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Vision (im)possible? The effects of in-store signage on customers' visual attention

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Abstract

We used two eye-tracking field experiments to investigate the extent to which in-store signage is used during navigation and decision making, and how the viewing of signage influences customers' visual attention and choice behavior. One hundred and seventy-five customers at a grocery store were exposed to signage stimuli while carrying out predefined shopping tasks. Experiment 1 shows that attention toward signage is affected by customers' levels of store familiarity and in-store search stage (navigation vs. decision making). Experiment 2 demonstrates that signage has a considerable impact on the direction and magnitude of customers' visual attention during decision making.

Keywords: in-store signage, eye tracking, visual attention, store familiarity, perceptual priming, field experiment.

Article classification: Research paper.

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1. Introduction

In-store signage is a competitive marketing tool that is crucial for forming customers' initial impressions of the retail environment (Bitner, 1992). Each year, retailers spend millions of dollars on distributing and monitoring such in-store material (Kiran et al., 2012). Customers often interpret displayed products as "good deals," which results in more unplanned purchases and increased average spending (Chevalier, 1975; McKinnon et al., 1981; Woodside & Waddle, 1975). Chevalier (1975) found that in-store displays with price reductions led to unit sales that were as much as 2345 percent of regular weekly unit sales. As this and numerous other examples show, exposure to in-store signage has a significant impact on customers' decision-making and purchase behavior.

Signage stimuli also facilitate navigation (Hölscher et al., 2006, O'Neill, 1991; Passini, 1984; Peponis et al. 1990; Titus & Everett, 1995; Weisman, 1981). Sorensen (2009) found that 80 percent of shoppers' in-store time is spent navigating and the remaining 20 percent is spent deciding which items to purchase; on this basis, it is likely that customers will be exposed to, and influenced by, signage material during both the navigation and decision-making stages of the in-store search process.

Most of the previous research on in-store signage has focused on sales (Chevalier, 1975; McKinnon et al., 1981; Patton, 1981; Woodside & Waddle, 1975), field observations (Yim et al., 2010, Study 1), recall (Bennett, 1998; Russell, 2009; Yim et al., 2010, Study 2), and qualitative approaches, including self-reported perception (Bava et al., 2009; Müller et al., 2009; Newman et al., 2010). An important limitation in studies based on sales, field observations, or self-reporting is the absence of explicit measures of customers' visual attention toward the signage material. As a result, it is not possible to conclude in a non-implicit or non-subjective manner that the signage stimuli have really been looked at and have actually influenced the customer. Measures such as sales only comprise data regarding

an outcome, not the process that precedes the outcome (such as how in-store signage influences visual attention and how this is reflected in subsequent choice and purchase behavior). In some respects, self-reported perception and recall measures contain information about what *might* have been looked at, but this information is typically obtained *after* the actual search process has taken place.

The present study intends to provide less subjective and more detailed measures of visual attention *during*, rather than after, the in-store search process. To the best of our knowledge, this is the first field study to explicitly investigate how in-store signage influences customers' visual attention and the process that precedes actual choice behavior. Given that vision is a necessary condition for selecting and purchasing a product (Otterbring et al., 2013; Wästlund et al., 2013), we argue that more knowledge is required about the entire search process, not just the outcome of the shopping trip, in terms of choices or purchases (cf. Liu et al., 2008). This is particularly important since a key focus of shopper marketing is to influence customers throughout the entire shopping cycle (Shankar, 2011), which includes both navigation and decision-making.

The present study has two main aims. Experiment 1 examines the extent to which signage stimuli are used during the in-store search process (during navigation and decision making) and explores whether this depends on customers' levels of store familiarity. Experiment 2 focuses on the decision-making stage of the search process and investigates whether exposure to in-store signage material influences customers' visual attention and choice behavior. We define in-store signage as all signs and displays that are located in a store with the purpose of conveying textual and/or pictorial information to customers about products or services.

2. Theory and Hypotheses Development

2.1. *Visual Attention Toward In-Store Signage During Navigation and Decision-Making*

Previous research has suggested that familiarity with the shopping environment is an important factor when investigating the extent to which customers use visual in-store cues, such as signage stimuli, during navigation and decision-making. Store-familiar customers (that is, customers who are used to visiting a particular store during grocery shopping) are better at correctly identifying their location in the shopping environment (Dogu & Erkip, 2000; Titus & Everett, 1996), which means that their in-store navigation should be less cognitively demanding than that of store-unfamiliar customers (Inman et al., 2009; Park et al., 1989). This reasoning is supported by theories on processing fluency (“the subjective experience of ease with which people process information;” Alter & Oppenheimer, 2009, p. 219), which show that familiar stimuli are processed more fluently than new stimuli (Jacoby & Dallas, 1981; Schwarz, 2004; Weaver et al., 2007; Winkielman et al., 2003). A large body of research in fields as diverse as environmental psychology, architecture, marketing, and consumer behavior has consistently concluded that familiarity improves a person’s performance on navigational tasks (Bryant, 1982; Chebat et al., 2005; Dogu & Erkip, 2000; Gärling et al., 1983; Hölscher et al., 2006; O’Neill, 1992; Prestopnik & Roskos-Ewoldsen, 2000; Titus & Everett, 1995; 1996).

