naturalistic conditions. The utility of this metric is contingent on establishing relative value for advertising impact based on the quality of viewer attention. To this end, there are several cases in which an attention metric can be applied to valuing audience viewership.

Application 1: The Use of Attention Metrics to Monitor and Shape Advertising Efficiency. An attention metric based on eye-tracking can be used to evaluate a range of different advertising elements (e.g., position, clutter, exposure duration, device). These factors can be standardised against an attention metric that operates across platforms, enabling advertisers to compare the effectiveness of their campaigns with an empirically devised measure.

There is evidence of corporate interest in attention metrics, leading the transition of this research into commercial products and services (*Amplified Intelligence*, 2021), confirming the relevance and value of eye-tracked attention to measuring advertising.

Application 2: Differentiating High, Low and No-Attention Viewing Across Ad View. There is also the opportunity for an attention metric to leverage levels-of-attention for more granular currency trading. Levels of attention, referring to *High, Low and Non-Attention*, offer a rich view of graded engagement within audiences and reflects the reality of real-world consumer attention. Categorising consumer attention in this manner enables researchers to determine the exact amount of attention an ad received during viewing, as well as the percentage of each type of attention the ad received throughout ad time-in-view.

Practically, this information can be applied through aggregating the relative percentages of High, Low and Non-Attention during an ad view against the projected costs of engagement for that media platform. On average, certain platforms perform better than others in terms of

viewer engagement, ascribing increased costs to seeking higher levels of attention, with decreased costs for lower levels of attention on platforms where ad visibility is poorer. In addition to providing a modular view of audience attention, an attention metric based on levels of attention could permit a true cross-platform valuation of audience viewership – one which is sensitive to modal differences between platforms.

Application 3: Measuring Attention for 'Time-in-View' and Location. A formalised attention metric could also utilise time- and position-based measures to provide views of changes in viewer engagement across the ad view. This would allow advertisers to compare the behavioural performances associated with changes in viewing attention, from low-level to high level focus, in response to different advertising characteristics.

Furthermore, a per-second attention metric could be leveraged to produce a measure of 'attention-time' in response to advertising characteristics. This may consider the total consecutive seconds where advertising is in receipt of attention, or the frequency of seconds spent in either state of attention. Such information could assist advertisers in evaluating the relative peaks and troughs in performance based on the state of audience focus.

Application 4: Attention Data Can Inform Creative Planning. Lastly, an attention metric could serve a role regarding the creative planning of advertising content. Above all else, advertising is designed to attract consumers' attention (Barnard & Ehrenberg, 1997). The specific advertising creative chosen to be displayed to consumers is one manner in which advertisers can capture audience attention. By consulting attention data, advertisers can examine the relative performance of their creative and determine the role of specific creative factors in increasing or minimising audience attention.

To conclude, there are significant opportunities for a metric based on attention to enhance existing advertising analytic suites and inform creative planning of advertising. Through establishing time-based attention metrics, consideration can be given to how attention changes across an ad view as well as the specific media/creative factors which may underlie these changes. The potential to enhance advertising design as well as its evaluation offered by such an attention metric will assist both buyers and sellers of attention to navigate the many complexities of our attention-based advertising marketplace in years to come.

2.7. CONCLUSION

More than ever before, the digital era sees consumer attention limited, rare and highly valuable for advertisers. The rise of new media technologies has created a surplus of information at the same time as a deficit of consumer attention, making it difficult for advertisers to reach consumers. Advertisers also face difficulty in assessing consumer attention through existing viewability or opportunity-to-see measures, which, along with other opaque metrics of advertising performance, misrepresent the true nature of audience exposure. The lack of an evidence-based framework to support the buying and selling of media attention is of critical relevance to these issues. Yet, there is great potential in a metric of attention, developed from the attention literature, for the formalisation of attention as a tradable currency of advertising effectiveness on digital platforms; dependent on the mode of technology and acceptance, real time monitoring of viewer attention and appropriate charging to advertisers is within the realm of possibility. The use of valid, scalable and attention-sensitive biotechnical detection technologies such as eye-tracking offers a gold-standard by which to measure consumer attention. The unobtrusiveness of these recent measures combined with their

simplicity of application enables widespread industry adoption of attention measurement. The use of an advertising metric based on attention will see greater transparency established within a media industry in need of reform.

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**CHAPTER 3. HIGH ATTENTION, LOW ATTENTION, BRAND
CHOICE AND RECALL ACROSS SINGLE AND REPEATED
EXPOSURES**

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Statement of Authorship

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Contribution to the Paper	Developed conceptual paper and data analysis, wrote manuscript and revised manuscript		
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Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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By signing the Statement of Authorship, each author certifies that:

- the candidate's stated contribution to the publication is accurate (as detailed above);
- permission is granted for the candidate to include the publication in the thesis; and
- the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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ABSTRACT

It has been argued that visual attention is as valuable as it is rare, but for many advertisers and media owners, value is the product of actual behaviour. Over two phases, brand behavioural outcomes including choice and recall (prompted and unprompted) were investigated against a model of attention comprising a focal 'high attention' and a peripheral 'low attention'. Following one exposure, high attention was related positively to brand choice and recall, while low attention was related only to recall (Phase 1). At two exposures, low attention, not high attention, was positively associated with brand choice, while both high and low attention were related to brand recall (Phase 2). These results demonstrate that the value of attention is in part reflective of the outcomes advertisers wish to achieve by capturing it – if long-lasting brand memory is critical, then targeting low attention (at a reduced media cost) may suffice. If, however, advertisers are looking to motivate purchase at first sight, it may be prudent to seek higher-cost, high attention audiences, whereas long-duration advertising campaigns may be better suited for low attention. Additional demographic findings, as well as their interaction with attention, are also discussed.

Keywords: visual attention, eye-tracking, naturalistic testing, repeated measures, involvement.

3.1. HIGH ATTENTION, LOW ATTENTION, BRAND CHOICE AND RECALL ACROSS SINGLE AND REPEATED EXPOSURES

In the digital age of distraction, the success of advertising is determined largely by the amount of attention it commands. The term ‘attention economy’ (Simon 1971) describes a system of inequity between near-endless supplies of information and ever-decreasing opportunities to consume that information, a scenario which has rendered human attention to valued currency (Nelson-Field 2020). Investment in human attention has grown exponentially in the past twenty years, with a number of high profile technology companies developing suites of attention metrics based on web users’ online behaviours for the purposes of tailored advertising (Merritt 2017). However, such attempts have been rudimentary in nature, with such ‘attention metrics’ often failing to truly capture viewer attention, instead relying on estimates of cursor movement or page activity - artefacts of technological limitations from early website analytic systems (Merritt 2017). Lacking accurate and standardised measures of attention and its value, advertisers are forced to rely on such metrics as the basis for their commercial pricing decisions. Concomitantly, the development of new accessible, scalable, and non-invasive attention capture technologies provides new opportunity to value the relative impact of consumer attention on advertising outcomes across a range of digital contexts. Current technology allows us to measure attention and its impact on advertising outcomes in a naturalistic environment and empirically observe effects. Using a ‘high/low attention processing’ model (Heath 2001a, 2001b), this research uses naturalistic, webcam-based eye-tracking to measure the relationship between different forms of attention (i.e., on-screen vs. near-screen) and their influence on consumer responses such as brand choice and recall across three digital media platforms, Television, Facebook, and YouTube. Two research phases were conducted, examining the impact of viewing attention on brand choice and recall following a

single exposure to advertising (Phase 1) and repeated exposures (Phase 2). Following a discussion of the theoretical background to this research, these two phases will be detailed below.

3.2. THE ROLE OF ATTENTION IN CONSUMER ADVERTISING APPRAISAL

Attention is a critical variable in assessing and predicting advertising performance. Described as a gatekeeper to advertising impact (Awh, Vogel & Oh 2006) attention determines which advertisements are assessed and remembered by consumers. In addition to filtering environmental information for processing (Broadbent 1958), attention also encompasses more complex consumption processes, impacting preference evaluation and attitudes (Rizzolatti, Riggio & Sheliga 1994). Furthermore, there is strong evidence to suggest that attention is closely associated with consumer behaviour (Janiszewski 2008; Wedel, Pieters & Liechty 2008). According to these studies, attention is responsible for not only bringing products and brands into consumers' consideration, but that the very act of paying attention can in and of itself influence what consumers like and remember (Bordalo, Gennaioli & Shleifer 2016; Florack, Egger & Hubner 2020; Pieters, Warlop & Wedel 2002; Zajonc 1968).

In the context of visual attention, two distinct research streams have emerged, one which examines the influence of focal, or 'high' attention (i.e., where a stimulus falls at the locus of attention) on advertising appraisal (Florack et al. 2020; Isbell et al. 2017; Janiszewski, Kuo & Tavassoli 2013; Salo et al. 2017), while the other has examined the influence of incidental, or 'low' attention (i.e., where a stimulus falls outside of the locus of attention but remains within focal view) (Heath 2001a, 2001b; Huang & Huh, 2018; Janiszewski, 1993; Sauerland, Felser

& Krajewski 2012; Shapiro, Macinnis & Heckler 1997; Wang & Teo 2012). Research has revealed that objects positioned closer to the locus of attention receive more intense processing than those further away, but that objects placed anywhere within focal view receive at least moderate degrees of cognitive processing (Heath & Nairn 2005). We do not know, however, if the effect on consumer advertising response varies; this is the purpose of this paper.

Thus, both streams of research are of relevance to this article. Given emerging conversation surrounding the attention economy (Nelson-Field 2020), where attention is rare, limited and valuable for advertisers, it is critical to discern the true value of the attention which advertising receives. However, in order to compare these forms of attention and their effects on advertising outcomes we will review the literature pertaining to high and low attention advertising effects and develop a number of hypotheses for subsequent testing (see Table 1 below for a Summary of these hypotheses).

3.2.1. HIGH ATTENTION

Studies of consumer attention have focused on forms of focused or selective attention, where attention is highly active and specific to the advertising stimulus. High attention processing is said to emerge through a conscious analysis of the advertising message (Heath & Feldwick 2008), either on the basis of personal relevance (Katsuki & Constantinidis 2014) or surprise (Corbetta & Shulman 2002), thus providing incentive to critically examine an advertisements' message or presentation. Achieving high attention in audiences is critical for advertisers on digital platforms, as it improves the likelihood that advertising will break through the clutter and render a positive impression on viewers (Pieters, Warlop, & Wedel, 2002); but given today's media environment, how likely is this to occur?

One of the first research studies to deal with high attention in the context of visual exposure was Yarbus (1967). In this widely influential article, Yarbus demonstrated how observers' eye movements can be used to reveal the presence of top-down processing tasks or goals when looking at objects. Subsequent research into goal-directed attention (Ohman, Flykt & Esteves 2001; Pieters & Wedel 2007; Tatler et al. 2010) has shown that the presence of specific processing goals can increase attention to advertisement elements, including text, pictorial and design factors. Unsurprisingly, high levels of attention to advertising have been shown to relate to deeper processing of advertising elements (Nordhielm 2002).

Other work has demonstrated a close association between high attention and purchasing behaviour (Krajbach, Armel & Rangel 2010; Lohse et al. 2014; Maughan, Gutnikov & Stevens 2007; Mormann, Towal & Koch 2013; Richardson, Spivey & Hoover 2009). For instance, in Janiszewski et al. (2013), selective attention to a previously seen product was found to increase the likelihood of selection, while inattention inhibited selection. Using a similar paradigm to Janiszewski et al. (2013), Florack et al. (2020) have demonstrated that attended products were rated more positively than non-attended products, as well as those seen only briefly. Similarly, in a study of young consumers' responses to a toy-commercial, the likelihood of selection was greater among those children who were highly attentive compared to those who were distracted (Neeley & Schumann 2004). Across these studies, it is suggested that high attention may directly influence choice by guiding viewers to process advertising of motivational significance, up until the point where a decision threshold (i.e., choice) is reached. In turn, these studies lend support to the notion that high attention determines not only what elements of the advertisement are processed, but how they are evaluated and ultimately acted upon by consumers.

Furthermore, a moderation effect of brand use on high attention and choice is revealed by Baker et al. (1986); brand familiarity resulting from brand use may serve as an input to choice behaviour, particularly when attention to an advertisement occurs for extended durations. Similarly, Obermiller (1985) has also suggested that brand use effects may be facilitated by attentional strength. In this research, greater brand preference emerged when attention was focused to the advertisement rather than distracted. As a result of this literature, we expect attention to drive brand choice and furthermore, that brand use will moderate the relationship between attention and choice, as such, the following hypotheses for testing are proposed:

H1a: High attention is positively associated with choice.

H2a: Brand use moderates the relationship between high attention and choice.

While a positive relationship between attention and product selection is well-established in the above studies, the literature concerning the role of high attention in motivating top-of-mind recall is less-clear. Although it is commonly understood that attention is required for the creation of explicit memory (Baddeley & Hitch 1994; Broadbent, 1958; Craik et al. 1996), several recent studies (Chandon 2002; Tangmanee 2016) have reported relatively low rates of recall despite attentive behaviour. Specifically, Chandon (2002) has shown that while brand familiarity increased unprompted recall by a factor of 7.3, attention increased unprompted recall only by a factor of 1.2. Recently, Simmonds et al. (2020) have demonstrated a positive association between visual attention and prompted recall, however this was evident only among non- and light-users of a brand; attention had little effect on recall for heavier users. That explicit memory recall at high attention may differ based on brand usage or familiarity is well-substantiated in a number of other studies (Holden & Vanhuele 1999; Pieters et al. 2002), suggesting that brand use may act as a moderating influence on attention and recall.

Against this literature, it is expected that high attention will be positively associated with recall, and that this relationship will be more positive among non- and light-users of advertised brands, leading to the following hypotheses:

H1b: High attention is positively associated with prompted recall.

H1c: High attention is positively associated with unprompted recall.

H2b: Brand use moderates the association between high attention and prompted recall.

H2c: Brand use moderates the association between high attention and unprompted recall.

As for other demographic variables, studies have reported associations between high attention, gender and age (Pan et al. 2004). According to Merritt et al. (2007) an analysis of gender reveals a number of differential attentional responses within selective attention tasks. Specifically, this difference was found to be salient in terms of cue type (informative cues vs. invalid cues), as well as attentional onset (i.e., time taken to attend to cue). In eye-tracking research (Pan et al. 2004), males have been shown to exhibit longer fixation durations (i.e., periods of stationary visual processing) than females, consistent with research showing a smaller locus of attention among males than females, who tend to process more available information (Riley et al. 2017). Similarly, other attention-tracking studies (Goodrich, 2014) provide evidence that males devote greater levels of attention to online ads than female. Thus, relative to females, males are expected to show greater attention to advertisements, which is expected to positively influence brand choice.

H3a: At high attention, males show relatively greater brand choice for advertised products than will females.

In contrast to brand choice, prior research indicates that women tend to recall advertised products more so than men. A robust memory advantage has been revealed amongst women relative to men (Madden & Langley 2003) for both prompted and unprompted recall (Graves et al. 2017). Furthermore, examining gender differences in product recall of mobile advertising, Okazaki (2007) reveals that female consumers' recall was greater than that of males (although this difference failed to achieve statistical significance).

Consequently, we anticipate that females devoting high attention to advertising will recall more brands than males, leading to the following hypotheses.

H3b: At high attention, females show relatively greater prompted recall for advertised products than will males.

H3c: At high attention, females show relatively greater unprompted recall for advertised products than will males.

Limited research has focused on the role of age in high attention behaviours (Kitajama et al. 2008). While it has previously been shown that age causes a general decline in the extension of visual attention (Madden et al. 1994), particularly on digital devices (Madden & Langley 2003), Suto and Kumada (2010) have demonstrated that this effect is most salient for goal-driven, high attention. These authors have shown that, with declines in visual attention and working memory, older participants experienced more disruptions in searching for objects on the screen, as well as greater issues maintaining visual processing goals. In contrast, younger participants, measuring higher in visual attention functioning, demonstrated consistently shorter response onsets to task-relevant visual information. Younger viewers exhibit greater information processing capacity than older viewers (Madden et al. 1994), particularly on digital

platforms, thus there will potentially be greater attentional and thus behavioural (i.e., choice) effects among younger participants than for old. The following hypothesis is thus proposed:

H4a: At high attention, younger participants show relatively greater brand choice for advertised products than will older participants.

Furthermore, similar age-related findings are reported for memory. Memory, specifically recall memory, is thought to decline steadily with aging. A study by Ballesteros and Mayas (2015) reported that, at high attention, young adults remembered previously-seen objects faster than older adults, while also demonstrating more accurate recognition memory. In Russo and Parkin (1993), older adults' recall memory under conditions of focused attention was found to be worse than younger participants under the same conditions, equivalent to that of younger participants who were distracted at exposure. These results suggest an increasing inability to effectively utilise explicit memory with age (Hashtroudi, Chrosniak & Schwartz 1991). Against this work, we expect older participants to perform worse on measures of recall (i.e., prompted and unprompted) than younger participants for advertised brands, leading to the following hypotheses:

H4b: At high attention, younger participants show relatively greater prompted recall for advertised products than will older participants.

H4c: At high attention, younger participants show relatively greater unprompted recall for advertised products than will older participants.

3.2.2. LOW ATTENTION

Recently, a number of research studies have claimed that advertising continues to be effective even when consumers are distracted or devote little attention to advertising (Chatterjee 2008;

Santoso et al. 2020); these studies offer a major empirical contribution to this present research. Known otherwise as ‘low attention processing’ (Heath 2001b), it has been posited that advertising is often analysed and processed incidentally by consumers in a non-conscious manner; particularly when attentional resources are limited or divided across multiple screens at a time (Lang 2000). Across studies of this phenomena, low attention processing has been associated with enhanced preference and product selection (Janiszewski 1993), as well as the creation of durable brand memories (Grimes 2006; Lee & Labroo 2004).

