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Eye-tracking customers' visual attention in the wild: Dynamic gaze behavior moderates the effect of store familiarity on navigational fluency

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**Eye-tracking Customers' Visual Attention in the Wild:
Dynamic Gaze Behavior Moderates the Effect of Store Familiarity
on Navigational Fluency**

Abstract

A retail store is a multi-sensory environment filled with messages to tempt customers into making unplanned purchases. The purpose of this field study was to examine the interplay between three factors claimed to precede and influence unplanned purchases: store familiarity, visual attention, and navigational fluency (the subjective ease of navigating). Eye-tracking recordings and post-study questionnaires from 100 grocery store shoppers showed that store familiarity was positively associated with navigational fluency. However, customers' levels of dynamic gaze behavior (a frequent, widely distributed viewing pattern) moderated this effect. Dynamic gaze behavior significantly predicted navigational fluency among customers with low and moderate store familiarity, but not among customers familiar with the store. These findings challenge the formerly held assumption that store familiarity automatically implies navigational ease, and store unfamiliarity implies navigational difficulty. The results have implications for navigational aspects in stores.

Keywords: eye tracking; visual attention; navigation; navigational fluency; store familiarity; field study

1. Introduction

Approximately 80 percent of a shopper's in-store time is spent navigating, and the remaining 20 percent is spent deciding which items to purchase (Sorensen, 2009). The present research focuses on the 80 percent of time when customers navigate through the store. In today's retail environment, one type of in-store stimulus that customers frequently encounter during navigation is digital signage – screens displaying digitally linked messages, advertisements, and promotions. According to the Outdoor Advertising Association of America (OAAA, 2007), the number of digital signs in the United States will increase by approximately 900 percent within 10 years. The digital signage market is projected to generate 15 billion USD in revenue in 2016 (Want & Schillit, 2012), and retailers spend millions of dollars each year on distributing and monitoring in-store signage stimuli (Kiran, Majumdar, & Kishore, 2012). This development is not surprising given the positive effects of signage on recall and recognition of advertised brands and products, as well as on brand familiarity and purchase intentions (Yim, Yoo, Till, & Eastin, 2010). Studies further suggest that digital signage leads to increased consumption, higher levels of approach behavior (drawing customers towards merchandise), and a more favorable shopping atmosphere.

Signage stimuli are also crucial to customers' initial impressions of their physical surroundings (Bitner, 1992), and facilitate their navigation (O'Neill, 1991); therefore, customers are highly likely to be exposed to and influenced by such stimuli during navigation. In support of this notion, in-store stimulus exposure during navigation is considered a main contributor to unplanned buying behavior (Park, Iyer, & Smith, 1989). However, the results of existing research are inconsistent.

Iyer (1989) and Park et al. (1989) found that customers who visited a store where they had not previously shopped made significantly more unplanned purchases when available shopping time was unlimited. This was because they relied more on in-store stimuli such as signage

material. Customers with limited knowledge of the store's layout would be more likely to direct their attention towards in-store cues than customers who are familiar with the store. The latter group does not need to rely on such stimuli to navigate around the store, or to find products or store sections.

On the other hand, Inman, Winer, and Ferraro (2009) found that store familiarity had a significant positive effect on unplanned purchases. They concluded that store-familiar customers (customers familiar with the store) had a greater ability to use the store environment to guide their shopping needs. Without having to spend time and effort on search activities, store-familiar customers would use in-store stimuli for purposes other than navigation. Therefore, exposure to such stimuli would have a stronger influence on their decision-making.

The main objective of this field study was to investigate the interplay between three factors that tend to precede and influence unplanned purchases: store familiarity, visual attention, and navigational fluency (the subjective ease of navigating in a particular area). Iyer (1989), Park et al. (1989), and Inman et al. (2009) relied on these factors to interpret and discuss their findings. Although they used customers' presumed different levels of, and needs for, search activities to explain unplanned buying behavior, they never explicitly measured visual attention or navigational ease.¹ Instead, they measured familiarity with the store environment, which was defined as the number of times that customers shopped in a particular grocery store. This measure was then used to infer that store familiarity would translate into navigational ease, and store unfamiliarity into navigational difficulty. However, these claims were unexplored, and cannot be taken for granted.

¹ Admittedly, Iyer (1989) and Park et al. (1989) partially covered the navigational aspects of the shopping experience with a manipulation check.

