What Does it Take to Get your Attention?

The Influence of In-Store and Out-of-Store Factors on Visual Attention and Decision Making for Fast-Moving Consumer Goods

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“The eye sees only what the mind is prepared to comprehend”

- Henri Bergson (1859–1941)
Abstract

Decision making for fast-moving consumer goods involves a choice between numerous similar alternatives. Under such demanding circumstances, a decision is made for one product. The decision is dependent on the interaction between the environment and the mind of the consumer, both of which are filled with information that can influence the outcome. The aim of this dissertation is to explore how the mind and the environment guide attention towards considered and chosen products in consumer decision making at the point-of-purchase.

Consumers are equipped with several effort reduction strategies to simplify complex decision making. The selection of strategies can be conscious or automatic and driven by information in the environment or the mind of the decision maker. The selected decision strategy reduces the set of options to one alternative in an iterative process of comparisons that are fast and rely on perceptual cues to quickly exclude irrelevant products. This thesis uses eye-tracking to explore this rapid processing that lacks conscious access or control. The purpose is to explore how product packaging and placement (as in-store factors), and recognition, preferences, and choice task (as out-of-store factors) influence the decision-making process through visual attention.

The results of the 10 experiments in the five papers that comprise this thesis shed new light on the role of visual attention in the interaction between the environment and the mind, and its influence on the consumer. It is said that consumers choose with their eyes, which means that unseen is unsold. The results of this thesis show that it is just as important to be comprehended as it is to be seen. In split-second decision making, the ability to recognize and comprehend a product can significantly impact preferences. Comprehension stretches beyond perception as consumers infer value from memory structures that influence attention. Hence, the eye truly sees what the mind is prepared to comprehend.
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APPENDED PAPERS

Paper I: Consumer Perception at Point-of-Purchase: Evaluating Proposed Packaging Designs in an Eye-tracking Lab

Paper II: Left isn’t always right: Placement of pictorial and textual package elements

Paper III: The Verticality Heuristic: Why top shelf is not always top notch in product placement


Paper V: Using Heuristics to Revisit Consumer Choice Processes through the Eyes of the Consumer
1 Introduction

A new product launch is a challenge every consumer goods firm faces. Brand owners and product developers have many hurdles to overcome before a product is launched on the market. Product development in itself is often a challenge, as is convincing retailers to accept the brand. However, it is not until the product reaches the supermarket shelf that the effort is judged. The judges are the consumers that will include or exclude the product in split-second decision making by employing simplification rules that quickly cut through the clutter of the environment with minor information processing and cognition. What does it take to be considered an option? This dissertation explores this question by studying the influence of the environment and the mind of the consumer on visual attention in point-of-purchase (POP) decision making.

With individual stores now carrying up to 100,000 different items (Ball, 2004), the average consumer encounters a vast amount of products across all channels of distribution. Yet the typical family gets 85 percent of their needs from only 150 products (Roberts, 2003). Finding a product on the shelf has become a challenge, not just because of the number of options, but also because of shared product attributes and copycat products. This has resulted in fierce competition for shelf space as retail selling space is a fixed resource (Ball, 2004). Hence, suppliers invest heavily in in-store marketing (Forster, 2002); in fact, suppliers have increased their in-store marketing by spending more on it rather than out-of-store promotions (Ball, 2005). This competition has changed the role of shelf space from stocking area to an essential and scarce strategic resource that needs to be controlled as efficiently as possible (Urban, 1998).

In addition, fast-moving consumer goods (FMCGs) are increasingly competing for the consumer's attention, which has resulted in innovative methods for in-store communication. Despite the in-store activities that are designed to lure attention, in the end, it is the customer that makes a decision through the interaction between the environment and the mind. The decision can be formed by experiences in-store and what has been experienced out-of-store. However, little research has been done on the influence of in-store factors and out-of-store factors on consumer attention and decision-making. Hence, in-store and out-of-store influence has become an increasingly important research topic, specifically in relation to visual attention throughout the POP decision-making process. This topic has been advocated by previous researchers for
many years (see e.g., Olshavsky, 1979; Payne, 1976; Russo, 2011). There have been technological and methodological hurdles to overcome before process-tracing methods could be used to study visual attention in the decision-making process. However, some researchers have made great efforts to illuminate consumers’ POP decision making despite these hurdles (Chandon, 2002; Chandon, Hutchinson, Bradlow, & Young, 2009; Pieters, Warlop, & Hartog, 1997; Pieters & Warlop, 1999; Pieters, Warlop, & Wedel, 2002; Russo & Leclerc, 1994; Russo & Rosen, 1975; Van Der Lans, Pieters, & Wedel, 2008a; Van Der Lans, Pieters, & Wedel, 2008b). The main objective of the present dissertation, as the following chapters outline, is to study the influence of product packaging and placement (as in-store factors), and recognition, preferences, and choice task (as out-of-store factors) on consumer visual attention and decision making.

1.1 The Research Domain

The types of decision making studied in the present thesis are characterized by non-conscious and non-habitual POP consumer behavior. At first, these types of decision making may seem a fraction of the decisions made in-store. However, planned brand-level purchasing is not the most common consumer behavior as only 40 to 60 percent of the products that are bought are planned (Block & Morwitz, 1999; Inman, Winer, & Ferraro, 2009). Furthermore, a majority of FMCG buying decisions are made at POP (Bucklin & Lattin, 1991; Hoch & Deighton, 1989; Prone, 1993; Rundh, 2005; Underwood & Ozanne, 1998; Van Der Lans et al., 2008b). A consumer is aided in planned purchasing when a shopping list is used, but not hindered from unplanned purchasing as deviations from the shopping list are common and dependent on the level involvement in the decision (Block & Morwitz, 1999). The decisions studied here require evaluation of options and represent the 20 percent of time spent in-store making decisions in front of the shelf (Sorensen, 2009). Instead of trying to provide a universal model of decision making, a limited number of influencing factors are studied in a controlled setting to understand the fundamental decision-making properties and their influence on attention, consideration, and choice. The present research has a descriptive approach to decision making with an emphasis on process tracing (Payne, 1976; Svensson, 1979). The following sections will further illuminate the research domain and the type of decision making studied.
1.1.1 Decision-Making Journey

There are many factors influencing consumer decision making for FMCGs in the supermarket; as a whole, the in-store decision-making process cannot be explored in one dissertation. However, in-store decision making can be broken down into activities that can be isolated and studied collectively as a sub-process. FMCG decision making can be waived as a sequential process starting with some need and then moving to information processing and ending with outcome and, in some cases, confirmation or adjustment of choice (Brim, Glass, Lavin, & Goodman, 1962; Puccinelli et al., 2009). This process is much like any rudimentary problem-solving model (see e.g., Engel, Blackwell, & Miniard, 1995; McGuire, 1976). However, a multitude of decisions are made before the actual choice of a specific product. Some of these decisions are product-related, but many are not directly related to fulfilling the realized need. In the circumstance of, for example, running out of shampoo and realizing the need to buy a new bottle, the need for shampoo starts at home and would either be noted on a shopping list or memorized until the next shopping trip. Deciding whether to use a memory aid already greatly influences in-store behavior (Block & Morwitz, 1999). At some point, the decision is made to realize the need of shampoo and presumably other products as well. Up until entering the store of choice, there are several decisions made about where, when, and how to fulfill the needs. When entering the store, the needs will be reactivated through external or internal memory aids and the consumer will start navigating to the store section containing the product category. Navigation is described as the bulk of in-store decision making, as, “…80 percent of shoppers’ time is spent simply in moving from place to place in the store…” (Sorensen, 2009, p. 8). During navigation, the consumer is bombarded with information. These influencing factors span from store atmosphere to consumer-specific factors (Bittner, 1992; Baker, Grewal, & Parasuraman, 1994; Baker, Parasuraman, Grewal, & Voss, 2002; Donovan & Rossiter, 1994; Inman et al., 2009; Inman, McAlister, & Hoyer, 1990; Turley & Milliman, 2000). For example, if the store of choice is playing music, consumers are expected to spend more time and money on the shopping trip, depending on music style and consumer age (Turley & Milliman, 2000). Furthermore, with consumers in a hurry, time pressure will influence the number of considered products (Pieters et al., 1997).
1.1.2 The Point-of-Purchase Domain

The domain of this dissertation, namely POP decision making, is termed the “first moment of truth” by Procter & Gamble (Nelson & Ellison, 2005). This subpart of the greater decision-making process is defined as an opportunity for brand owners to be, “…obtaining customers’ attention and communicating the benefits of an offer.” (Löfgren, 2005, p. 113). The time to obtain attention and communicate benefits is less than 40 seconds, as this is the time spent on buying a single item (Sorensen, 2009). In this limited timeframe, the consumer enters a decision-making process that is in itself influenced by a multitude of factors, excluding those mentioned above. In the present thesis, there are some factors that are controlled for, some that are held constant, and some that are manipulated. The manipulated and explored factors are described in depth in the coming chapters. However, three influencing factors, namely shelf elasticity, product price, and purchase involvement, are described in this section to set the premises of the present research.

The shelf content and structure has been widely studied (Corstjens & Doyle, 1981; Murray, Talukdar, & Gosavi, 2010) and is a strategic tool (Chen & Chaiken, 1999; Urban, 1998) since methods for shelf allocation influence profitability (Corstjens & Doyle, 1981; Lim, Rodrigues, & Zhang, 2004). Shelf space is a restricted area that can be arranged according to many principles (e.g., brand, color, size, price, profit). Space elasticity, defined as the relationship between sales and the location of products on the shelf, has been modeled by previous researchers (Curhan, 1972; Curhan, 1973; Dréze, Hoch, & Purk, 1994). For the present thesis, space elasticity is held constant between manipulations. Nevertheless, shelf space is included in this research, but from the perspective of consumer value association and value inferences. Hence, the main focus is on space quality (e.g., top-level versus floor-level) rather than space elasticity (Corstjens & Doyle, 1981).

The well-studied factors of price elasticity and the price-quality relationship (Wilkinson, Mason, & Paksoy, 1982), have been excluded from the present thesis since price is a debated topic that has been shown to have a modest influence on consideration and choice without other consumer-influencing factors (Allenby & Ginter, 1995), and the relationship between price and quality is product-specific and weak in general (Gerstner, 1985). Furthermore, the factors addressed herein, such as product recognition, are non-price-related and price comparisons could be confounding.
Involvement, defined as, “A person’s perceived relevance of the object based on inherent needs, values, and interests” (Zaichkowsky, 1985, p. 342), is an important research factor, particularly as low involvement has been shown to decrease the influence of in-store factors (Hoyer, 1984; Olshavsky & Granbois, 1979), specifically, inter-brand comparisons (Baker, Hutchinson, Moore, & Nedungadi, 1986). Outcome-relevant involvement influences information processing while higher involvement increases information search (Chaiken, 1980; Fazio, 1990; Howard & Sheth, 1969; Pieters & Wedel, 2004; Rayner, Rotello, Stewart, Keir, & Duffy, 2001), thus increasing the probability of interaction with in-store influence factors. In the present thesis, low involvement is parallel with habitual purchase behavior as consumers buying products habitually are less malleable in their decision making (Hoyer, 1984; Leaong, 1993). To exemplify this, POP behavior of habitual buyers of the same shampoo brand is about locating the product. Hence, any comparison between products on the shelf is done to exclude distractors. However, if the buyer recently discovered that he or she has dandruff, the shampoo has to fulfill this need. In this situation, information processing has a heightened decision-making role as the buyer needs to consider options in detail. When making non-habitual decisions, consumers become more malleable and open for POP information, such as product packaging or displays.

To summarize, involvement level is important as non-habitual decision making encompasses evaluations made between options. For habitual decisions, visual attention is reduced to measuring visual search; that is, the act of locating a target among distractors. To control for involvement, forced-choice tasks, which have proved effective in inducing involved decision making, were implemented to engage participants and increase information processing (Bialkova & Van Trijp, 2011; Chandon et al., 2009; Pieters & Wedel, 2007; Rayner et al., 2001; Wedel & Pieters, 2000). However, involvement level is not comparable to high-involvement decision making, such as automotive choice, but rather is slightly heightened to induce both heuristic and analytic information processing via the complexity of the choice (Chaiken, Liberman, & Eagly, 1989; Chen & Chaiken, 1999; Payne, Bettman, & Johnson, 1992; Payne, Bettman, Coupey, & Johnson, 1992; Plous, 1993) and the involvement in the choice, respectively (Chaiken, 1980).
1.1.3 Perspective on Information Processing and Attention

It is important to point out that the emphasis of this dissertation is not specifically on information processing (e.g., top-down and/or bottom-up processing), but rather on how the processed information influences POP decision making. It is assumed that both the mind and the environment influences any given decision situation (Desimone & Duncan, 1995; Pieters & Wedel, 2004; Pieters & Wedel, 2007; Wedel & Pieters, 2008b; Wolfe, 2000) and that this is generally non-conscious (Bargh & Ferguson, 2000; Dijksterhuis, Smith, Van Baaren, & Wigboldus, 2005; Fitzsimons et al., 2002). Therefore, the emphasis is on the factors that influence information processing, henceforth denoted as in-store (factors that influence consumers through visual attention) and out-of-store (factors that influence consumers through memory activation).

To clarify the perspective of information processing, the “sculpture and construction” metaphor by Janiszewski (2008) is used. The metaphor is centered on creation of meaning (a sculpture) through the interaction between environment (the piece of marble) and the individual mind (the sculptor). The main perspective of this metaphor is that:

“People are not machines that produce a consistent output given a constant input. The output changes depending on the meanings the person needs to generate, even if the environment is constant. Thus, in the sculpture and construction metaphors, it is the variability in meaning, and the events that encourage a person to strive for each of the varied meanings, that is the focus of inquiry.” (Janiszewski, 2008, p. 285).

Hence, the sculptor can be told to create a sculpture and, depending on the focus of the inquiry, the sculpture can differ, even with the same piece of marble. Thus, it is in the interaction between the environment and the mind of the consumer that meaning is created; by controlling inquires, the meaning can be studied. Janiszewski (2008) formulates this as:

“[t]o the extent we can understand the task a consumer is trying to accomplish, we should be able to understand the meanings that are acceptable or relevant to that task…The relativism of meaning should be predicted by the goals the perceiver is trying to accomplish during his interaction with the environment.” (p. 283).

In addition, the role of attention is central to this perspective:
“Attention is a collection tool in the strategic behavior and attention is a chiseling tool in intuitive behavior.” (Janiszewski, 2008, p. 287).