Iyer (1989) and Park et al. (1989) argued that customers without repetitive shopping experiences in a store will attend to a larger number of in-store cues in their navigation than customers who are familiar with the store’s layout. This line of thought is justified by neuroscientific findings that unfamiliar stimuli elicit more attentional orienting than familiar stimuli (Desimonde et al., 1995). People who are unfamiliar with a place primarily use external sources of information in their navigation, whereas those who are familiar with the environment rely more heavily on information stored in their long-term memory (Chebat et

al., 2005; Gärling et al., 1983). In their article on customers' in-store search behavior, Titus and Everett (1996) found that individuals with little or no familiarity with a supermarket performed a larger number of product searches (and arguably looked at a larger number of in-store stimuli) than individuals who were familiar with the shopping environment. Moreover, a recent field study at a grocery store by Otterbring et al. (2014) found that a frequent and widely distributed viewing pattern positively influenced navigational fluency (that is, the subjective ease of navigating in a particular area) among store-unfamiliar customers, but had no effect on navigational ease among store-familiar customers.

Findings regarding the effect of store familiarity on visual attention during the decision-making stage of the in-store search process are scarce. However, some studies have provided indirect evidence that store-familiar customers use visual in-store cues differently than store-unfamiliar customers during decision-making. For instance, Inman et al. (2009) found that store-familiar customers made more unplanned purchases than store-unfamiliar customers, which the authors interpreted as meaning that that store-familiar customers use in-store cues as a guide for their shopping needs more than store-unfamiliar customers. Thus, such stimuli should be more persuasive and influential among store-familiar customers. Consequently, store familiarity should result in greater in-store decision making.

We posit that one potential explanation of Inman et al.'s results is that store-familiar customers direct more of their visual attention toward in-store cues (for example, in-store signage) at a later stage of the search process. Because store-familiar customers do not need to look at in-store cues as much as store-unfamiliar customers in order to navigate successfully, they will presumably direct a relatively larger share of their visual attention toward such stimuli during decision making (for example, when standing in front of the store shelves). This, in turn, will increase the probability of making unplanned purchases. Therefore, we expect to find an interaction between store familiarity (unfamiliar vs. familiar)

and in-store search stage (navigation vs. decision making), as described in the hypothesis below.

H1: Store-familiar customers direct less visual attention toward signage stimuli than store-unfamiliar customers during the navigational stage of the in-store search process and more visual attention toward signage stimuli during the decision-making stage.

2.2. The Effects of In-Store Signage on Customers' Visual Attention and Choice Behavior

Another interesting issue is how the viewing of in-store signage influences customers' visual attention and choice behavior. For instance, will customers who attend to products displayed on in-store signs be more likely to look at and choose these products from the store shelves? Previous research suggests that this could indeed be the case.

Perceptual priming² (that is, improved processing of previously seen material, relative to unseen material; Wiggs & Martin, 1998) is one way of facilitating the identification of a given stimulus, and thereby enhancing the processing ease of its corresponding perceptual features (Forster et al., 2013; Oppenheimer, 2008; Reber et al., 2002; 2004; Zajonc, 1968). Humans have lower perceptual identification thresholds for previously seen stimuli (Tulving & Schachter, 1990); therefore, a prime that is perceptually similar or equal to a later presented target will enhance the processing of the target by influencing the speed and accuracy of perceptual identification (Bar & Biederman, 1998; Jacoby, 1983; Jacoby & Dallas, 1981; Mandler et al., 1987; Winkielman et al., 2003). This will increase the likelihood of attending features with characteristics that are identical or similar to those of the recently seen prime (Kristjánsson & Campana, 2010). Reber et al. (1998) found that processing fluency through perceptual priming led to faster recognition of, and increased liking for,

² Similar to Labroo et al. (2008), we use the terms perceptual priming and mere exposure interchangeably.

pictures primed by matching contours. More recently, Sigurdardottir et al. (2008) showed that priming led to a greater probability of detecting a target. Although these results were obtained in controlled lab experiments with non-complex primes (picture contours in the Reber et al. study, and differently colored bars and dots in the Sigurdardottir et al. study), similar effects could be generalized and therefore applied to other stimuli, even under a single exposure of a more complex prime in real-life settings. In support of this notion, perceptual priming effects are more apparent when the stimuli used are complex (such as in-store signs comprising both textual and pictorial information) and the number of exposures is small (Bornstein, 1989; Bornstein et al., 1990). Therefore, we propose the two following hypotheses:

H2: Perceptual priming of in-store signage material leads to faster detection of displayed products and such products are looked at earlier than similar non-primed alternatives.

H3: Perceptual priming of in-store signage material increases the amount of visual attention directed toward displayed products and such products are looked at more frequently than similar non-primed alternatives.

