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Shopper Eye-Cue: Understating the In-Store Decision Process With Field Eye-Tracking Data

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In the first part of the paper we focus on unplanned purchases and show that visual attention and product engagement are associated with purchase conversion in a complex way. In the second part, we explore “failed engagements” in the category and examine the role of price saliency and deliberation duration.

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The Eyes Have It: New Insights From Tracking Attention Patterns in Consumer Research

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Paper #1: Consumer Attention and Behavior: Insights from Eye-Tracking and Directions for Future Research

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Paper #2: Coordination of Attention: Eye Fixations, Pupil Diameter, and Head Distance, Respond to Goals and Predict Memory

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Paper #3: Shopper Eye-Cue: Understating the In-Store Decision Process with Field Eye-Tracking Data

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Paper #4: Media Multitasking and Visual Attention: Switch Triggers in Context and Content

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SESSION OVERVIEW

A large portion of what informs our behaviors is perceived through our eyes; in fact, visual perception is such an important and complex activity that about 50% of the brain is involved with it (Bear, Connors, and Paradiso 2007). Research has demonstrated that overt attention can predict higher-order processes such as choice (e.g., Liversedge and Findlay 2000). More importantly, studying visual attention offers a detailed and unbiased measure of the consumer decision and its underlying process and often outperforms self-reported measures (Chandon et al. 2009). Surprisingly, there are few papers in marketing that use attention measures. The proposed session aims to bridge this gap by bringing together four papers that provide new insights into the role of attention in consumer behavior.

In the opening paper, **Mormann** draws on insights from several fields (neuroscience, psychology, marketing, etc.) to develop a comprehensive framework for studying visual attention in consumer research. Furthermore, the author provides valuable guidelines for using eye-tracking and discusses the unique insights that this methodology can bring to consumer researchers.

Next, **Pieters and Wedel** examine the predictive power of head position, eye fixation, and pupil size on memory. A particularly interesting finding of this paper reveals that participants had better implicit memory of the ads they saw earlier in the session when their head was positioned closer to the pictorial and farther from the text information, regardless of their viewing goals.

In a field study, **Kovacheva and Inman** examine the effect of visual attention and engagement with the category on in-store decision making and suggest several moderators. The authors also explore “failed engagements” – incidents in which the shopper actually picked up a product but eventually returned it to the shelf – and find support for their predictions that price considerations and consideration duration influence these returns.

Finally, **Brasel and Gips** explore a very relevant topic – media multitasking behaviors. They identify the individual, contextual, and stimuli-related factors that prompt switching from one media environment to another. Interestingly, they report that participants’ recollections of switching behaviors were far off from their actual behaviors, thus emphasizing the importance of using objective measures of visual attention.

Overall, the papers in this session provide new insights into the role of visual attention in consumer behavior and highlight the advantages of using unobtrusive observation to obtain process measures of consumer attitudes and actions. Using diverse methods (lab experiments and field studies) and drawing on insights from different fields (neuroscience, marketing, cognitive psychology), these papers collectively aim to answer the question: How does visual attention influence and predict downstream processes such as choice, consumption, and memory? We expect that this session will appeal to a broad audience of researchers interested in visual attention, advertising, media content consumption, and consumer decision making.

Consumer Attention and Behavior: Insights from Eye-Tracking and Directions for Future Research

EXTENDED ABSTRACT

Everyone involved with marketing appreciates the importance of gaining consumers’ attention (Bettman 1979; Lynch and Srull, 1982; Pieters and Wedel, 2004). In his seminal work, Bettman (1979) dedicated an entire chapter to attention and perception processes and recognized that “the particular information attended to and perceived can have a great impact on choice”. He further remarked that “attention and perceptual processes have important linkages to other components in (consumer choice) theory”, such as motivation, information search, memory, decision processes, and so on. Similarly, Lynch and Srull (1982) recognized that attention often affects decision outcomes by modifying the inputs that are considered. Yet, research on consumer attention is relatively scarce. Rosbergen, Pieters, and Wedel (1997; Pieters and Wedel 2004) recognized this gap in the literature and pioneered some early work on attention. Little research, however, has followed since (see Janiszewski, Kuo and Tavassoli 2013; Atalay, Bodur and Rasolofarison 2012; Milosavljevic, Navalpakkam, Koch and Rangel 2012; Chandon, Hutchinson, Bradlow and Young 2009).