In the present thesis, the focus is on visual attention as the “chiseling tool” as it shed light on rapid information processing that lacks conscious access or control (Wedel & Pieters, 2008b). This metaphorical perspective is fundamental in the assessment of information processing. Throughout the present studies, choice tasks are used with different levels of semantic interpretation. Some are specific, such as ‘buy dandruff shampoo’, and some are vague, such as ‘buy a shampoo’. Depending on the specificity of the tasks, the focus of the inquiry changes and guides the creation of meaning, thus revealing the semantically important factors that influence the decision-making process for that specific individual and choice.

1.2 Purpose

The purpose of the present dissertation is to explore the influence of in-store and out-of-store factors on visual attention and consumer POP decision making. Hence, the contextual framework is consumer POP decision making for FMCGs, while the methodological framework is primarily on visual attention. Furthermore, the theoretical framework is centered on consumer decision-making and the explored influencing factors. To accomplish this purpose, it was particularly important to understand consumers’ general visual behavior in POP decision making. Hence, the starting point is to explore how consumers generally observe the product shelf. This was underpinning for the coming studies that reveal how five specific in-store and out-of-store factors influence the consumer at POP. In general, the purpose of the thesis is studied in the appended papers to answer the following questions:

- How does a consumer visually observe the product shelf when making consumer goods decisions?
- How does product packaging influence visual attention?
- How does product shelf placement influence visual attention in task-oriented decision making?
- How do product recognition and visual attention influence product preference in decision making?
- How do product recognition and decision task influence the decision-making process?
The remainder of the present dissertation is dedicated to answering these questions and exploring the implications and theoretical contributions of the appended papers.

1.3 Structure of Thesis

The structure of this dissertation consists of five chapters. The commonalities between the chapters are the four components that form the conceptual model in Figure 1. The components decision making, visual attention, and the influencing factors are reviewed in the theoretical framework in chapter 2. Chapter 3 sets the foundation of the framework used in the appended papers to measure and manipulate the components in the conceptual model. In chapter 4, each appended paper is discussed in relation to the theoretical framework and conceptual model. Chapter 5 concludes the dissertation with a summary of the main results and implications for managers and future research, and is followed by references and the appended papers.

1.4 Conceptual Model

The conceptual model in Figure 1 consists of four main components, of which out-of-store and in-store factors are, individually and conjointly, studied in relation to their consumer decision-making influence through visual attention. Of visual attention’s three functions, the main function is to measure the influence of in-store and out-of-store factors on decision making. For example, in Paper II, the influence of the horizontal positioning of pictorial and textual elements on detection through visual attention was tested. Pictorial and textual elements are then treated as in-store factors that can only influence consumer decision making through visual attention. Moreover, Paper III explores both out-of-store and in-store influencing factors on consumer decision making. In this case, product packaging and vertical product placement are treated as in-store factors and consumer recognition and choice task as out-of-store factors. The second function of visual attention, which was examined in depth in Paper IV, is to measure its influence on decision making, independent of other influencing factors. The third function is to explain the decision-making process through visual attention. This is explored in Paper V. However, it is important to keep in mind that the appended papers have cross-related research purposes, such as the influence of product recognition on decision making.
Hence, the purpose of visual attention in the appended papers is generally described above to clarify its multifaceted role. The last component of the conceptual model is decision making, which is treated as a process starting with decision task and ending with a choice. Hence, the whole decision-making process, from the initial observation to the final choice, is studied to explore the influence of in-store and out-of-store factors.

Figure 1: The four components of the conceptual model, of which out-of-store and in-store components comprise five influencing factors.

In summary, this conceptual model is primarily focused on decision making as a process that is studied through visual attention and influenced by the interaction between the environment and the mind of the consumer. The conceptual model consists of three decision-making constructs, namely attention, signifying the act of attending information in the environment; perception, representing the interaction between the mind and the environment; and comprehension, which is the act of creating meaning from the attended and perceived information. The following section introduces the appended papers and contextualizes the model that supports the present dissertation. The summary is followed by the theoretical framework in which the conceptual model is broken down into its components.
1.5 Summary of Appended Papers

The appended papers have the same general purpose, which is to explore the influence of in-store and out-of-store factors on consumer visual attention and decision making. The papers test the components of the conceptual model from two perspectives, which involves the general visual attention of consumers, and individual factors and their influence on visual attention in decision making. In-store and out-of-store factors are emphasized as these factors conjointly and individually influence consumer decision making and visual attention. This is further described in this section which introduces and summarizes the appended papers.

1.5.1 Paper I: Consumer Perception at Point-of-Purchase: Evaluating Proposed Packaging Designs in an Eye-tracking Lab

This paper was coauthored with Dr. Erik Wästlund, who was the main author, Dr. Martin Löfgren, Dr. Lars Witell, and Dr. Anders Gustafsson. The paper has been presented in the 1st Nordic Retail & Wholesale Conference (NRWC 2008) in Norrtälje, Sweden. This paper has been published in Journal of Business and Retail Management Research (Wästlund et al., 2010).

Paper I is exploratory and constitutes the first step toward understanding the general properties of visual attention in POP decision making. The paper is divided among three unrelated experiments that evaluate eye tracking as a method for studying consumer POP decision making. The purpose of the first experiment was to determine general consumer visual behavior that must be taken into account when studying digitally displayed products. The second experiment was designed to explore the properties of visual attention in product findability; that is, the likelihood of a package being found based on packaging attributes. The third experiment was conducted to evaluate the influence of minute differences in packaging design on visual attention and decision making.

In this opening paper, both general visual attention and individual factors were studied to get a general understanding of how visual attention measures can be employed for future experiments. This paper contributed greatly to the subsequent papers by generating new ideas that were tested in the resulting experiments. Second, the methodological knowledge accumulated in this paper was used to improve procedural and statistical hurdles for the forthcoming
papers. Further contributions of this opening paper are discussed in the forthcoming paper summaries.

1.5.2 Paper II: Left isn’t always right: Placement of pictorial and textual package elements

Paper II was coauthored with fellow doctoral student Tobias Otterbring, who was the main author of the paper, Dr. Erik Wästlund, and Dr. Anders Gustafsson. This paper is currently in press to be published in British Food Journal.

Paper II studies the horizontal positioning of textual and pictorial elements and their influence on visual attention and detection. What makes this study unique is that previous research has mostly focused on recall or preference of packaging elements; by contrast, this paper focuses on packaging element detection through visual attention. The addition of visual attention complements traditional packaging element evaluation and allows for a precise measurement of packaging attribute positioning and its influence on detection and recall. This paper derives from experiment 2 in Paper I, which tested textual packaging elements and the detection of target products based on packaging attributes.

The results of this paper show that textual elements should be placed on the left-hand side and pictorial elements on the right-hand side to receive the most visual attention.

1.5.3 Paper III: The Verticality Heuristic: Why top shelf is not always top notch in product placement

Paper III is a working paper co-authored with Dr. Erik Wästlund and Dr. Anders Gustafsson. The paper has been presented at the 2nd Nordic Retail & Wholesale Conference (NRWC 2010) in Gothenburg, Sweden. The paper has also been presented at The 12th International Research Symposium on Service Excellence in Management (QUIS 12) in Ithaca, New York.

Paper I found that consumers generally direct vision to the top shelf section before the bottom. This is intriguing and prompted questions about the influence of vertical product positioning that were the starting point for Paper
III and several experiments stretching over two continents. Verticality, in general, is believed to influence decision making through cognitive processing, resulting in inferred value at different vertical positions. In this paper, verticality is treated as a mental shortcut used by consumers to direct attention to the position believed to contain products with a specific value (premium or budget). The purpose of Paper III, which was to examine the influence of vertical shelf position and product packaging on consumer visual attention, consideration, and choice, was thus two-fold: (1) to understand the influence of vertical shelf position, and (2) to understand the influence of product packaging. To further extend the contributions, participants were introduced to unfamiliar products. Familiarity as a concept was introduced to explore how naïve decision making influences the use of verticality as an indication of value.

The results show that consumers use verticality in the initial part of the search process. However, verticality loses its influence during evaluation of products. Furthermore, the influence of product packaging on consideration and choice is independent of product recognition. Thus, product packaging is the main indicator of value based on cue-level familiarity such as color, glossiness, and other packaging attributes. The results of Paper III indicate that product recognition has small influence on consideration and choice when consumers search for products with high or low value. Nonetheless, participants had a specific task to find different quality levels; therefore, it is not known how familiarity would influence consideration and choice if a preference choice task were given. The questions resulting from Paper III initiated Paper IV, which explores the influence of product recognition and visual attention on preference formation.

1.5.4 Paper IV: Familiar Packaging in a Crowded Shelf – The Influence of Product Recognition and Visual Attention on Preference Formation

Poja Shams is the single author of this working paper. A previous version of this paper has been presented at The Scandinavian Workshop on Applied Eye Tracking (SWAET 2012) in Stockholm.

Complex consumer decision making is characterized by simplification strategies to decrease cognitive load. One such strategy, product recognition, is a well-studied factor that has a positive influence on preference formation. Furthermore, visual attention influences preference formation as the consumer
moves further into decision making. The gist of preference formation through visual attention is that the more consumers look at a product, the more they prefer the product. The purpose of Paper IV was to explore the relationship between product recognition and visual attention. Results show that both recognition and visual attention contribute to preference formation. Furthermore, higher familiarity moderates the influence of visual attention on preference construction. However, the influence of product recognition is greater than that of visual attention on preference formation because it constructs a consideration set the preferences of which are then assessed through visual attention.

The result of Paper IV indicates how product recognition is used as a simplification strategy in decision making. However, the present paper does not empirically explore the decision-making process; rather, it is theoretically assumed. To understand the influence of product recognition in the decision-making process, then this assumption needed to be tested, which initiated Paper V and the investigation of product recognition.

1.5.5 Paper V: Using Heuristics to Revisit Consumer Choice Processes through the Eyes of the Consumer

Paper V is coauthored with Dr. Erik Wästlund and Dr. Lars Witell. This working paper has been presented at the Eye Tracking Research & Applications Symposium (ETRA 2012) in Santa Barbara, California.

Past research in decision making has divided it into stages that are understood as sub-processes of a consumer choice process and consist of iterations of elimination and consideration. Russo and Leclerc (1994) identified three stages of the consumer choice process: (1) orientation, (2) evaluation, and (3) verification. They also identified that visual attention varies over the different stages. In the initial stage, simplification strategies, such as product recognition, are employed to gather information to eliminate inappropriate alternatives, which results in a set of products that a consumer will consider in the evaluation stage. Furthermore, when consumers are given specific decision tasks, memory structures are activated; the task influences visual attention toward the products with the features related to the task. However, depending on whether consumers are given a choice or a consideration task, the decision can be more or less time-consuming. It is not established which stage accounts
for the added time and the role of product recognition in relation to the decision task. The purpose of Paper V was to test the three-stage model, as suggested by Russo and Leclerc (1994). Furthermore, three experiments examined choice and consideration task, product recognition and there influence on the three stages of the decision-making.

The results of the first experiment generally confirmed the staged decision-making model with some differences in the number of attended products during each stage and the time spent in the evaluation and verification stages. When examining the influence of product recognition in the second experiment, the results showed that decisions for familiar brands take longer than for unfamiliar brands and that product recognition mostly influences evaluation and verification. In the third experiment, the results showed that product recognition influence is dependent on choice task, since its influence on staged decision-making does not apply when a consideration task is given to consumers.
2 Theoretical Framework

This section provides an overview of the relevant literature in decision making and visual attention. The conceptual model (Figure 1) sets the foundation of the theoretical framework; each section is introduced with the components included in the model. Decision making is the first component, as it sets the positioning of the framework.

2.1 Decision-Making Framework

The disciplines of marketing and psychology have developed decision-making theories for over 60 years (Ranyard, Crozier, & Svenson, 1997), with a gradual shift from normative theory (Edwards, 1954; Morgenstern & Von Neumann, 1944) to behavioral decision theory (Simon, 1955), which recognizes the limitations of the human mind. The framework of bounded rationality defines the restrictions of cognition as the processing that can be done at one moment of time, and sets the foundation of sequential processing in complex decision making. This framework shifted the theoretical focus from decision outcomes to the process of decision making (Payne, 1976; Svenson, 1979). Many theories have developed within the framework of behavioral decision theory (Payne et al., 1992). However, the present section is not focused on one specific decision-making theory. Several theories, such as image theory (Beach & Mitchell, 1987); differentiation and consolidation theory (Svenson, 1992); Constructive Choice framework (Bettman et al., 1998); The Adaptive Decision Maker (Payne et al., 1993); and feature-integration theory (Treisman & Gelade, 1980), among others, have jointly shaped the present theoretical framework.

There are some commonalities between theories emphasized in the present framework. First, the decision maker constructs preferences for one option through several stages in a process. Second, in complex decisions, the decision maker first simplifies the decision into a reduced set of alternatives using strategies that demand less cognitive effort. Third, the simplification of the decision is mostly a non-conscious and automatic process. Fourth, the reduced set of alternatives is evaluated to reach a final decision. Fifth, evaluation of alternative can be non-conscious or conscious demand more cognitive effort by involving working memory. The coming section further establishes the present theoretical framework.
2.2 Process Perspective of Decision Making

The normative decision theory, developed from economics, assumes that the decision maker is rational. Consumer norms can be explained as expected behavior for achieving the highest payoff. However, normative theory assumes that decisions are based on unlimited information that can easily be utilized with full knowledge about options (Plous, 1993). Since consumers have bounded rationality (Simon, 1955), the assumptions of normative decision theory is a major issue (see e.g., Tversky & Kahneman, 1986; Payne et al., 1992). Bounded rationality, the starting point of behavioral decision theory, is defined by Simon (1955) as consumers seeking satisfaction, not maximization. Hence, in complex decisions, consumers do not search for all available alternatives, but choose the alternative that exceeds a certain level of payoff. The shift from normative decision theory paved the way for the process approach of decision-making research (Payne, 1976; Svenson, 1979). The sequential nature of the process approach divides decision making into stages that extend over time (Ranyard et al., 1997). In the process perspective, the decision maker is seen as adaptive; thus, payoff is not constant (Payne et al., 1990; Payne et al., 1993; Payne, Bettman, Johnson, & Luce, 1995; Payne et al., 1988; Payne et al., 1992; Senter & Wedell, 1999). The adaptive decision maker has a variety of strategies that can be employed in any given situation depending on cost and benefit (Payne et al., 1993). The payoff is dynamically influenced by processed information, such as the environment (Bettman, Johnson, Luce, & Payne, 1993; Huber & Klein, 1991), and the mind of decision maker (Bettman & Park, 1980; Coupey, Irwin, & Payne, 1998; Marewski, Gaissmaier, Schooler, Goldstein, & Gigerenzer, 2010). Some decision strategies can involve multiple options at the same time; other strategies compare attributes across options serially. The strategies can be quick and demand little cognitive effort, or they can be slow and place a greater demand on the decision maker’s working memory (Bettman, Luce, & Payne, 1998).