Products are processed more fluently and chosen more frequently in environments that contain perceptually related primes (Berger & Fitzsimons, 2008). There is considerable evidence that fluency through perceptual priming procedures positively influences product and brand attitudes (Bornstein, 1989; Janiszewski, 1993; Labroo et al., 2008; Meyers-Levy, 1989) as well as actual choice behavior (Baker, 1999; Mandel & Johnson, 2002; Nedungadi, 1990). Therefore, given the presumed effects of signage priming on customers' visual attention (H2 and H3) and the documented effect of perceptual priming on choice behavior, we offer the following hypothesis:

H4: *Perceptual priming of in-store signage material increases the probability that displayed products will be chosen over similar non-primed alternatives.*

3. Methodology

Visual attention was measured by eye tracking, a method that makes it possible to study *in situ* ongoing search behavior on a second-by-second basis (Spiers & Magurie, 2008). Eye-tracking enables more precise measures of consumer responses (Grewal et al., 2011) and has led to deeper insights into how marketing stimuli are processed and how their effectiveness could be measured (Chandon et al., 2009). Eye tracking also investigates cognitive processes in a more standardized way than memory-based measures and is less influenced by response biases than self-reporting (Krajewski et al., 2011). People find it difficult to repress their own eye movements because they are generally unaware of them (Russo, 1978).

Our study used the video-based pupil and corneal reflection method (for details, see Duchowski, 2007). Tobii Glasses, a mobile eye-tracking system that looks similar to a regular pair of glasses, recorded participants' eye fixations at a sampling frequency of 30 Hz (Tobii Eye-Tracking Research, 2012). An eye fixation is the point at which the eye fixates upon an object and acquires information (Russo, 2011).

In addition to the eye-tracking measures, data were obtained through post-study questionnaires.

4. Experiment 1

The aim of Experiment 1 was to test H1 and thereby investigate the extent to which customers use in-store signage during navigation and decision making, depending on their levels of store familiarity.

4.1. Participants

We approached customers while they were shopping in a grocery store, and 101 (39 female) voluntarily agreed to participate in the study. At the completion of the session, which lasted for approximately 10–15 minutes, participants were given a lottery ticket (valued at approximately US\$2) and a 5 percent discount off all food they purchased in the store that day.

One male participant had to be removed from later analyses because of insufficient eye-tracking recordings. In addition, all cases with z-scores above an absolute value of 2.00 standard deviations on the dependent variable were treated as outliers ($n = 8$) and were therefore excluded from the analyses (cf. Englich & Soder, 2009; Mussweiler & Strack, 2000).

4.2. Design and Stimuli

A quasi-experimental 2 (store familiarity: unfamiliar vs. familiar) \times 2 (search stage: navigation vs. decision making) mixed design was adopted, with self-reported store familiarity as the between-subjects factor and search stage as the within-subjects factor. Participants were asked to perform a shopping task that involved them walking past several signage stimuli. In total, participants could pass up to 30 in-store signs (16 during navigation and 14 during decision making) while completing the task.

4.3. Measures

In order to investigate H1, we focused on three main measures: fixation count, store familiarity, and navigational fluency.

4.3.1. Fixation Count. Signage stimuli facilitate navigation (e.g., O'Neill, 1991) and positively influence unplanned purchases (e.g., Chevalier, 1975). Therefore, the number of eye fixations toward the in-store signs was used as a measure of customers' visual attention during both navigation and decision-making. Accordingly, fixation count on in-store signs during navigation and decision-making was used as the dependent variable. Eye fixations are valid measures of visual attention (Wedel & Pieters, 2008) and are the most reported events in eye-tracking data (Holmqvist et al., 2011). For complex stimuli, such as in-store signage material and food products, fixations are essential for object identification (Chandon et al., 2009). In addition, the number of eye fixations is often viewed as an index of importance, with frequently fixated objects considered more important (Russo, 2011).

4.3.2. Store Familiarity. Similar to Inman et al.'s (2009) definition of store familiarity, which focuses on how often customers visit a particular store during grocery shopping, we measured store familiarity with the statement "I often shop at this store". The statement was graded on a seven-point Likert-scale, ranging from 1 (strongly disagree) to 7 (strongly agree). Following Inman et al.'s (2009) procedure, the store-familiarity construct was collapsed into one unfamiliar category ($n = 54$) and one familiar category ($n = 38$). This served as the independent variable.

4.3.3. Navigational Fluency. Previous studies have found that navigational fluency is an important factor when investigating search behavior in retail settings (Otterbring et al., 2014). Therefore, participants used the same seven-point scale as explained above to indicate their agreement with the statement "I think it is easy to find my way around in this store". This measure was included to isolate the effect that store familiarity had on customers' visual attention from the potentially confounding influence of navigational fluency. Otterbring et al. (2014) found that store familiarity correlated moderately with navigational fluency, but they also demonstrated that customers could feel navigationally fluent despite limited store

familiarity *if* they relied more heavily on their visual attention. Therefore, navigational fluency was used as a covariate in the analysis.