It is suggested that the positive effects of low attention processing on preference formation may be driven through a misattribution of familiarity with advertising (Grimes & Kitchen 2007; Lee & Labroo 2004). Consistent with the mere exposure effect, whereby brief exposures to an object can subconsciously foster more positive ratings (Zajonc 1968, 1980), one proposition is that low attention processing may lead consumers to mistakenly attribute their familiarity with a product, resulting from non-conscious exposures, for an assumed affective value (i.e., ‘It must be familiar because I like it’) (Jacoby, Kelley & Dywan 1989). In doing so, consumers may be unable to recognise the impact of exposure on their preferences, misattributing their ease of processing advertising as enhanced preference for it (Jacoby et al. 1989).

Though empirical research on low attention processing is scarce, several studies exist and support its propositions in relation to product selection. According to Acar (2007), while incidental exposure to online advertising did not have a direct positive effect on participants’ attitudes or choice, incidental exposure did increase their level of familiarity with the product, which increased its probability of selection among similar alternatives. In addition, Santoso et al. (2020) revealed a positive overall effect of low attention on brand choice. Specifically, these authors found that even when advertising was not the subject of attentional focus; exposed

merely incidentally, a positive effect on choice remained. Similarly, a number of attention-tracking studies of incidental exposure have revealed weak but positive effects of low attention on choice, particularly in multiple-alternative choice tasks (Goodrich 2014; Kamleitner & Marckhgott 2021; Meißner, Musalem & Huber 2016). Against this research, the following hypothesis is proposed here:

H5a: Low attention is positively associated with choice.

Furthermore, recent research has shown that brand use may influence the relationship between low attention and choice. Santoso et al. (2020) found brand familiarity significantly moderated the relationship between low attention and brand choice, though this was only the case for divided attention, not incidental attention. Despite this, the direction of effect (negative) was consistent between the two forms of low attention (Santoso et al. 2020), suggesting that brand familiarity may potentially decrease the effect of low attention processing of advertisements, leading to the following hypothesis:

H6a: Brand use moderates the association between low attention and brand choice.

In contrast, research has demonstrated dissociative effects of low attention exposure on memory (Grybinas, Kantner & Dobbins 2019). For instance, in Yoo (2007), while low attention exposure was related to an increase in implicit memory for brands, it was not related to an enhancement in explicit memory (i.e., recall). Similar findings have been reported among a number of studies (Heath & Nairn 2005; Shapiro et al. 1997), covering a range of buying situations, product categories and creative factors.

However, McQuarrie and Mick (2003) reported that incidental exposure to advertising was related to an increase (of 7%) in aided recall relative to no exposure, although this effect was

smaller in magnitude than for focused exposure. Similarly, Krishnan and Chakravarti (2003) demonstrated that incidental exposure facilitated the aided recall of advertising information. Likewise, in a study of incidental exposure to product placements within video games, Nelson (2002) demonstrated that low attention exposure is related to an increase in brand recall for advertised products, an effect the author described as to be moderated by brand use.

Given these findings, it is expected that, while low attention exposure to advertising will negatively predict recall, this effect will be moderated by brand use. The following hypotheses reflect this:

H5b: Low attention is negatively associated with prompted recall.

H5c: Low attention is negatively associated with prompted recall.

H6b: Brand use moderates the association between low attention and prompted recall.

H6c: Brand use moderates the association between low attention and unprompted recall.

Furthermore, a gendered difference in low attention advertising effects has been demonstrated by Goodrich (2014). Specifically, it was shown that relative to females, males were more likely to prefer and remember advertising when it was seen at very low levels of attention. Thus the following hypotheses to be examined here are:

H7a: At low attention, males show relatively greater brand choice for advertised brands than will females.

H7b: At low attention, males show greater prompted recall for advertised brands than will females.

H7c: At low attention, males show relatively greater unprompted recall for advertised brands than will females.

As for age, recent research reports that while older and younger adults tend to respond relatively similarly in terms of preference at low attention, older adults tend to remember items more so than younger adults when advertising is exposed incidentally (Palumbo et al. 2021). A potential explanation for these findings is that younger adults tend to prioritise goal-directed attention over habitual attention (Twedell, Koutstaal & Jiang 2017), meaning that younger viewers may be more likely to ‘zap’ across the screen, while older adults fixate and process items for longer periods of time.

Consequently, we expect that, while both younger and older adults will exhibit similar preference for advertised products at low attention, manifested through increased brand choice, older adults will show greater recall relative to younger adults, as the following hypotheses suggest.

H8a: At low attention, there is no difference in brand choice by age.

H8b: At low attention, older participants show greater prompted recall for advertised than will younger participants.

H8c: At low attention, older participants show greater unprompted recall for advertised products than will younger participants.

Table 1. Summary of Hypotheses

HIGH ATTENTION	
High attention and Consumer Responses to Advertising 1. High attention is positively associated with consumer response to advertising a. High attention is positively associated with choice b. High attention is positively associated with prompted recall. c. High attention is positively associated with unprompted recall.	
Brand Use Effect on Attention & Consumer Response to Advertising 2. Brand use moderates the effect of High Attention on consumer response to advertising a. Brand use moderates the association between high attention and brand choice b. Brand use moderates the association between high attention and prompted recall. c. Brand use moderates the association between high and attention and unprompted recall.	
Gender Effect on Attention & Consumer Responses to Advertising 3. Gender has an effect on high attention to advertising and resulting consumer responses to advertising a. At high attention, males will show relatively greater brand choice for advertised products than will females. b. At high attention, females will show relatively greater prompted recall for advertised products than will males. c. At high attention, females will show relatively greater unprompted recall for advertised products than will males.	
Age Effect on Attention & Consumer Responses to Advertising 4. Age has a decreasing effect on consumer responses to advertising a. At high attention, younger participants will show relatively greater brand choice for advertised products than will older participants. b. At high attention, younger participants will show relatively greater prompted recall for advertised products than will older participants. c. At high attention, younger participants will show relatively greater unprompted recall for advertised products than will older participants.	
LOW ATTENTION	
Low attention and Consumer Responses to Advertising 5. Low attention is positively associated with preference, but not explicit memory responses to advertising a. Low attention is positively associated with choice b. Low attention is negatively associated with prompted recall. c. Low attention is negatively associated with unprompted recall.	
Brand Use Effect on Attention & Consumer Responses to Advertising 6. Brand use moderates the effect of low attention on consumer response to advertising a. Brand use moderates the association between low attention and brand choice b. Brand use moderates the association between low attention and prompted recall. c. Brand use moderates the association between low attention and unprompted recall.	
Gender Effect on Attention & Consumer Responses to Advertising 7. Gender has an effect on low attention to advertising and resulting consumer responses to advertising a. At low attention, males will show relatively greater brand choice for advertised products than will females. b. At low attention, females will show relatively greater prompted recall for advertised products than will males. c. At low attention, females will show relatively greater unprompted recall for advertised products than will males.	
Age Effect on Attention & Consumer Responses to Advertising	

- | |
|---|
| <p>8. Age has a decreasing effect on consumer responses to advertising</p> <ul style="list-style-type: none">a. At low attention, younger participants will show relatively greater brand choice for advertised products than will older participants.b. At low attention, younger participants will show relatively greater prompted recall for advertised products than will older participants.c. At low attention, younger participants will show relatively greater unprompted recall for advertised products than will older participants |
|---|

3.3. THE NEED FOR OBSERVATIONAL ATTENTION RESEARCH

Together, the studies discussed form the basis of our understanding of visual attention and consumer behaviour, proposing that attention enhances advertising appraisal and memory retention. However, what is also shared across these studies is a strong reliance on laboratory-based measurement paradigms and research designs which have the potential to unduly influence participant attention and behaviour (Wong & Stephen, 2019). By contrast, comparatively few studies (Heath & Nairn 2005; Teixeira 2014) have examined consumer attention through ‘lab-in-the-field’ research where consumers’ behaviours are observed in their natural environments (Gneezy & Imas 2017); this is a major contribution of this research.

Naturalistic research conducted within real-world settings tend to produce findings of high ecological validity by using testing conditions which closely match those which participants normally encounter in their day-to-day lives (Neisser 1976). Whereas laboratory-based studies of attention provide researchers with a high degree of control over research parameters, field research harbors important conceptual value in that it enables researchers to non-invasively assess the combined impact of not just those variables of interest (i.e., attention), but all other factors (i.e., media/demographic/situational factors) which impact consumer behaviour (Sun & May 2013). Hence, field experiments can be useful in establishing practical validation of the findings from clinical studies of attention.

Furthermore, field experiments can also highlight potential new avenues for research potentially overlooked by clinical research (Steinle 1997). While much of the lab-based work on attention has been driven by a confirmatory approach to conducting research, wherein relevant variables are selected *a priori* from the literature for testing, such a design also limits the scope of discovery to only those discreet variables chosen (Valli, Stahl & Feit 2017). Undertaking research in a solely confirmatory manner may then obfuscate new ideas, concepts or relationships between variables potentially made evident through exploratory research approaches.

A recent example of this (Nelson-Field & Ewens 2019; *WARC* 2019) used a naturalistic research design, with the authors investigating how consumers extend their attention to television advertising in their homes. The results revealed that, across a normal ad viewing session, up to 96% of the sample cycled through states of high, low and no attention when watching advertising (Nelson-Field & Ewens, 2019). Importantly, these results demonstrated that consumer attention is not stochastic and in fact varies substantially within the period of advertising exposure. Thus, such a finding questions the empirical value of artificially manipulated high/low attention conditions within traditional lab-based studies, given the evident variability of human attention in free viewing tasks.

Consequently, there is need for further observational research into the relative impact and value difference between high and low attention, as well as how changes in attention across an ad view impact consumer behaviour. Moreover, it is necessary to consider how elements of the ad viewing experience, including the influence of digital media platform/viewing mode (i.e., television vs. mobile; sound/no sound), may impact the relationship between attention and

behaviour. The findings from this research may also inform research design – if the present results corroborate those found in laboratory settings, researchers may be free to choose comparable designs based on research question, cost or practicality, with many recent examples of new, accessible research technologies (Chen & Konstan 2015; Papoutsaki 2015). Alternatively, if findings are found to differ across experimental setting, this could have significant consequences for both consumer attention theory as well as mainstream research practices in the marketing area. This may include the need to critically re-examine past results through methodological triangulation (e.g., by combining qualitative, qualitative, and observational research), as well as shifting greater focus towards the role of research methodology in influencing consumer responses.

3.4. MATERIALS AND METHODS – PHASE 1

3.4.1. Design and Participants

A cross-sectional, observational research design was used to explore attention and consumer behaviour across three digital media platforms, including free-to-air television, Facebook and YouTube.

A multinational sample was gathered from three European countries (Germany, Switzerland and Austria) using the online labour sourcing service Lucid. This sample consisted of 466 subjects, 380 of whom were from Germany, 38 from Austria, and 48 from Switzerland. Participants were remunerated 5 EUD for their time. All respondents were fluent in German. Furthermore, in order to participate in this study, respondents on mobile platforms were

required to own and use an Apple iPhone 6s (or subsequent iOS device), while television respondents were sent a package containing an iPhone 6s.

3.4.2. Stimuli

The stimuli selected for the viewing session were twelve branded advertisements, covering a range of product categories. These advertisements were for real brands from categories including fast food, chewing gum, rice, cat food, soft drink, men's fragrance, women's deodorant, shampoo, sneakers, car and washing machines, reflected across both the test brand and other category-consistent brands.

After completing the viewing session, subjects were asked to complete a 72-item survey questionnaire which consisted of questions exploring participants' choice (36 items) and recall (36 items) responses to the twelve categories of consumer brands.

3.4.3. Hardware and software

In order to understand the impact of viewing attention to advertising on consumer behaviour, participants' eye movements were recorded while viewing advertising on one of the three research platforms.

Depending on platform, subjects were either provided with a non-cellular Apple iPhone 6s device preloaded with a custom research application (Television group) or required to own at least an iPhone 6s and download the application from the App Store (Facebook & YouTube groups). Additionally, the television group was sent a device charger and tripod stand for mounting the device horizontally beneath the lower bezel of subjects' televisions.

3.4.4. Eye-Tracking and Data Preparation Procedure

A proprietary gaze prediction system was used to monitor participants' head, facial and eye features while viewing advertisements on a television screen. This system relies on a custom regression model to map (120D) vectors to a predicted location on the device screen. This relationship depends on the positioning and rotation of subjects' heads in relation to the camera and screen (Papoutsaki 2015). Prior research into such systems (Huang 2018; Papoutsaki 2015) has demonstrated relative congruence between such technologies and specialised eye-tracking interfaces, lending credibility to their use in the present research.

Synchronising gaze to a location on screen required a mapping of the position and rotation of participants' head in 3D space. To achieve this, specific participant facial features, including brow, nose and eye position, were recorded by a webcam at a rate of five frames per second and processed through a custom neural network, thereby deriving five gaze locations on screen per-second. Gaze locations were identified through unique display coordinates.

Once the five gaze locations were calculated, an aggregated per-second attention score was generated in reference to the location of the advertisement on-screen. The range of attention scores was between 0 (if 0% of the gaze location and bounds are outside of the screen) to 100 (if 100% of the gaze location and bounds are within the screen). High attention was defined as any gaze point on-screen (and where applicable, on-advertisement), while low attention was defined as any gaze point occurring near-screen. Instances of non-attention (i.e., where no visual attention of any kind could be detected) were excluded from the present analysis.

3.4.5. Procedure

The present research study was advertised on the online labour sourcing website Lucid. The purpose of the study was described as measuring audience reactions to advertising. Prior to participation, subjects were informed of the study's use of their personal media accounts, but in accordance with local and international privacy regulations (i.e., *Privacy [Market and Social Research] Code 2014*), no personal data (i.e., passwords, searches, activity) were collected or stored. Furthermore, subjects were informed that facial recording would take place but that such images would be processed by visual algorithms, meaning researchers had access only to simple numeric values denoting visual attention.

Upon participation in this study, subjects were directed to navigate with their own or study-provided iOS device to the Apple *App Store*, where they were instructed to download a proprietary attention-tracking application. Once logged into this application, subjects were required to enable permissions allowing the app to intercept and replicate the subjects' live ad feeds on television, Facebook and YouTube. Subjects were then presented with a normal log-in page pertaining to their research platform.

Once logged into the platform, subjects were free to browse through photo, video and text content (as each platform allows) at their leisure for a period of 30 minutes on Television and 10-20 minutes on the digital platforms (YouTube & Facebook). While browsing, participants' eye movements were recorded, assessing variables such as position and duration of attention on- and off-screen. After the respective viewing times were reached, the viewing session concluded, and subjects were automatically re-directed to a URL-based Qualtrics survey assessing the behavioural component of exposure. Here, subjects were asked to view and choose, out of several unexposed brands and one exposed test brand for each product category,

which one they would purchase if price and need were irrelevant. Additionally, subjects were also asked to recall which brand they saw during initial exposure.

Once the survey was completed, subjects were thanked for their participation and provided with a unique identifier to be used within Lucid for remuneration purposes.

3.5. RESULTS

Demographic characteristics of the sample are shown in Table 2. The respondents' age ranged from 18 to 74 years, with a mean of 38 years and standard deviation of 15 years.

To assess the influence of attention and other variables (i.e., age, gender, and brand use) on choice and recall (prompted/unprompted), the authors estimated a binary logistic regression model, using SPSS (version 24). Logistic regression is a multivariate regression which enables analysis of the impact of several independent variables on a dependent variable with respect to the values of a set of predictor variables.

Table 2: Demographic Characteristics Phase 1 & 2

Phase 1 ($n = 466$)						
Characteristic	TV		Facebook		YouTube	
	Frequency	%	Frequency	%	Frequency	%
Country						
Germany	137	81.5	109	81.3	134	81.7
Austria	16	9.5	12	8.9	10	6.1
Switzerland	15	8.9	13	9.7	20	12.2
Age (years)						
(18-35)	60	37.5	75	58.6	101	63.9
(35-44)	35	21.9	28	20.9	30	19.0
(45-54)	29	18.1	16	12.5	21	13.3
(55-64)	25	15.6	6	4.7	6	3.8
(65-74)	11	6.9	3	2.3		
Gender						
M	82	48.8	71	53.0	91	55.5
F	86	51.2	63	47.0	71	43.3
Phase 2 ($n = 523$)						
Country						
Germany	142	79.3	137	87.8	155	82.4
Austria	17	9.5	13	8.3	16	8.5
Switzerland	20	11.7	6	3.8	17	9.0
Age (years)						
(18-35)	56	33.9	60	54.1	113	62.8
(35-44)	44	26.7	34	30.6	40	22.2
(45-54)	32	19.4	15	13.5	19	10.6
(55-64)	29	17.6	2	1.8	7	3.9
(65-74)	4	2.4			1	.6
Gender						
M	86	50.3	58	49.6	97	51.6
F	85	49.7	59	50.4	91	48.4

In this study, we utilise a logistic regression method to predict brand choice and recall for advertised products. These dependent variables are analysed with respect to the five predictor variables presented in Table 3. The logistic regression analysis assigns the value “1” to “yes” answers provided to the independent variable “Would you buy this product?/Which product do you recall seeing?”, and “0” to the “no” answers. Hence, the results are interpreted with respect to these values.