It is important to emphasize that the process perspective applies to complex decision making (Svenson, 1996), which can result from consumers’ bounded cognitive capacity and amplified by such factors as missing information, time pressure, level of experience, and number of alternatives (Payne et al., 1992). The most recognized driver of complexity is number of available alternatives, which increases choice complexity (Payne et al., 1992). In the context of POP decision making, past research has shown that consumers favor an increase in assortment size (Broniarczyk, Hoyer, & McAlister, 1998; Chernev, 2008; Kahn
& Lehmann, 1991), which, nonetheless, increases the cognitive cost of decision making (Chernev, 2006) and the complexity of the choice (Iyengar & Lepper, 2000). One consequence of increased complexity is the need for simplification (Chaiken et al., 1989; Chen & Chaiken, 1999). For example, Payne (1976) argued that when there are many alternatives, the decision process is divided into stages that screen for acceptable alternatives that can be evaluated in more detail. The initial stage is described as fast, crude, holistic, and parallel, while the subsequent stage is deliberate, attentive, detailed, and sequential. The concept of two processing modes is defined in the Dual Process Theory as two distinct systems, namely System 1, which is automatic/heuristic/intuitive/associative, and System 2, which is controlled/systematic/analytic/rule-based (see e.g., Evans, 2008, for review). System 1 is believed to involve implicit cognitive processing, while System 2 involves more explicit cognitive processing (Evans, 2008). Furthermore, System 1 is a supportive system that feeds a continuous stream of content to working memory for analytical processing in System 2. However, analytical reasoning in System 2 can intervene and adjust the automatic judgment in System 1 (Evans, 2008). Thus, memory structures that are seemingly conscious in nature, such as recognition, can automatically adjust judgment.

In the decision-making process approach, information processing is given a heightened importance as the source of predictability, which involves assessing and reaching a decision based on acquired and processed information. There have generally been two approaches to studying decision making (Ranyard et al., 1997), the structural approach, which builds on input and outcome with statistical models explaining the strategies used by the decision maker (e.g., Kahneman & Tversky, 1979), and the process-tracing approach, which differs from early decision-making research by focusing on the process prior to decision (e.g., Billings & Marcus, 1983; Payne, Braunstein, & Carroll, 1978; Svenson, 1979). Process tracing illuminates the mind of the consumer as the decision can be explored in relation to exogenous and endogenous factors throughout the whole decision-making process. Process tracing has been advocated by researchers in the past as the decision outcome is not sufficient for understanding human decision making (Lohse & Johnson, 1996; Olshavsky, 1979; Payne, 1976; Russo, 1978; Svenson, 1979). Specifically, the use of eye movements in complex decision making has been advocated (Bettman et al., 1998; Russo, 2011; Shah & Oppenheimer, 2008). In fact, visual attention is central to decision making (Russo, 2011; Russo, 1978) as all information
acquisition and processing activities are coordinated by the visual system (Sheliga, Riggio, & Rizzolatti, 1994). Hence, visual attention gives insight into the processed information and its influence on the decision.

2.2.1 Staged Decision Making

Independent of context, an individual decision is not isolated temporally. Decisions span over time and are divided into stages that form a sequential process (Brim et al., 1962; Simon, 1960). However, the sequential perspective has been criticized because it cannot be generalized for all decision contexts. In addition, some evaluations can be simultaneous with information collecting (Witte, 1972). Consequently, a more realistic view is that decision making is non-sequential or, rather, parallel, meaning that the relationships between decision-making stages are iterative, and dynamic (Mintzberg, Raisinghani, & Théorêt, 1976). However, it is important to note that non-sequential decision making is not analogous with considering large amounts of information simultaneously. Because of limited cognitive capacity, the amount of information that can be considered simultaneously is about seven units (Miller, 1956). Decision making has been studied by numerous researchers, resulting in models that divide the decision-making process into stages based on different criteria (Edwards & Fasolo, 2001; Payne et al., 1992; Reisen, Hoffrage, & Mast, 2008; Russo & Leclerc, 1994; Senter & Wedell, 1999; Wedell & Senter, 1997). Historically, researchers have suggested that consumer decision making is structured in a predetermined manner; however, there are no models that can accurately predict consumer choice. Research has shown that consumer choice is either a single-stage process or a multiple-stage process involving screening, evaluation, and choice (Elrod, Johnson, & White, 2004; Shao, Lye, & Rundle-Thiele, 2008; Russo & Leclerc, 1994). Single-stage models are based on a compensatory decision strategy, which means that every attribute of an object affects the utility of that object independent of its other attributes (Elrod et al., 2004). Moreover, these models suggest that consumers choose from a set of alternatives by screening and choosing the first acceptable alternative (Andrews & Srinivasan, 1995). However, there is a common understanding within the field that single-stage choice models do not explain the choice process in complex environments with a large number of products and attributes (Andrews & Srinivasan, 1995; Genseh, 1987). On the other hand, multi-stage consumer decision models are based on the idea that consumers first screen
and evaluate the alternatives and then enter the choice stage with clear decision boundaries (Bettman et al., 1998; Olshavsky, 1979; Payne, 1976; Shao et al., 2008). Stages are defined as multiple behaviors with distinct parts that include screening, consideration, elimination of alternatives and choice (Bettman et al., 1998; Fader & Hardie, 1996; Miller, 1993; Olshavsky, 1979; Payne, 1976; Wedell & Senter, 1997; Shao et al., 2008).

The concept of a multi-staged decision-making process in the context of POP decision making was introduced by Russo and Leclerc (1994) and broke with previous research favoring two stage models. In their study, Russo and Leclerc identified three stages by using process tracing to map the visual attention of consumers during FMCG decision making. They used direct observation of eye movements recorded through a one-way mirror and verbal protocols to draw boundaries between decision-making stages. The study aimed to identify an empirical foundation for a consumer choice process model. Based on their data, they suggested that consumer choice is a gradual discriminating among the alternatives. During evaluation, one alternative emerges as superior. Continued evaluations based on acquisitions, comparisons, and eliminations bolster the identified alternative until it is announced as the choice. The three-stage consumer choice model includes (1) orientation, (2) evaluation, and (3) verification, where the third stage is itself divided into sub-stages (3A and 3B) that address verification before and after actual consumer choice. In orientation, the decision maker gathers an overview of the product display. This stage is characterized by relatively short mean observation times and a low proportion of single eliminations (looking at a product once). The second stage, evaluation, incorporates consideration and elimination, which is a set of comparisons that are considered more seriously. Selective visual attention ensures that non-selected information is suppressed and relevant information is elicited (Howard & Sheth, 1969). Thus, by minimizing options, fewer products need to be considered and decision making is simplified. The evaluation stage includes the majority of observations (54 percent) made by consumers and subsequently takes the longest time (63 percent of total time) to complete. Finally the third stage, verification, acts as a confirmation of the decision that was made. Russo and Leclerc suggested that the choice process is optimized globally, one of the key characteristics of which is that operations such as elimination of alternatives occur throughout the choice process and are not limited to a specific stage.
Independent of the decision-making process being two-stage or multi-stage, the consumer first screens the original set of products and then considers a reduced set of alternatives. For example, Russo and Leclerc (1994) identified the evaluation stage in the multi-stage model to be, “…devoted to deliberate, effortful evaluation, especially of the alternatives that are considered more seriously” (p. 278). Instead of considering all products on a shelf, a choice is made from options within a consideration set (Bettman, 1979; Howard & Sheth, 1969; Huber & Klein, 1991; Johnson & Payne, 1985). Even though it is difficult to directly observe this process (Shocker, Ben-Akiva, Boccara, & Nedungadi, 1991), there is empirical support that consumers use consideration sets (Hauser & Wernerfelt, 1990; Payne & Ragsdale, 1978; Russo & Leclerc, 1994; Russo & Rosen, 1975). Some researchers have found that the screening stage may be used to gather relevant information to eliminate inappropriate alternatives (Andrews & Srinivasan, 1995; Glaholt & Reingold, 2009; Wedell & Senter, 1997). Hence, the initial screening stage of decision-making results in a consideration set (Lapersonne, Laurent, & Le Goff, 1995; Payne, 1976), which is a subset of the available products (Howard, 1977). The consideration set is evaluated and further reduced to what some authors have termed the choice set that is further reduced to one alternative that is chosen (Lapersonne et al., 1995; Roberts, 1989; Shocker et al., 1991). The construction of a consideration set is dynamic, hence changing during information processing (Chakravarti, Janiszewski, Mick, & Hoyer, 2003; Mitra, 1995; Nedungadi, 1990; Shocker et al., 1991). The dynamic nature of consideration sets is influenced by the choice task that brings certain cues to the mind (Nedungadi, 1990), hence increasing the probability of brands associated with those cues being included. Similarly, the decision-making strategies are dynamic and change depending on context and the stages of decision-making process (Bettman, 1979; Gensch, 1987; Nedungadi, 1990; Payne et al., 1988; Wright & Barbour, 1977).

2.2.2 Decision-Making Strategies

Decision making demands different amounts of cognitive effort and can be analytic, which is more demanding, and simple, which is less demanding. Both analytic and simple strategies can be used in any given decision situation (Payne et al., 1995); however, simple strategies are used at the early decision-making stages, while more cognitively demanding strategies are used in the later stages (Payne, 1976). In a simple strategy, consumers make fewer information search trade-offs (Jacoby et al., 1994), and quickly cut through the clutter to a
manageable consideration set. The strategies used to simplify the decision are known as heuristics (Newell, Shaw, & Simon, 1958; Simon & Newell, 1971).

The field of heuristic research is represented by two perspectives, namely heuristics as bias (Kahneman & Tversky, 1996; Tversky & Kahneman, 1974) and heuristics as fast-and-frugal decision rules (Gigerenzer & Goldstein, 1996). Independent of perspectives, it is clear that heuristics are used to simplify decision making (Newell et al., 1958; Simon & Newell, 1971). Heuristics rely on one or several basic rules that are unconsciously employed to reduce effort, such as (1) examining fewer cues, (2) reducing the difficulty associated with retrieving and storing cue values, (3) simplifying the weighting principles for cues, (4) integrating less information, and (5) examining fewer alternatives (Shah & Oppenheimer, 2008). Furthermore, heuristics are employed as the complexity of the decision increases (Chaiken et al., 1989; Chen & Chaiken, 1999; Payne et al., 1992; Payne et al., 1992; Plous, 1993). Even though fewer trade-offs are made in simple heuristics, they can be more accurate than demanding procedures (Gigerenzer, 2008; Plous, 1993). Simple heuristics employ informational structures that enable the decision maker to be accurate with a small processing effort (Gigerenzer & Brighton, 2009).

Goldstein and Gigerenzer (1999) argue that consumers are guided by different heuristics during the retail choice process. A heuristic, they argue, is not an inferior mental shortcut performed by the lazy mind, but rather an effective selection strategy. It has been suggested that, depending on the context, individuals utilize different strategies from an “adaptive tool box” of heuristics and core cognitive capabilities (Gigerenzer & Gaissmaier, 2011). Following this line of research, a number of choice heuristics have been identified (see, e.g., Gigerenzer & Gaissmaier, 2011; Gigerenzer & Goldstein, 2011). In terms of consumer choice, the fast-and-frugal decision rules are more likely to be used in repeat-purchase, low-cost categories as seen in the supermarket, rather than in high-involvement transactions, such as automotive choices (Hauser, 2011). Heuristics can generally be divided between non-compensatory and compensatory strategies. In non-compensatory strategies, trade-offs are not made between cue-level information, and the focus is on meeting the cutoff level for a specific criterion. Non-compensatory heuristics are based on the relationships between a list of cues used for the decision strategy. If the value of one cue outweighs any possible succeeding cue or combination of cues, then the strategy is non-compensatory (Marewski et al., 2010). However, if the
succeeding cue outweighs the previous cue, then the strategy is compensatory. Hence, compensatory heuristics require extensive information processing to make trade-offs on multiple cues for the criterion. Consequently, non-compensatory heuristics ignore cue-level criterion comparison, thus eliminating products that don’t meet the requirements of the criterion. In some non-compensatory strategies, the decision maker first examines alternatives based on attributes with highest importance. If alternatives do not match the attributes, they are eliminated and the set of alternatives decreases for the next iteration. This process relies on the importance of cues, which is based on preference (Hogarth & Karelaia, 2005). It is believed that the influence of heuristics is reflected in the decision-making process (Shah & Oppenheimer, 2008), specifically via visual attention (Russo, 2011).

2.2.3 Attention in Decision making

Visual attention is composed of two separate systems, perception and attention. Perception is a non-conscious information collection tool that constantly feeds the brain with neural impulses from sensory input. Visual attention is a conscious process of directing cognitive processing or working memory toward sensory input. To visually attain information for processing, there must be an alignment between attention and perception (Posner, 1980). This has previously been described as orienting, which is the “aligning of attention with a source of sensory input or internal semantic structure stored in memory” (Posner, 1980, p. 4). The alignment of attention and visual perception can be voluntary or involuntary, meaning that the decision maker voluntarily searches the environment (e.g., visual search) or involuntarily becomes conscious of the environment (e.g., saliency effect) (Bettman et al., 1998). Visual search, the process of finding a target among distractors (Wolfe, 1994; Wolfe, 1998), is an attention-guiding mechanism that relies on semantic memory structures (top-down information) and perceptual features (bottom-up information) (Treisman & Gelade, 1980; Wolfe & Horowitz, 2004).

The two attention guiding mechanisms constitute the framework that has much in common with the dual-process theory. The two component framework also divides visual search into two stages (Treisman & Gelade, 1980). In the first stage, the perceptual features are processed pre-attentively; in subsequent stages, the features are integrated to identify the product attentively. Thus, the framework is composed of a pre-attentive, parallel, bottom-up process, and an
attentive, serial, top-down process (Itti & Koch, 2001; Treisman & Gelade, 1980). The bottom-up process is believed to be a fast-and-crude creation of a topographic map of the saliency of perceptual features. The top-down process is believed to be a task-dependent, slow, and analytical adjusting of the topographical map to highlight its informative parts. In the two-state model, bottom-up processing is related to “where” information is located, and top-down processing to “what” the information is (Itti & Koch, 2001; Sagi & Julesz, 1985). When looking past trivial search tasks (find a red triangle among green circles) that are common in visual attention research, inspection of alternatives within a set of distractors is done serially (Treisman & Gelade, 1980; Wolfe, 1994).