2. Theory and Hypotheses Development

Store-familiar customers are better at identifying their location in the shopping environment (Dogu & Erkip, 2000; Titus & Everett, 1996), and therefore should find the search process less cognitively demanding than store-unfamiliar customers (Inman et al., 2009; Park et al., 1989). Consequently, store-familiar customers should be more likely to report navigational fluency. Research on processing fluency (the relative ease of processing information) support this reasoning by showing that familiar stimuli are more fluently processed than new stimuli (Jacoby & Dallas, 1981; Weaver Garcia, Schwarz, & Miller, 2007; Winkielman, Schwarz, Fazendeiro, & Reber, 2003). In addition, a large body of research in the areas of environmental psychology, architecture, marketing, and consumer behavior has consistently indicated that familiarity improves a person's performance in navigational tasks (Chebat, G elinas-Chebat, & Therrien, 2005; Dogu & Erkip, 2000; G arling, Lindberg, & M antyl a, 1983; H olscher, Meilinger, Vrachliotis, Br osamle, & Knauff, 2006; O'Neill, 1992; Prestopnik & Roskos-Ewoldsen, 2000; Titus & Everett, 1995, 1996). Therefore, we hypothesize:

H1: Store-familiar customers are more navigationally fluent than customers who have lower levels of store familiarity.

Previous studies on navigation have typically overlooked aspects such as processing visual information regarding the environment (Spiers & Maguire, 2008). Despite this lack of research, visual attention can be assumed to have a positive effect on navigational fluency. Even though this effect should be more pronounced among customers with lower levels of store familiarity (as described in H3), it is reasonable to think of navigational fluency as being partly determined by the amount of attention people pay to stimuli in their surrounding environment. A more dynamic gaze behavior (a frequent, widely distributed viewing pattern) with more visual

attention towards various in-store cues should result in more fluent navigation (and vice versa).

Accordingly, we hypothesize:

H2: Customers with dynamic gaze behavior are more navigationally fluent than customers with lower levels of dynamic gaze behavior.

However, due to the knowledge possessed by store-familiar customers regarding store layout, floor configurations, and product locations (Park et al., 1989), visual attention should be less important for their navigational fluency than it is for customers who are unfamiliar with the store. The latter group of customers must pay more attention to visual in-store cues, and therefore should display a more dynamic gaze behavior in order to successfully navigate through the store (for example, see Titus & Everett, 1995). People unfamiliar with a place primarily use external sources of information (such as visual stimuli) in their navigation, whereas those familiar with the environment rely more heavily on their internal long-term memory (Chebat et al., 2005; Gärling et al., 1983). In addition, unfamiliar stimuli elicit more attentional orienting than familiar stimuli do (Desimonde, Miller, Chelazzi, & Lueschow, 1995). Therefore, we hypothesize:

H3: The assumed effect of store familiarity on navigational fluency (H1) is moderated by customers' levels of dynamic gaze behavior. Store-familiar customers are navigationally fluent, independent of dynamic gaze behavior. Conversely, dynamic gaze behavior has a significant positive impact on navigational fluency among customers with lower levels of store familiarity.

3. Methodology

We measured visual attention by eye tracking, which is less influenced by response bias than self-reporting is, and has a more standardized way of investigating cognitive processes than memory-based measures (Krajewski, Sauerland, & Muessigmann, 2011). Eye tracking is also one way of collecting detailed data about a customer's search behavior (Shankar, Inmann, Mantrala, Kelley, & Rizley, 2011). To record participants' eye fixations (the points at which the eye fixates upon an object and acquires information) (Russo, 2011), we used a head-mounted eye-tracking system (Tobii glasses), which look similar to a regular pair of glasses. The sampling frequency was 30 Hz (Tobii Eye-tracking Research, 2012). In addition to the eye-tracking recordings, we obtained data from post-experiment questionnaires.

3.1. Participants

The sample consisted of 100 shoppers (61 male) at a grocery store. Participants with z-scores more than 2 standard deviations above or below the mean on the visual attention measure were treated as outliers ($n = 8$), and were excluded from the dataset (for instance, see Mussweiler & Strack, 2000; Otterbring, Löfgren, & Lestelius, 2014). After completing the session, which lasted approximately 10 to 15 minutes, participants were given a lottery ticket (valued at approximately 2 USD), and were offered a 5 percent discount off all food they purchased in the store that day.