In binary logistic regression analysis, several statistical assumptions must be met prior to analysis, including a) multicollinearity, b) non-consistent variance (non-homogeneity), c) linearity, and d) autocorrelation. To address the assumption of multicollinearity, Variance Inflation Factors (VIF) was used to measure and quantify variance in the predictor coefficients. Multicollinearity was not detected among any of the predictor variables across the three dependent variables, signalling suitability for use in analysis. As for linearity with logit values, a Box-Tidwell test with brand choice as the outcome variable revealed that the low attention predictor variable violated this assumption ($p < .05$). To achieve linearity in this variable, a natural log transformation was undertaken on low attention for the choice model, used within subsequent analyses. Additionally, all observations were independent from one another.

An advantage of logistic regression is its flexibility across variable type, capable of assessing both continuous and categorical variables of which are present in the data. In the present analysis, attention (high/low) reflects a continuous predictor, while age, gender and brand use reflect categorical predictors, together regressed onto choice and recall as binary outcome variables. Thus, a number of covariates were included in the regression model as fixed effects.

Additionally, moderation effects were assessed through testing the significance of the two-way interaction between an independent variable and its potential moderator.

Table 3: Parameter Estimations for Reduced Binary Logistic Regression Models on Brand Choice and Recall After A Single Exposure

	Choice		Prompted Recall		Unprompted Recall	
Reduced model summary	$X^2 = 793.125$ df = 6, $p = .000$		$X^2 = 126.563$ df = 6, $p = .000$		$X^2 = 106.440$, df = 10, $p = .000$	
Nagelkerke R^2	.284		.054		.051	
Overall accuracy	77.8%		79.5%		84.5%	
Reduced model effects	β	Exp(B)	β	Exp(B)	β	Exp(B)
constant	-2.412**	.090	-	.168	-2.145**	.117
high attention (base = 0)	.035**	1.035	1.786**	1.033	.046**	1.047
low attention (base = 0)			.032**	1.025	.032**	1.032
brand use			.025**	1.025		
brand use (once vs. never)	1.457**	4.294	.223*	1.250	.148	1.159
brand use (between 1-2 times vs. never)	1.768**	5.861	.803**	2.232	.704**	2.023
brand use (3+ times vs. never)	2.905**	18.266	.812**	2.253	.749**	2.114
gender (female (reference) = 0, male = 1)			-.280**	.756	-.256**	.774
high attention (base = 0) * gender (female (reference) = 0, male = 1)	-.031**	.970				
high attention (base = 0) * age						
high attention (base = 0) * age (35-44 vs. 18-34)					-.023	.977
high attention (base = 0) * age (45-54 vs. 18-34)					-.016	.984
high attention (base = 0) * age (55-64 vs. 18-34)					-.008	.992
high attention (base = 0) * age (65-74 vs. 18-34)					-.065*	.937

* Significant at $\alpha = .01$ ** Significant at $\alpha = 0.05$

The values of the regression coefficients and their statistical significance obtained by 'Enter logistical regression' method are included in Table 3. Table 3 also provides information as to the impact of the independent variables on brand choice and recall (see odds ratio [Exp B]). An odds ratio value above 1 indicates a positive association between the predictor and outcome variable, whereas values below 1 reveal a negative association.

Attention – main effect. A simple main effect of high attention on choice was revealed ($b = .035, p < .01$), indicating that the probability of a respondent choosing an advertised brand was higher among those who spent more time watching on-screen. The odds ratio for the predictor indicates that the odds of a respondent who chooses a brand change by a factor of 1.035 with each raw score increment in time (seconds) spent on-screen (i.e., high attention). However, low attention did not significantly influence the respondents' choice decision. Thus, hypothesis 1a is supported by the present results while hypothesis 5a is not supported.

As for prompted recall, the regression slope for high attention ($b = .032, p < .01$) and low attention ($b = .025, p < .01$) are positive and statistically significant indicating that the probability of a respondent recalling an advertised brand with prompting was higher for those who spent more time attending to advertising. The odds ratio for the predictor indicates that the odds of a respondent recalling the advertised brand change by a factor of 1.033 with each raw score increment on high attention, and 1.025 on low attention.

Similarly for unprompted recall, the regression slope for high attention ($b = .046, p < .001$) and low attention ($b = .032, p < .01$) are positive and statistically significant indicating that the probability of a respondent successfully recalling an advertised brand without prompting was higher for those who spent more time attending to advertising. The odds ratio for the predictor indicates that the odds of a respondent recalling the advertised brand change

by a factor of 1.047 with each raw score increment on high attention, and 1.033 on low attention.

In summary, both high and low attention are positively related to correct prompted and unprompted recall for advertised brands, while high attention is also positively associated with brand choice. Hence, hypotheses 1a, 1b, 5b and 5c are supported, while 5a is not supported.

Brand use – main effect. Regarding brand use, a planned contrast was used to compare three levels of brand use (light [once], moderate [1-2 times], heavy [3+ times]) against non-users (never) on brand choice and recall. Simple main effects on brand choice were observed for all three levels of brand use, while a main effect on recall was found only for moderate and heavy users.

For brand choice, the regression slope for light users ($b = 1.457, p < .01$), moderate users ($b = 1.768, p < .01$), and heavy users ($b = 2.905, p < .01$) are positive and statistically significant indicating that the probability of a respondent choosing an advertised brand was higher among users of a brand. The odds ratio for the predictor indicates that the odds of a respondent choosing an advertised brand change by a factor of 4.294 with each raw score increment on light use, 5.861 with each raw score increment on moderate use, and 18.266 with each raw score increment on heavy use.

For prompted recall, the regression slope for light users ($b = .223, p < .05$), moderate users ($b = .803, p < .01$) and heavy users ($b = .812, p < .01$) are positive and statistically significant indicating that the probability of a respondent recalling an advertised brand with prompt was higher among moderate and heavy brand users. The odds ratio for the predictor indicates that the odds of a respondent recalling an advertised brand with prompt change by a factor of 1.250 with each raw score increment on light use, 2.232 with each raw score increment on moderate use, and 2.253 with each raw score increment on heavy use.

Similarly for unprompted recall, the regression slope for moderate users ($b = .704, p < .01$) and heavy users ($b = .749, p < .01$) are positive and statistically significant indicating that the probability of a respondent recalling an advertised brand was higher among moderate and heavy brand users. The odds ratio for the predictor indicates that the odds of a respondent recalling an advertised brand change by a factor of 2.023 with each raw score increment on moderate use, and 2.114 with each raw score increment on heavy use. Furthermore, light brand use did not significantly influence the respondents' unprompted recall for advertised brands.

In summary, while significant main effects of brand use on choice and recall were detected, no interactions between attention and brand use were identified. Thus, support was not found for hypotheses 2a, 2b, 2c, 6a, 6b or 6c.

Gender – main effect and interactions. A simple main effect of gender on prompted recall was revealed. The regression slope for gender was negative ($b = -.280, p < .01$) and statistically significant indicating that, relative to women, men were less likely to recall an advertised brand upon prompt. The odds ratio for the predictor indicates that the odds of a male successfully recalling the advertised brand was .756 times less likely than for a woman. Conversely, inverted odds ratios for gender indicate that the odds of successful prompted recall were 1.322 times greater for women than for men.

Furthermore, an interaction effect was identified between gender and high attention on brand choice. The regression slope was negative ($b = -.031, p < .01$) and statistically significant indicating that, relative to women, men who spent more time on-screen were less likely to choose an advertised brand. The odds ratio for the predictor indicates that the odds of a male choosing the advertised brand was .970 times less likely than compared to a woman. Conversely, inverted odds ratios for gender show that the likelihood of choice was 1.031 times greater for women than for men. Thus, H3a, H3b and H3c are not supported.

Furthermore, no interaction effects were identified for low attention. Hence, support was not found for hypotheses 7a, 7b or 7c.

Age – interaction effect. Analysis of age by high attention revealed a significant negative interaction effect on unprompted recall ($b = -.065$, $p < .05$), but this was true only for specific ages.

Relative to participants aged between 18-34, 64-75 year old participants that spent more time on-screen were less likely to correctly recall the advertised brand unprompted. The odds ratio for the predictor indicates that the odds of 64-75 year old participant correctly identifying the advertised brand without prompting was 0.937 times less likely than an 18-34 year old. Conversely, inverted odds ratio for age indicates that participants aged 18-34 were 1.059 times more likely to correctly recall the advertised brand without prompting. Thus, hypothesis 4c is supported, while hypothesis 4a, 4b, 8a, 8b and 8c are not supported (see Table 4 for a Summary of Phase 1 Hypotheses).

Table 4: Summary of Phase 1 Hypotheses

Hypothesis	High attention	Low attention
Attention and Consumer Responses to Advertising Attention is associated with consumer response to advertising a. Attention is positively associated with choice. b. High (Low) attention is positively (negatively) associated with prompted recall. c. High (Low) attention is positively (negatively) associated with unprompted recall.	Yes (H1a) Yes (H1b) Yes (H1c)	No (H5a) Yes (H5b) Yes (H5c)
Brand Use Effect on Attention & Consumer Responses to Advertising Brand use moderates the effect of attention on consumer response to advertising a. Brand use moderates the association between attention and brand choice b. Brand use moderates the association between attention and prompted recall. c. Brand use moderates the association between attention and unprompted recall.	No (H2a) No (H2b) No (H2c)	No (H6a) No (H6b) No (H6c)
Gender Effect on Attention & Consumer Responses to Advertising Gender has an effect on attention to advertising and resulting consumer responses to advertising a. Males will show relatively greater brand choice for advertised products than will females b. Females will show relatively greater prompted recall for advertised products than will males. c. Females will show relatively greater unprompted recall for advertised products than will males.	No, interaction significant (H3a) No (H3b) No (H3c)	No (H7a) No (H7b) No (H7c)
Age Effect on Attention & Consumer Responses to Advertising Age has a decreasing effect on consumer responses to advertising a. Younger participants will show relatively greater brand choice for advertised products than will older participants. b. Younger participants will show relatively greater prompted recall for advertised products than will older participants. c. Younger participants will show relatively greater unprompted recall for advertised products than will older participants.	No (H4a) No (H4b) Yes (H4c)	No (H8a) No (H8b) No (H8c)

3.6. DISCUSSION

The results of Phase 1 suggest that attention, both high and low, serves to enhance consumer responses to advertising. Specifically, it was revealed that high attention to brand advertisements increased the likelihood of said brands being selected by viewers in a subsequent choice task. However, low attention, defined as attention near-screen, was not associated with brand choice.

However, the results also indicate that both high and low attention processing of advertisements enhance consumer's recall of advertised brands. In particular, high attention was associated with an increased likelihood of recall relative to low attention. Furthermore, this increase was more prominent for unprompted recall than for prompted recall.

Examining potential moderation effects of attention on choice and recall revealed several significant interactions, notably concerning gender and age. Regarding the moderation of attention and choice by gender, it was revealed that women devoting high attention to advertisements were less likely to choose an advertised brand than men devoting high attention. As for the moderation of low attention and recall by age, the results showed that relative to younger viewers, older viewers watching advertisements at low attention were less likely to recall an advertised brand without prompting.

It should be noted however, that while attention was positively and significantly related to an increase in choice (high attention) and recall (high and low attention), these effects were relatively smaller in comparison to variables such as brand use. For instance, heavy brand users were almost twenty times more likely to buy an advertised brand than non-users, while the likelihood of successful brand recall was more than doubled for heavy users compared to light users.

Furthermore, the results identified a gendered effect on prompted recall; females were more likely to recall the advertised brand than males. A similar effect was identified through the interaction of gender and high attention on choice, as discussed. Hence, gender appears to exert a robust influence over consumer responses to digital advertising, particularly at high attention.

3.7. RESEARCH PHASE 2 – REPEATED EXPOSURES

Research Phase 1 demonstrated that, following a single exposure to advertising, viewing attention positively affects brand choice and recall. Specifically, it was revealed that while both high and low attention are associated with both prompted and unprompted recall, only high attention predicted brand choice. Yet, it is not clear how repetition of exposure may affect these relationships. Thus, Phase 2 was designed to assess the impact of repetition on viewing attention, and resultant consumer behaviour.

While a substantial number of studies have examined the effects of repetition on visual attention in the context of reaction time tasks (Barel & Tzischinsky 2020; Ninio & Kahneman 1974; Reigal et al. 2019), speeded recognition tasks (Knott & Dewhurst 2007), and stimulus priming (Asgeirsson, Kristjansson & Bundesen 2013; Kristjansson & Campana 2010), there is comparatively little focus devoted to the influence of multiple advertisement viewings on attentive behaviour.

According to several early studies of effective frequency (Anand & Sternthal 1990; Pechmann & Stewart 1988), the relationship between increasing exposures to advertising and performance resembles an inverted-‘U’, signalling strong initial impact but falling returns with subsequent exposures. Conversely, others have proposed that the effect of repetition follows an ‘S’ shaped curve, where only the first, second and third exposures render unique consumer responses (Krugman 1972), termed the ‘three hit theory’.

Findings from Janiszewski et al. (2013) and Florack et al. (2020) have questioned both inverted-U as well as S-shaped relationships between repetition and response, demonstrating that additional repeated exposures to a product at high attention continues to increase its likelihood of selection across subsequent presentations. Likewise, in Nordhielm (2002), research participants who processed ad features deeply expressed more favourable attitudes to the advertisement as the number of repetitions increased. Similarly, priming effects (i.e., response times to previously attended-to stimuli) have also been demonstrated to be stronger the more an object is focally exposed to viewers (Janiszewski et al. 2013). Consequently, it is expected that at high attention, repetition of exposure will increase brand choice and memory over single exposure.

At low attention, Huang and Huh (2018) report that repeated exposures to online advertising produces greater brand memory and preference judgements than do single exposures. According to the author, repetition of incidental exposure rendered subject's preference for advertised products stronger, as well as decreasing consumer's time taken to reach a decision, relative to single exposure. In addition, repetition also fostered stronger brand recall for exposed advertisements (Huang, 2018). In another study by Chatterjee (2008), the effects of repeated low attention exposures on prompted recall were shown to increase with each presentation, up until 15 times. Furthermore, other research has supported the notion that repeated exposures are more effective than single exposures (Xiang, Singh & Ahluwalia 2007; Lee & Briley 2005; Yaveroglu & Donthu 2008; Yoo 2008).

In line with the above literature, it is expected that repeated exposures at low attention will result in more positive evaluations of the advertised brands, leading to increased brand choice and recall (see Table 5 for a Summary of Phase 2 Hypotheses).

Table 5: Summary of Phase 2 Hypotheses

Hypothesis	High attention	Low attention
Attention and Consumer Responses to Advertising Attention is associated with consumer response to advertising a. Attention is positively associated with choice. b. High (Low) attention is positively (negatively) associated with prompted recall. c. High (Low) attention is positively (negatively) associated with unprompted recall.	H9a H9b H9c	H13a H13b H13c
Brand Use Effect on Attention & Consumer Responses to Advertising Brand use moderates the effect of attention on consumer response to advertising a. Brand use moderates the association between attention and brand choice b. Brand use moderates the association between attention and prompted recall. c. Brand use moderates the association between attention and unprompted recall.	H10a H10b H10c	H14a H14b H14c
Gender Effect on Attention & Consumer Responses to Advertising Gender has an effect on attention to advertising and resulting consumer responses to advertising a. Males will show relatively greater brand choice for advertised products than will females. b. Females will show relatively greater prompted recall for advertised products than will males. c. Females will show relatively greater unprompted recall for advertised products than will males.	H11a H11b H11c	H15a H15b H16b
Age Effect on Attention & Consumer Responses to Advertising Age has a decreasing effect on consumer responses to advertising a. Younger participants will show relatively greater brand choice for advertised products than will older participants. b. Younger participants will show relatively greater prompted recall for advertised products than will older participants. c. Younger participants will show relatively greater unprompted recall for advertised products than will older participants.	H12a H12b H12c	H16a H16b H16c

3.8. MATERIALS AND METHODS

3.8.1. Design and Participants

The design of Phase 2 was identical to that of Phase 1, reflecting a cross-sectional, observational approach to measuring consumer responses to advertising across three digital media platforms.

Respondents from three European countries (Germany, Switzerland & Austria) were sampled from the online labour sourcing service Lucid, in exchange for 5 EUD. This sample consisted of 523 subjects, 434 of whom were sampled from Germany, 46 from Austria, and 43 from Switzerland).

3.8.2. Stimuli

The stimuli selected for the viewing session were six branded advertisements, covering a range of product categories. These advertisements were for real brands from categories including fast food, chewing gum, rice, cat food, soft drink, men's fragrance, women's deodorant, shampoo, sneakers, car and washing machines, reflected across both the test brand and other category-consistent brands.

3.8.3. Procedure

The procedure used was the same as in Phase 1. The only difference was a manipulation of the frequency of test ads used during the free viewing task. To maintain parity in viewing duration between the two phases, participants were exposed to six unique test ads twice throughout their viewing session.

3.9. RESULTS

Demographic characteristics of the sample for Phase 2 are shown in Table 7. The respondents' age ranged from 18 to 74 years, with a mean of 36 years and standard deviation of 12 years.