There is strong support for the two-component visual search framework; however, there is some disagreement about the role of top-down and bottom-up processing and its influence on visual attention. Some research points toward top-down processing as predominant in influencing visual attention (Desimone & Duncan, 1995; Treisman & Gelade, 1980; Van Der Lans et al., 2008a), while other research points toward bottom-up structures (Itti & Koch, 2000; Theeuwes, 2010). Nonetheless, there is a common understanding that both top-down and bottom-up information is processed during visual search (Desimone & Duncan, 1995; Lee, 2002; Wolfe, 1994; Wolfe, 2000; Yantis, 2000).

The saliency of a package is an important factor for visual search, as opposed to merely standing out when a customer is looking at a shelf in general. However, saliency has previously been described as task-dependent because certain information can be salient for a specific task and not salient for other tasks (Van Der Lans et al., 2008b). According to previous research, visual search is guided by the sum of the bottom-up and top-down information that together constructs a master saliency map (Treisman & Sato, 1990) during brand choice (Van Der Lans et al., 2008a). The master saliency map is based on the perceptual features (bottom-up saliency) that are suppressed or enhanced depending on their relevance to the search task (top-down saliency). In opposition to the dominance of top-down driven visual attention, it is argued that the visual attention is completely bottom-up-driven at first and that it is only later that top-down information can bias visual attention (e.g., Connor, Egeth, & Yantis, 2004; Theeuwes, 2010). Pre-attentive processing is assumed for bottom-up information to be dominant in the initial discrimination of
alternatives. In this case, the pre-attentive processing does not include any top-
down information other than spatial information (Theeuwes, 2010).

It is appealing to believe that visual search fully illuminates the attention and
cognition of the consumer. However, it is important to understand that both
vision and attention are used in decision making and both these components
have limitations. The volume of information collected from the visual system
\((10^8 \text{ bits per second})\) exceeds the cognitive capacity of any consumer (Itti &
Koch, 2001; Itti & Koch, 2000); hence, visual attention is bounded by the
principles of behavioral decision making. The issue of “what has” and “what
has not” been processed and attained in the field of vision has been debated by
previous researchers. In addition to directing the eyes, consumers direct the
mind toward informative and meaningful parts of the gathered information.
The fundamental issue of measuring vision is that only the attention of the eyes
(overt attention) is measured; however, the attention of the mind (covert
attention) is similarly important for decision outcome. The coupling of overt
and covert attention is essential as the fundamental assumption is that
consumers process through the visual system, hence giving insight into rapid
information processing (Wedel & Pieters, 2008b). Covert attention can freely
move within the field of vision (Strasburger, Rentschler, & Jüttner, 2011), and a
disassociation between overt and covert attention would constitute
methodological issues.

Based on the previous research, it is reasonable to assume tight coupling
between overt and covert attention in the context of POP decision making as
(1) it is a complex decision task with many alternatives, and (2) the covert
attention directs overt attention. Full dissociation between covert and overt
attention, that is, the consumer using peripheral vision in decision making,
would reduce the reliability of visual measurements. However, there is a
consensus within the field that disassociation is dependent on task complexity
(Pieters & Wedel, 2008). In complex tasks, such as POP decision making, there
is a tight coupling between covert and overt attention (Findlay, 2005; Rayner &
Castelhano, 2008) that has metaphorically been compared to a rubber band
(Henderson, 1992; Pieters & Wedel, 2008). In most decision-making situations,
covert and overt attention are linked such that it is possible to get insight into
covert attention through eye movements, hence insight into the mind of
consumer in the decision-making process (Findlay, 2005; Findlay & Gilchrist,
2003; Glaholt & Reingold, 2011; Pieters, Wedel, & Jie Zhang, 2007). However,
it is important to point out that covert attention moves to the extremities of the field of vision and leads the way for overt attention (Hoffman, 1998). Thus, consumers use the whole field of vision in directing the eyes to the next interesting area (Deubel & Schneider, 1996; Hoffman, 1998; Kowler, Anderson, Dosher, & Blaser, 1995). Even so, the limits of the perceptual span within peripheral vision is not clear (Rayner, 2009). Previous research has defined it as somewhere between 1.5 to 30 degrees from the center of the visual field (Rayner, 2009; Strasburger et al., 2011). However, peripheral vision is more useful for gist recognition then central vision (Larson & Loschky, 2009). For example, a person can understand the first gaze at a scene by gist recognition if they are looking at a living room or forest using peripheral vision. Furthermore, there is evidence showing that the gist of a scene is available to guide visual recognition and selection (Chun & Jiang, 1998). Henceforth, covert and overt attention will be referred to as visual attention as both components together form the underlying information acquisition needed for processing the decision environment.

With this theoretical background on decision making, the focus of this dissertation will shift to a review of the research on the factors that influence the decision-making process.

### 2.3 Influencing Factors

To understand consumer behavior and decision making from the process perspective, it is fundamental to understand the factors influencing the process. Generally, for POP decision making these factors can be divided between in-store and out-of-store influences. The adaptive decision maker is known to be influenced by processed information from the environment (Bettman et al., 1993; Huber & Klein, 1991) and the mind (Bettman & Park, 1980; Coupey et al., 1998; Marewski et al., 2010). This is also reflected in the concept of information processing and the two-component framework of visual search (Itti & Koch, 2001). Hence, out-of-store influencing factors are parallel with top-down information processing that influences the consumer at POP through some level of memory activation (Bettman, 1979; Chandon et al., 2009; Dréze et al., 1994; Van Der Lans et al., 2008a). In contrast, in-store influencing factors are parallel with bottom-up information processing that influences consumers only by attending the information at POP (Bettman, 1979; Chandon et al., 2009; Dréze et al., 1994; Van Der Lans et al., 2008a).
Product recognition and preference formation are two examples that illustrate the intricacy of drawing boundaries between in-store and out-of-store influencing factors. Preferences can be formed through retrieval (Smith, 1989; Smith, 1994) and construction (Lichtenstein & Slovic, 2006; Slovic, 1995; Slovic, Finucane, Peters, & MacGregor, 2002). Preference retrieval can influence decisions depending on previous experiences. In contrast, preference construction can influence decisions through the interaction between memory structures and attention of the decision maker. Similar intricacy exists in product recognition, which is composed of familiarity and recollection (Hintzman, Caulton, & Levitin, 1998; Hintzman & Curran, 1994). With this in mind, the boundaries in the present thesis have been drawn based on the assumed influence of these factors. The assumption is that in complex decision making with multitude of options, product recognition is primarily an out-of-store factor influencing the consumer as a simplification strategy (Gigerenzer & Goldstein, 1996; Simon, 1990). Similarly, preference formation is emphasized as an out-of-store influencing factor as it is perceived to be formed in the mind of the decision maker (Gregory, Lichtenstein, & Slovic, 1993; Payne et al., 1992) through choice task and memory activation (Payne et al., 1990; Payne et al., 1993; Payne et al., 1988). Hence, as product recognition and preference formation are not purely bottom-up-driven and involve top-down memory activation, they are categorized as out-of-store influencing factors in POP decision making.

Since past researchers have struggled with quantifying information seeking (Newman & Staelin, 1972), it has been a challenge to study the influence of in-store and out-of-store factors. However, the general concept of combining these factors has been acknowledged for a long period (Newman & Staelin, 1972). Nevertheless, it was not until recent research that the influence of in-store and out-of-store factors has been explored in terms of their impact on attention, consideration, and choice in the decision-making process (Chandon et al., 2009; Van Der Lans et al., 2008a; Van Der Lans et al., 2008b).

Figure 2 presents three out-of-store factors relevant to the thesis. The first is product recognition which is a simplification strategy (Gigerenzer & Goldstein, 1996; Goldstein & Gigerenzer, 2002; Simon, 1990). The second is the concept of choice task and task-oriented information search. When consumers are given specific search or choice tasks, memory structures (Huffman & Houston, 1993;
Huffman & Kahn, 1998; Meyvis & Janiszewski, 2002) influence visual attention toward products with associated features (Van Der Lans et al., 2008a; Wedel & Pieters, 2008b). The third is the influence of consumer preferences on decision making and the formation of preferences through retrieval (Smith, 1989; Smith, 1994) and construction (Slovic, 1995).

In-store promotion has been an important research topic as it has a great influence on consumer POP decision making. In-store marketing is central as the majority of FMCG buying decisions made at POP. Furthermore, consumer decision making is especially malleable at POP as the decisions are rapid (Hoyer, 1984) with few price comparisons (Dickson & Sawyer, 1990; Woodside & Waddle, 1975) and low involvement level (Underwood & Ozanne, 1998). In fact, it has been shown that two-thirds of products’ saliency results from in-store factors (Van Der Lans et al., 2008a). As seen in Figure 3, two in-store influencing factors have been studied, namely product packaging and product placement. Product packaging influences visual attention (Wedel & Pieters, 2008a) and product assessment based on packaging cues (Underwood & Klein, 2002; Zeithaml, 1988). Product placement influences value via such things as vertical or horizontal placement (Chandon, Hutchinson, Bradlow, & Young, 2008; Dréze et al., 1994; Sigurdsson, Saevarsson, & Foxall, 2009; Van Nierop, Van Herpen, & Sloot, 2011).
In the coming sections, research on the included in-store and out-of-store factors and their influence on consumer visual attention and decision making is reviewed.

2.3.1 Recognition

Recognition is the most rudimentary consumer knowledge that includes all past experience with a product independent of exposure context. Recognition can generally be divided between familiarity and recollection (Hintzman et al., 1998; Hintzman & Curran, 1994). Familiarity is the ability to identify with small cognitive effort an object that has previously been processed through the use of implicit memory. Implicit memory is non-intentional and non-conscious retrieval of previously acquired information. Conversely, recollection involves a higher level of cognition as it requires detailed, explicit, conscious recall of processed information (Chun & Jiang, 1998). An example is to imagine all the products in the soda category. A few products, such as Coca-Cola, Mountain Dew, and Dr. Pepper, would be easy to recall. However, if you were exposed to the shelf, you would with high certainty be familiar with several other brands that you could not recall.

It is well established that product recognition results in higher choice probability (Axelrod, 1968; Haley & Case, 1979) and higher preference (Coupey et al., 1998; Harrison, 1977; Kara, Rojas-Méndez, Kucukemiroglu, & Harcar, 2009; Underwood & Klein, 2002; Zajone, 1968). Rao and Monroe (1988) showed that familiarity acts as a mediator to price-perceived quality effects. Furthermore, price-perceived quality effects are stronger for high- and low-familiar subjects compared to moderately familiar subjects and cues had a stronger effect on perceived quality with higher product familiarity than with lower product familiarity. In a later paper, Rao and Monroe (1992) returned to
the influence of familiarity and found that high-knowledge consumers did not
discount price as much as low-knowledge subjects, mostly because of their
understanding of the actual quality. In addition, there findings show that higher
knowledge leads to higher willingness to pay because of the ability to judge
quality. Familiarity has also been researched in relation to product features in
Zhou and Nakamoto (2007), who showed that product features and
preferences are moderated by familiarity and that products with unique features
are perceived more favorably by experienced consumers. Bredahl (2004) also
researched familiarity and found that different cues are used depending on the
level of familiarity toward the products. Furthermore, Underwood and Klein
(2002) discovered that familiar private label and national brands were rated
both better-tasting and healthier then less-familiar brands.

The influence of recognition on decision making can be explained by
mechanisms of processing fluency that are perceptual or conceptual (Tulving &
Schacter, 1990). Processing fluency can be explained as the ease with which a
product comes to the consumer’s mind (Winkielman, Schwarz, & Fazendeiro,
2003; Winkielman, Schwarz, Fazendeiro, & Reber, 2003), resulting in higher
preference (Willems, Van der Linden, & Bastin, 2007). Perceptual fluency is the
ease with which attributes from the environment can be identified through low-
level processing (Jacoby, Kelley, & Dywan, 1989), while conceptual fluency
involves higher-level processing through interpretation of appropriate mental
concepts for the product (Whittlesea, 1993). Processing fluency is the result of
the mere exposure effect (Bornstein, 1989; Seamon et al., 1995) formed when
consumers are repeatedly exposed to a product to make it less threatening
(Zajonc, 1968; Zajonc, 1980) and more familiar (Coupey et al., 1998; Harrison,
1977; Kara et al., 2009). Hence, exposure results in enhanced processing fluency
that makes a brand more accessible in memory (Jacoby & Dallas, 1981) and
more approachable and preferred by the consumer (Bornstein, 1989; Seamon et
al., 1995). Furthermore, the exposure effect has been shown to influence
preference formation and choice at fast-exposure durations (Seamon, Marsh, &
Brody, 1984). Hence, only a fraction of a second is needed for a consumer to
be influenced and become more familiar with a product. In fact, the most
extensively researched effect of familiarity has been on preference formation
and the positive attitude resulting from mere exposure effect (Willems et al.,
2007).
In their paper on brand familiarity, Baker et al. (1986) concluded that recognition results in (1) enhanced perceptual identification, (2) increased probability of inclusion in the consideration set, (3) forms preferences, and (4) enhanced influence on choice behavior. These conclusions can be explained by the use of decision strategies throughout the decision-making process.

First, regarding perceptual fluency, there is a strong belief that recognition is the first simplification strategy used by the consumer in the construction of consideration sets (Gigerenzer & Goldstein, 1996; Goldstein & Gigerenzer, 2002; Simon, 1990). It is argued that product recognition results in a faster and more selective decision process which in turn results in better decision outcomes (Kuusela, Spence, & Kanto, 1998; Russo & Leclerc, 1994). For example, Pieters and Warlop (1997) identified that product recognition has a probable causal effect on attention attraction and in preference formation. Furthermore, research on recognition and attention showed that repeated exposure to a setting produced a form of learning that will direct attention toward a target (Chun & Jiang, 1998). This can be explained by the consumers’ use of recognition as a heuristic in the decision-making process. The recognition heuristic is a non-compensatory strategy which states that if a decision-maker presented with two options and one option is more recognized than the other, then the recognized option will have a higher value for the criterion (Goldstein & Gigerenzer, 2002). The recognition heuristic was later extended to more than two options, thus more comparable to the concept of familiarity (Gigerenzer & Goldstein, 2011). When the recognition heuristic is applied to more than two options, it has been shown to be part of the formation of consideration sets (Marewski et al., 2010). However, when the consideration set is established, the alternatives within the set can be ranked based on cues (Marewski et al., 2010). Furthermore, product recognition is not limited to one perceptual attribute, such as brand name, since all attributes can be recognized as cues, such as color and shape (Wolfe & Horowitz, 2004), indicating properties that are diagnostic and meaningful for the consumer (Alba & Hutchinson, 1987). If products are not recognized, then consumers may infer values for a missing attribute using heuristics based on other information (Bettman et al., 1998) depending on the accessibility of the information.