4.4. Procedure

Participants were told that the study's aim was to investigate how visual attention is directed while completing an ordinary shopping task. Subjects who agreed to participate had the eye-tracking equipment adjusted on their heads, after which a nine-point calibration procedure started. Once the calibration was successful, recordings of eye fixations started. At the store entrance, each participant was given a shopping list (identical between subjects) and the following cover story as a shopping task:

Imagine that you forgot some food items last time you were shopping. Those items have been written down for you on this list. Your task is to put them in your shopping basket, but of course you will not have to pay for them. You are free to choose whatever you like as long as it is on the list. Try to behave as naturally as possible and take your time. I will meet you up again at the checkouts.

The list consisted of six products/product categories (e.g., hamburger buns, tomatoes). To collect the products, participants' had to pass 30 in-store signage stimuli, located either on the way to (16 signs) or at the actual products (14 signs). This so-called *shopping-list procedure* has been used in previous research (Otterbring et al., 2014; Titus & Everett, 1996) and maximizes the probability that participants take approximately the same route while in the store, without actually instructing them where to go or which specific products to look for.

Once a participant had put all the products in his or her shopping basket, the eye-tracking equipment was removed and the participant filled out a paper-and-pencil questionnaire that included demographic information and the statements linked to store familiarity and navigational fluency.

4.5. Results and Discussion

To examine H1, we conducted a 2 (store familiarity: unfamiliar, familiar) \times 2 (search stage: navigation, decision making) mixed ANCOVA with store familiarity as the between-subjects factor, search stage as the within-subjects factor, and navigational fluency as the covariate. The analysis revealed a statistically significant effect of the covariate ($F(1, 89) = 4.85, p = .030, r = .23^3$), which indicated that navigational fluency was positively associated with visual attention toward in-store signage. The main effect of search stage was marginally significant ($F(1, 89) = 3.17, p = .078, r = .19$). Customers had a slightly larger number of eye fixations toward the signage stimuli at the decision-making stage ($M = 11.11$) compared to the navigational stage ($M = 8.86$). The main effect of store familiarity on visual attention was non-significant ($F < 1$), as was the navigational fluency \times search stage interaction ($F(1, 89) = 2.05, p = .156$). However, the analysis revealed a statistically significant store familiarity \times search stage interaction ($F(1, 89) = 3.99, p = .049, r = .21$). As hypothesized, and consistent with H1, store-unfamiliar customers ($M = 10.84$) had a larger number of eye fixations toward the signage stimuli than store-familiar customers ($M = 6.04$) during the navigational stage of the search process. Conversely, store-familiar customers ($M = 11.83$) had a larger number of eye fixations toward the signage stimuli than store-unfamiliar customers ($M = 10.60$) during the decision-making stage (see Figure 1).

Insert Figure 1 here

Although it often makes sense to compare cell means (Rosnow & Rosenthal, 1989), such a method should not be used by itself to describe the interaction (cf. Rosnow & Rosenthal, 1991). When the interaction is central for the hypothesis, as is the case in the present study, a

³According to Cohen (1988), the correlation coefficient r represents a small, medium, and large effect size when $r = .10, .30, \text{ and } .50$, respectively.

residual means analysis is necessary (Rosnow & Rosenthal, 1989; Ross & Creyer, 1993; Umesh et al., 1996). Therefore, we conducted such an analysis by following the guidelines described in Rosnow and Rosenthal (1989; 1991; 1995). The interaction (as depicted in Figure 2) shows that store-unfamiliar customers had a larger number of eye fixations toward the signage stimuli during navigation and a smaller number of eye fixations toward these stimuli during decision-making than could be expected based on the main effects. Store-familiar customers displayed the opposite pattern. Thus, H1 was supported.

Insert Figure 2 here

This finding suggests that in-store signs, and presumably other visual in-store stimuli, are prioritized during different stages of the search process depending on customers' levels of store familiarity. Store-unfamiliar customers direct more of their visual attention toward in-store signs at an earlier stage of the search process (during navigation) than their store-unfamiliar counterparts, and may therefore use these stimuli primarily as a way-finding tool. Conversely, store-familiar customers direct more of their visual attention toward in-store signs at a later stage of the search process (during decision making), which means they may be more easily influenced by the viewing of these stimuli than store-unfamiliar customers. This may partly help to explain Inman et al.'s (2009) finding that store-familiar customers are more likely to make unplanned purchases.

5. Experiment 2

The purpose of Experiment 2 was to test H2-H4 and, therefore, to examine how in-store signage priming affects customers at the decision-making stage of the search process. Unlike Experiment 1, which explored the amount of visual attention directed to in-store signage

during *both* navigation and decision making, Experiment 2 focuses solely on how the viewing of signage material influences customers during decision making. Whereas Experiment 1 investigated determinants of visual attention towards in-store signage, the focus of Experiment 2 examined *the effects of* in-store signage on customers' visual attention and choice behavior during the actual choice situation.

5.1. Participants

Seventy-four customers (43 female) participated in the same grocery store as described in Experiment 1. As compensation for completing the 5–10 minute sessions, participants were given a lottery ticket valued at approximately US\$2.