Table 6: Parameter Estimations for Reduced Binary Logistic Regression Models on Brand Choice and Recall After Two Exposures

	Choice		Prompted Recall		Unprompted Recall	
Reduced model summary	$X^2 = 526.274$ df = 7, $p = .000$		$X^2 = 298.672$, df = 6, $p = .000$		$X^2 = 243.287$, df = 6, $p = .000$	
Nagelkerke R^2	.312		.181		.152	
Overall accuracy	76.3%		66.4%		65.2%	
Reduced model effects	β	Exp(B)	β	Exp(B)	β	Exp(B)
constant	-2.957**	.052	-.959**	.383	-1.290**	.275
high attention (base = 0)			.075**	1.078	.071**	1.073
low attention (base = 0)	.357**	1.429	.054**	1.055	.045**	1.046
gender (female [reference] = 0, male = 1)			-.434**	.648	-.247*	.781
brand use						
brand use (once vs. never)	1.687**	5.404	.404**	1.497	.267*	1.306
brand use (between 1-2 times vs. never)	2.714**	15.088	1.472**	4.356	1.335**	3.798
brand use (3+ times vs. never)	3.397**	29.887	1.305**	3.689	1.098**	2.999
low attention (base = 0) * brand use						
low attention (base = 0) * brand use (once vs. never)	-.287	.750				
low attention (base = 0) * brand use (between 1-2 times vs. never)	-.383*	.682	-		-	
low attention (base = 0) * brand use (3+ times vs. never)	-.279	.756	-		-	

* Significant at $\alpha = .01$ ** Significant at $\alpha = 0.05$

Attention – main effect. A simple main effect of low attention on choice ($b = .357$, $p < .01$) was revealed, indicating that at two exposures, the probability of a respondent choosing an advertised brand was greater for those who spent more time watching near-screen. The odds ratio for the predictor indicates that the odds of a respondent choosing the advertised brand

change by a factor of 1.429 with each 2.718 score increment¹ in time (seconds) spent near-screen (i.e., low attention). By contrast, high attention did not significantly influence respondents' brand choice following two exposures. Hence, following two exposures, H13a is supported by the present results while H9a is not supported.

For prompted recall, a simple main effect of both high attention ($b = .075, p < .01$) and low attention ($b = .054, p < .01$) was found. For both predictors, the regression slope was positive and statistically significant, indicating that, following two exposures, the probability of a respondent recalling the advertised brand with prompting was greater among those who spent more time on- or near to the screen. For high attention, the odds ratio indicates that the probability of a successful prompted brand recall change by a factor of 1.078 with each raw score increment in time (seconds) spent on-screen. For low attention, the odds ratio indicates that the probability of a successful prompted brand recall change by a factor of 1.055 with each raw score increment in time (seconds) spent near-screen. Thus at two exposures, H9b is supported while H13b is not supported.

Similarly for unprompted recall, a simple main effect was revealed for both high attention ($b = .071, p < .01$) and low attention ($b = .045, p < .01$). For both predictors, the regression slope was positive and statistically significant, indicating that, following two exposures, the probability of a respondent recalling the advertised brand without prompting was greater among those who spent more time on- or near to the screen. For high attention, the odds ratio indicates that the probability of a successful unprompted brand recall change by a factor of 1.073 with each raw score increment in time (seconds) spent on-screen. For low attention, the odds ratio indicates that the probability of a successful unprompted brand recall change by a

¹ This is due to a logarithmic conversion on the low attention variable for the choice model. The natural log is 2.718, meaning each 2.718 fold increase has the effect of the OR.

factor of 1.046 with each raw score increment in time (seconds) spent near-screen. Consequently, H9c is supported while H13c is not supported.

Brand use – main effect and interaction. For brand use, a planned contrast was used to compare three levels of brand use (light [once], moderate [1-2 times], heavy [3+ times]) against non-users (never) on brand choice and recall following two exposures. Simple main effects on brand choice and brand recall were observed for all three levels of brand use, while an interaction effect was revealed between low attention and brand choice, but only for moderate brand users.

For brand choice, the regression slope for light users ($b = 1.687, p < .01$), moderate users ($b = 2.714, p < .01$), and heavy users ($b = 3.397, p < .01$) are positive and statistically significant indicating that the probability of a respondent choosing an advertised brand was higher among users of a brand who saw two brand exposures. The odds ratio for the predictor indicates that the odds of a respondent choosing an advertised brand change by a factor of 5.404 with each raw score increment on light use, 15.088 with each raw score increment on moderate use, and 26.887 with each raw score increment on heavy use.

For prompted recall, the regression slope for light users ($b = .404, p < .01$), moderate users ($b = 1.472, p < .01$) and heavy users ($b = 1.305, p < .01$) are positive and statistically significant indicating that the probability of a respondent recalling an advertised brand with prompt was higher among moderate and heavy brand users who saw two brand exposures. The odds ratio for the predictor indicates that the odds of a respondent recalling an advertised brand with prompt change by a factor of 1.497 with each raw score increment on light use, 4.356 with

each raw score increment on moderate use, and 3.689 with each raw score increment on heavy use.

For unprompted recall, the regression slope for light users ($b = .267, p < .05$), moderate users ($b = 1.335, p < .01$) and heavy users ($b = 1.098, p < .01$) was positive and statistically significant indicating that the probability of a respondent recalling an advertised brand with prompt was higher among moderate and heavy brand users who saw two brand exposures. The odds ratio for the predictor indicates that the odds of a respondent recalling an advertised brand with prompt change by a factor of 1.306 with each raw score increment on light use, 3.798 with each raw score increment on moderate use, and 2.999 with each raw score increment on heavy use.

Furthermore, an interaction effect was identified between low attention and brand use on brand choice for moderate users. The regression slope was negative ($b = -.383, p < .05$) and statistically significant indicating that, relative to non-users, moderate users who spent more time (seconds) near-screen were less likely to choose an advertised brand. The odds ratio for the predictor indicates that the odds of a moderate user choosing the advertised brand was .683 times less likely compared to a non-user. Conversely, inverted odds ratios reveals that the likelihood of brand choice was 1.317 times greater for non-users than for moderate users. Thus, H14a is supported, while H10a is not supported along with H10b, H10c, H14b and H14c also not being supported by the present results.

Gender – main effect. A simple main effect of gender on prompted recall was found following two exposures. The regression slope for gender was negative ($b = -.434, p < .01$) and statistically significant indicating that, relative to women, men were less likely to recall an

advertised brand upon prompt. The odds ratio for the predictor indicates that the odds of a male successfully recalling the advertised brand was .648 times less likely compared to a female. Inverted odds ratio for gender indicates that the odds of successful prompted brand recall at two exposures were 1.543 times greater for women than for men.

Similarly, a simple main effect of gender on unprompted recall was revealed at two exposures. The regression slope was negative ($b = -.247, p < .05$) and statistically significant indicating that, relative to women, men were less likely to recall an advertised brand without prompting. The odds ratio for the predictor indicates that the odds of a male successfully recalling the advertised brand was .781 times less like compared to a female. Inverted odds ratio for gender reveals that the odds of a successful unprompted brand recall at two exposures was 1.280 times greater for women than for men.

3.10. DISCUSSION

The results of Phase 2, which examined the impact of repetition on consumer responses, demonstrate that consecutive attentive exposures to advertising generally enhances viewer preference (choice) and memory (recall) relative to single exposure, with some notable exceptions.

Regarding the impact of attention on brand choice at two exposures, low attention was positively and significantly related to selection of the advertised brand, while high attention was not related to brand choice. This is in contrast with the results of Phase 1, which showed that high attention was significantly associated with increased probability of choice at a single

exposure, while low attention was not. Of further relevance is the relative increase in the probability of brand choice occurring between high attention at a single exposure and low attention at two exposures. Despite having less focus on the advertisements, low attention viewers who saw two exposures were more likely to select a given brand than were high attention viewers at a single exposure. These findings suggest that the two forms of attention exhibit dissociative effects on brand preferences as the number of exposures increases, with high levels of attention being most impactful at first view, with its effects diminishing with repetition. In contrast, low levels of attention may be more appropriate for affecting preference across multiple advertising presentations; this is significant in today's digital low attention environment.

Furthermore, when considering potential interaction effects between attention and outcome choice at two exposures, the results of Phase 2 reveal a notable moderation effect of brand use at low attention. Specifically, it was shown that at low attention, moderate brand users were less likely to choose said brands than non-users. This is despite the fact that, at two exposures, both brand use and low attention are positively related to brand choice. Thus, the effectiveness of low attention processing may be relatively enhanced among non-users than users.

In addition, brand use exerted a strong positive effect on both outcome variables, though this was particularly evident for brand choice. Light brand use was associated with a 5-fold increase in brand choice, while heavy brand use was associated with a near 30-fold increase. In contrast, light brand use was associated with a 1.5x increase in prompted recall and 1.3x increase in unprompted recall, while heavy brand use increased the probability of recall by factors of 3.6x and 3x respectively.

As for the relationship between attention and recall at two exposures, a robust enhancement in both prompted and unprompted recall was detected for both high and low attention relative to one exposure; it was most pronounced for prompted recall. Furthermore, in comparing the magnitude of effect on recall between the two forms of attention, it was revealed that high attention viewers exhibited greater likelihood (in terms of odds ratio) of brand recall than low attention viewers, a finding consistent across both recall types. Hence, in addition to the findings from Phase 1, which showed that both high and low attention facilitate the encoding and retrieval of brand-related information, the results of Phase 2 demonstrate that these effects are made more pronounced following two exposures to advertising.

Finally, analysis of gender on recall revealed positive effects among females and negative effects among males. Although this effect was present for both forms of recall, it was marginally more pronounced for prompted recall than unprompted recall. These findings support and expand on previous reports of higher rates of recall among female consumers than male (Zhou, Schafer & Desimone 2016).

3.11. GENERAL DISCUSSION

This research examined the effects of viewing attention and demographic factors and attention-by-demographic interactions on brand choice and recall responses in consumers. Several notable differences of the present study relative to previous work examining consumer attention and brand responses were the use of a large, cross-country research sample, examined in naturalistic conditions with non-invasive measurement of attention, and the comparative examination of a proposed ‘high/low’ model of attention processing (Heath 2001a, 2001b),

along with its effects on choice and recall across single and repeated exposures. A key finding of this work is that attention measurement undertaken within a naturalistic environment is largely consistent with that of laboratory-based research, with the exception of certain relationship as previously described. This is noteworthy, given that the use of a naturalistic measurement approach enables researchers to examine and compare the relationship consumer attention and behaviour, as well as the role of demographic factors such as age, gender and brand use on such relationships, across significantly expanded research populations and at significantly reduced cost relative to laboratory studies. Thus, the present analyses of the effects of attention and other demographic variables on consumer responses in real-world environments are novel and informative.

There was a significant positive effect of attention on consumer's responses, evident at both single and repeated exposures. At one exposure, high attention demonstrated a strong positive association with all brand choice, prompted recall and unprompted recall. This finding supports and expands upon a contention from Florack et al. (2020) of enhanced preference formation in the high attention manipulation relative to the distracted manipulation. Florack et al. (2020) interpreted their findings to be in line with the evidence from previous studies for a biasing effect of high attention on advertisement features, engendering heightened familiarity and preference formation (Janiszewski et al. 2013). Although feature-specific fixation data were not examined in the present study, the observation of a significant positive relationship between high attention and brand choice is in line with this evidence. Similar to the findings reported by Simmonds et al. (2020), the present findings also complement evidence from eye-tracking studies exhibiting a close association between high attention and recall (Goodrich 2011; Sorum 2018).

In contrast, low attention did not exhibit any relationship with brand choice at one exposure, though it was positively associated with brand recall. That low attention was not related to brand choice is largely inconsistent with previous work into incidental- (Humphrey, Laverie & Rinaldo 2017; Machouche, Gharbi & Elfidha 2017; Shapiro et al. 1997) and divided-attention (Santoso et al. 2020) research into advertising appraisal. Thus, it was surprising to see that the present study did not provide similar evidence for a robust effect of low attention on choice, using a large naturalistic sample tested across several major entertainment platforms (i.e., TV, Facebook and YouTube). One explanation for this is simply that, within natural environments with myriad distractions, a single exposure may not have been sufficient to affect brand preference. Through the mere-exposure effect (Shapiro et al. 1997; Yagi & Inoue 2018), it has been shown that repeated presentations to an object can positively affect preference. From this, it is proposed that we may see an additive effect of repeated exposures on brand choice outcomes at low attention.

However, we did observe a positive effect of low attention on both prompted and unprompted recall at one exposure, a result inconsistent with literature propositions that low attention exposure may not be sufficient to stimulate the formation of explicit memory (Heath 2007). For instance, in Simmonds et al. (2020), prompted brand recall increased with visual attention, with low levels of attention failing to produce brand recall. Similarly, in Lee (2002), low attention was associated with poor recall for advertised brand names. In contrast, the present findings reveal that robust brand recall may emerge even with a single, low attention exposure to advertising. This extends the incidental exposure literature by demonstrating that not only can low attention exposure enable the encoding and retrieval of unconscious brand memory (Heath 2001b), but also that repetition of exposure is not necessarily required to achieve this

effect (Heath & Nairn 2005); a significant expansion to our understanding of consumer attention theory.

A further effect of note pertaining to single exposure was a high attention-by-gender interaction effect on brand choice. Counter to expectations, it was revealed that female viewers at high attention were more likely to choose an advertised brand than males at high attention. This finding aligns with (Goodrich 2014), who found that females exhibited more favourable attitudes at high attention than did males. In complement of these findings, the present study demonstrates that such effects may extend beyond attitudes to preference formation.

Additionally, a high attention-by-age interaction effect on unprompted recall was revealed at one exposure. Specifically, it was found that younger viewers (18-34 years of age) at high attention were more likely to recall an advertised brand without prompting than older viewers (65-74) at high attention. This finding is consistent with and expands upon evidence from earlier studies of age-related impairment in recall memory (Craik & McDowd 1987). Thus, it was not surprising to see that the present study provided evidence for a robust high attention-by-age interaction effects on unprompted recall, particularly between the youngest and oldest age groups (See Table 7 for a Summary of hypotheses across the two phases of this study).

Table 7: Summary of Hypotheses Across Phases

Hypothesis	Phase 1		Phase 2	
	Support		Support	
	High attention	Low attention	High attention	Low attention
Attention and Consumer Responses to Advertising Attention is associated with consumer response to advertising a. Attention is positively associated with choice. b. High (Low) attention is positively (negatively) associated with prompted recall. c. High (Low) attention is positively (negatively) associated with unprompted recall.	Yes (H1a) Yes (H1b) Yes (H1c)	No (H5a) Yes (H5b) Yes (H5c)	No (H9a) Yes (H9b) Yes (H9c)	Yes (H13a) No, reverse (H13b) No, reverse (H13c)
Brand Use Effect on Attention & Consumer Responses to Advertising Brand use moderates the effect of attention on consumer response to advertising a. Brand use moderates the association between attention and brand choice b. Brand use moderates the association between attention and prompted recall. c. Brand use moderates the association between attention and unprompted recall.	No (H2a) No (H2b) No (H2c)	No (H6a) No (H6b) No (H6c)	No (H10a) No (H10b) No (H10c)	Yes (H14a) No (H14b) No (H14c)
Gender Effect on Attention & Consumer Responses to Advertising Gender has an effect on attention to advertising and resulting consumer responses to advertising a. Males will show relatively greater brand choice for advertised products than will females. b. Females will show relatively greater prompted recall for advertised products than will males. c. Females will show relatively greater unprompted recall for advertised products than will males.	No, interaction significant (H3a) No (H3b) No (H3c)	No (H7a) No (H7b) No (H7c)	No (H11a) No (H11b) No (H11c)	No (H15a) No (H15b) No (H15c)
Age Effect on Attention & Consumer Responses to Advertising Age has a decreasing effect on consumer responses to advertising a. Younger participants will show relatively greater brand choice for advertised products than will older participants. b. Younger participants will show relatively greater prompted recall for advertised products than will older participants. c. Younger participants will show relatively greater unprompted recall for advertised products than will older participants.	No (H4a) No (H4b) Yes (H4c)	No (H8a) No (H8b) No (H8c)	No (H12a) No (H12b) No (H12c)	No (H16a) No (H16b) No (H16c)

Examining the impact of two exposures on attention and brand choice revealed a positive effect for low attention but no significant effect for high attention. In contrast to Phase 1, where high attention was positively associated with choice at one exposure, the results of Phase 2 suggest

that repetition exerts a negative effect on preference-formation at high attention. This finding supports and expands upon a contention from Nordhielm (2002) of an inverted-U shaped relationship between repetition and response; reinforcing that such a relationship may be appropriate when consumers engage in deeper processing. Thus, the present study contributes to such understandings by augmenting a ‘processing depth’ explanation with measured consumer attention, thereby proposing that an inverted-U relationship is accurate when modelling the impact of repeated exposures at high attention.

Whereas low attention was not associated with brand choice at a single exposure, repeated exposures revealed a significant effect on brand choice. This finding is consistent with propositions of the mere exposure effect (Zajonc 1968), whereby brief, repeated stimulus presentations enhance our affective response to it, manifesting as increased preference for advertised brands (Bornstein & D’Agostino 1994). Furthermore, inspection of odds ratios revealed that, relative to high attention at a single exposure, low attention at two exposures was associated with a greater likelihood of brand choice. These observations, coupled with previous findings that the effects of low attention may be more robust with added repetitions (Pieters, Rosbergern & Hartog 1996), suggests that the influence of repetition under low attention processing conditions is quite effective from a consumer behaviour perspective.