Non-compensatory or compensatory strategies are used in the later stages of the decision-making process to discriminate between the alternatives on a cue level. One such example is the take-the-best heuristic, which is a binary model
based on the inferred cue value (Gigerenzer & Goldstein, 2011). The rule for this heuristic is to search through the cues in order of their validity. Search is stopped when the first cue that discriminates between alternatives is found. The cues are ordered unconditionally according to their validity. In a multi-alternative setting, such as the retail shelf, take-the-best heuristic is reformulated to the deterministic-elimination-by-aspect heuristic (Marewski et al., 2010), which proposes that attributes can be ordered in relative importance; in a multi-stage process, alternatives are examined sequentially by attributes (Hogarth & Karelaia, 2005). Thus, the decision-maker first examines alternatives based on attributes with highest importance. If alternatives do not match the attributes, they are eliminated and the set of alternatives decreases for the next iteration. This heuristic relies on the importance of cues and their ordering, which is in turn based on preference (Hogarth & Karelaia, 2005).

In conclusion, the recognition heuristic is believed to be the first used in complex decision making (Gigerenzer & Goldstein, 1996; Simon, 1990) when constructing the consideration set (Oeusoonthornwattana & Shanks, 2010) and serves as the first step into other strategies. However, after the initial screening of the alternatives, recognition becomes one among several factors evaluated by the consumer (Oeusoonthornwattana & Shanks, 2010). Recognition influences the decision-making process, but it is not the only precursor of choice. Consumers employ recognition-based strategies in the initial shelf screening, with recognized products progressing further into the decision-making process. Furthermore, these products will receive more attention and increased preference as a result of mere exposure and processing fluency. This indicates that the relationship between exposure, fluency, and preference formation is an ongoing process as preference is constructed every time a consumer interacts with a product. Since preferences are known to be formed through construction and retrieval (Payne et al., 1990; Payne et al., 1993; Payne et al., 1988), comparative cue judgment depends on preference formation through both in-store and out-of-store factors as discussed in the following section.

2.3.2 Preference

One important difference between normative and behavioral decision theory is the concept of preference construction. In normative decision theory, the assumption is that preferences are constant and independent of other available options. However, in behavioral decision theory, preferences are constructed
using information processing strategies and subject to influence (Bettman, 1979; Bettman & Park, 1980; Payne et al., 1992; Slovic, 1995) because of limited cognitive capacity (March, 1978).

Consumer preferences are adaptive and influenced by in-store and out-of-store factors such as decision task, environment, and experience (Payne et al., 1990; Payne et al., 1993; Payne et al., 1988). Nonetheless, consumer preferences are not always constructed as they are dependent on experience levels (Kuusela et al., 1998; Nowlis & Simonson, 1997). There are two main perspectives of how preferences are formed during the decision-making process. First, some research points toward consumers having a consistent set of preferences that are based on cognition and previous experiences (Smith, 1989; Smith, 1994). Second, research has identified that preferences are not fixed, but rather constructed in the decision-making process through anchoring, prominent dimensions, elimination of elements, and addition of new attributes (Slovic, 1995). Consumers use previous experiences that influence preferences in any given situation (Slovic et al., 2002). Nevertheless, research has shown through several preference-reversal experiments (Cox & Epstein, 1989; Cox & Grether, 1996) that in complex decision-making situations, preferences are constructed rather than retrieved (Gregory et al., 1993; Payne et al., 1992). Furthermore, preferences can also be constructed when consumers have insufficient or conflicting preferences or insufficient familiarity (Lichtenstein & Slovic, 2006). Thus, preferences can be formed through construction and retrieval (Shafir, Simonson, & Tversky, 1993; Weber & Johnson, 2006) depending on the level of complexity (Gregory et al., 1993; Shafir et al., 1993; Slovic, 1995) and familiarity (Lichtenstein & Slovic, 2006).

In visual attention research, the phenomenon of preference construction has been described as “preferential looking” (Shimojo, Simion, Shimojo, & Christian, 2003). Preferential looking is closely linked to the mere exposure effect and explained as an increase of visual attention leading to increase of preference toward the object (the more we look, the more we like). Similar to preference construction, preferential looking is influenced by the complexity of the decision. As the decision making gets more complex, visual attention has a greater influence in preference formation (Shimojo et al., 2003). The mechanisms of preferential looking were developed and tested in an empirical research study by Simion and Shimojo (2007) that examined the relationship between mere exposure, visual attention, and preference. Simion and Shimojo
(2007) proposed that mere exposure effects interact with preferential looking to create a positive feedback loop, a process that is defined as the gaze cascade model; that is, the more we look, the more we like, and the more we like, the more we look. In fact, in some cases, increased attention on a product adds 13 percentage points to the probability of consideration for choice (Chandon et al., 2008). Previous research has shown that there is a relationship between visual attention and preference formation. One such example is Pieters and Warlop (1999) who used eye tracking to measure the effect of time pressure and task motivation on decision making. The stimuli were color slides of consumer goods, stacked in two rows of three brands on each row with product categories ranging from rice to canned soup. Pieters and Warlop showed that visual attention on the chosen alternative was longer (53 milliseconds) than for the unchosen alternative. Preference construction is believed to be based on activated goals as a function of the cues that are available for the decision (Kruglanski et al., 2002) as discussed in the next section.

2.3.3 Choice Task

The constructive view of preference formation has been researched from several perspectives (Payne et al., 1992). There are two closely related concepts, namely concreteness and framing, which are fundamental to preference construction (Lichtenstein & Slovic, 2006). The first is the concept of concreteness principle which states that people accept and use information and format of the information which they are given (Slovic, 1972). Hence, when given the premises of a decision (decision criterion), the consumer will seek the preferred alternative within that structure which that will influence decision process and choice (Sethuraman, Cole, & Jain, 1994). The framing effect has been shown to influence decision outcome through changes in information acquisition based on how the decision criterion is framed (Tversky & Kahneman, 1986). By framing a problem with different decision criterion, the decision-making will be influenced through changes in information acquisition (Bettman, 1979). Tversky and Kahneman (1981) describe that the framing effect as a visual illusion more than a computation error, because framing governs the perception and attention of the decision maker. The influence of framing is described as, “individuals will devote more effort to examining information they believe will help them attain whichever goals are more heavily weighted in that situation” (Bettman et al., 1998, p. 193). However, if no decision criterion is given, the consumer will construct their own criterion (Bettman & Sujan, 1987). One
interesting aspect of goal choice is its influence on consumers with different levels of familiarity. Independent of familiarity for the products, consumers can make intelligent and goal-consistent choices when given a decision criterion (Huffman & Houston, 1993). It is also noteworthy that the influence of the framing effect is highly dependent on the decision criterion’s wording (Schneider, 1992; Tversky & Kahneman, 1986) and mental associations (Barsalou, 1999). Thus, if the consumer is asked to “buy” a product from the shelf, the associations made are dependent on relevant consumer cues. However, if the consumer is asked to “buy the healthiest” product on the shelf, associations are made toward the cues that the consumer believes communicate healthiness, as defined by the decision criterion.

In visual search, choice tasks influence visual attention deployment (Desimone & Duncan, 1995; Van Der Lans et al., 2008a; Yantis & Johnson, 1990) as the consumer must visually search for task-relevant information to find a target within a set of distractors (Yantis, 2000). Therefore, choice tasks activate memory structures (Huffman & Houston, 1993; Huffman & Kahn, 1998; Meyvis & Janiszewski, 2002) that direct visual attention (Van Der Lans et al., 2008a; Wedel & Pieters, 2008b) to different meaningful elements (Nedungadi, 1990; Nedungadi, Chattopadhyay, & Muthukrishnan, 2001). Product recognition and product preference are activated when consumers are given choice tasks (Lee & Labroo, 2004; Payne et al., 1990; Payne et al., 1993; Payne et al., 1988). Previous research has shown that it is possible to alter consumers’ motivational mindset by using different choice goals or choice tasks (Morales, Kahn, McAlister, & Broniarczyk, 2005; Quinlan & Humphreys, 1987; Treisman & Sato, 1990; Wolfe, 1994). The alteration of the motivation mindset also alters decision-maker searching behavior, which can be observed through visual attention (Underwood & Foulsham, 2006). One such example is the study by Bialkova and Trijp (2011) which tested the effects of nutritional labels on attention. Their results showed that a shopping goal directed attention toward design features that were meaningful in relation to the goal. The shopping goal was also tested by Chandon et al. (2009) who examined a choice or consideration goal condition. Their results showed that participants spent less time in the choice than in the consideration goal condition. The participants were fast and efficient when choosing a product and more analytical in considering one. The difference in time between the two tasks can be related to the different heuristic strategies used in the decision-making process. Tversky et al. (1988) suggested that choice invokes qualitative reasoning, while
consideration requires more quantitative searching. It is well known that search tasks influence consumers’ visual attention toward the inherent properties of the search task (Henderson, Weeks, & Hollingworth, 1999; Henderson, 2003). Van der Lans et al. (2008a) exemplified this phenomenon by using ketchup as a search task. If the consumer is given the task to find ketchup, the cues (e.g., red color) will be more salient than other cues that are not relevant. The influence of shopping goals in consumer evaluation, search, and shopping behavior is an important future research area (Puccinelli et al., 2009).

In the present dissertation, choice task or shopping goals are used to alter the motivational mindset of the consumer. Shopping goals are used to direct visual attention of the consumer towards perceptual features that are related to the task, hence giving homogenous preparatory retrieval of cues. Nonetheless, the shopping goals used in the present thesis are not target (ketchup) or brand-specific (Heinz); rather, they are more conceptual (exclusive/healthy) and related to associations between conceptual and perceptual features. Product packaging is an influencing factor that embodies both perceptual and conceptual features as discussed in the coming section.

2.3.4 Product Packaging

There are several definitions of product packaging that span over different research fields (Ampuero & Vila, 2006; Vila & Ampuero, 2007). Prendergast and Pitt (1996) divide the function of product packaging into logistic and marketing functions. Even though both perspectives are important research areas, the focus of the present thesis is on the marketing function, since a large body of research has illustrated the importance of packaging design as a communicative tool that influences consumer attention (Berkowitz, 1987; Bloch, 1995; Bloch, Brunel, & Arnold, 2003; Schmitt, Simonson, & Peters, 1997). Packaging is the first point of interaction with the product in the retail environment; product perception is based on this interaction which in turn influences the decision making (Bloch et al., 2003). Furthermore, most consumers make their purchase decisions solely by looking at the front of the package (Urbany, Dickson, & Kalapurakal, 1996). Product packaging has been acknowledged as a silent salesperson (Pilditch, 1973) that not only captures consumers’ attention, but maintains it amid the visual clamor of competing products (Judd, Aalders, & Melis, 1989). Thus, product packaging can be used as a powerful POP in-store influencing tool (Prone, 1993). Since a majority of
decisions are made in-store, brand owners can greatly influence decision making through packaging (Bucklin & Lattin, 1991; Hoch & Deighton, 1989; Prone, 1993; Rundh, 2005; Van Der Lans et al., 2008b); this is especially true for low-involvement consumer nondurables (Underwood & Ozanne, 1998).

As a marketing tool, product packaging is used by the consumer as a surrogate indicator of value (Sullivan & Burger, 1987) based on the cues that together form the holistic impression of a product. The cue utilization theory label attributes that signal cue properties of a product (Richardson, Dick, & Jain, 1994) and divides them into intrinsic and extrinsic cues (Olson & Jacoby, 1972). Intrinsic cues involve the physical composition of the product; such as, flavor, texture, and sweetness (Zeithaml, 1988). Extrinsic cues are product-related, yet are not a part of the physical product itself. Information such as brand name, price, and logo are considered as conceptual extrinsic cues (Zeithaml, 1988). Furthermore, what the product conveys in its appearance, such as color, luminance, shape and size, are perceptual extrinsic cues; based on the classifications by Zeithaml (1988) and Underwood and Klein (2002). These cues are combined together to communicate the diagnosticity of the product; that is, the likelihood of cues leading the consumer to a successful task resolution (Dick, Chakravarti, & Biehal, 1990).

Prior research on cue utilization has predominantly tested the relationship between price and quality perception (Bredahl, 2004; Burnkrant, 1978; Dodds, Monroe, & Grewal, 1991; Jacoby, Olson, & Haddock, 1971; Mitra, 1995; Rao & Monroe, 1988; Rao & Sieben, 1992; Richardson et al., 1994; Rigaux-Bricmont, 1982; Szybillo & Jacoby, 1974; Valenzi & Andrews, 1971; Warlop, Ratneshwar, & Van Osselaer, 2005). In a study testing the relationship between price and taste quality, Valenzi and Andrews (1971) showed that taste quality ratings were positively related to price information; that is, that price is a quality cue. This was further tested by Jacoby et al. (1971) in an experiment with price, brand image, and product tasting that found that when price is the only varied cue, it has an effect on quality perception. However, price is not an indicator of quality in a multi-cue setting. Similar results were found by Szybillo and Jacoby (1974) who showed that price had no effect on quality perception in a multi-cue setting. Furthermore, Burnkrant (1978) discovered in a price and advertisement study that price is related to product quality perception if the product is complex. In a study of willingness to buy, Dodds et al. (1991) investigated how price, brand name, and store information influenced perceptions of product
quality and value and showed that consumers' quality perception was based on price when it was the only available cue. Dodds et al. further showed that product evaluation expands beyond price-perceived quality relationships. In fact, the relationship between price and quality is product-specific and weak in general (Gerstner, 1985). On the other hand, product packaging cues have in several studies been shown to influence quality perception.

Rigaux-Bricmont (1982) showed that packaging and brand name influences product quality perception. In an effortful study with 1,564 participants using product packaging ingredients, Richardson et al. (1994) discovered that in the assessment of product quality, consumers rely on packaging cues. Furthermore, in a study of individual packaging cues, Underwood and Klein (2002) discovered that manipulations on packaging cues have a strong influence on attitude towards the product. Bredahl (2004) added several more packaging and product-related cues. Some cues tested were brand name, price, cardboard tray, product label, package sleeve, and information leaflet. Bredahl also showed that cues were used to assess health and expected eating quality. For both, brand, not price, was the predominant cue. In an experimental study, Warlop et al. (2005) investigated whether brand name, price, packaging shape, and packaging color facilitate quality difference awareness. Warlop et al. discovered that brand name has a greater effect on awareness and quality retrieval if the name is differentiated, as compared to similar or alphabetic names. However, even if brand names are similar but packaging shapes and colors are differentiated, memory-based quality judgments will increase based on packaging cues. Despite the use of deceptive price cues, distinctive brand cues improve the accuracy of quality judgment independent of price manipulations. In summary, it is apparent that price is not a decisive cue in the judgment of quality; however, product packaging cues have an influence on quality perception and decision outcome.