3.2. Design, Stimuli and Procedure

The study used a quasi-experimental design. All customers were given an overview of the study's purpose, including the stated aim of investigating how visual attention is directed when completing an ordinary shopping task. The shopping task, referred to as the *shopping-list procedure*, served as a cover story. It was also designed to maximize the probability that participants took approximately the same route around the store, and were exposed to an equal number of digital signs (for a similar approach, see Titus & Everett, 1996).

At the store entrance, each customer was fitted with a pair of Tobii glasses, and was given an identical shopping list with instructions to collect the products on the list (for example, bread, sandwich spreads, tomatoes, lemons) during a fill-in shopping trip just for those items (cf. Kollat & Willet, 1967; Nordfält, 2005). Sandwich meat, vegetables, and fruit are among the most frequently purchased products in grocery stores (Dove, 2011; Herzig-Marx, 2012), and have well-defined locations; therefore, the selection of these products was made based on the assumption that customers would have a reasonable knowledge of where these products might be found even if they have not been to that particular store before. During the task, participants passed 16 digital signs located in the vicinity of the products they sought (see Figure 1 for an example of the signage). After a calibration procedure of the eye-tracking equipment, recordings of eye fixations began, and participants were sent on their shopping trip. When they had collected the items and reached the checkout, the eye-tracking equipment was removed. Participants then filled out a survey that included providing demographic information, and giving their responses to statements linked to navigational fluency and store familiarity.



Figure 1: Examples of the digital signs that participants walked past during their shopping task.

3.3. *Measures*

Three main measures were applied to examine H1 to H3: dynamic gaze behavior, store familiarity, and navigational fluency.

3.3.1. Dynamic gaze behavior was measured as the total number of eye fixations on the digital signs. Fixations are valid measures of visual attention (Wedel & Pieters, 2008), and are the most reported events in eye-tracking data (Holmqvist et al., 2011). Because customers with higher levels of dynamic gaze behavior will generally look around more while in the store, some eye fixations will fall on the digital signs by pure chance. It should be noted, however, that the signage stimuli did not contain information that helped customers navigate through the store. In other words, none of the products on the shopping list were displayed on any of the digital signs, and the signage content did not show information of nearby products. Hence, even if customers paid more attention to digital signage (dynamic gaze behavior), this behavior did not facilitate navigation *per se*. Since signage stimuli are used both during navigation and when decisions about purchases are made, we deemed it suitable to measure visual attention towards such stimuli as a way of capturing a customer's dynamic gaze behavior.

3.3.2. Store familiarity. Based on Inman et al.'s (2009) definition of store familiarity, which focused on how often a customer visits a particular store during grocery shopping rather than the customer's overall familiarity with the store brand, we measured store familiarity using 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).

3.3.3. Navigational fluency was measured on the same seven-point scale using the statement, "I think it is easy to find my way around this store." Although there was a correlation between navigational fluency and store familiarity ($r = .41, p < 0.001$), the moderate size of the correlation indicates that these measures should be regarded as distinct constructs.

3.4. Reliability Analysis

For the head-mounted eye-tracking equipment being used (Tobii glasses), there is no software available to enable automatic coding of the eye fixations. Hence, measures that can easily be collected with a stationary eye-tracking apparatus used in a laboratory (such as fixation duration, and time to the first fixation) could not be obtained in the present field study, and the data had to be manually coded. Two assessors with extensive eye-tracking experience individually coded the data set to establish the number of eye fixations, if any, that participants had made on each digital sign. The level of agreement between the assessors was excellent ($r = 0.996, p < 0.001$). Disagreements were solved by discussion between the two assessors.

4. Results

To investigate the effects that store familiarity and dynamic gaze behavior had on navigational fluency (H1–H3), a simple moderation analysis was conducted using the PROCESS computational tool (Hayes, 2012). Store familiarity was the independent variable (denoted by X in the conceptual model illustrated in Figure 2), dynamic gaze behavior was the moderator (denoted by M), and navigational fluency was the dependent variable (denoted by Y).

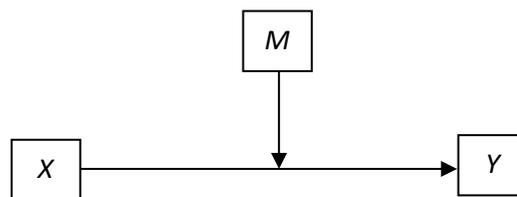


Figure 2: Conceptual model for the simple moderation, with letters representing store familiarity (X), dynamic gaze behavior (M) and navigational fluency (Y).