When considering the role of repetition on brand recall, positive effects were evident for both high and low attention, increasing relative to single exposure. Echoing trends evident in Phase 1, the results from Phase 2 suggest that both forms of attention positively contribute to consumer memory, here measuring explicit brand recall. Additionally, comparison of odds ratios between the two phases revealed an enhancing effect of repeated exposures on brand recall across both forms of attention. This increase was to such a degree that that the highest

odds ratio value at one exposure (high attention/unprompted recall) was approximately equal to that of the lowest odds ratio value at two exposures (low attention/unprompted recall). Reflected against the results of Phase 1, the findings from Phase 2 expand upon Lee's (2002) proposition that repetition moderates the association between attention and brand recall.

Finally, at two exposures, a low attention-by-brand use interaction effect on brand choice was observed. Specifically, it was revealed that moderate brand users who paid low attention to advertisements were less likely to choose an advertised brand than non-users at low attention. Notably, this finding occurred despite the fact that both brand use (all levels) and low attention were independently related to increases in brand choice. Although brand use has previously been found to moderate the relationship between attention and consumer responses, such as in the case of light brand use and recall (Simmonds et al. 2020), the present results expand upon such findings by demonstrating a similar moderation effect of moderate brand use-by-low attention on choice, measured across repeated exposures. In support of the brand use literature, the current findings suggest that, following two exposures, brands may suffer from low attention appraisal if audiences are already users of that brand, presumably because such viewers need little encouragement to continue purchasing, while low attention reflects a lower grade of processing, thereby potentially increasing the likelihood of brand misattribution in subsequent choice.

One notable limitation of the present study is the lack of an implicit memory task. Implicit memory, referring to a form of long-term memory which is not consciously accessible but revealed by performances on tasks or activities is associated with low attention in a number of previous studies (Heath 2001a; Yoo 2007). Across much of this work, low attention is shown to relate positively to implicit memory and negatively to explicit memory (i.e., recall) (Heath

2001a). In contrast, the present findings reveal that low attention is related to enhanced explicit brand recall, and notably, that such effect is not dissimilar in magnitude to high attention, itself understood to relate positively to brand recall in prior studies. Despite this, we acknowledge the lack of an implicit memory task as a limitation of the present study and believe it will be important for future studies to closely examine and address the potential similarities or differences in consumer memory responses between high and low attention.

3.12. CONCLUSION

For advertisers and media owners, value is derived from the actual consumers' behaviour in response to that investment in advertising. Due to a lack of accurate and standardised measures of attention and its value, advertisers have been forced to rely on rudimentary 'attention metrics' as the basis for their commercial pricing decisions. The development of new accessible, scalable, and non-invasive attention capture technologies provides new opportunity to value the relative impact of consumer attention on advertising outcomes across a range of digital contexts.

Research has shown that devoting attention to advertising can predict a range of positive behavioural outcomes, from encoding advertising materials in memory through to affecting consumer's preferences. Despite this research background, however, there is uncertainty as to the relative value of different exposure conditions, due to a limited empirical focus on 'low' or 'incidental' attention as a mode of exposure. This present eye-tracking study supports and expands upon a strong association between attention and consumer responses to advertising reported in prior studies, an effect that was observed in naturalistic conditions across both

single and repeated exposures. For high attention, positive associations with all consumer responses were revealed at one exposure, while only recall effects were observed following two exposures. For low attention, positive associations with recall were observed at one exposure, while relationships with all consumer responses were revealed at two exposures. The present findings bolster the existing literature on attention and related consumer factors by offering novel insight into the effects of high and low attention, age, gender and brand use on brand choice and recall, as well as providing a thorough examination of previously discussed moderation effects in a large sample across several mainline digital platforms. Recognising the potential of such findings in addressing industry issues of the relative value of focused viewers against distracted viewers, this work signals the value of attention as a metric of exposure quality, yet it can also be used at scale.

3.13. DATA COLLECTION INFORMATION

The third author supervised the collection of data for this study, conducted by the research measurement entity Amplified Intelligence in 2019. The first and third authors jointly managed the collection of data using the Qualtrics panel described in the methods section in 2019. Due to a commercial agreement between Amplified Intelligence and the University of Adelaide, the data are stored confidentially under management of the first author and Amplified Intelligence.

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**CHAPTER 4. IS AFFECTIVE ADVERTISING EFFECTIVE
ACROSS HIGH AND LOW ATTENTION?**

Kellen Ewens, Steven Goodman and Karen Nelson-Field

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Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- the candidate's stated contribution to the publication is accurate (as detailed above);
- permission is granted for the candidate to include the publication in the thesis; and
- the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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ABSTRACT

This study examines the impact of arousal and valence on consumer responses, possible interactions between arousal, valence and the two forms of attention, as well as any further relationships between emotion and viewer demographics. In addition to the main effects of arousal and valence on brand choice and recall, a specific interaction between valence and low attention on choice and unprompted recall are observed. This paper contributes empirically to attention theory, specifically Heath's (2001) 'low attention processing' model, as well as to present a number of findings related to the impact of different emotions on consumer responses.

4.1. IS AFFECTIVE ADVERTISING EFFECTIVE ACROSS HIGH AND LOW ATTENTION?

In the pursuit of viewer attention, the portrayal of affective stimuli in advertising has become increasingly commonplace within the last half-century. Echoing recent calls from Poels and Dewitte (2018), there is a pressing need to better evaluate emotional advertising, as emotions can be an effective tool for attracting viewer attention and effecting consumer responses (Bettiga et al. 2020; Friestad & Thorson 1986). Hence, understanding emotion better could equip researchers and practitioners to implement emotion-specific strategies within advertising.

Research has shown that emotional information can increase the speed with which affective stimuli are processed as well as the degree to which they are retained in memory, factors critical to performance within high clutter media environments. Sharma et al. (2019) have shown that attention is drawn faster to emotional faces than to neutral faces; Mirandola and Toffalini (2016) have shown that participants were more accurate and committed fewer memory errors when responding to emotional vs. non-emotional images; and Baird, Wahlers and Cooper (2007) have shown that emotional stimuli increased memory retention. These findings reflect privileged access to human attention by emotionally-significant materials, particularly when cognitive resources are scarce or limited (Vuilleumier & Huang 2009).

Across the studies, a common theme in their explanation of the impact of emotion on consumer responses is attention, specifically visual attention. However, much of this research has focused on situations in which viewers' attention is artificially controlled, both in the sense of direction (Sharma et al. 2019; Sutherland & Mather 2017; Wang, Kennedy & Most 2012), and capacity

(Aquino & Arnell 2007; Fernandes et al. 2011; Schimmack & Derryberry 2005). Thus, this study investigates the potential differences in emotive processing under two conditions of attention - high and low – in a naturalistic exposure setting.

4.2. THE INFLUENCE OF AROUSAL AND VALENCE ON CONSUMER VISUAL PROCESSING

Many emotion theorists define emotion based on two orthogonal dimensions, valence and arousal; where valence reflects the degree of pleasantness of an affective stimulus, and arousal refers to the level of physiological activation prompted by the stimulus, irrespective of valence (Feldman Barrett & Russell 1998; Russell 1980; Russell, Weiss & Mendelsohn 1989). Hence, explaining emotion through the terms ‘arousal’ and ‘valence’ permits discussion of both an emotion’s thematic content, being either positive or negative, as well as its level of excitement.

A number of studies have reported separable influences of valence and arousal on consumer processing, with arousal relating closely to the level of processing and valence to the breadth of processing (Shapiro & Macinnis 2002). In other work, arousal and valence have been said to control the distribution of visual attention, thereby affecting associated judgement and memory performances (Jefferies et al. 2008). Common across these studies is the prevailing finding that arousal encourages robust memory encoding, often specific to the source of the arousal (Sutherland & Mather 2017) with increased arousal shown to negatively impact brand and product preferences (Dalenberg et al. 2014). In contrast, positive valence is seen to encourage evaluation and preference for consumer products, through enhancing semantic processing (Rowe, Hirsh & Anderson 2007), which does occur at the cost of recall and recognition performance (Guest et al. 2016).

From this literature, the following hypotheses are proposed (see Table 1 for a Summary of Hypotheses):

H1: There is a mixed relationship between arousal and consumer responses; specifically for testing:

H1a: There is a negative relationship between arousal and brand choice.

H1b: There is a positive relationship between arousal and prompted brand recall.

H1c: There is a positive relationship between arousal and unprompted brand recall.

H2: There are mixed relationships between valence and consumer responses; specifically for testing:

H2a: There is a positive relationship between valence and brand choice.

H2b: There is a negative relationship between valence and prompted brand recall.

H2c: There is a negative relationship between valence and unprompted brand recall.

In addition to the direct effects of arousal and valence on consumer responses, it is postulated that an advertisement's emotive profile can stimulate different consumers responses based on a viewer's level of attention. According to Nordhielm (2002), highly-attentive viewers' responses to emotional advertising differed significantly from those of low attention viewers, an effect also observed by Heath, Nairn and Bottomley (2010).

A small number of studies have explored the notion that specific combinations of the emotional dimensions of arousal and valence may facilitate a certain style of visual perception, including

a focal (i.e., on-screen) high attention mode of viewing, or a peripheral (i.e., near-screen) low attention approach. With regard to the former, it is demonstrated that viewers' speed of detection (Saxton et al. 2020), total fixation counts (Sharma et al. 2019), and memory recall (Brave & Nass 2009; Parrot & Spackman 2000) for on-screen stimuli is greater for negatively-valenced, high arousal emotions, than positively-valenced, low-arousal emotions. Contrastingly, for positively-valenced, low-arousal emotions, attention and memory performance are said to be maximised for peripherally-presented advertising materials (Breuer, Rumpf & Boronczyk 2021; Talarico, Berntsen & Rubin 2009).

4.3. AROUSAL, VALENCE AND HIGH ATTENTION

Emotive content high in arousal has been shown to increase attention to advertising through tightening attentive focus, as well as enhancing the processing and evaluation of objects positioned within this focus (Jefferies et al. 2008; Teixeira, Wedel & Pieters 2012). According to the cue-utilisation hypothesis (Easterbrook 1959), states of high arousal encourage the processing of central information related to the arousing stimulus. Thus, stimuli which reflect potential threat or danger receive heightened access to limited attentional resources (Kensinger & Corkin 2004). Supporting this proportion are findings which show reduced attention onset times for high arousal emotions relative to low arousal (Saxton et al. 2020).

Moreover, other studies demonstrate that not only does high arousal motivate focal attentive behaviour but can also increase consumer recall (Brave & Nass 2009; Lim, Hur & Mi Song 2018). For instance, Cahill et al. (1996) have shown that emotionally arousing visual stimuli generate greater recall than non-arousing images. Such effects on recall have also been observed in the context of high arousal taboo images (Myers et al. 2019). Furthermore, Parrot

and Spackman (2000) report that increases in arousal were accompanied by greater rates of brand recall, but only for brands positioned closer to the centre of the screen. A conclusion drawn from these studies is that arousal is positively related to consumer recall, and that this effect may be enhanced for either high intensity or centrally presented visual stimuli.

Prior research on choice suggests that high arousal enhances product and brand evaluation, particularly for centrally-positioned ad elements. It is proposed that increases in emotional arousal catalyse higher intensity visual processing of central information (Bergmann et al. 2012). One suggestion for the cause of this effect is that during early stages of visual processing, where objects within a scene begin to be parsed for their meaning (Greenwald & Leavitt 1984; Shapiro, Macinnis & Heckler 1997), arousal increases the speed with which an attended item is perceived and processed into “one coherent object representation” (Bergmann et al. 2012, p. 7). Concomitantly, this renders greater attention towards the fixated-item, and subsequently, the likelihood of positive preference formation (Janiszewski, Kuo & Tavassoli 2013); this notion is supported and expanded on by (Gutjar et al. 2015), who found a significant relationship between the use of high arousal emotions and choice, likewise reporting a tightening of visual attention span. Belanche, Perez-Rueda and Flavian (2014) also describe a higher probability of purchase for respondents to high arousal emotional advertising than low arousal.

Hence, it is anticipated that at high attention, high arousal brand advertising will enhance rates of brand choice, leading to the following hypotheses:

H3: Arousal moderates the effect of high attention on consumer responses to advertising; specifically for testing:

H3a: Arousal moderates the effect of high attention on brand choice.

H3b: Arousal moderates the effect of high attention on prompted brand recall.

H3c: Arousal moderates the effect of high attention on unprompted brand recall.

There are also indicators that the effects of arousal may interact with the degree of negative emotional valence or ‘unpleasantness’ stimuli during attention capture, further restricting the locus of attention to advertising materials positioned centrally on the screen. Unpleasant emotions have previously been seen to restrict viewers’ attentional focus to central ad elements positioned on-screen (Johnson, Waugh & Frederickson 2010). Prior research has established that the more negative emotional content is, the less likely visual exploration of a scene will occur (Hirschmann & Stern 1999; Kahn & Isen 1993). For instance, in Wadlinger and Isaacowitz (2006), participants’ eye movements were tracked while responding to emotionally charged images. Those induced into a negative mood demonstrated a greater number of fixations on central stimuli compared to peripheral, suggesting negative (positive) stimuli narrowed (broadened) attention (Wadlinger & Isaacowitz 2006). Related to this is an increase in the affective evaluation of discrete objects which fall within this reduced attentional range, as noted by previous studies (Florack, Egger & Hubner 2020; Janiszewski et al. 2013); this is also supported by Guerreiro, Rita and Trigueiros (2015), in their finding that visual attention to centrally presented brand logos was accompanied by an increase in brand choice for those advertised brands.

Similarly, the recall of advertising is suggested to be enhanced by negatively-valenced emotions, possibly due to the added distinctiveness of unpleasant themes over pleasant ones (Hourihan, Fraundorf & Benjamin 2017). In one study where participants were induced into either positive or negative moods, Myers and Sar (2015) found that those in the negative mood condition engaged in more detail-oriented processing of advertisements, while reducing their

mental imagery processing. Consequently, those participants in the negative mood condition performed better in tests of memory relating to specific advertisement claims than those in the positive mood condition, signalling unpleasant emotions may stimulate data-driven forms of processing more so than pleasant emotions. This notion is also supported by Shapiro et al. (2002), who found that valence affects the nature of information processing, with negative valence encouraging data-driven forms of processing.

The above findings highlight the possibility that the control of attention and subsequently, the nature of processing, may relate to the degree of pleasant-unpleasantness of advertising, with negatively valenced emotions enhancing the focal evaluation of specific ad elements. Consequently, the following Hypotheses are proposed:

H4: Valence moderates the effect of high attention on consumer responses to advertising; specifically for testing:

H4a: Valence moderates the effect of high attention on brand choice.

H4b: Valence moderates the effect of high attention on prompted brand recall.

H4c: Valence moderates the effect of high attention on unprompted brand recall.

4.4. AROUSAL, VALENCE AND LOW ATTENTION

At low attention, where advertising is peripheral to a viewer's gaze, research has demonstrated how low levels of arousal may relate to deeper consumer processing and memory for non-central brands or products. Evident across a number of recent studies exploring an emotion-attention connection is the notion that advertisements low in arousal enhance visual exploration across the screen (Fernandes et al. 2011; Saxton et al. 2020). Breuer et al. (2021) found states

of low arousal led to participants extending greater attentive focus paid to sponsorship signage positioned peripherally on the screen over centrally. Similar broadening effects have been reported in a number of related studies (Jager & Russeler 2016), as well as smaller response latencies for low arousal stimuli during visual search (Vogt et al. 2008), both reflective of enhanced visual exploration behaviour.

One potential explanation for these findings is the fact that decreased levels of arousal increase the number of available attentional resources (Kensinger & Corkin 2004). Hence, at low attention, focus can be directed beyond central elements of a scene to information presented peripherally (Breuer et al. 2021). Although this is likely to compromise focal analysis (of specific elements), widened attentive focus has been associated with enhancements in general familiarity and understanding of a visual scene (Mather & Sutherland 2011; McConnell & Shore 2011).

In the specific case of the recall of low arousal emotions, Jeong and Biocca (2012) have reported increased memory recognition for peripherally-presented brands at low arousal. In line with prior theorising, Bergmann et al. (2012) have shown enhanced working and long-term memory for low arousal images, but notably only when such images reflected positive, rather than negative, valence. Similarly, Breuer et al. (2021) demonstrate that states of low arousal are linked to enhanced recall of advertised brands. Like Bergmann et al. (2012), this was only the case for emotions that also reflected positive valence. Thus, low arousal emotions, supported also by positive valence, could underlie the low attention-based recall of non-focal advertising materials.

Though, counter to the positive effects on memory, low arousal emotions may reduce choice-based evaluations for advertised brands. For instance, Mitchell and Nelson (2018) report that following an exposure to advertising, research participants who viewed ads consisting of low-arousal, positive valence elements were less likely to intend to purchase the advertised product relative to high arousal, positive valence pairs. Likewise, Gutjar et al. (2015) has shown that, in a food choice context, products marketed by using low arousal emotions receive fewer selections than those using high arousal emotions in their commercials.

As to the dissociation in effect between choice and recall for low-arousal emotions, it is possible that a broadened attentive focus may limit viewers' ability to form and maintain intra-item associations necessary for establishing preference (Dolcos et al. 2019; Treisman 1998), while encouraging inter-item relationships beneficial for the creation of associations in memory (Bergmann et al. 2012). Research supports this notion, showing a greater preference for parallel processing at low arousal, with less focus on discreet data-driven analysis (Shapiro et al. 2002). According to the authors, viewers responding to low-arousal commercials experienced less difficulty focusing on and discriminating different ad elements at encoding than those in the high arousal condition (Shapiro et al. 2002). Hence, it is expected that low levels of arousal, associated with a widened range of attention, will increase brand recall for branded advertising, at the same time decreasing brand choice:

H5: Arousal moderates the effect of low attention on consumer responses; specifically for testing:

H5a: Arousal moderates the effect of low attention on brand choice.