Even though packaging cues have influence, it is important to point out that they only have an influence if they are meaningful for the consumer (Sullivan & Burger, 1987). For example, imagine the cues that are important for purchasing a tomato. Certainly the color is one such cue as it indicates ripeness of the tomato. However, this is dependent on how experienced the consumer is in buying tomatoes. If the consumer never purchased a tomato before, then color is not predictive for the decision outcome as the consumer is unable to use this cue confidently. This concept was introduced by Cox (1967) and named the
predictive and the confidence value of cues. If the packaging design cues have high predictive and confidence value, then the salient beliefs are triggered and the consumer can evaluate the product. This is the case when the designer isolates and incorporates meaningful cues into the packaging design. However, when this fails, the product becomes invisible to the consumer (Dick et al., 1990). Previous research has shown that appealing and attractive packaging design influences memory and visual attention while unattractive designs activate uncertainty, disgust, and expected risk (Stoll, Baecke, & Kenning, 2008). Furthermore, it has been argued that the influence of product packaging on consumer behavior should be studied by focusing on separate package elements and how they relate to decision making (Underwood, Klein, & Burke, 2001). In addition, design element organization can facilitate information search and influence which packaging aspects receive attention (Janiszewski, 1998).

Textual and pictorial cues have been recognized as important in influencing perception. Researchers often classify text and pictures into separate categories, such as verbal and visual (Rettie & Brewer, 2000), or informational and visual package cues (Silayoi & Speece, 2004; Silayoi & Speece, 2007). Pictorial elements are central for capturing and retaining consumer attention (Childers & Houston, 1984; Pieters & Wedel, 2004; Underwood et al., 2001), and textual elements have a large impact on consumers’ choices (Pieters & Wedel, 2004). For instance, Feiereisen et al. (2008) showed that words, more than pictures, generally enhance comprehension of new products. There is quite extensive research regarding the processing of textual and pictorial information in the human brain. The functional asymmetry of the brain’s hemispheres has been acknowledged for more than a century (Witelson & Pallie, 1973). Because of the cross-connection between the hemispheres and the visual fields, information from the left visual field is processed in the right hemisphere, and information from the right visual field is processed in the left hemisphere in normal subjects (Hansen, 1981; Jordan et al., 2003; Koivisto & Revonsuo, 2003). Apart from some recent studies (Deng & Kahn, 2009; Pieters & Warlop, 1999; Rettie & Brewer, 2000; Silayoi & Speece, 2004; Silayoi & Speece, 2007; Underwood et al., 2001; Underwood & Klein, 2002), there is a general lack of research on the communicative aspects of textual and pictorial package elements, specifically in relation to visual attention.

In summary, product packaging is the most influential tool in capturing POP consumer attention (Berkowitz, 1987; Bloch, 1995) and communicating value
(Page & Hen, 2002). The visual aesthetics of packaging design can influence consumer perception by differentiation from competitors, comprehension of properties, and formation of a relationship between consumer and product through the sensory experience (Bloch et al., 2003). The package influences decision making because it is a medium of attention, information, and aesthetics. Packaging that captures consumer attention facilitates quick in-store decision making (Silayoi & Speece, 2004). Attracting consumer attention, however, can be difficult because of the large number of competing products in-store, and the fact that most of these products are ignored (Inman et al., 2009), specifically by consumers who shop habitually (Underwood et al., 2001). Nonetheless, once the consumers’ attention has been caught, the features of the packaging can serve to underline the uniqueness and originality of the product (Silayoi & Speece, 2007). Furthermore, perceptual packaging cues play a major role, especially during low-involvement shopping or rushed shopping situations (Silayoi & Speece, 2004). Few studies have investigated the communicative effects of product packaging, as well as the link between packaging and consumer attention (Underwood et al., 2001). Nevertheless, even the slightest change in attention can have a significant impact on brand memory (Wedel & Pieters, 2000), perception (Pieters & Warlop, 1999), and sales (Janiszewski, 1998). Even though capturing attention is not always enough for brand selection (Janiszewski, 1993), visual attention is crucial for choice as explained previously. Consumers choose with their eyes (Clement, 2007) in brand consideration (Pieters & Warlop, 1999; Russo & Leclerc, 1994), which means that unseen products are unsold products. On the other hand, a majority of the seen products are also unsold; hence, communicating values is as important as being seen at POP.

2.3.5 Product Placement

As mentioned in the previous chapter, product packaging has influence on consumer decision making. Nevertheless, the product is rarely exposed unaccompanied by competitors in the shelf display; thus, such factors as category structure (Nedungadi et al., 2001) and space elasticity (Chandon et al., 2009; Dréze et al., 1994) also influence consumer attention, perception, and choice. For instance, Dréze et al. (1994) showed through an empirical study on shelf space management that number of facings and facing area influences consumer decision making. Furthermore, product value is also communicated through the placement of the product (display orientation) in the shelf (Hansen,
Raut, & Swami, 2010; Murray et al., 2010). In the present thesis, the focus is on space quality (e.g., top-level versus floor-level shelving), specifically the inferred value from vertical placement of products.

Only a few research papers have tested the influence of product placement on consumer decision making (Chandon et al., 2008; Chandon et al., 2009; Dréze et al., 1994; Hansen et al., 2010; Sigurdsson et al., 2009; Valenzuela & Raghubir, 2010; Valenzuela & Raghubir, 2009; Van Nierop et al., 2011). In a study of 115 items in eight product categories, Dréze et al. (1994) showed that sales almost doubled when moving products from the worst (top- or bottom-level) to the best (mid-level) vertical location. However, a horizontal movement did not have a similar effect. Comparable results were found by Hansen et al. (2010), who showed that the effect of vertical positioning is double the size of horizontal positioning and that facing effect is less than position effect. Sigurdsson et al. (2009) and Van Nierop et al. (2011) also found similar results, with the latter showing that sustainable brands received more market share when placed in the middle of the shelf and that eye level is the best vertical position.

One explanation for how product placement influences decision making is that products at certain placements in the shelf can have a perceptual advantage (eye-level position grabs attention). Of the few studies testing the influence of shelf verticality on visual attention, one by Chandon et al. (2008) explored POP brand consideration using visual measurements. The study was done on two product categories with 309 participants. The shopping goal was to find brands they would consider buying. Results showed that brands in the center of the shelf were seen by almost all consumers and the likelihood was low for noticing a brand on shelf extremities. However, this result could be related to the natural resting position of the eyes (Dréze et al., 1994). In fact, previous research in visual attention has identified central fixation bias or center bias (Foulsham & Underwood, 2008; Parkhurst, Law, & Niebur, 2002; Tatler, 2007; Tseng, Carmi, Cameron, Munoz, & Itti, 2009) that can explain this effect. In an attempt to explore center bias, Tatler (2007) tested 120 natural scenes in an empirical study with 52 participants with free viewing and search task condition. Tatler discovered that when participants view complex scenes, there is a stronger tendency to look at the center of the image than at the extremities. Similar results were found by Foulsham and Underwood (2008) in an empirical study with 22 participants using eye tracking to predict fixation locations. Their
results indicated that participants were more likely to move from any position of the shelf to the center region across any task or image. Furthermore, Chandon et al. (2008) showed that shelf verticality has a greater effect on attention than shelf facing and that eye-tracking experiments should be used to explore product placement. In a later paper, Chandon et al. (2009) tested in- and out-of-store factors in relation to visual attention, consideration, and choice. Their results showed that shelf verticality has a strong influence on attention: a product on the top shelf (compared to bottom) increased visual attention by 17 percent and choice by 20 percent. They believed their results were related to participants’ preferences for premium products in the chosen categories.

A second explanation for how product placement influences decision making is that products at certain placements can have a conceptual advantage (e.g., top shelf is exclusive), resulting in inferred value. Consumers use several decision strategies from which they infer value and the placement of products can be one such inference point (Buchanan, Simmons, & Bickart, 1999). Consumers make many product evaluation inferences during the decision-making process and these inferential beliefs also have impact on the decision outcome (Huber & McCann, 1982). For instance, it has been observed that verticality is used to infer value on objects or people. Schubert (2005) investigated the social concept of power and found that it is embodied in vertical spatial positions. Meier and Robinson (2004) showed that objects that are high in visual space are perceived as good, whereas objects that are low in visual space are perceived as bad. Hence, previous research indicates that value can be inferred from vertical object positioning. This was further studied in the context of POP decision making by Valenzuela and Raghubir (2009), who showed that when consumers’ goals are consistent with purchasing the most popular items, items in the center are more likely to be chosen. Furthermore, in a later study, Valenzuela and Raghubir (2010) showed that consumers make value inferences based on shelf verticality, as products on the bottom were priced lower than products on the top shelf.
2.4 Summary of Theoretical Framework

In summary, it is evident from past research that consumers are adaptive decision makers who are bounded by the limitations of cognition and attention. These limitations force consumers to simplify complex decision making at different stages of the decision-making process by employing appropriate strategies. The selection of strategies can be conscious or automatic, stemming from information that is processed in the environment or from the mind of the decision maker. Iterations of comparisons based on the selected decision strategy reduce the set of alternatives to one option. Product recognition is believed to be the first strategy used in complex decision making when constructing the consideration set, and it also serves as the first step towards other strategies. Recognition-based strategies are used in the initial shelf screening, with recognized products progressing further into the decision-making process. The recognized products will receive greater attention and increased preference as a result of mere exposure and processing fluency. However, preferences are formed through construction and retrieval, which means that they depend on both in-store and out-of-store factors. Product packaging is one such in-store factor that induces processing fluency as a medium of attention, information, and aesthetics. In fact, product packaging is believed to be the most influential tool for capturing POP consumer attention and communicating value. Product value is also communicated through the placement of the product on the shelf, as consumers can infer value from display orientation. The influence of out-of-store and in-store factors is reflected in the decision-making process and can be measured via visual attention and manipulated by choice tasks. The choice tasks change the focus of the inquiry and guide visual attention, thereby revealing the semantically important factors that influence the decision-making process. The following section describes the methods used to manipulate and measure the influence of in-store and out-of-store factors on consumer decision making.
3 Methodology

This chapter provides detailed background on the equipment and procedures that constituted the two methods that were combined in all experiments to explore the research questions. This chapter also covers the different experiments’ stimulus image manipulations and a justification for their design in relation to the selection of eye tracking as a process-tracing method.

3.1 Measuring Vision

Eye movement studies have their roots in reading research (Just & Carpenter, 1976) and pre-date modern computers by 100 years. Initially, an observer using mirrors registered the participant’s eye movements on paper. The tools that were developed in the end of 18th century were crude and often inaccurate. Techniques for tracking eye movements were intrusive, involving direct mechanical contact with the eyes. Progress in photography led to a technique based on retaining the light reflected from the cornea on photographic plate. Early in the 20th century, the first non-intrusive eye-tracker was developed, using light reflections from the cornea (Holmqvist, Nyström, Andersson, Dewhurst, & Van de Weijer, 2011). Many advances in eye tracking were eventually made by combining the corneal reflection and video-based techniques. Although less intrusive eye-trackers had been developed by the end of the 1940s, intrusiveness was still a problem. Eye movement research flourished in the 1970s, with advances in both technology and methods to link eye movements to cognitive decision-making processes. Prior to the 1970s, psychologists who studied eye movements attempted to avoid factors such as memory and cognitive workload, preferring to focus on lower-level visual stimulus properties, such as contrast and target location. However, the focus changed in the 1970s to higher-level cognition and eye movement.

Because of recent technological development, modern eye-trackers are more accurate and less intrusive than their predecessors. Independent of the developments, an important aspect of eye-tracking is to understand its applicability to research questions. The tool in itself only records the consumer’s eye movements, but eye movements have no meaning if they cannot be translated into insights or actions. The developed research methods play a central role in the practical use of the tool. In the coming sections, the application of eye tracking to the present thesis is discussed.
3.1.1 Eye tracking as a Process Trace Method

Researchers have advocated process-tracing methods in studying decision-making mechanisms (Olshavsky, 1979; Payne, 1976), such as effort reduction and simplification strategies based on heuristics (Shah & Oppenheimer, 2008). Specifically, visual attention measurements are highlighted as a promising method for studying decision making (Glaholt & Reingold, 2011; Russo, 2011). Eye-movement measurement boosts the understanding of consumer POP decision making as every retail environment decision requires visual information acquisition. Following the sequence of eye movements from the first interaction to choice illuminates the mind of the consumer and the factors that are influential in this process (Russo, 2011; Wedel & Pieters, 2008b). The use of eye tracking in consumers decision making research has made it possible to study the decision-making process (Clement, 2007; Russo & Leclerc, 1994), the effects of time pressure during brand choice (Pieters & Warlop, 1999), the saliency of a package in terms of its top-down and bottom-up qualities (Chandon et al., 2008), and how placement and the number of facings affect attention (Chandon et al., 2009). Furthermore, rigorous tests have shown that eye fixations are a valid measure of attention and that equipment does not disturb ongoing cognitive processing (Russo, 1978). It has also been shown that eye tracking is a valid tool, even when there is a possibility for social desirability bias (Russo, 1978). Eye tracking also has high predictive validity when measuring information processing that is generated from cognition (Rosbergen & Pieters, 1997), which is similar to the information processing explored in the current thesis. Eye tracking has been advocated by Russo for well over 30 years because of its advantages in understanding consumer behavior and decision making (Russo, 2011; Russo, 1978).

3.1.2 Eye tracking Laboratory Equipment and Setup

There are several techniques for measuring eye movements, but the most common procedure is through video-based, combined-pupil/corneal reflection systems (Duchowski, 2007; Holmqvist et al., 2011). This method has the advantage of point-of-regard measurement, which allows for a higher degree of freedom for head movements when multiple ocular features are measured. Corneal reflection is created by infra-red light and is measured relative to the location of the pupil center. These ocular features are thus constant to each
other, independent of head movement. The distance between the corneal reflection and the pupil remains constant during head movements; however, the distance between these points shifts during eye movement. The output of a video-based corneal reflection device is x and y coordinates from the position of the eyes relative to the digital or physical stimulus. Measurements with a corneal reflection device have an accuracy of 0.3 to 2.0 degrees depending on the eye-tracking system, the setup of the equipment, and environmental conditions (Holmqvist et al., 2011). The different systems on the market range from 25 Hz to 2,000 Hz in camera sampling frequency.