It has been suggested that the main impediments to research on attention stem from methodological challenges. Lynch and Srull (1982) recognized this lack of appropriate measurement and suggested that “[w]hen researchers introduce an equal degree of methodological sophistication to their empirical investigations [as they do to their theories], a rapid increase in the scope and depth of our understanding should result.” They looked for the required “methodological sophistication” in the field of cognitive psychology. In the current review, the range of useful methodologies is further broadened to include those found in vision science. Specifically, I will here focus on eye-tracking as a critical and sophisticated methodology that allows consumer behavior researchers to fulfill the promise of Bettman’s early research on attention and its effects on consumer behavior.

The current conceptual paper (1) develops a formal framework of attention and proposes future areas of research related to consumer attention and other downstream marketing processes, such as learning, memory, emotions, judgment and decision making, and (2) discusses eye-tracking as a solution to the previously identified measurement problem (Russo 1978; 2011; Payne and Venkatraman 2011) and explicate guidelines for the effective use of eye-tracking in academic consumer research.

The current framework of attention draws on a recent comprehensive review of attention found in the cognitive neuroscience lit-

erature (Knudsen 2007). Consumer attention has three fundamental components: (1) bottom-up attention, (2) top-down attention, and (3) competitive selection. First, bottom-up attention, or preattention, refers to the brain's automatic selection of the most important information that we are exposed to. This selection is based on the simple features of the environment: color, luminance, orientation, size, shape, motion. Second, top-down attention, also known as goal-driven selection, depends on the goals, expectations, and intentions of the observer. Thus, looking for a can of (classic) Coke will enhance the processing of red areas in our visual input by increasing the neuronal sensitivity for that particular color. The information that is relevant for goal attainment will be attended to more than irrelevant information. For example, when we are thirsty we pay more attention to drinks than other items (Aarts, Dijksterhuis and de Vries 2001). Finally, competitive selection refers to moving from the initial preattentive processing to focused, attentive processing. Visual selection is spatially organized, i.e., attention is allocated to a particular location in space. Once an item has been selected, top-down control determines whether to further process or not that particular information.

Building on this framework I will discuss a number of specific open questions related to consumer attention, including: which bottom-up visual features attract attention, how these features interact with top-down goal related information, and how bottom-up and top-down features interact with downstream consumer processes such as motivation, learning, memory, emotions, judgment and decision making. Specific topics for future research will be proposed for each of these categories.

In addition, drawing on 10 years of research on attention in an interdisciplinary setting (marketing, psychology, economics, vision science and cognitive neuroscience) I will develop recommendations how to effectively use eye-tracking for the study of consumer attention, answering, among others, the following questions: What are different eye-tracker options? How to design eye-tracking experiments? What is the appropriate sample size? How to obtain clean and useful data? What are the key dependent variables? How can we relate attention to other constructs of interest?

Coordination of Attention: Eye Fixations, Pupil Diameter, and Head Distance, Respond to Goals and Predict Memory

EXTENDED ABSTRACT

The visual attention system developed to protect people from being overloaded by the massive stimulation in the environment, to select stimuli from this environment that are relevant to goal pursuit, and to coordinate attention to these stimuli for successful goal completion. These functions are of even more crucial importance in today's overstimulated marketing environments. This research proposes and provides an initial test of a model of attention coordination, which focuses on the role of three key observable parameters of the visual attention system: head position, eye fixations, and pupil diameter. Prior attention research in marketing and cognitive psychology has emphasized eye fixations during exposure to stimuli such as advertising or brand packaging. Early research in marketing on the role of the pupil diameter during ad exposure had inflated and perhaps biased claims and has not yet been replicated. No research to date has examined the role of the head position during ad exposure, despite the fact that the head position is under conscious control and calibrated during goal pursuit to have optimal viewing position. The present research is the first to examine the relationships between and

coordination of these three observable parameters of the visual attention system during ad exposure: eye, pupil, and head.

Two experiments are reported in which task goals were systematically varied, eye fixations, pupil dilation and the distance between the head and the stimulus were recorded, and advertising memory was subsequently measured.

A multi-level mixed response structural equation model was estimated to examine the relationships between the attention and memory measures, and their response to the task goals. The model makes it possible to disentangle relationships between the attention measures at the participant-level, due to person and goal characteristics, and relationships between the measures at the ad-levels, due to specific ad features.