H5b: Arousal moderates the effect of low attention on prompted brand recall.

H5c: Arousal moderates the effect of low attention on unprompted brand recall.

Furthermore, prior studies have associated positively valenced emotions with a broadened attentive focus (Frederickson & Banigan, 2011) heightening affective-based judgements as well as the processing of peripheral details of advertising. In a study tracking participants' attention during live sports broadcasts, Breuer et al. (2021) revealed that positively-valenced emotions encouraged a broadening of viewers' scope of attention, directing greater attention to sponsor messages placed peripherally (such as in the audience stands). As predicted by the 'broaden-and-build' hypothesis (Frederickson 2001), positive emotions encourage a broadening of visual focus and increase the processing of peripheral information (Estrada, Isen & Young 1997) by encouraging viewers' curiosity and visual exploration. Indeed, negative emotions exert an opposite effect by narrowing attentional focus and decreasing viewers' ability to process peripheral information (Estrada et al. 1997; Johnson et al. 2010).

In line with the above notions, Talarico et al. (2009) have demonstrated that for positive valence, the recall of peripheral detail is greater than that of central detail of an event. Yegiyan and Yonelinas (2011) and Frederickson and Banigan (2011) have all shown that a broadening effect of positive emotion on memory performance and a narrowing effect of negative emotion, suggesting that positive emotion may be driven less by goal-relevant action than exploratory action. While few studies exist to confirm these relationships in the context of visual attention, it is anticipated that peripheral, low attention will positively relate to brand recall in response to positively valenced advertising.

Furthermore, positive valence appears to also enhance affective judgements, with several studies showing relatively greater rates of positive evaluations (Guest et al. 2016; Shapiro et al. 2002) and brand choice (Fernandes et al. 2011; Hirschmann & Stern 1999) for positively valenced brands over negatively valenced emotions. In Murray and Dacin (1996), participants

were induced into a positive mood while carrying out brand-choice tasks. According to the authors, positively valenced emotions improve a person's beliefs about the outcome of anticipated experiences or events. In turn, this may prompt respondents to explore and elaborate on advertised materials more extensively (Murray & Dacin, 1996). When asked whether they liked the television program displayed prior, those in the positive valence group reported preference for the commercial while those in the negative valence group reportedly did not like the program.

These findings can be taken to infer that for the recall of peripherally-located advertisement materials as well as their preferential evaluation, the use of pleasant, positively-valenced emotive tones will increase the effectiveness of low attention viewing of advertisements. Consequently, we propose the following hypotheses:

H6: Valence moderates the effect of low attention on consumer responses to advertising; specifically for testing:

H6a: Valence moderates the effect of low attention on brand choice.

H6b: Valence moderates the effect of low attention on prompted brand recall.

H6c: Valence moderates the effect of low attention on unprompted brand recall.

4.5. EMOTION AND DEMOGRAPHIC VARIABLES

It is also possible that specific socio-demographic variables such as age, gender and brand use may further moderate the relationships discussed above, as well as provide insight into the differences between mood states across these categories. Relating to age in the evaluation of arousal-valence dimensions of emotion, van der Goot, Beentjes and van Selm (2015) have shown that for ads high in arousal, aging reflects a trend of decreased liking and recall of

advertised products across the lifetime. This notion is supported and expanded upon by several other studies which show a decline in sensitivity to high arousal emotions across the lifetime, but relative stability in terms of valence (Deckert et al. 2020; Otamendi & Martin 2020). However, one study in question, Deckert et al. (2020), did not find a general distinction in behaviour between age groups in response to either arousing words or faces, but did so in conjunction with arousal-elicited words, combined with negative faces. Thus, while age-differences in the appraisal of arousal are expected, as no differences are expected for valence, future research is necessary to determine whether such effects hold true in the context of digital advertising. Hence, it is anticipated that for high arousal advertising, increased age will relate negatively to consumer responses, as noted in the following Hypotheses:

H7: Younger participants will show enhanced consumer responses for high arousal advertising than will older participants; specifically for testing:

H7a: Younger participants will show relatively greater brand choice in response to high arousal than will older participants.

H7b: Younger participants will show relatively greater prompted brand recall in response to high arousal than will older participants.

H7c: Younger participants will show relatively greater unprompted brand recall in response to high arousal than will older participants.

H8: There will be no age-related differences in consumer responses based on valence; specifically for testing:

H8a: There will be no age-related differences in brand choice based on valence.

H8b: There will be no age-related differences in prompted brand recall.

H8c: There will be no age-related differences in unprompted brand recall.

As for gender, women have been shown to exhibit generally greater sensitivity to unpleasant and high arousal emotional stimuli relative to men, with some exceptions (Lithari et al. 2010; Thayer & Johnsen, 2000). According to Deckert et al. (2020), a significant portion of females yield higher sensitivity to arousal, whereas the remaining females yield the lowest arousal. By contrast, males collectively fall between these groups in arousal sensitivity (Deckert et al. 2020). In the context of valence, a similar finding is revealed by (Otamendi & Martin 2020), who demonstrate that while discrete age-groups of women show peaks of different negative emotions across the lifespan (i.e., young - disgust; middle-age – fear; old – sadness), males instead demonstrate a consistent preference for a specific negative, high arousal emotion, that is, anger.

From the above literature, it is anticipated that there will be a gender difference in consumer responses to arousal, but not valence, as the following Hypotheses indicate.

H9: Females will show relatively enhanced consumer responses in response to high arousal than will males; specifically for testing:

H9a: Females will show relatively enhanced brand choice in response to high arousal than will males.

H9b: Females will show relatively enhanced prompted brand recall in response to high arousal than will males.

H9c: Females will show relatively enhanced unprompted brand recall in response to high arousal than will males.

H10: There will be no gender-related differences in consumer responses based on valence; specifically for testing:

H10a: There will be no gender-related differences in brand choice based on valence.

H10b: There will be no gender-related differences in prompted brand recall based on valence.

H10c: There will be no gender-related differences in unprompted brand recall based on valence.

Finally, while prior research establishes the enhancing role of brand use on consumer choice and recall, the influence of emotion on these relationships is presently unclear. A well-established empirical generalisation is that users of a brand are typically more likely to remember and evaluate favourably branded advertising than non-users (Nicholls, Romaniuk & Sharp 2003). This has been demonstrated in the context of general web banner advertising (Neubert 2018), as well as applied instances such as advergames (van Berlo et al. 2021; Van Reijmersdal et al. 2020). However, presently few works have explored the influence of brand use in the context of emotion on consumer responses. In the context of ad attitude, Derbaix (1995) has shown that affect exerts stronger impact on evaluations for novel over familiar brands. Subsequent research generally supports these findings but additionally reveals that the moderating role of brand use may be true only for positive valence (Brown, Homer & Inman 1998; Homer 2006). From this, it is anticipated that valence will act as a moderator of the effects of brand use on consumer responses, while arousal will not act as a moderator.

H11: Valence moderates the effect of brand use on consumer responses to advertising; specifically for testing:

H11a: Valence moderates the effect of brand use on brand choice.

H11b: Valence moderates the effect of brand use on prompted brand recall.

H11c: Valence moderates the effect of brand use on unprompted brand recall.

H12: Arousal will not moderate the effect of brand use on consumer responses to advertising.

H12a: Arousal will not moderate the effect of brand use on brand choice.

H12b: Arousal will not moderate the effect of brand use on prompted brand recall.

H12c: Arousal will not moderate the effect of brand use on unprompted brand recall.

Table 1: Summary of Hypotheses

Arousal and Consumer Responses
1. There are mixed relationship between arousal and consumer responses a. There is a negative relationship between arousal and brand choice b. There is a positive relationship between arousal and prompted brand recall c. There is a positive relationship between arousal and unprompted brand recall
Valence and Consumer Responses
2. There are mixed relationships between valence and consumer responses. a. There is a positive relationship between valence and brand choice. b. There is a negative relationship between valence and prompted brand recall c. There is a negative relationship between valence and unprompted brand recall
Arousal and High Attention
3. Arousal moderates the effect of high attention on consumer responses a. Arousal moderates the effect of high attention and brand choice b. Arousal moderates the effect of high attention on prompted brand recall c. Arousal moderates the effect of high attention and unprompted brand recall
Valence and High Attention
4. Valence moderates the effect of high attention on consumer responses a. Valence moderates the effect of high attention and brand choice b. Valence moderates the effect of high attention on prompted brand recall c. Valence moderates the effect of high attention on unprompted brand recall
Arousal and Low Attention
5. Arousal moderates the effect of low attention on consumer responses a. Arousal moderates the effect of low attention on brand choice b. Arousal moderates the effect of low attention on prompted brand recall c. Arousal moderates the effect of low attention on unprompted brand recall
Valence and Low Attention
6. Valence moderates the effect of low attention on consumer responses a. Valence moderates the effect of low attention on brand choice b. Valence moderates the effect of low attention on prompted brand recall c. Valence moderates the effect of low attention on unprompted brand recall
Emotion and Age
7. Younger participants will show enhanced consumer responses for high arousal advertising than will older participants a. Younger participants will show relatively greater brand choice in response to high arousal than will older participants b. Younger participants will show relatively greater prompted brand recall in response to high arousal than will older participants c. Younger participants will show relatively greater unprompted brand recall in response to high arousal than will older participants 8. There will be no age-related differences in consumer responses based on valence a. There will be no age-related differences in brand choice based on valence

b. There will be no age-related differences in prompted brand recall based on valence c. There will be no age-related differences in unprompted brand recall based on valence
Emotion and Gender
9. Females will show enhanced consumer responses for high arousal advertising than will males a. Females will show relatively greater brand choice in response to high arousal than will males b. Females will show relatively greater prompted brand recall in response to high arousal than will males c. Females will show relatively greater unprompted brand recall in response to high arousal than will males 10. There will be no gender-related differences in consumer responses based on valence a. There will be no gender-related differences in brand choice based on valence b. There will be no gender-related differences in prompted brand recall based on valence c. There will be no gender-related differences in unprompted brand recall based on valence
Emotion and Brand-use
11. Valence moderates the effect of brand use on consumer responses a. Valence moderates the effect of brand use on brand choice. b. Valence moderates the effect of brand use on prompted brand recall c. Valence moderates the effect of brand use on unprompted brand recall 12. Arousal will not moderate the effect of brand use on consumer responses a. Arousal will not moderate the effect of brand use on brand choice b. Arousal will not moderate the effect of brand use on prompted brand recall c. Arousal will not moderate the effect of brand use on unprompted brand recall

4.6. MATERIALS AND METHOD

4.6.1. Design and Participants

A cross-sectional, observational research design was used to explore attention and consumer behaviour across three digital media platforms, including free-to-air television, Facebook and YouTube.

Respondents from three European countries (Germany, Switzerland and Austria) were sampled from the online labour sourcing service Lucid, in exchange for 5 EUD. This sample consisted of 466 subjects, 380 of whom were sampled from Germany, 38 from Austria, and 48 from Switzerland, all respondents being fluent in German. Furthermore, in order to participate in this study, respondents on mobile platforms were required to own and use an Apple iPhone 6s

(or subsequent iOS device), while television respondents were sent a package containing an iPhone 6s.

4.6.2. Stimuli

The stimuli selected for the viewing session were twelve branded advertisements, covering a range of product categories. These advertisements were for real brands from categories including fast food, chewing gum, rice, cat food, soft drink, men's fragrance, women's deodorant, shampoo, sneakers, car and washing machines, reflected across both the test brand and other category-consistent brands.

After completing the viewing session, subjects were asked to complete a 72-item survey questionnaire which consisted of questions exploring participants' choice (36 items) and recall (36 items) responses to the twelve categories of consumer brands.

4.6.3. Hardware and software

In order to understand the impact of viewing attention to emotional advertising on consumer behaviour, participants' eye movements were passively recorded while viewing advertising on one of the three research platforms.

Depending on platform, subjects were either provided with a Wi-Fi only Apple iPhone 6s device preloaded with a custom research application (Television group) or required to own at least an iPhone 6s and download the application from the App Store (Facebook & YouTube groups). Additionally, the television group was sent a device charger and tripod stand for mounting the device horizontally beneath the lower bezel of subjects' televisions.

4.6.4 Eye-Tracking & Data Preparation Procedure

A proprietary gaze prediction system was used to monitor participants' head, facial and eye features while viewing advertisements on a television screen. This system relies on a custom regression model to map (120D) vectors to a predicted location on the device screen. This relationship depends on the positioning and rotation of subjects' heads in relation to the camera and screen (Papoutsaki 2015). Prior research into such systems (Huang 2018; Hwang & Lee 2017) has demonstrated relative congruence between such technologies and specialised eye-tracking interfaces, lending credibility to their use in the present research.

Synchronising gaze to a location on screen required a mapping of the position and rotation of participants' head in 3D space. To achieve this, specific participant facial features, including brow, nose and eye position, were recorded by a webcam at a rate of five frames per second and processed through a custom neural network, thereby deriving five gaze locations on screen per-second.

Once the five gaze locations were calculated, an aggregated per-second attention score was generated in reference to the location of the advertisement on-screen. The range of attention scores was between 0 (if 0% of the gaze location and bounds are outside of the screen) to 100 (if 100% of the gaze location and bounds are within the screen). High attention was defined as any gaze point on-screen (and where applicable, on-advertisement), while low attention was defined as any gaze point occurring near-screen. Instances where no visual attention could be detected were defined as non-attention.

4.6.5. Procedure

The present research study was advertised on the online labour sourcing website Lucid. The purpose of the study was described as measuring audience reactions to advertising. Prior to participation, subjects were informed of the study's use of their personal media accounts, but in accordance with local and international privacy regulations (i.e., *Privacy [Market and Social Research] Code 2014*), no personal data (i.e., passwords, searches, activity) would be collected or stored. Furthermore, subjects were informed that facial recording would take place but that such images would be processed by visual algorithms, meaning researchers had access only to simple numeric values denoting visual attention.

Upon participation in this study, subjects were directed to navigate with their own or study-provided iOS device to the Apple *App Store*, where they were instructed to download a proprietary attention-tracking application. Once logged into this application, subjects were required to enable permissions allowing the app to intercept and replicate the subjects' live ad feeds on television, Facebook and YouTube. Subjects were then presented with a normal log-in page pertaining to their research platform.

Once logged into the platform, subjects were free to browse through photo, video and text content (as each platform allows) at their leisure for a period of 30 minutes on Television and 10-20 minutes on the digital platforms (YouTube & Facebook). While browsing, participants' eye movements were recorded, assessing variables such as position and duration of attention on- and off-screen. After the respective viewing times were reached, the viewing session concluded and subjects were automatically re-directed to a URL-based Qualtrics survey assessing the behavioural component of exposure. Here, subjects were asked to view and choose, out of several unexposed brands and one exposed test brand for each product category,

which one they would purchase if price and need were irrelevant. Additionally, subjects were also asked to recall which brand they saw during initial exposure.

4.7. RESULTS

Table 2: Demographic Characteristics Across Single and Repeated Exposures

Single exposure ($n = 466$)

	TV		Facebook		YouTube	
Characteristic	Frequency	%	Frequency	%	Frequency	%
Germany	142	79.3	137	87.8	155	82.4
Austria	17	9.5	13	8.3	16	8.5
Switzerland	20	11.7	6	3.8	17	9.0
Age (years)						
(18-35)	56	33.9	60	54.1	113	62.8
(35-44)	44	26.7	34	30.6	40	22.2
(45-54)	32	19.4	15	13.5	19	10.6
(55-64)	29	17.6	2	1.8	7	3.9
(65-74)	4	2.4			1	.6
Gender						
M	86	50.3	58	49.6	97	51.6
F	85	49.7	59	50.4	91	48.4

To assess the influence of attention and other variables (i.e., age, gender and brand use) on choice and recall (prompted/unprompted), the authors estimated a binary logistic regression model, using SPSS (version 24). Logistic regression is a multivariate regression which enables analysis of the impact of several independent variables on a dependent variable with respect to the values of a set of predictor variables.

In this study, we utilise a logistic regression method to predict brand choice and recall for advertised products. These dependent variables are analysed with respect to the five predictor variables presented in Table 4. The logistic regression analysis assigns the value “1” to “yes” answers provided to the independent variable “Would you buy this product?/Which product do you recall seeing?”, and “0” to the “no” answers. Hence, the results are interpreted with respect to these values.

In binary logistic regression analysis, several statistical assumptions must be met prior to analysis, including a) multicollinearity, b) non-consistent variance (non-homogeneity), c) linearity, and d) autocorrelation. To address the assumption of multicollinearity, Variance Inflation Factors (VIF) was used to measure and quantify variance in the predictor coefficients. Multicollinearity was not detected among any of the predictor variables across the three dependent variables, signalling suitability for use in analysis. As for linearity with logit values, a Box-Tidwell test with brand choice as the outcome variable revealed that the low attention predictor variable violated this assumption ($p < .05$). To achieve linearity in this variable, a natural log transformation was undertaken on low attention for the choice model, used within subsequent analyses. Additionally, all observations were independent from one another.

An advantage of logistic regression is its flexibility across variable type, capable of assessing both continuous and categorical variables of which are present in the data. In the present analysis, attention (high/low) reflects a continuous predictor, while age, gender and brand use reflect categorical predictors, together regressed onto choice and recall as binary outcome variables. Thus, a number of covariates were included in the regression model as fixed effects. Additionally, moderation effects were assessed through testing the significance of the two-way interaction between an independent variable and its potential moderator.