The model explained 29 percent of the variance in navigational fluency ($R^2 = 0.29, F[3, 88] = 11.93, p < 0.001$). The direct effect of store familiarity on navigational fluency was statistically significant ($\beta_1 = 0.380, SE = 0.072, t = 5.27, p < 0.001$), as was the direct effect of dynamic gaze behavior ($\beta_2 = 0.071, SE = 0.020, t = 3.55, p < 0.001$). Therefore, the positive slope on the store-familiarity coefficient supports H1: as store familiarity increases, so does

navigational fluency. The positive slope on the dynamic gaze behavior coefficient also corroborates H2: as dynamic gaze behavior increases, so does navigational fluency. In addition, consistent with H3, these main effects were qualified by a statistically significant interaction between store familiarity and dynamic gaze behavior ($\beta_3 = -0.013$, $SE = 0.006$, $t = -2.40$, $p = 0.019$), which we investigated further using a spotlight analysis.

For the spotlight analysis, dynamic gaze behavior was plotted at one standard deviation above the mean and one standard deviation below the mean, which allowed us to compare the simple effect of store familiarity on navigational fluency for customers with high versus low dynamic gaze behavior. Figure 3 shows that high dynamic gaze behavior significantly predicted navigational fluency for customers with low store familiarity ($t = 5.10$, $p < 0.001$) and those with moderate store familiarity ($t = 4.73$, $p < 0.001$), but not among those with high store familiarity ($t = 1.39$, $p = 0.170$). Therefore, customers with higher levels of dynamic gaze behavior may be navigationally fluent despite lacking store familiarity. Conversely, customers with high store familiarity will be navigationally fluent, independent of their gaze behavior.

Navigational Fluency



Figure 3: Conditional effect of store familiarity on navigational fluency at one standard deviation below the mean (Low) and one standard deviation above the mean (High) on dynamic gaze behavior.

5. Discussion

The present field study highlights both store familiarity and dynamic gaze behavior as important factors for navigational fluency. In accordance with H1, a customer's store familiarity positively influenced navigational fluency. Likewise, in support of H2, dynamic gaze behavior positively affected navigational fluency; however, this pattern was only prominent among customers with lower levels of store familiarity. In line with H3, the effect of store familiarity on navigational fluency was moderated by gaze behavior, whether dynamic or otherwise.

5.1. Theoretical Implications

Prior to this study, the concept of navigation had not been addressed in the fluency literature. In addition, the number of studies focusing on subjective fluency is limited (Reber, Fazendeiro, & Winkielman, 2002), despite recent findings showing that subjective feelings of fluency are more influential than objectively manipulated fluency, at least for determining liking (Forster, Leder, & Ansorge, 2013). Furthermore, the well-documented effects of fluency on consumer judgment and decision-making (for example, Schwarz, 2004) suggest that navigational fluency could influence actual choice behavior. For instance, customers who feel navigationally fluent

may be more likely to make unplanned purchases, as Inman et al. (2009) indirectly proposed. The positive effect of store familiarity on navigational fluency also supports the claim that in-store stimuli should have a greater influence on store-familiar customers (Inman et al., 2009). The reason for this is that familiar events and stimuli are processed more fluently than new ones (Winkielman et al., 2003), and elicit a more local, concrete information-processing style (Förster, 2012; Förster, Liberman, & Shapira, 2009), which facilitates the perception of details in such circumstances (Förster & Denzler, 2012; Hansen & Trope, 2013). Such details could include advertising appeals, special deals, and other marketing tactics taking place in the store.

As the moderation analysis showed, store familiarity positively influenced navigational fluency, but this effect was moderated by the customer's level of dynamic gaze behavior. Although Park et al. (1989) and Inman et al. (2009) implicitly translated store (un)familiarity into navigational (dis)fluency, our results provided evidence that this is not always the case. For instance, customers who have more dynamic gaze behavior may feel navigationally fluent without having ever been to the store. Therefore, a frequent, more widely distributed viewing pattern can compensate for unfamiliarity. This distinction between store familiarity and navigational fluency also supports research in psychology that suggests that judgments of familiarity are suboptimal fluency measures (see Whittlesea & Williams, 2001).