**Eye trackers**

In the process of writing the present thesis, there have been many advances in eye-tracking technology. There are two types of equipment used in the experiment, namely the Tobii X50 and Tobii X120, produced by Tobii Technology. The eye trackers are similar in function and setup; however, the X120 is the most recent generation of static remote eye-trackers developed and provided by Tobii Technology. Both the X50 and X120 are binocular, video-based, combined-pupil/corneal reflection systems; however, the sampling frequency differs between the units. The X50 has a 50 Hz and the X120 has a 120 Hz sampling frequency of the camera that records the corneal reflection and pupil. The X50 is used in the experiments for Paper I and the X120 in succeeding papers. The eye-tracking units have a freedom of head movement within a 12x19x12 inch (30x22x30 cm) head box at a 25.6 inch (65 cm) distance from the eye tracker.

**Eye-tracking Setups**

Throughout the experiments, three different eye-tracking laboratories have been used. The setup of the labs has been almost identical with some minute differences in projection quality and projected screen size. Table 1 describes the equipment used in the three different lab setups. In general, Figure 4 illustrates the setup of the three labs used for this thesis. The labs were designed with two separate rooms. One room was used as a waiting room and the other dedicated for eye-tracking recordings. Eye-tracking experiments were performed on full-scale product shelf projections resembling real product shelves in size and proportion. To be able to perform tests on full-scale shelves, a remote eye-tracker was mounted on a specially developed foot-stand. For the purpose of shelf-testing, the quality of the projected shelf is important and was measured by the resolution of the projected picture in relation to the projected distance.
Higher resolution gives a smaller individual pixel size at a specific distance. For example, the projection distance at one of the eye-tracking laboratories is 122 inches (310 cm), from lens to screen, with a resolution at 720P. This setup gives a pixel size of approximately 0.0071 inch (1.8 mm). This is sufficient to illustrate shelves that are three sections wide and five sections tall with great picture clarity and detail.

Eye-tracking experiments can be done on both digital and real shelf mockups. The disadvantage of using real shelf mockups is the aspect of moving real products and switching between product categories. Changing product positions and switching between product categories becomes time-consuming as real products need to be moved around. Experimental flow is also a problem as the respondent will need to wait between each shelf mockup. Digital shelf mockups have the advantage of flexibility. Changes to the shelf mockup are done quickly and switching between shelf stimuli takes only milliseconds. Another aspect of this method is the parallel face angle between the products at different vertical shelf levels. If the face angle is the same on all the products on the shelf, the products on the lower level will be seen from the same aspect as the products in the middle and the top. The advantage is that none of the faces will be seen more or less due to the angle. However, the disadvantage is that the picture will be unrealistic for subjects that notice the visual glitch.
Eye-tracking recordings produce a vast amount of data as the movements of the eyes are recorded at high frequency. The data in turn can be used to produce a great number of measures for analysis and interpretation of POP consumer behavior. The following section provides an overview of the measures used in the present thesis.
### 3.1.3 Eye-tracking Measures

The eye-tracking data can generally be divided between (1) eye movements toward or (2) eye position at a specific area of interest (AOI). An AOI is a stimulus surface area that has established boundaries, such as two different products in a product shelf or two different shelf levels. The boundaries of the AOIs are set by the researcher and stem from research inquiries and the experiment design. Eye movements and positions are aggregated on AOIs over time. The AOIs are then statistically analyzed in compressions between each other and/or in relation to other variables. The eye movements and position data can be categorized in more than 120 different measures that have been defined through many years of research (see Holmqvist et al., 2011 for an overview of measure definitions).

Eye movements are often related to fast eye motion from one AOI to the next AOI. These rapid movements are expressed as saccades (Duchowski, 2007; Holmqvist et al., 2011). During the saccadic movement that lasts between 30–80 milliseconds (ms), the visual input is stopped until the next onset of the eyes on an AOI (Holmqvist et al., 2011; Rayner, 1998). Saccadic eye movements are not the focus of the present dissertation as information gathered from saccadic eye movements is not applicable, in the present context, and often these measures are not validated. Furthermore, the eye-tracking equipment used in the present dissertation does not allow for analysis of saccadic eye movements with high reliability. Hence, the applied measures are related to eye position data such as aggregation of observations on an AOI and time until an AOI is observed.

Eye position measures are defined when the eyes rest for a short moment and visual information is gathered; this is known as a fixation. The definition of a fixation is that the eyes remain somewhat still over a period of time that lasts between 200–300 ms depending on the decision task (Duchowski, 2007; Holmqvist et al., 2011; Rayner, 2009). In all experiments for the present dissertation, 200 ms is used as the defining fixation limit. Hence, fixations below 200 ms are not included in the fixation-based measures. Several time- and count-based measures can be defined from fixations and aggregation of fixation. The following section describes application and purpose of the eye-tracking measures used in the present dissertation. Table 2 shows a classification for the different measures used in the papers.
<table>
<thead>
<tr>
<th>Measure Name</th>
<th>Definition</th>
<th>Function</th>
<th>Applied in</th>
<th>Alternative Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of Participants Noted</td>
<td>Percent of participants that noted AOI</td>
<td>Explore spread of attention and possible biases</td>
<td>Paper I</td>
<td>Noting</td>
</tr>
<tr>
<td>Fixation Count</td>
<td>Number of fixation within an AOI</td>
<td>General viewing pattern</td>
<td>Paper I</td>
<td>Number of Fixations</td>
</tr>
<tr>
<td>Time to First Fixation</td>
<td>Order of visual impact between different AOIs expressed in time</td>
<td>Saliency of AOIs depending on search task and location</td>
<td>Paper I</td>
<td>Paper II Paper III</td>
</tr>
<tr>
<td>Observation Count</td>
<td>Number transition into an AOI</td>
<td>Distribution of observations during stages of decision making</td>
<td>Paper V</td>
<td>Total Observation Count, Mean Observation Count</td>
</tr>
<tr>
<td>Observation Duration</td>
<td>Aggregation of fixations durations within an AOI</td>
<td>Semantic importance in general and relation to search task and attention</td>
<td>Paper I</td>
<td>Paper III Paper IV Paper V</td>
</tr>
<tr>
<td>Time to First Fixation</td>
<td>Order of visual impact between different AOIs expressed in time</td>
<td>Saliency of AOIs depending on search task and location</td>
<td>Paper I</td>
<td>Paper II Paper III</td>
</tr>
<tr>
<td>Observation Count</td>
<td>Number transition into an AOI</td>
<td>Distribution of observations during stages of decision making</td>
<td>Paper V</td>
<td>Total Observation Count, Mean Observation Count</td>
</tr>
</tbody>
</table>

Table 2: Table of eye-tracking measures used with definition and function in thesis.

Proportion of Participants Noted

This is one of the most basic measurements of eye movement, which is used to find the proportion of participants that have looked at a certain AOI. This is a straightforward measure that is expressed in percentage of participants that noted different AOIs. The measure is interpreted as reflecting the attention-grabbing properties of an AOI (Holmqvist et al., 2011). If the AOI is related to a successful task resolution, then a low proportion of participants noting is an indicator for redesigning or reallocating the AOI (Poole & Ball, 2005). In the present thesis, this measure is used to identify the general spread of attention on the product shelf. The spread of attention is expressed as the proportion of participants that have observed the horizontal and vertical positions of the shelf.
independent of shelf content. This measure was used in Paper I to understand participants’ visual behavior at POP and to identify possible attention biases.

**Fixation Count**

Fixation count is the number of fixations (dwell over 200 ms) within a specific AOI. The fixations are aggregated over time, either throughout the whole stimulus exposure or at specific time segments. As illustrated in Figure 5, each circle represents a fixation within four different AOIs. There are a total of eight fixations in Figure 5. However, the fixation count differs between the different AOIs. For example, AOI A1 has three fixations while AOI B2 has one fixation. Number of fixations is one of the most used and most rudimentary measures (Holmqvist et al., 2011). However, the interpretation of fixation count is twofold as it is positively correlated with semantic importance (Henderson et al., 1999) and negatively correlated with search efficiency (Goldberg & Kotval, 1999). Hence, if an AOI is meaningful to the search task, then an increase of fixation count is expected. On the other hand, if the AOI is confusing or difficult to interpret, the fixation count will also increase on the AOI. The definition of fixation count as a measure of semantic importance is more applicable in the context of POP decision making, as participants would exclude confusing products as they are not semantically important. Fixation count was used in Paper I as a measure of general gaze behavior.

**Time to First Fixation**

Time-to-first-fixation (TTFF) is the time it takes from stimulus onset until a specific AOI receives its first fixation. This measure shows the order of visual impact between different AOIs, expressed in time. For example, the AOI B1 in Figure 5 has a TTFF at 0 ms as this is the entry point in the metric of AOIs. However, AOI A1 has a TTFF at 700 ms resulting from sum of successive fixations in B1. Furthermore, AOI A2 will have a TTFF at 1,100 ms resulting from the sum of fixation time in B1 and A1. Only two fixations are made in A1 before the transition to A2; hence, the added time from fixations in A1 is 400 ms. Shorter TTFF reflects increased efficiency in locating an AOI (Holmqvist et al., 2011), which can be related to the visual saliency of the AOI. Typical visual impact measurements include the TTFF and proportion of participants noted.

TTFF has been applied as a measure in Papers I–III for different purposes in relation to the research question. In Paper I, TTFF was applied to explore
general viewing patterns toward the vertical and horizontal parts of the shelf independent of product shelf content or structure. Furthermore, TTFF was also used to understand the influence of minute differences in packaging on detection time. In Paper II, TTFF was used to measure the saliency of pictorial and textual elements at different horizontal locations on the packaging. TTFF had a decisive role in Paper III as search tasks were combined with shelf manipulations to understand how shelf verticality and product packaging influence the direction of attention.

**Observation Count**

Observation count is the number of occurrences a specific AOI has been observed over time. Observation count is different from fixation count as there may be many fixations within one AOI, but few observations on the same AOI. This is illustrated in Figure 5, as AOI A1 has three fixations and two observations. Similarly, AOI A2 has two fixations and two observations. Hence, every transition to an AOI adds one unit of observation to that AOI. Similar to fixation count, observation count is believed to be related to semantic importance (Henderson et al., 1999). Furthermore, observation count is one of two critical measures in the three-stage decision-making model by Russo and Leclere (1994). Observation count was applied in Paper V as the three-stage decision-making model was replicated with modern eye-tracking equipment.

**Observation Duration**

Observation duration is the main measure used in this dissertation and included in several experiments. This measure is defined as the aggregation of fixation duration within an AOI for each observation count. In Figure 5, AOI B1 has observation duration of 700 ms based on two fixations and one observation. However, AOI A1 has two observations with the first observation having 400 ms observation duration and the second have 200 ms, as the first observation consists of two fixations and the second one fixation. Observation duration can in turn be expressed as mean observation duration or total observation duration. Mean observation duration is the average duration over the number of observations; hence, AOI A1 has a mean observation duration of 300 ms. Total observation duration is the aggregation of all durations within an AOI; hence AOI A1 has a total observation duration of 600 ms. Similar to fixation count and observation count, observation duration reflects the semantic importance of an AOI in relation to a search task (Henderson et al., 1999; Holmqvist et al., 2011).
Observation duration is of great interest as it is a good indicator of consideration and choice in the context of POP decision making. A positive relationship exists between observations on a product and consideration of that product (Janiszewski, 1998; Pieters & Warlop, 1999; Russo & Leclerc, 1994; Wedel & Pieters, 2008b). For example, it has been shown that observations on a product add 13 percentage points to the probability of consideration (Chandon et al., 2008). The relationship between observation duration, consideration, and choice can be understood through the nature of staged decision making. As participants include some options into a consideration set, the excluded options will receive fewer observations. Furthermore, the evaluation of options within a consideration set initiates an iterative search process that aggregates further visual attention on the evaluated products (Russo & Leclerc, 1994). At the end of decision making, only a few options are considered and these options have travelled the furthest in the evaluation process, hence aggregating the most observations throughout the process. Observation duration, as total and mean, has been used in Papers I and III–V. In Paper I, it was used to understand the general distribution of observation time on multiple shelves. It was also used to measure the semantic importance of packaging elements in relation to their design features and placement. In Paper III, observation duration measured whether participants draw value inferences from shelf verticality or from product packaging. In Paper IV, observation duration measured the influence of visual attention in relation to product recognition in preferences constructed during product choice. Similar to observation count, observation duration is a critical measure in the different stages of the three-stage decision-making model by Russo and Leclerc (1994). Hence, in Paper V, observation duration is included as a measure to replicate and extend their findings.
In conclusion, several years of rigorous analysis of the different measures detailed a covariance between the measures used in this dissertation. For example, increase in observation count often results in an increase in fixation count as alternatives are evaluated and compared. Furthermore, they both represent semantic importance or interest in relation to choice task. In addition, the increase of fixation and observation count in turn increases the total observation duration on an AOI. Hence, instead of exploring the variance with numerous measures that point toward the same direction, the focus is set on few measures. Holmqvist et al. (2011) wrote that, “the number of methods and measures for eye-tracking grows much faster than the validation of their interpretations” (p. 468). For this exact reason, this dissertation is geared toward using few measures and focusing instead on their theoretical contributions.
3.2 Measuring Decision

Independent of decision context, environment, or task, the endpoint of the decision-making process is some form of choice. In the present thesis, choice is measured via several methods. Some methods explicitly indicate the chosen product from a set of alternatives. Other methods are used for indicating familiarity and preference level for the chosen alternative among a set of alternatives. In the coming section, these methods are described.

3.2.1 Choice

In the initial pilot experiments for Paper I, the discovery was made that the choice of the participant needed to be separated from the screening and evaluation process due to a procedural issue with eye-tracking recordings. The issue was that the choice of the participant had to be registered at the end of the recording without disturbing the process data that had been recorded. As eye-tracking equipment records all eye movements from stimulus onset to offset, the participant’s choice through verbal cues, laser pointer, or mouse-clicking records artificial process data related to the choice procedure. To solve this issue, an external human-computer-interaction device (large red button) was given to the participants to initiate the recording and define the point of choice that ended it. To initiate stimulus onset and eye-tracking recording, the participant used the button, which was placed comfortably in front of them. Participants were instructed to push the button again when the choice was made. After pushing the button a second time, they received an identical shelf-image and were asked to indicate their decision by left-clicking the mouse cursor on the chosen product. The separation between the process data image and choice data image was not noticeable by the human eye. In conclusion, the separation of decision process and choice was made to remove any eye movements that were caused by looking at the mouse cursor while indicating the chosen option. This procedural method was used for all experiments with different types of choice cues (button and verbal cues) and choice indication methods (mouse cursor, laser pointer, and verbal indication).