Before we analyzed the results, we removed one male subject because he had failed the priming procedure (he did not attend to the in-store signage prime, which was a prerequisite for the hypotheses to be tested). Following the same outlier criterion as in Experiment 1, all cases with z-scores exceeding an absolute value of 2.00 standard deviations on the visual attention measures ($n = 4$) were treated as outliers, and were therefore excluded from the analyses.

5.2. Design and Stimuli

The experiment used a 2 (product: product 1 vs. product 2) \times 2 (priming condition: priming vs. no priming) mixed design, with product as the between-subjects factor and priming condition as the within-subjects factor. Participants were randomly assigned to one of two priming conditions, with an equal number of subjects in each group. In both conditions, the prime was a 71.5 x 50.0 cm (28.1 x 19.7 inches) printed in-store sign depicting a muesli product and some additional information about the product's name, brand, weight, price, and unit price (see Figure 1). The products were of the same brand, had identical weight, and

were approximately the same price (the difference was less than US\$0.3). Both products were located on the shelves behind the in-store sign, with one product placed directly above the other on the shelf. Therefore, in each condition, one of the products was used as target (that is, the prime) and the other product was used for reference. This design was adopted in order to ensure that any differences in visual attention would be due to the prime and not the specific product used.

Insert Figure 3 here

5.3. Measures

We applied three main dependent variables to examine H2–H4: first fixation count, observation count, and product choice.

5.3.1. First Fixation Count measured the number of times that the participants' first eye fixation fell on the target before falling on the reference product (and vice versa) when standing in front of the shelves.

5.3.2. Observation Count measured the average number of times the participants observed (and therefore had at least one eye fixation on) the target and the reference product. An observation is the continuous viewing of a given area or object, disregarding the actual number of eye fixations.

5.3.3. Product Choice measured which, if any, of the products were chosen.

5.4. Procedure

Participants were recruited in the store and were individually given an overview of the study's purpose. They were told that the aim was to explore consumer behavior, including visual attention and choice, in a real store environment. Participants who then agreed to

continue underwent the same eye-tracking procedure as described in Experiment 1 (adjustment of equipment and calibration). The eye recordings started before the actual instructions were given in order to ensure that the participants actually looked at the signage prime. When each participant approached the target area, a research assistant gave the following instructions:

Can you see the muesli sign over there? [Pointing at the in-store sign] The shelves behind it are filled with cereals, and your task is to select one of the muesli products that you would consider buying today. Do you understand? [Awaiting answer] Please walk to the shelves and make your choice. I will be waiting on the other side. Bring your product of choice over to me when you are finished. Take your time.

Once the participant had selected one of the products, the eye-tracking equipment was removed and the participant was asked to complete a paper-and-pencil-based questionnaire with questions concerning demographics and shopping habits, including past usage and of products from the category.

5.5. Results and Discussion

In order to investigate H2 and determine whether the first eye fixations toward the target and the reference product were randomly distributed, we conducted a Pearson's chi-square analysis on 2 (product: product 1 vs. product 2) \times 2 (priming: target vs. reference) crosstabs. The chi-square value was statistically significant ($\chi^2(1, N = 60) = 5.41, p = .038$ [two-tailed], $V = .30^4$). When standing in front of the shelves, participants' first eye fixation occurred on the target before the reference product nearly twice as often as the other way around. The target was detected before the reference product 90 percent more frequently when product 1 was used as signage prime and 82 percent more frequently when product 2 was used as prime. These findings support H2 (see Figure 4).

⁴ In a 2 \times 2 table, the Cramér's V coefficient represents a small, medium, and large effect size when $V = .10, .30,$ and $.50,$ respectively (Cohen, 1988).

Insert Figure 4 here

To address H3, we conducted a 2 (product: product 1 vs. product 2) \times 2 (priming: target vs. reference) mixed-ANOVA, with product as the between-subjects factor and priming as the within-subjects factor. No main effect was found for product ($F < 1$), which means that participants had an approximately equal number of observations on both products. However, the analysis revealed a statistically significant main effect for priming ($F(1, 65) = 6.13, p = .016, r = .29$). In support of H3, a larger number of observations occurred on the targets ($M = 1.18; SD = 1.07$) than on the reference products ($M = 0.91; SD = 1.14$). Not only were the targets detected before the reference products, they also received more observations (see Figure 5). The two-way interaction was non-significant ($F < 1$).

Insert Figure 5 here

Given that only three participants (4 percent) chose the actual target, H4 was not supported. Thirty-one participants (45 percent) reported that they always bought the product that they selected during the choice task (which in 30 cases was a product other than the target). As such, past usage proved to be far more influential than signage priming in forecasting choice. To some extent, these results are comparable with those reported in Chandon et al. (2009), where 49 percent of participants chose brands with which they had previous experience, and only 1 percent selected unfamiliar brands. Our results are also consistent with McKinnon et al. (1981), who found that in-store signs displaying regularly priced products (which was the case in the present study) did not increase sales.