Experiment 1 is a re-analysis of prior work with new measures and models. In the experiment, 220 participants saw display ads under one of five different task goal conditions, namely free viewing, brand learning, brand evaluation, ad memory, and ad attractiveness. After exposure, implicit memory was assessed with a brand identification task. Experiment 2 is new. In it, 203 participants saw display ads under one of two different task goal conditions, namely ad informativeness and ad attractiveness. After exposure, both implicit and explicit memory was assessed.

Random-ANOVA models show that, as expected, most of the variation in eye fixations is between ads. This reflects that the pictorial (intra-class coefficient ρ , respectively, .330 in experiment 1, and .228 in experiment 2) and text (ρ is, respectively, .311 and .219) in some ads receive much more fixations than others, independent of individual and task differences between participants. In contrast, most of the variation in head distance to the pictorial and text (ρ , respectively .792 and .584 in experiment 1 and .798 and .577 in experiment 3) is between participants. Also, variation in pupil diameter is predominantly at the participant level rather than the ad level (in all cases, ρ is greater than .880). This shows that in our experiments, the pupil varies only to a small extent between ads but varies mostly between participants. How goals specifically affect the attention measures, and whether the differences between ads predict down-stream communication effects was examined next.

Model estimations reveal that task goals have modest but reliable effects on the attention measures. Relative to the free viewing condition, the other task goals activate participants in experiment 1 to move the head a little closer to the ad, about one centimeter. In study 2, the informativeness goal activates participants to move the head a little closer as well. These effects are independent of the influence of task goals on eye fixations. All goals in experiment 1, and the informativeness goal in experiment 2 lead to more fixations of the text and on the picture of the ads. Pupil diameter responds less systematically to the task goals. Although no reliable task goal effect on pupil diameter was observed in experiment 1, a reliable effect was observed in experiment 2, probably due to the greater statistical power in the latter experiment. Importantly, there were reliable effects of the attention measures on implicit and explicit memory, independent of the direct goal effects. Specifically, a larger head distance to the text and a shorter head distance to the pictorial, larger fixation frequencies on the pictorial, and independent of these effects, a smaller pupil diameter all predicted better implicit memory in both experiments. Also, higher fixation frequencies and smaller pupil diameters predicted better explicit memory, even while controlling for task goals and the false alarm rate.

These findings are the first to show how three observable parameters of the visual attention system vary systematically between consumers and between ads, how they are contingent on task goals, and predictive of memory. They reveal that "attention coordination

takes place in the head” but in quite unexpected ways. A small but reliable movement of the head of about one centimeter and an even smaller change of less than a millimeter in the pupil diameter predicted better memory. The findings were obtained across a combined sample of over 400 participants and multiple ads from different categories.

Shopper Eye-Cue: Understating the In-Store Decision Process with Field Eye-Tracking Data

EXTENDED ABSTRACT

Recent research has found that the majority of grocery purchase decisions are made in the store (e.g., Inman, Winer, and Ferraro 2009). Yet, our knowledge about in-store decisions is mostly inferred from consumers’ self-reports and the products listed on their receipt (but see Hui et al. 2013; Stilley, Inman, and Wakefield 2010; Hoyer 1984). We still know little about the consideration process that happens between the start and the end of the shopping trip. This paper addresses this gap by exploring the role of visual attention and engagement in in-store decisions.

Research has shown that visually attending to a stimuli increases the probability of choosing that stimuli (Janiszewski, Kuo, and Tavassoli 2013; Pieters and Warlop 1999). Drawing on the literature on choice overload (Iyengar and Lepper, 2000) and visual clutter in ads (Pieters, Wedel, and Batra 2010), we propose that perceived assortment size in the store will moderate this effect such that greater perceived variety coupled with a greater number of fixations will be associated with a lower number of unplanned purchases since it will be more difficult to make a choice as the number of considered alternatives increases. Furthermore, physically touching a product has been related to unplanned purchase conversion (Hui et al. 2013). We aim to extend this finding by suggesting that shopping enjoyment will strengthen this effect since consumers who construe shopping as fun will be more receptive to in-store stimuli. Previous research has demonstrated that, as the shopper’s mental budget for the trip depletes, the number of unplanned purchases decreases as well (Stilley et al. 2010). We expect that this mechanism will hold even at the category level and suggest that the higher number planned purchases (which deplete shopper’s mental account) will crowd out unplanned purchases.