The values of the regression coefficients and their statistical significance obtained by 'Enter logistical regression' method are included in Tables 3 and 4. This also provides information as to the impact of the independent variables on brand choice and recall (see odds ratio). An odds ratio value above 1 indicates a positive association between the predictor and outcome variable, whereas values below 1 reveal a negative association.

Arousal – main effect. At one exposure, significant negative main effects of arousal on brand choice ($b = -.875, p < .01$) and unprompted recall ($b = -.734, p < .01$) were identified, indicating that the probability of a respondent choosing and remembering an advertised product changes by a factor of .417 for choice and .480 for unprompted recall with each raw score increment in arousal. Hence, Hypothesis 1b is supported while Hypothesis 1a and 1c are not supported.

However, following two exposures, significant positive effects of arousal on choice ($b = .945, p < .05$), prompted recall ($b = .980, p < .01$), and unprompted recall ($b = 1.005, p < .01$) were observed, demonstrating that the likelihood of a respondent choosing and recalling an advertised brand changes by a factor of 2.575, 2.666 and 2.732 respectively with each raw score increment on arousal. Thus, Hypothesis 13a, 13b, and 13c are supported by the present results.

Valence – interactions. No main effects of valence on any of the three dependent variables (choice, prompted recall, and unprompted recall) were detected, across both single and repeated exposures. Hence, support is not found for Hypothesis two or 14.

Table 3: Parameter Estimations for Reduced Binary Logistic Regression Models on Brand Choice and Prompted/Unprompted Brand Recall at One Exposure

	Choice		Prompted Recall		Unprompted Recall	
Reduced model summary	$X^2 = 848.241$ df = 13, $p = .000$		$X^2 = 95.711$, df = 8, $p = .000$		$X^2 = 112.989$, df = 7, $p = .000$	
Nagelkerke R^2	.301		.042		.053	
Overall accuracy	77.9%		79.3%		84.7%	
Reduced model effects	β	Exp(B)	β	Exp(B)	β	Exp(B)
constant	-3.037**	.048	-1.769**	.171	-2.329**	.097
arousal	-.875**	.417			-.734**	.480
high attention (base = 0)	.026**	1.026	.027**	1.027	.036**	1.036
brand use						
brand use (once vs. never)	1.986**	7.289	.196	1.216		
brand use (between 1-2 times vs. never)	2.666**	14.387	.767**	2.153		
brand use (3+ times vs. never)	3.084**	21.849	.787**	2.196		
age						
age (35-44 vs. 18-34)			-.131	.877		
age (45-54 vs. 18-34)			.018	1.018		
age (55-64 vs. 18-34)			.273(*.057)	1.314		
age (65-74 vs. 18-34)			-.078	.925		
valence * low attention (base = 0)	.022**	1.022			.039**	1.039
valence * brand use						
valence * brand use (once vs. never)	-1.156**	.315				
valence * brand use (between 1-2 times vs. never)	-1.497	.224				
valence * brand use (3+ times vs. never)	-.614*	.541				
arousal * brand use						
arousal * brand use (once vs. never)	1.205**	3.335			.286	1.331

arousal * brand use (between 1-2 times vs. never)	.834**	2.302			.764**	2.146
arousal * brand use (3+ times vs. never)	.683*	1.979			1.115**	3.049

* Significant at $\alpha = .01$ ** Significant at $\alpha = 0.05$

Table 4: Parameter Estimations for Reduced Binary Logistic Regression Models on Brand Choice and Recall at Two Exposures

	Choice		Prompted Recall		Unprompted Recall	
Reduced model summary	$X^2 = 521.436$ df = 11, $p = .000$		$X^2 = 320.799$, df = 9, $p = .000$		$X^2 = 282.670$, df = 14, $p = .000$	
Nagelkerke R^2	.335		.194		.184	
Overall accuracy	76.6%		66.9%		66.3%	
Reduced model effects	β	Exp(B)	β	Exp(B)	β	Exp(B)
constant	-2.600**	.074	-1.074**	.342	-1.304**	.272
arousal	.945*	2.575	.980**	2.666	1.005**	2.732
high attention (base = 0)			.076**	1.079	.069**	1.072
low attention (base = 0)			.053**	1.055	.045**	1.046
gender (female [reference] = 0, male = 1)	-.050	.951	-.435**	.647	-.901**	.406
brand use						
brand use (once vs. never)	1.384**	3.991	.518**	1.678	.345*	1.412
brand use (between 1-2 times vs. never)	2.146**	8.546	1.870**	6.489	1.466**	4.331
brand use (3+ times vs. never)	2.835**	17.035	1.422**	4.146	1.122**	3.071
arousal * age						
arousal * age (35-44 vs. 18-34)	-.560	.571			.191	1.211
arousal * age (45-54 vs. 18-34)	-.871*	.419			.072	1.075
arousal * age (55-64 vs. 18-34)	-.375	.688			-.894*	.409
arousal * age (65-74 vs. 18-34)	-.120	.887			-1.160	.314
arousal * brand use						
arousal * brand use (once vs. never)	-	-			-	-
arousal * brand use (between 1-2 times vs. never)	.014	1.014	-1.601**	.202	-1.425**	.241
arousal * brand use (3+ times vs. never)	1.837**	6.277	-.993**	.370	-.947*	.388

* Significant at $\alpha = .01$ ** Significant at $\alpha = 0.05$

However, an interaction effect was revealed between valence and brand use on brand choice following one exposure. For brand use, a planned contrast was used to compare three levels of brand use (light [once], moderate [1-2 times], heavy [3+ times]) against non-users [never] on brand choice. The regression slopes for light users ($b = -1.156, p < .01$) and heavy users ($b = -.614, p < .05$) are negative and statistically significant, indicating that the probability of a respondent choosing an advertised product portrayed as negatively valenced was greater for light- and heavy-users, relative to moderate- and non-users of a brand. The odds ratio for each significant level of the predictor indicates that the odds of a respondent choosing the advertised brand change by a factor of .315 with each raw score increment on light use, and .541 with each raw score increment on heavy use. Thus, Hypothesis two is not supported.

Attention – main effect and interactions. Following a single exposure, simple main effects of high attention on brand choice ($b = .026, p < .01$), prompted recall ($b = .027, p < .01$), and unprompted recall ($b = .036, p < .01$) were observed, indicating that the probability of a respondent choosing and remembering an advertised brand, with or without prompting, changes by a factor of 1.026, 1.027 and 1.036 respectively with each increment in time (seconds) spent watching on-screen (i.e. high attention).

Further interaction effects were observed at one exposure between valence and low attention on both brand choice ($b = .022, p < .01$), and unprompted recall ($b = .039, p < .01$), indicating that the probability of a respondent choosing and remembering an advertised brand portrayed as positively-valenced changes by a factor of 1.022, and 1.039 respectively with each raw score increment in time (seconds) spent near-screen (i.e., low attention). Hence, Hypotheses 6a and 6c are retained while Hypotheses 3, 4, 5, and 6b are not supported.

At two exposures however, significant positive main effects were observed only for prompted recall ($b = .076, p < .01$), and unprompted recall ($b = .069, p < .01$), demonstrating that the probability of a respondent recalling an advertised brand with or without prompting changes by a factor of 1.079 and 1.072 respectively with each increment in time (seconds) spent watching on-screen (i.e., high attention). Furthermore at two exposures, main effects of low attention on prompted recall ($b = .053, p < .01$) and unprompted recall ($b = .045, p < .01$), were observed, demonstrating that the probability of a respondent recalling an advertised brand with and without prompting changes by a factor of 1.055 and 1.046 respectively with each increment in time (seconds) spent watching near-screen (i.e. low attention). No interaction effects were observed between arousal and valence, and high and low attention at two exposures. Consequently, Hypotheses 15, 16, 17 and 18 are also not supported by the present results.

Brand use – main effect and interactions. Regarding brand use, a planned contrast was used to compare three levels of brand use (light [once], moderate [1-2 times], heavy [3+ times]) against non-users [never] on brand choice and recall. At both single and repeated exposures, significant positive main effects on brand choice were observed for all three levels of brand use, as was the case for prompted and unprompted recall following two exposures, while a main effect on prompted recall was observed only for moderate and heavy users at one exposure.

At one exposure, an interaction was identified between arousal and brand use on brand choice. The regression slope for light users ($b = 1.205, p < .01$), moderate users ($b = .834, p < .01$), and heavy users ($b = .683, p < .05$) are positive and statistically significant, indicating that the probability of a respondent choosing an advertised brand portrayed as high arousal was greater among users of a brand, relative to non-users of a brand. The odds ratio for each level of the

predictor indicates that the odds of a brand user choosing an advertised brand portrayed by high arousal emotions was 3.335 times more likely for light-users, 2.302 times more likely for moderate users, and 1.979 times more likely for heavy users, when compared to a non-user.

In addition, a further interaction effect between arousal and brand use was detected for unprompted recall. The regression slope for moderate users ($b = .764, p < .01$), and heavy users ($b = 1.115, p < .01$) are positive and statistically significant, indicating that the probability of a respondent recalling without prompting an advertised brand portrayed as high arousal was higher among moderate-to-heavy users of a brand, relative to light- and non-users of a brand. The odds ratio for each level of the predictor indicates that the odds of a brand user recalling an advertised brand change by a factor of 2.146 with each raw score increment on moderate use, and 3.049 with each raw score increment on heavy use. Thus, while Hypotheses 12a and 12c are not supported, there is evidence of a significant moderation effect of arousal and brand use on brand choice and unprompted recall, though support is not found for prompted recall (Hypothesis 12b).

At two exposures, a similar interaction was observed between arousal and brand use on brand choice, but only for heavy users. The regression slope for and heavy users ($b = 1.837, p < .01$) are positive and statistically significant, indicating that the probability of a respondent choosing an advertised brand portrayed as high arousal was greater among users of a brand, relative to non-users of a brand. The odds ratio for each level of the predictor indicates that the odds of a brand user choosing an advertised brand portrayed by high arousal emotions were 6.277 times more likely for heavy users, when compared to a non-user.

Furthermore, an interaction effect was observed between arousal and brand use for prompted recall. The regression slope for moderate users ($b = -1.601, p < .01$) and heavy users ($b = -.993, p < .01$) are negative and statistically significant, indicating that the probability of a respondent recalling with prompting an advertised brand portrayed as high arousal was lower among moderate-to-heavy users of a brand, relative to non-users of a brand. The odds ratio for each significant level of the predictor indicates that the odds of a brand user recalling an advertised brand change by a factor of .202 with each raw score increment on moderate use and .370 with each raw score increment on heavy use.

In addition, an interaction effect between arousal and brand use was detected for unprompted recall. The regression slope for moderate users ($b = -1.425, p < .01$), and heavy users ($b = -.947, p < .01$) are negative and statistically significant, indicating that the probability of a respondent recalling without prompting an advertised brand portrayed as high arousal was lower among moderate-to-heavy users of a brand, relative to non-users of a brand. The odds ratio for each level of the predictor indicates that the odds of a brand user recalling an advertised brand change by a factor of .241 with each raw score increment on moderate use and .388 with each raw score increment on heavy use.

In summary, reverse support was found for Hypothesis 24, which reflected significant interactions of arousal and brand use on consumer responses (i.e., brand choice and recall). By contrast, valence was found not to moderate the effect of brand use on consumer responses, and as such, Hypothesis 23 is not supported.

Age – interaction. Following two exposures, analysis of age by arousal revealed a significant negative interaction effect on brand choice and unprompted recall, but this was true only for specific ages.

Regarding brand choice, relative to participants aged between 18-34, 45-54 year old respondents were less likely to select an advertised brand portrayed as high in arousal ($b = -.871, p < .05$). The odds ratio for the predictor indicates that the odds of a 45-54 year old participant selecting an advertised brand was .419 times less likely than for a respondent aged between 18 and 34 years of age. Thus, partial support is found for Hypothesis 19a.

As for unprompted recall, relative to participants aged between 18-34, 55-64 year old participants were less likely to recall the advertised brand portrayed as high in arousal without prompting ($b = -.894, p < .05$). The odds ratio for the predictor indicates that the odds of a 55-64 year old participant recalling an advertised brand was .409 times less likely than for a respondent between 18 and 34 years of age. Hence, partial support is also evident for Hypothesis 19c. Additionally, no significant differences in consumer responses by age were observed for valence. Thus, Hypothesis eight is not supported.

Gender – main effect. At two exposures, significant positive main effects of gender on brand choice ($b = -.050, p < .951$), prompted recall ($b = -.435, p < .01$), and unprompted recall ($b = -.901, p < .01$) were identified, indicating that men were less likely to choose and remember an advertised brand by factors of .951, .647 and .406 respectively. Thus, given no interactions were detected between emotion and gender on the outcome variables, Hypothesis nine is rejected, while Hypothesis 22 is supported.

Table 5: Summary of hypotheses and results

	Phase 1	Phase 2
Hypothesis	Support	Support
Arousal and Consumer Responses		
1. There are mixed relationship between arousal and consumer responses		
a. There is a negative relationship between arousal and brand choice	Yes (H1a)	Yes (H13a)
b. There is a positive relationship between arousal and prompted brand recall	No (H1b)	Yes (H13b)
c. There is a positive relationship between arousal and unprompted brand recall	No (H1c), reverse true	Yes (H13c)
Valence and Consumer Responses		
2. There are mixed relationships between valence and consumer responses		
a. There is a positive relationship between valence and brand choice	No (H2a)	No (H14a)
b. There is a negative relationship between valence and prompted brand recall	No (H2b)	No (H14b)
c. There is a negative relationship between valence and unprompted brand recall	No (H2c)	No (H14c)
Arousal and high attention		
3. Arousal moderates the effect of high attention on consumer responses		
a. Arousal moderates the effect of high attention and brand choice	No (H3a)	No (H15a)
b. Arousal moderates the effect of high attention on prompted brand recall	No (H3b)	No (H15b)
c. Arousal moderates the effect of high attention and unprompted brand recall	No (H3c)	No (H15c)
Valence and high attention		
4. Valence moderates the effect of high attention on consumer responses		
a. Valence moderates the effect of high attention and brand choice	No (H4a)	No (H16a)
b. Valence moderates the effect of high attention on prompted brand recall	No (H4b)	No (H16b)
c. Valence moderates the effect of high attention on unprompted brand recall	No (H4c)	No (H16c)
Arousal and low attention		
5. Arousal moderates the effect of low attention on consumer responses		
a. Arousal moderates the effect of low attention on brand choice	No (H5a)	No (H17a)
b. Arousal moderates the effect of low attention on prompted brand recall	No (H5b)	No (H17b)
c. Arousal moderates the effect of low attention on unprompted brand recall	No (H5c)	No (H17c)
Valence and low attention		
6. Valence moderates the effect of low attention on consumer responses		
a. Valence moderates the effect of low attention on brand choice	Yes (H6a)	No (H18a)
b. Valence moderates the effect of low attention on prompted brand recall	No (H6b)	No (H18b)
c. Valence moderates the effect of low attention on unprompted brand recall	Yes (H6c)	No (H18c)

Emotion and Age		
7. Younger participants will show enhanced consumer responses for high arousal advertising than will older participants		
a. Younger participants will show relatively greater brand choice in response to high arousal than will older participants	No (H7a)	Partial support (H19a)
b. Younger participants will show relatively greater prompted brand recall in response to high arousal than will older participants	No (H7b)	No (H19b)
c. Younger participants will show relatively greater unprompted brand recall in response to high arousal than will older participants	No (H7c)	Partial support (H19c)
8. There will be no age-related differences in consumer responses based on valence		
a. There will be no age-related differences in brand choice based on valence	Yes (H8a)	Yes (H20a)
b. There will be no age-related differences in prompted brand recall based on valence	Yes (H8b)	Yes (H20b)
c. There will be no age-related differences in unprompted brand recall based on valence	Yes (H8c)	Yes (H20c)
Emotion and Gender		
9. Females will show enhanced consumer responses for high arousal advertising than will males		
a. Females will show relatively greater brand choice in response to high arousal than will males	No (H9a)	No (H21a)
b. Females will show relatively greater prompted brand recall in response to high arousal than will males	No (H9b)	No (H21b)
c. Females will show relatively greater unprompted brand recall in response to high arousal than will males	No (H9c)	No (H21c)
10. There will be no gender-related differences in consumer responses based on valence		
a. There will be no gender-related differences in brand choice based on valence	No (H10a)	Yes (H22a)
b. There will be no gender-related differences in prompted brand recall based on valence	No (H10b)	Yes (H22b)
c. There will be no gender-related differences in unprompted brand recall based on valence	No (H10c)	Yes (H22c)
Emotion and Brand Use		
11. Valence moderates the effect of brand use on consumer responses		
a. Valence moderates the effect of brand use on brand choice	No (H11a)	No (H23a)
b. Valence moderates the effect of brand use on prompted brand recall	No (H11b)	No (H23b)
c. Valence moderates the effect of brand use on unprompted brand recall	No (H11c)	No (H23c)
12. Arousal will not moderate the effect of brand use on consumer responses		
a. Arousal will not moderate the effect of brand use on brand choice	No (H12a), interaction significant	No (H24a), interaction significant
b. Arousal will not moderate the effect of brand use on prompted brand recall	Yes (H12b)	No (H24b), interaction significant

c. Arousal will not moderate the effect of brand use on unprompted brand recall	No (H12c), interaction significant	No (H24c), interaction significant
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4.8. DISCUSSION

The present study examined the effects of two facets of emotion – arousal and valence – on consumer responses, taking place across both single and repeated exposures to advertising. Additionally, potential interactions between emotion and viewing attention, as well as with specific demographic factors, were of interest to this work.