Taken together, the results of Experiment 2 show that when customers do attend to in-store signage, this will significantly influence their subsequent visual attention, making them look faster and more frequently at stimuli that are perceptually similar to the signage prime.

6. General Discussion

The results of the present study show the influence of store familiarity on customers' visual attention toward in-store signage during navigation and decision making, respectively. The results also highlight the effects of signage on customers' decision making.

Experiment 1 revealed that the amount of attention directed toward in-store signage varies as a function of customers' store familiarity and the specific search stage of the in-store search process (navigation vs. decision making). Whereas store-unfamiliar customers direct more of their visual attention toward signage stimuli during navigation than during decision making, store-familiar customers' gaze behavior involved a larger number of eye-fixations toward in-store signage during the decision-making stage of the search process, as opposed to the navigational stage. This finding supports H1.

Experiment 2 demonstrates that *when* customers attend to in-store signage, the signage content has a significant influence on where they later direct their visual attention. In line with H2 and H3, shelf products that have previously been seen on in-store signs are looked at more quickly and more frequently. However, this is not automatically transferred into product choice, which leaves H4 unsupported.

6.1. Theoretical Implications

As mentioned above, Experiment 1 showed that store-familiar customers direct a larger share of their visual attention toward in-store signs at a later stage of the search process (during decision making). This finding indirectly support the findings by Inman et al. (2009), who

found that store-familiar customers were more likely to make unplanned purchases, and argued that these customers use in-store cues more as a guide for their shopping needs, which results in greater in-store decision making. Due to their limited use of in-store cues during navigation, store-familiar customers will attend to such stimuli more during decision making, which should increase the chance of making unplanned purchases.

However, this is directly contradictory to two earlier studies, which have showed that customers *without* previous shopping experience in a store make more unplanned purchases; at least when the time available for shopping is not limited (Iyer, 1989; Park et al., 1989). However, it should be noted that Iyer (1989) and Park et al. (1989) *manipulated* store familiarity by assigning participants either to a grocery store in which they shopped most frequently or to stores in which they had never shopped before. On the contrary, both the present study and the Inman et al. (2009) study *measured* store familiarity. Furthermore, in both the present study and in the Inman et al. (2009) study, customers were not asked to express their activities and decisions during the shopping trip. Conversely, Iyer (1989) and Park et al. (1989) explicitly instructed participants to verbalize their thoughts and describe their actions while shopping (with an interviewer following them at close distance). Although it is difficult to compare verbal protocols with nonverbal data (such as eye-tracking measures), “the evidence consistently suggests that verbal protocols do not provide as detailed a process trace as eye fixations” (Russo, 1978, p. 566). Asking individuals to think aloud interferes with their natural behavior (Russo, 1978) and concurrent verbalization reduces decision accuracy (Russo et al., 1989). Therefore, the different methodologies used could be one explanation for these inconsistent results.

Experiment 2 shows that perceptual priming of in-store signage material has a clear impact on customers’ visual attention, despite having a limited effect on choice behavior. This supports the conclusion drawn by Chandon et al. (2009) that “attention is largely

influenced by factors other than those that influence choice” (p. 16). Our results also corroborate and generalize Sigurdardottir et al.’s (2008) finding that priming enhanced the probability of *detecting* a target, but did not affect judgments for that target. Instead of conducting a controlled lab environment with differently colored bars or dots as targets (as in Sigurdardottir et al., 2008), our results were obtained in field settings with more complex targets (that is, food products comprising both textual and pictorial information); however, the effects remained the same. Perceptual priming of in-store signage material did indeed facilitate detection of the targets, with a larger number of participants detecting them before the reference products. However, this was not transferred into subsequent choice behavior (viewed as the final judgment of the targets). This result also suggests that the targets were detected automatically and unconsciously due to their recently seen perceptual features on the in-store signs, such as color and shape, rather than through a conscious search for goal-relevant information. Processes based on goals, needs, and desires are said to have a larger impact on choices than processes based on perceptual features (Chandon et al., 2009); therefore, our targets were detected, but were not chosen (as participants generally used to buy products other than the targets).

Given the call for priming research into unconscious perceptual and behavioral effects outside the lab (Bargh, 2006), Experiment 2 contributes to an ecologically valid test of how perceptual priming influences customers’ visual attention and choice behavior. Research is only in the initial stages of investigating how priming affects customers in real-world settings (Berger & Fitzsimons, 2008); therefore, our findings that perceptual priming of in-store signage material significantly influence the direction and magnitude of customers’ visual attention will serve to extend earlier lab-based findings.