To test these predictions, we analyzed a dataset containing the trips of 158 US shoppers who wore eye-tracking glasses while shopping. The field study was completed in 2012 by the Point of Purchase Advertising International (POPAI). The dataset consists of number and type of purchases (unplanned, planned, planned not purchased) for each shopper for each category considered (1034 data points), number of informational fixations (i.e. fixations related to orientation or reviewing the label), fixations on the price tag, product touches (i.e. touches to examine the product as well as to return it to the shelf), and several self-reported measures about shopper, trip and store characteristics (e.g., money pressure, perceived store variety, etc.)

Due to the nested structure of the data, we conducted a hierarchical model with number of unplanned purchases as the DV and shopper as the grouping factor. We find that shoppers who allocated more visual attention to the category had a greater number of unplanned purchases ($\beta=.01$, $p<.001$). More importantly, this effect is moderated by perceived product assortment – in stores rated as offering a greater abundance of products, the higher number of fixations is associated with fewer unplanned purchases ($\beta=-.01$, $p<.001$). This suggests that during the orientation stage, abundance of choice may cause confusion and deter choice. As expected, product engage-

ment (i.e. number of touches) is associated with higher incidence of unplanned purchases ($\beta=.11$, $p<.001$) and this effect is further enhanced for shoppers who report higher enjoyment from shopping ($\beta=.02$, $p=.01$). Interestingly, we find a significant positive interaction between perceived assortment size and product touches ($\beta=.04$, $p<.001$) such that product touches have a stronger effect on purchase conversion when the store was perceived as carrying a wide selection of products. We speculate that, once the shopper has oriented herself and identified a need, assortment variety helps seal the deal by ensuring preference match. Finally, we find that the number of planned purchases in the category decreases the number of unplanned purchases ($\beta= -.33$, $p<.001$).

In the second part of our paper, we focus on an in-store decision making process that can only be studied by observing the shopping trip through the eyes of the shopper – failed product engagements (i.e. instances when the shopper changed her mind and returned a product to the shelf). There were 334 occurrences of failed engagement in our field data ($M=2.30$, $SD=2.04$, ranging from 1 to 13). The two categories with the highest incidence were fresh produce and refrigerated meat and seafood, suggesting that at least some of these rejected considerations may be driven by freshness concerns.

In order to explore what factors predict these returns, we ran a hierarchical model with number of returns per category as the DV and shopper as the grouping variable. We explored the effect of two main groups of factors – price salience and time resources allocated to making a decision. We hypothesized that attention to price and longer deliberation will result in more returns since they imply that the shopper processed the decision in more depth. Consistent with our predictions, we find that the number of price fixations is positively related to the number of returns ($\beta=.16$, $p<.001$). Furthermore, shoppers who indicated they are under greater money pressure (i.e. chronic price salience) were more likely to change their minds ($\beta=.18$, $p=.05$). These effects were qualified by a significant interaction such that shoppers who were chronically pressed for money and paid more attention to the price tags had more returns ($\beta=.07$, $p=.01$). Further, we find that the total number of fixations (a proxy for deliberation time) is positively associated with failed engagements ($\beta=.01$, $p<.001$). Finally, the number of purchased products (also related to time spent in the category) is positively associated with the number of returns ($\beta= .13$, $p=.03$).

In conclusion, our research provides unique insight into the in-store decision making process using field data. We show that visual attention and product engagement are associated with purchase conversion in a complex way – abundance of choice can decrease the positive effect of fixations during the orientation phase but enhance it during the purchase selection phase. Furthermore, we find that price saliency and time deliberation increase the number of times the shopper “changes her mind” and returns a product to the shelf.

Media Multitasking and Visual Attention: Switch Triggers in Context and Content

EXTENDED ABSTRACT

Media multitasking is fast becoming the modal form of entertainment media consumption for consumers. In Nielsen data released in 2010, 59% of respondents reported using the television and internet simultaneously, with an estimated 34% of their internet usage occurring concurrently with television. Yet there remains calls in the literature for foundational experimental work in the area (McDonald and Meng 2009, as well as observational work using natural stimuli (Jackel & Wollscheid 2007). The current research argues that before

we can begin to build models of why consumers engage in media multitasking and how multitasking affects traditional marketing outcome variables, we must first establish *what* exactly media multitasking behavior looks like. Two studies using video observation and direct eye-tracking identify multitasking attentional patterns and begin to outline a basic framework of how context and content can modify multitasking behavior.