5.2. *Practical Implications*

Stimuli that are easy to process are generally viewed as more familiar (Jacoby & Whitehouse, 1989; Monin, 2003; Whittlesea & Williams, 2001). Therefore, efforts to make in-store navigation more fluent may induce feelings of familiarity, even among customers who have never visited the store before, and especially if they have more dynamic gaze behavior. Enhanced in-store navigation can be beneficial for retailers (Ng, 2003; Titus & Everett, 1995, 1996) since processing fluency in general, and familiarity in particular, can lead to more favorable evaluations and increased liking (Rindfleisch & Inman, 1998; Winkielman et al.,

2003; Zajonc, 1968). Processing fluency and familiarity also positively affect purchase intentions (Payne, Hyman, Niculescu, & Huhmann, 2013; Söderlund, 2002), investment propensity (Alter & Oppenheimer, 2006; Huberman, 2001), and choice behavior (Hoyer & Brown, 1990; Novemsky, Dhar, Schwarz, & Simonson, 2007). Therefore, the consequences of making in-store navigation easier may be far-reaching because the effects of such a strategy can influence customers' decision-making processes all the way down to their final purchases.

5.3. *Limitations and Future Research*

The number of eye fixations on digital signs reported in this study may underestimate the visual attention that such stimuli receive in general. Titus and Everett (1995) identified two broad classes of retail search strategies: epistemic and hedonic. Epistemic search strategies are mainly used to locate products to be purchased in an efficient and timely manner, whereas hedonic search strategies reflect the more experiential aspects of retail search activity (such as seeking sensory stimulation). Customers using epistemic search strategies are primarily concerned with product acquisition and task fulfillment, which was the case for participants in this study; therefore, they should be less susceptible to visual in-store cues than customers using hedonic search strategies.

Recent studies also show that customers with well-defined shopping tasks are less attracted by signage stimuli than customers engaged in browsing or socializing are (Burke, 2009). Apart from this, the use of a shopping list effectively reduces reliance on visual in-store cues (Block & Morwitz, 1999) and unplanned purchases (Inman et al., 2009). Although most grocery shoppers use shopping lists to maximize selection accuracy (Liu, Chen, Melara, & Massara, 2008), the shopping-list procedure we used in the experiment may have limited the attention of some participants towards, and processing of, digital signage and other in-store stimuli. However, most grocery store shoppers, regardless of whether or not they have a shopping list, visit the store with the intention to buy something. When shopping for clothes, however, a

purchase is not always the obvious task or goal. Therefore when grocery shopping, list users and customers without shopping lists may exhibit smaller differences in visual attention towards in-store stimuli than when they are shopping for clothes.

Kollat and Willet (1967, p. 29) found that “The percentage of unplanned purchases was larger during major shopping trips than during fill-in trips.” In contrast, Nordfält (2005) found that customers undertaking a fill-in trip to the grocery store (such as participants in our study) made more unplanned purchases than customers undertaking regular major trips. Because of these inconsistent results, future research could examine how visual attention varies as a function of the customer’s specific shopping task. As visual attention is task-dependent, and various processing goals influence people’s visual attention to advertising in different ways (Pieters & Wedel, 2007), future research could explore how different shopping tasks affect customers’ perceptual mechanisms, and whether or not this is reflected in subsequent choice and purchase behaviors.

5.4. Conclusion

The main objective of this field study was to investigate the interplay between store familiarity, visual attention, and navigational fluency. From a theoretical standpoint, the key finding of the current research is the result that a customer’s dynamic gaze behavior moderates the effect that store familiarity has on navigational fluency. Thus, customers who have more dynamic gaze behavior may feel navigationally fluent despite lacking store familiarity. Previous scholars have theorized, but never explicitly tested, the notion that store unfamiliarity should result in navigational disfluency. However, the present study shows that store unfamiliarity does not automatically translate into navigational disfluency. Rather, customers who are unfamiliar with a particular store can still feel navigationally fluent if they compensate by exhibiting a more widely distributed viewing pattern.

From a practical standpoint, the main implication of this research is that managers should try to facilitate navigation around their stores. Although this may seem obvious, some consultants even advise retail chain managers *not* to make products too easy to find (Chebat et al., 2005) in order to force customers to look at more items in their search, and thus make more unplanned purchases. However, our results do not support this strategy. In addition, related research has shown that customers become irritated and confused when the arrangement of items changes, and they cannot find what they need (d'Astrous, 2000; Geuens, Brengman, & S'Jegers, 2003). This suggests that changes in the placement of items in the aisles, and in displays, may result in customer dissatisfaction, stress, frustration, and ultimately patronage withdrawal and lost revenue (d'Astrous, 2000; Gensch & Recker, 1979; Hacket, Foxall, & Van Raaij, 1993; Titus & Everett, 1995, 1996).

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