6.2. Managerial Implications

The present study has shown that in-store signage, when perceived visually, has a major impact on where customers' direct their visual attention. The products used as signage primes in Experiment 2 were not typically the first choices among participants, and they did not offer any price reduction or promotion, or contain any arguments for why they should be chosen (thus minimizing the chance of the targets being selected). Nevertheless, the signage priming was sufficient to lead customers to include the targets in their consideration sets (that is, which of the marketplace's brands or products they considered as possible purchase options) (Shapiro et al., 1997), which had substantial effects on visual attention. Because attention and consideration are necessary conditions for a product to be selected and purchased – “unseen is unsold” – these findings suggest that investing in in-store signage can indeed pay off. However, in order to continue the decision-making process all the way to final purchases, it is not always sufficient to simply provide product-specific information about the item displayed. Additional arguments for *why* the product deserves to be put in the shopping cart should also be provided. For instance, the signage material could communicate that an item is new, reduced in price, or marketed as a special offer. When located on signage stimuli, such communications have been found to significantly increase sales (Burke, 2009; Chevalier, 1975; McKinnon et al., 1981; Woodside & Waddle, 1975), and also create a more favorable shopping atmosphere (Newman et al., 2010).

Managers should also try to ensure that signage material is located on places that are easy to find, since store-unfamiliar customers seem to use in-store signs as a navigation tool when searching for products or certain sections of a store. This implies that the content displayed on the signage stimuli should be congruent with, and adjusted to, the location in the store (showing information or advertisements of nearby products).

6.3. Limitations and Future Research

This research has certain limitations. It should be noted that the main objective of our first field experiment was to explore the extent to which customers use in-store signage during navigation and decision making, and the main objective of the second experiment was to examine the effects that signage has on customers' visual attention and choice behavior. However, we are not able to offer anything explicit about *how* customers have used the information displayed on the signage stimuli or about the extent to which they have *actively searched* for such stimuli. Although beyond the scope of the current research, such questions deserve attention in future studies of in-store signage.

The vast majority (93.1 percent) of our participants reported buying muesli less than once a week. One could argue that the products used as primes in Experiment 2 generally have relatively long interpurchase cycles (that is, they are bought infrequently), which makes it more difficult to obtain differences in visual attention and choice behavior due to the signage primes than it is for products with shorter interpurchase cycles, such as yoghurt, bread or sandwich spreads. When displayed, such products tend to have more impact on unplanned purchases than infrequently purchased products (Inman et al., 2009). Thus, the longer interpurchase cycle of the signage primes used in Experiment 2 may have decreased the chance of influencing actual product choices.

A final limitation is that the structured tasks used in both experiments impeded the possibility to directly study unplanned purchases. For instance, the shopping-list procedure in Experiment 1 only asked participants to collect the items on the shopping list, which, by implication, prevented them from making any unplanned purchases. Thus, the well-structured tasks may have reduced the potential effects of in-store signage. An interesting suggestion for future research would be to investigate whether the specificity of the task at hand influences

customers' subsequent visual attention; that is, whether an initial shopping task with a high (vs. low) level of detail would lead to more or less visual attention being directed toward various in-store cues at a subsequent shopping task. If customers rely heavily on their visual attention toward in-store cues at one task, will they continue to do this on a later task, or will they behave differently?

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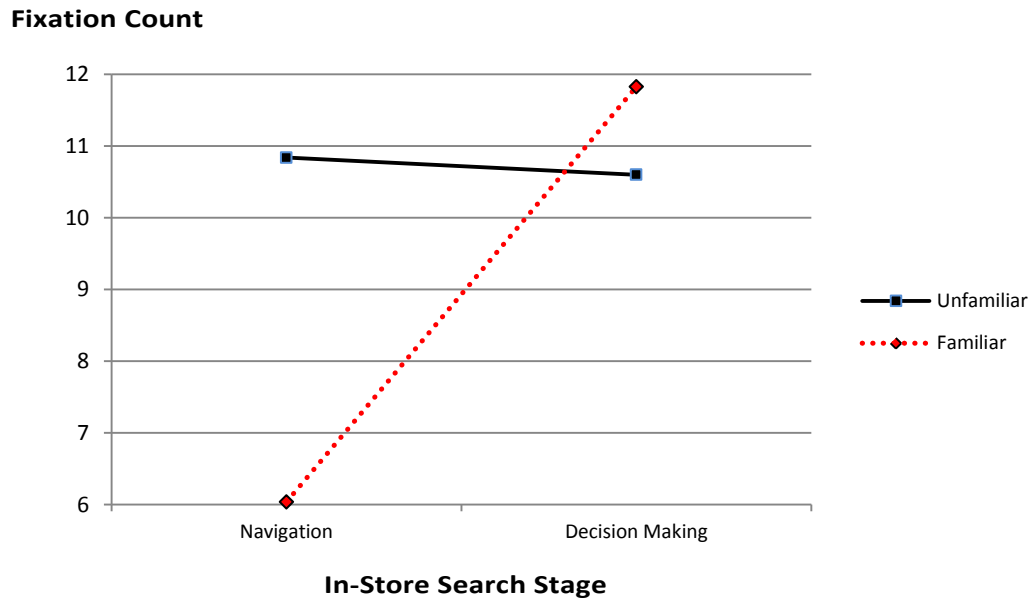


Figure 1: Store-unfamiliar and store-familiar customers’ total number of eye-fixations toward in-store signage during navigation and decision making, after controlling for navigational fluency.