Unfortunately, self-report measures are ill-suited to explore this issue. Media consumption is habitual with little self-awareness (Saling & Philips 2007), and routinized mental scripts guide media selection and attention (Adams 2000). Prior work has also explored 'attentional inertia' within media (Anderson, Choi & Lorch 2007), and consumers have little real-time insight into their media consumption behavior. Applied multitasking research from educational fields is of limited use in entertainment environments, as it largely focuses on switching costs and performance degradation in splitting attention between two goal-driven tasks. In addition, people overestimate their ability to multitask, as self-reported good multitaskers are less able to focus and more easily distracted by irrelevant stimuli (Ophir, Nass & Wagner 2009). This suggests that our lay theories of multitasking behavior has little relation to our actual behavior, and there remains a strong need to establish basic patterns of multitasking activity.

In the first study, 42 participants were brought into the lab, seated in front of a laptop and television with remote, and told they had 30 minutes to use both however they wanted. Their behavior was recorded using high-definition video cameras that captured whether their point-of-gaze was on the laptop monitor or television. This attentional record was then matched frame-by-frame with the content on both screens to explore how different forms of content may encourage or discourage switching. After the 30 minutes were completed, they were asked to fill out a self-report survey of their multitasking behavior.

Results show that the average gaze duration between switches was quite low, with roughly 50% of gazes lasting less than 1.5 seconds on the television and less than 5 seconds on the computer. Indeed, participants switched an average of 120 times, or over 4 switches a minute, while they only recalled 15 switches in their post-hoc survey, and post-hoc descriptions of the strategies they used to multitask had no relationship with what the video data revealed. Interestingly, switching patterns appeared no different for television or commercial content. Instead, there was evidence of a strong 'switch trigger' effect for break points either from show to commercial or vice versa, with switching rates dropping quickly after 5 seconds. This effect also occurs on the computer, with far more switches occurring within 5 seconds of a new webpage versus afterwards. The increased switching at breakpoints was also not directionally agnostic, with a strong bias towards switching to the computer from the TV regardless of whether the break point was show-to-commercial or commercial-to-show.

A second study used eye-tracker analysis to explore multitasking behavior in more detail. A single computer was used where a television show (*The Life of Birds*) was displayed on the left side of the widescreen monitor while a series of interactive spring break travel webpages were displayed on the right. Assistants coded the TV video at 30 frames per second on over 100 content variables, such as "human figure present," "movement from left to right," "camera movement," and so on. An ASL eye-tracker system recorded point-of-gaze and fixation data that could then be mapped to the stimuli. Three conditions were run across 60 participants; a multitasking condition where both the TV and web content were available, and two monotasking conditions where only the TV or web content were available.

Results show that motion in the non-attended medium encourages switching towards the media, but does not discourage switching away when the motion is taking place in the current media. TV audio was ineffectual in generating switching towards the TV, but dialogue exhibited attentional capture and discouraged switching away from the television media. Similar to the first study, natural breaks in the media guided switching; when participants clicked to load the next webpage, their eyes moved to the TV content, and remained there until the next scene change gave them freedom to move back. And compared to the monotasking conditions, simultaneous media presentation not only generated split attention, it also led to shorter fixations and increased saccadic movement within each media. Interestingly, followup analysis using Fast Fourier Transformations did not find evidence of an internal driver of switching, suggesting that switching behavior is largely in response to external media trigger rather than any internal pressure or "need to switch."

In conclusion, this work establishes a ground-level picture of media multitasking behavior through video observation and eye-tracking analysis in a controlled laboratory environment. Switching was shockingly frequent and constant, with natural breaks in the media generating large amounts of switching behavior. Switch triggers such as motion and audio cues showed differing effects in their ability to generate switches towards media versus discourage switching away from media, and media multitasking generated increased visual movement within a media in addition to attentional shifts between media. Across both studies, objective recorded behavior shared little in common with participants' post-hoc behavioral recall, suggesting that further work must maintain direct observational techniques, and traditional survey and self-report measures may be ill-suited for multitasking research.

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