In contrast with previous work on arousal and memory (Breuer et al. 2021; Kensinger & Corkin 2004), the present study revealed a negative relationship between arousal and unprompted brand recall following a single advertising exposure (Phase 1). Such an observation is generally inconsistent with the results from several studies showing that not only do arousing materials capture attention more quickly (Fernandes et al. 2011), as well as hold attention for longer periods (Schimmack & Derryberry 2005), but that arousal also heightens the processing of the arousal-eliciting stimuli in memory (Kensinger & Corkin 2004). However, Bergmann et al. (2012) have recently shown a ‘reversed arousal effect’, wherein low-arousal stimuli were processed and retained more effectively in working- as well as long-term memory tasks than higharousal stimuli. It is important to note that in Bergmann et al. (2012), such effects were present in multi-stimuli contexts, and absent for single-stimuli contexts. As the present study and its findings were observed in naturalistic, multi-sensory environments – circumstances under which consumers typically encounter advertising – it is possible that memory encoding processes may differentially affect processing between multi- and single-stimuli contexts, as well as high and low arousal ones. Consequently, in the case of higharousal advertising, it may

be the case that insufficient attentional resources were available for memory encoding, rendering greater ease of recall for low-arousal advertising.

Furthermore, in line with research on arousal and preference, the present findings also revealed a negative association between arousal and brand choice following a single exposure. This finding supports and expands upon Dalenberg et al. (2014), who found that states of greater arousal produced relatively lower rates of food product choice than low arousal emotions. Here, we reproduce that finding in the context of naturalistic, digital advertising across a range of categories, including food and beverages, as well as luxury brands and fragrance, fashion, and automotive.

At one exposure, two valence-by-low attention interaction effects on brand choice and unprompted brand recall were observed. Specifically, it was revealed that the likelihood of brand choice and recall occurring for positive advertisements was greater among viewers who spent more-time watching near-screen (i.e., low attention). This finding may be considered supportive of the ‘broaden-and-build’ hypothesis (Frederickson 2001), which proposes that positive emotions serve to widen the scope of attention, thereby devoting relatively greater attention to peripheral elements of a scene. Although wide or peripheral attentive focus has been shown to be effective for establishing preference (Estrada et al. 1997), such an effect has not been widely demonstrated in regard to recall, typically understood to emerge in response to overtly negative themes (Johnson et al. 2010). Despite this, a broadening of attention could affect memory performance in the sense that greater focus on peripheral information may assist the perceiver’s appraisal of not just the attended item, but its subcomponents, as well as object-scene or object-object interrelationships in memory (Bergmann et al. 2012). Based on Frederickson’s (2001) hypothesis, it is then plausible that positive emotional advertising may

be most effective when attention is directed non-centrally to advertising, or alternatively when the level of attention is low.

Whereas Phase 1 demonstrated that arousal was negatively associated with brand choice and recall at a single exposure, analysis of repeated exposures data (Phase 2) instead reveals positive relationships between arousal and the outcome variables. Prior studies have explored the influence of repeated exposures to images on attention performance (Saxton et al. 2020). However, these studies did not address whether one exposure to a stimulus of varying arousal and valence would influence a later exposure and subsequent consumer behaviour. The present findings suggest, at least in the case of arousal, that repeated exposure to high arousal advertisements may be critical for encouraging positive consumer response.

By contrast, the present study could not identify any direct relationships between valence and the outcome variables. This is consistent with the findings from several studies examining recall (Pavelchak, Antil & Munch 1988; Pham 1992), however here we observe this effect extending to brand choice also. It is however, plausible that the portrayal of valence, specifically negative, in the test advertisements was designed not to be overtly off-putting to viewers, given the commercial nature of the advertisements. Thus, future research examining these relationships outside of the context of promotional activity would be useful to qualify the notion raised by the present findings, as well as past findings (Mirandola & Toffalini 2016; Sutherland & Mather 2017), namely that arousal acts as a better determinant of consumer responses than valence.

A notable effect seen across both single and repeated exposures, as well as on all outcome variables, was brand use. In several previous studies, brand use has been shown to be a strong

predictor of future consumer behaviour, including brand perception (Nicholls et al. 2003) and recall (Neubert 2018; Romaniuk & Wight 2009). Thus, it was not surprising to see such a robust effect of brand use on brand recall, though the strength of its effect on brand choice could not be anticipated. Hence, the present results echo previous suggestions that brand use is strong predictive factor for prospective behaviour, both preferential-based and memory-based. In addition, the effect of repetition on brand use was greater for memory-based measures, whereas the likelihood of brand choice was greatest at one exposure.

At one exposure, a valence-by-brand use interaction on brand choice was observed. For light and heavy buyers of a brand, consumer responses are enhanced for negatively-valenced advertising. This is largely consistent with the results from the valence literature which demonstrate that positive emotions can decrease attention to advertising (Lim et al. 2018). The present findings expand upon these results to suggest that, specifically for light and heavy brand users, positive emotions appear to decrease the likelihood of brand choice.

Also at one exposure were the separate interactions between arousal and brand use on brand choice and unprompted brand recall. It was revealed that brand users are more likely to purchase and recall an advertised brand if it reflects higher arousal emotional themes than low arousal ones. However, the strength of this effect was seen to decrease with increasing brand use, signalling that light brand users responding to high arousal advertising were most likely to purchase the advertised brand. Given that light users are said to account for a majority of a brand's audience, this finding suggests that high arousal emotions may be more useful than low arousal for encouraging purchases amongst brand users.

In contrast to the effects on brand recall at one exposure, repeated exposures saw brand users responding negatively to high arousal advertisements in terms of memory: reducing the likelihood of brand recall either with or without prompting. One explanation for this is wear-out effect (Pechmann & Stewart 1988), wherein repeated presentations of an object can dull subject's responses to a stimulus (Schmidt & Eisend 2015). Particularly for existing brand-users, of whom have already seen the brand previously at least once, it could be the case that multiple exposures to high arousal advertising may have negatively affected brand response. It would be interesting to explore whether these wear-out effects occur following three, four or five exposures, as well as whether this differs across variations of arousal and valence.

An interaction between arousal and age on brand choice and unprompted brand recall provides additional insight into the role of emotion in influencing consumer responses. Specifically, it was shown that for advertising high in arousal, age was associated with a decrease likelihood of brand selection and recall. These observations, coupled with previous findings of negative effects of increasing arousal on age and recall (van der Goot et al. 2015), suggests a dissociation in consumers responses to arousal based on age. Consequently, advertisers wishing to stimulate brand-preference or memory in younger or older demographics may consider their use of arousing elements and themes within promotional materials in order to achieve the greatest impact.

4.9. CONCLUSION

This study offers novel insight into the effects of arousal and valence on consumer responses to advertising, as well as regarding a proposed emotion-attention association. Relative to

valence, arousal exerted the greatest impact on consumer responses, however, the direction of this initial effect (negative) changed to positive following repeated exposures. The results also provide support, albeit weak, for an emotion-attention connection, revealing a significant interaction between low attention (eyes near-screen) and positive valence on brand choice and recall, a finding consistent with the 'broaden-and-build' hypothesis. Additionally, variables such as brand choice, age and gender also exhibited significant interactions with arousal and valence on the outcome variables.

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CHAPTER 5. CONCLUSIONS

Substantial theoretical and managerial implications have arisen from this research, as it expanded and extended existing marketing literature concerning consumer attention and its relationship with consumer behaviour. Despite the extensive clinical research on attention, the prior literature has focused solely on instances where the level of attention is high, and intentionally directed to a marketing stimulus, and ignored the role of incidental or ‘low attention’ exposures in creating advertising impact. This research has thus pioneered a conceptual understanding which enables the empirical testing of the impacts of two forms of visual attention – high and low attention – on brand choice and recall responses. In particular, this study has considered the potential interaction effects between attention, demographic factors, and other contextual factors.

Three papers have been prepared for publication and were presented above as the basis of this research. Each paper was designed to provide a thorough examination of the perceptual and behavioural characteristics of high and low attention across advertising contexts. A combined conceptual/empirical paper provided the foundation upon which two subsequent empirical papers generated new insights. Flowing from the theoretical contributions of the research as presented above, this final conclusion chapter will discuss the managerial implications and then conclude with a brief discussion of the limitations of the research and some suggestions for future research directions.

5.1. THEORETICAL IMPLICATIONS

Although some empirical discussions have been around since the 19th century, our understanding of human attention and its relationship to consumer behaviour has developed

rapidly in the last twenty years, aided by advancements made in neurophysiological measurement techniques.

Such techniques have enabled greater insight into both overt and especially covert attentive behaviours, which were previously undetectable when relying on methods of attention measurement that depended upon inferred attention using explicit memory performance (Heath & Feldwick, 2008). However, existing research has mainly focused on selective attention, with only select studies exploring incidental or low attention (Jensen & Jepsen, 2007; Santoso et al., 2020; Sauerland et al., 2012; Shapiro et al., 1997). As such, conceptual development and empirical testing of an integrated model of consumer attention has been largely neglected.

In this research, the term attention (specifically visual) referred to a host of physio-cognitive processes through which a stimulus is perceived, its contents processed and evaluated for meaning, and action elicited. This interpretation has been drawn from an earlier definition of attention suggested by William James (1890) but is supported by contemporary findings (Rosenholtz, 2020; Chandon, 2002; Eriksen & St. James, 1986). This thesis has therefore generated a conceptual and empirical understanding of attention in the context of digital advertising, and has investigated the behavioural impacts of different levels of viewing attention, and thus it has made a significant contribution to the existing literature in this field.

Accordingly, this research has utilised Heath's integrated model of high/low attention, and provided an empirical test of consumer attention across digital contexts. Based on Heath's (2001) assertion that high and low attention serve unique purposes for advertising appraisal, this thesis has explored the notion that high attention is a powerful aid for top-of-mind brand awareness, while low attention positively affects subconscious preference. This 'high/low' perspective of consumer attention can only be gleaned by adopting a dyadic rather than

hierarchical approach to information processing, and this was adopted in this thesis. Taking this dyadic view of consumer attention enables us to understand the quantitative differences (in terms of brand choice and recall) between qualitatively different forms of advertising perception.

Specifically, this research has conceptualised the role of viewing attention across several real digital media platforms, akin to how audiences naturally encounter advertising, and thus makes an early contribution to this field of study.

5.2. MANAGERIAL IMPLICATIONS

These research findings have generated insight into a number of managerial implications regarding the role of visual attention as a tool by which to value advertising exposure. Specifically, the present research suggests that visual attention in two forms - high and low - in many cases retains or even exceeds the relative predictive strength of variables such as age and gender on brand consumer responses. Though unlike such variables, measuring visual attention provides greater analytical depth as it enables us to understand the relationship between positioning of attention on the screen and resulting responses through operationalising high attention as majority attention on screen (75% or more) and low attention as majority off-screen (0-75%).

Although both forms of attention predicted consumer responses, specific differences provided unique insights into their respective value for advertisers. For instance, more attention on-screen produced more durable explicit brand recall than at low attention, a finding observed across research contexts. By comparison, high levels of attention were not necessarily required to affect viewers' preferences, rather positive effects were observed even at low attention.

Yet not all attention is created equal; a notion observed in the relative rarity of high attention compared to low attention in the present results. Despite its greater predictive power relative to low attention for consumer responses, especially recall, high attention was recognised to be a particularly resource-heavy viewing mode. By contrast, the majority of time spent viewing advertisements was done so in a state of low attention, which saw comparable, if slightly reduced, effects on brand choice, but more surprisingly, robust positive effects on memory. This finding is promising as it suggests that while high attention is most valuable, there is considerable value in low attention audiences also.

A significant recommendation stemming from this proposition is the need for marketing strategies to consider more prominently the role of low attention viewership in affecting brand responses, particularly across repeated exposures. Alongside observing strengthening associations between low attention and recall (prompted and unprompted) following two exposures to advertising, a notable finding was the emergence of a significant relationship between low attention and choice at two exposures. Furthermore, it was also interesting to note the disappearance of a previously significant relationship between high attention and choice following two exposures.

Hence, these findings suggest that, at least for preference-based decisions, repetition is certainly beneficial for low attention modes of viewing. Furthermore, the observation of specific interactions between low attention and advertisement valence (i.e., the degree of perceived pleasantness) as well as factors such as brand use, position low attention as a unique and powerful determinant of consumer behaviour. From a creative standpoint, advertisers may recognise these findings by tailoring advertising to low attention viewing styles, for instance by utilising positive and easy to understand themes and messages, supported by repetition.

5.3. LIMITATIONS AND FUTURE RESEARCH

The significant contribution this research has made to theory and practice has been discussed in depth. However, there are some limitations to the study that must be considered.

This research has been the first to empirically expand on Heath's (2001) Low Attention Processing Model, by examining the impact of two forms of attention-high and low-on consumer preference and memory decisions. Although steps were taken to maximise the generalisability of these findings, through utilising several digital platforms and displaying real commercials, future research is required to elaborate on the role of high and low attention on consumer responses across a more diverse range of contexts, including device type, ad creative, or even factors such as the influence of physical characteristics of the audience's environment such as lighting and positioning.

Furthermore, such future research may benefit greatly from a close integration with emerging research technologies. While in the present research, the percentage of 'eyes on screen' per second formed the basis for our attention variable, new and ever-developing attention tracking processes highlight the advancing potential for attention-based measurement (Mormann et al., 2020). In regard to the focus of this thesis, future researchers could look more deeply at the relative composition of high and low attention across an ad view and how this divide contributes to preference or memory formation.

Indeed, any future research could also benefit from advances in mobile technology, thereby making it easier for researchers to access large-scale samples at reduced costs. A key component of the present research was the use of in-built cameras in mobile devices. Given the high resolution of such cameras, they are capable of recording participants' visual data within a few meters, meaning that such processes can occur in the background while

participants use the test platform. Additionally, due to the common use of such devices across the world, researchers could easily leverage international research samples, across industry and demographics. Consequently, the use and provision of such technologies, especially when conducting international research, is relatively cost-sensitive when compared to traditional laboratory-based eye-tracking research (Papoutsaki, 2015; Papoutsaki, Laskey, & Huang, 2017). Thus, the use of naturalistic eye-tracking in attention research need not be limited by cost or physical location, extending greater generalisability with fewer limitations to researchers and practitioners alike.

While this research has opened up several areas for future research, continuing attention should be devoted to the importance of naturalistic exposure in advertising measurement. Naturalistic exposure is critical for the observation of natural attention, which means it is necessary when drawing comparisons to real-world consumer behaviour. Hence, future work regarding the application of visual attention data to marketing outcomes should endeavour to minimise the number of unnatural elements in the testing process.

Thus, a notable empirical limitation of this thesis is highlighted. To answer the research questions, it was necessary to observe the impact of natural attention, free from outside influence, on consumers' brand responses. While this enabled a unique view into real-world consumer behaviour, it also impacted factors such as exposure durations, positioning from the screen, and situational interference, introducing testing variability. While this may have reduced the present researcher's ability to deduce cause-and-effect relationships, such a study design has improved the generalisability of its findings by reducing the discrepancy between testing conditions and real-world exposure conditions, where such factors mentioned earlier cannot be controlled for. Therefore, empirical research on naturalistic settings is necessary to further our understandings of the role of visual attention on consumer behaviour.

Another limitation of this study resulted from the empirical component of the theory being limited to preference (subconscious) and explicit recall (conscious), as these metrics are the ones commonly utilised by advertising practitioners. However, there are other measures of advertising performance, such as implicit recall that could be studied (Lee, 2002). Although brand choice may be considered a measure of subconscious preference (Zajonc, 1980), it would be worthwhile to also consider measures of implicit memory in future research, particularly following recent studies showing significant associations between low attention and implicit memory. Therefore, empirical research on other outcome measures of advertising effectiveness is necessary to investigate in depth, the role of low attention on implicit memory.

Although the conceptualisation of attention utilised in this thesis is consistent with prior research, and thus had been previously validated, these concepts had to be adapted to suit the context of this study, in particular relating to the measurement of ‘high’ and ‘low’ attention. For example, in Heath (2001), high and low attention are discussed primarily in terms of top-down and bottom-up visual influences, with the former being wilful and deliberate in the pursuit of a processing goal or motivation, and the latter being reactive to stimuli in the immediate environment. Defining attention by the nature of orienting stimuli became problematic when attempting to define a per-second measure of attention, particularly in the case of fluctuating attention to a static image.

Following recent studies (Holler, Schrammel, Tscheligi, & Paletta, 2009; Tamber-Rosenau & Marois, 2017), the present methodology operationalised high and low attention in terms of the proportion of the screen viewed by participants, each second. To this end, while high attention reflects selective attention, where attention is focal and exclusive to the screen, low attention instead reflects a form of peripheral, non-central attention, where advertising stimuli are visually processed in parallel with external stimuli.

5.4. SUMMARY

This research empirically investigated the relationship between consumer response and graded audience attention. Specifically, the research drew upon high/low attention theory, and developed and tested a conceptual framework which examined the conditions of focal attention and peripheral attention to advertising stimuli.

This framework explains how changes to an audience's visual focus may affect brand preference and memory decisions, as well as how specific creative content can moderate these relationships. Further, this research has been the first to consider the role of repetition in the context of naturalistic advertising exposure. Thus, this perspective helps to elucidate the potential differences in consumer perception and decision-making across single and repeated exposures to advertising, revealing a number of interesting findings. In addition, this research has examined advertising appraisal from the perspective of emotions, using the circumplex model of affect to measure the impacts of an advertisements' arousal and valence on brand choice and recall.

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