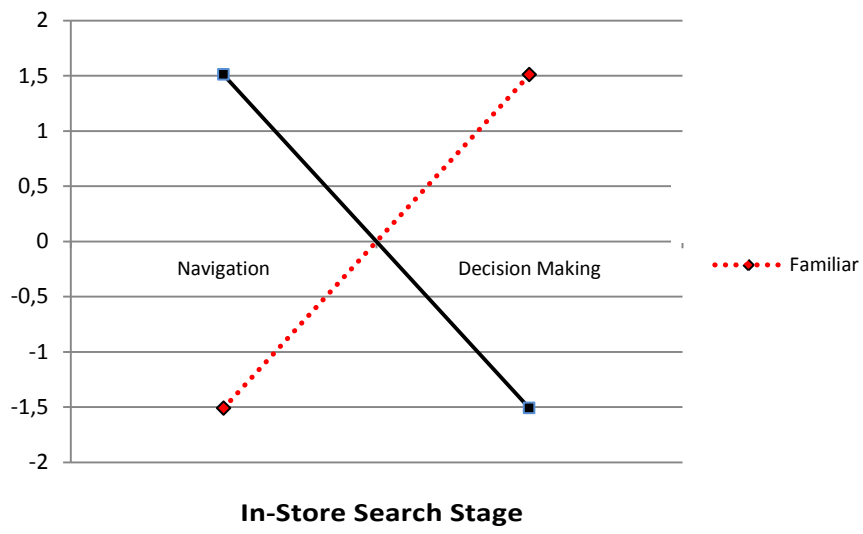


Figure 2: The interaction effect showed as residual means only.



Figure 3: The signage prime used in the first priming condition and a participant standing in front of shelves with cereals.

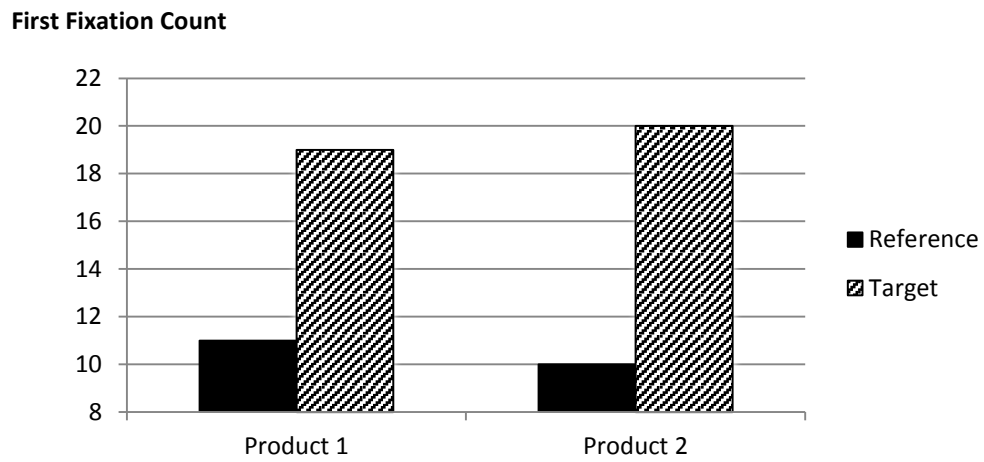


Figure 4: Number of times that the customers' first eye-fixation occurred on the target before the reference product (and vice versa) when standing in front of the shelves.

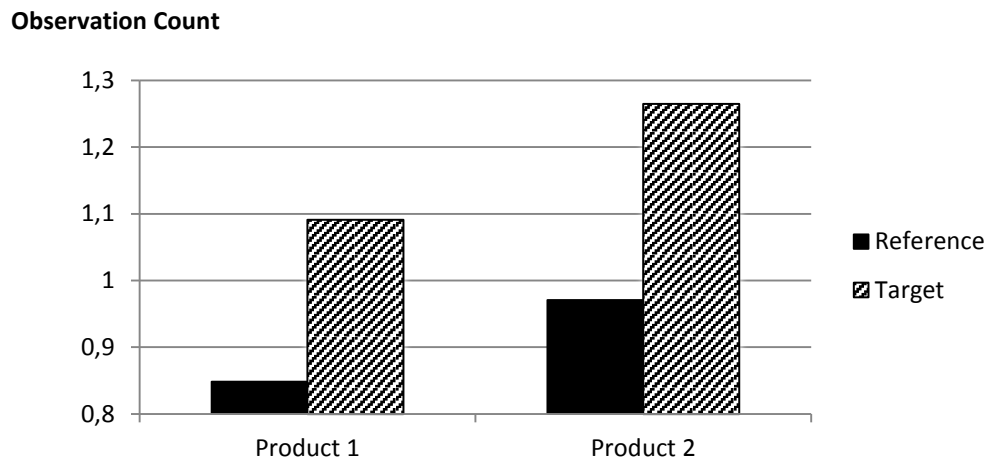


Figure 5: Average number observations on the target and the reference product.