3.2.2 Self-reported Preference rating

The purpose of Paper IV required preference measurements, as the relationship between product recognition, visual attention, and preference formation was
explored. Three approaches were used to measure participants preference for the products on the shelf. The first measure was the likelihood of buying, which was based on rating three products from the entire set of options on a printed shelf image in the questionnaire. The products would then be ordered in likelihood of buying, with 1 representing most likely to buy, 2 and 3 representing the second- and third-best options. The second measure of preference was choice, which was directly extracted from the eye-tracking part of the experiment. The third and most applicable measure was through a seven-point scale for the entire set of options from a printed product images in the questionnaire. The participants were asked to rate how likely they were to buy products on a scale of 1 to 7 where 1 represented the lowest and 7 the highest likelihood of buying that product. The likelihood-of-buying measure was used as an indicator of preference, independent of whether the preference was formed through construction or retrieved from memory. From a heuristic decision-making standpoint, the assumption was that the likelihood of choice would reflect preference formation on a cue-level comparison. Hence, products that fulfilled the value of a multitude of cues would have a higher “likelihood of choice” rating.

3.2.3 Self-reported Familiarity rating

For different reasons, attention measures in familiarity, preference, and choice research are often related to duration of stimulus exposure (Chun & Jiang, 1998; Hamid, 1973; Harrison & Zajonc, 1970; Janiszewski, 1993; Marcus & Hakmiller, 1975; Monahan, Murphy, & Zajonc, 2000; Reber, Winkielman, & Schwarz, 1998; Russo & Rosen, 1975; Seamon et al., 1984; Zajonc, 1968). Paper IV did not allow for any exposure experiments as visual attention in itself was tested as an influencing factor in preference formation. Hence, familiarity could not be manipulated through exposure time or frequency. Instead, familiarity measure was self-reported similar to the method used by Coupey et al. (1998). For each product on the shelf, the participants were asked to indicate whether they frequently bought the product and recognized it from their regular shopping trips. The two questions produced three levels of familiarity: (1) High Familiarity – products that were frequently bought; (2) Moderate Familiarity – products that were recognized, but not bought; and (3) Low Familiarity – products that were not recognized. Products that were rated as frequently bought, but not recognized were excluded.
3.3 Influencing Vision and Decision

Throughout the experiments, the main objective was to understand participants’ decision making through influencing endogenous or exogenous variables. Hence, exploring such factors as vertical product placement or product recognition entailed several manipulations on shelf structure, product categories, and individual products. Furthermore, to increase the validity of the measures in relation to the purpose of the experiments, several types of search tasks were used. The following section describes these manipulations and their role in influencing participants’ visual attention and decision making.

3.3.1 Recognition

Product familiarity has been manipulated in several experiments to understand the influence of product recognition on the decision-making process when participants are totally or partly unfamiliar with the products in the shelf. In Paper III for example, participants were exposed to an unfamiliar product shelf with foreign products. The purpose of the manipulation was two folded. First, to control for product recognition as an influencing factor during decision making, hence increasing the probability of influence from other factors that participants use to infer value on products. Second, to study the influence of product recognition throughout the decision-making process. In Paper V, both familiar and unfamiliar products were included in the product shelf. By including totally unfamiliar and somewhat familiar products in the shelf, the influence of product recognition could be controlled for and measured throughout the decision-making process.

3.3.2 Choice Task

Using different consideration and choice tasks has been one of the most important influencing factors in this dissertation. Eye tracking is particularly sensitive to decision task as it can fundamentally change the distribution of attention. In the present thesis, search tasks have been used to induce bias in the decision-making process. The bias in itself constitutes validity as the same decision criterion is used for an experimental condition. The decision criteria are always related to the purpose of the papers and experiments. This section will not cover all applied choice tasks, as these are explained in detail in the papers. However, a classification is found in Table 3 for tasks used in different
experiments and papers. The great advantage of using a search task is that visual attention, consideration, and choice can be paired with information processing that stems from the task and influenced by in-store or out-of-store factors. Hence, participants can evaluate the given search task based on preconceived knowledge or they can gather information from the shelf that communicates the semantic importance of the search task. Whichever is used, visual measurements will show when participants instinctively or selectively move their eyes toward products and shelf sections. Generally, there were two types of tasks used, namely consideration and choice tasks. Furthermore, in some experiments, the task was to look at the product shelf without making any decisions.

<table>
<thead>
<tr>
<th>Choice Task</th>
<th>Applied in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicate target package when identified.</td>
<td>Paper I, Experiment 2</td>
</tr>
<tr>
<td>Which is the most budget product on the shelf?</td>
<td>Paper III, Experiment 1, Experiment 2</td>
</tr>
<tr>
<td>Which is the most premium product on the shelf?</td>
<td>Paper III, Experiment 1, Experiment 2</td>
</tr>
<tr>
<td>Please choose a product that you would like to buy, as if you were about to do so in the store.</td>
<td>Paper IV, Experiment 1, Paper V, Experiment 1, Experiment 2, Experiment 3, Experiment 3</td>
</tr>
<tr>
<td>Buy the healthiest product on the shelf.</td>
<td>Paper V, Experiment 3</td>
</tr>
</tbody>
</table>

Table 3: Search and choice task used in the thesis

3.3.3 Product Placement

Manipulations of shelf layout positioning were done mainly in Paper III, which measured the effect of vertical product placement. One version of the shelf structure was congruent and the other incongruent with regard to the actual product placement in the supermarket. The congruent version had the premium products on the top and budget products on the bottom. The incongruent version had the budget products on the top and the premium products on the bottom. By switching the placement of the top and bottom of the shelf, the influence on attention, consideration, and choice of verticality inferred value was measured. There was only one target area and this was the shelf section that coincided with search task. Accordingly, if a participant was asked to search for a premium product that was placed at the bottom of the shelf, then this position was the target position. By manipulating the shelf structure in
combination with value specific search tasks, the influence on visual attention, consideration and choice could be pinpointed in relation to product recognition and packaging.

### 3.3.4 Packaging Attributes

The influence of packaging attributes on attention has been studied in Papers I and II from two different perspectives. Paper I explored information use in different designee cues and whether efficiency in locating target products could be influenced by manipulations to packaging attributed. Furthermore, Paper I explored whether minute differences in packaging could influence attention and identification. The first part of Paper I was designed as a response time experiment, whereby the participants were shown a series of pictures, each of which contained a set of four packages. Each set included three identical instances of the package containing the product intended for each specific application and one package containing the product intended for a different application, which was the target package. The participants were asked to indicate by clicking with a mouse which of the packages was the target package; that is, the product intended for a different application. The target packages came in four varieties: the original and three new designs. The manipulations on the three new designs were on the position and color of one informative part of the packaging related to the application of the product. The second part of Paper I addressed whether subtly different surface materials are detected. Participants were asked to view a number of displays, each of which contained three packages, and indicate whether they perceived any differences between them. The displays were arranged such that they contained one major difference and a number of minor differences. The deviations were on the cardboard material. In Paper II, the main purpose was to test the influence of textual and pictorial design element positioning on visual attention toward these element types. For this paper, a potato chip package was manipulated with three different design features (one pictorial and two textual), which were located on the top right or top left side of the package, thus creating six conditions. The pictorial element was a green clover symbol, and the textual elements contained the linguistic information “Win 100,000” and “New”. The locations (top left corner, top right corner) were chosen based on previous research showing that fixations are primarily performed toward a stimulus’ top left area and because a stimulus’ right side location is seen as a heavy position, which can make certain food products (such as snacks) more preferable.
4 Findings and Contributions within the Conceptual Model

This chapter summarizes the research findings of the five appended papers and their individual contributions in the present dissertation. The papers’ main contributions are divided between components of the model. As previously explained, the conceptual model consists of four individual components with the appended paper contributing to the different component. Together, the findings from the appended papers form the foundation of the conceptual model depicted in Figure 6. The following is a description of the individual contributions of the appended papers and their position within the conceptual model. Furthermore, the major results and contributions of each paper are described. The purpose of this chapter is to set the background for the general contribution of the thesis as a whole.

Figure 6: The complete conceptual model with individual influencing factors included.
4.1 Paper I: Consumer Perception at Point of Purchase: Evaluating Proposed Packaging Designs in an Eye-tracking Lab

This paper was the starting point in exploring the role of visual attention in decision making. For this paper, the relationship between in-store influencing factors, visual attention, and decision making was primarily examined, as seen in Figure 7. In addition, for experiment 2 a choice task was given to the participants. The approach of this paper was somewhat of a ‘fishing trip’ as Holmqvist et al. (2011) would call it. Despite the empirical focus, the result of this paper set the foundation for the succeeding papers. The general purpose of this paper was to evaluate eye-tracking methodology in package and shelf testing. This was done in three unrelated experiments.

**Experiment 1**: Determine whether there are any specific viewing patterns, in terms of viewing order, that must be taken into account when studying digitally displayed products.

**Experiment 2**: Evaluate the findability of a package; that is, the likelihood of a package being found when looked for.

**Experiment 3**: Evaluate the influence of small, perceived, and non-perceived variations in the packaging design on attention.

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<tr>
<th>Experiment 1</th>
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<th>Experiment 3</th>
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Figure 7: Position of Paper I within the conceptual model.
4.1.1 Findings

Consumers have general viewing patterns independent of product category. Consumers start looking at the center of the image; more participants see products in the center. Subsequent to the central position, they look at the top section, then move left or right, and finally move to the bottom section. Furthermore, they have more fixations on the left and right side of the shelf followed by the top and bottom section. Consumers’ evaluations of packaging elements contribute to target product findability. In addition, the design of packaging elements proved to be decisive in identification speed. Consumers can identify small deviations in packaging design and their attention is directed toward the deviating packaging faster.

4.1.2 Contributions

There are some visual attention biases that have been discovered in earlier research. One such bias is central fixation bias or “central bias” (Foulsham & Underwood, 2008; Parkhurst, Law, & Niebur, 2002; Tatler, 2007; Tseng, Carmi, Cameron, Munoz, & Itti, 2009). Chandon et al. (2009) noted that the center positions receive more, but shorter fixations, which they interpret as ‘stepping stone’ fixations; that is, fixations during eye movements between locations that exceed possible saccade length. Similar to previous findings, this paper points toward a bias of attention at the center of the shelf. The central bias effect can have its foundation in the natural resting place of the eyes, as pointed out by Dréze et al. (1994). Independent of its origin, the central bias was controlled for in the following papers.

Other than the central bias, verticality bias was one of the main contributions of this paper. The tendency of verticality bias was discovered as consumers generally start looking at the center of product shelf and then move to the top vertical position of the shelf. This effect has also been noticed by previous researchers as products on the top shelves attract more attention than products on the middle or bottom shelves (Chandon et al., 2008; Chandon et al., 2009). Previous research has qualified these findings as being artifacts of brand effects (Chandon et al., 2008) and preferences for premium products (Chandon et al., 2009). This was fascinating as the general viewing pattern can either be related to inferred value from vertical position or the product packaging. This question was further studied in Paper III.
Previous research has described the decisive role of packaging in consumer decision making (Berkowitz, 1987; Bloch, 1995; Bloch et al., 2003; Schmitt et al., 1997). Furthermore, it has been argued that the influence of product packaging on consumer behavior should be studied by focusing on separate package elements and how they relate to decision making (Underwood et al., 2001). In addition, element organization in the packaging design can facilitate information search and influence which aspects receive attention (Janiszewski, 1998). For example, Bialkova and Trijp (2011) showed that attention is directed toward design features with semantic importance. Similar findings were discovered in this paper as, the placement and design of information on product packaging proved to be important in relation to findability. Furthermore, the design of the element proved to be decisive in the speed of identification of target product. However, these results sparked new questions as the information on the packaging can be textual and pictorial in nature (Silayoi & Speece, 2004; Silayoi & Speece, 2007) and depending on if the information is textual or pictorial it can influence consumers’ attention (Childers & Houston, 1984; Pieters & Wedel, 2004; Underwood et al., 2001) or choice (Pieters & Wedel, 2004). This was the starting point of Paper II which focused on how textual and pictorial design elements influence consumers’ attention.

4.2 Paper II: Left isn’t always right: Placement of pictorial and textual package elements

This paper focused on placement of pictorial and textual attributes on product packaging and their influence on visual attention and detection. Packaging elements are in-store POP influencing factors as they form the holistic impression of a product. Furthermore, in this paper, packaging elements were explored as factors that influence visual attention. Hence, the position of this paper within the conceptual model was the relationship between in-store influencing factors and visual attention, as seen in Figure 8.

The purpose of this paper was to investigate how the positioning of textual and pictorial design elements on a package affects visual attention toward these element types.
4.2.1 Findings

The results of this study show that package element positioning influences detection time. Textual elements are detected fastest when they are located on the left side of a package, whereas pictorial elements are detected fastest when they are located on the right side. Further, this proves the importance of proper element organization as “wrong” location may leave a salient package element unseen.

4.2.2 Contributions

The paper has both methodological and theoretical contributions. Previous research has focused on recall (Rettie & Brewer, 2000) or preference (Silayoi & Speece, 2007) to measure the influence of pictorial or textual elements. The focus of the present study was whether respondents actually visually attended the different elements on a package, and how long it took them to detect such elements. Detection time for certain element types can be viewed as a new and complementary way of evaluating the position of package elements.

Nevertheless, the main contribution is theoretical and contradicts previous findings (Rettie & Brewer, 2000) by showing that, to facilitate detection, important textual elements should be positioned on the left side, while unappealing but necessary textual information should be located on the right side. However, selling or attention-grabbing pictorial elements should be placed on the right side of the package to minimize detection time. Furthermore, to facilitate and maximize recall, the element organization should be the reverse. These findings offer some support to Silayoi and Speece’s (2007) findings that
packages were preferred when there was textual information to the left and pictorial information to the right.

4.3 Paper III: The Verticality Heuristic: Why top shelf is not always top notch in product placement

The general purpose of this paper was to examine the influence of shelf verticality and product packaging on consumers’ attention, consideration, and choice. As both these factors are known to influence consumer decision making, the focus was to explore the point at which they were used in the decision-making process. Hence, this paper involved all components of the conceptual model. Product packaging is an in-store factor that influences consumers as they examine the shelf. Similarly, vertical product placement is an in-store factor, as consumers can infer value based on space quality. Choice tasks were used to activate top-down structures related product placement. In addition, product recognition was introduced as an out-of-store influencing factor to test the influence of verticality on decision making when consumer product knowledge is controlled for. Furthermore, this was examined through visual attention throughout the decision-making process, as seen in Figure 9. This paper consisted of two separate experiments to test the influence product placement with and without product recognition.

**Experiment 1:** The purpose of this experiment was to examine to what extent the participants’ attention, consideration, and choice were influenced by shelf verticality and product packaging when participants were instructed to buy a premium or budget product.

**Experiment 2:** The purpose of this experiment was to investigate influence of product packaging and shelf verticality on attention, consideration, and choice when product recognition was unavailable.
4.3.1 Findings

The main finding of the present paper was that consumers tended to move their eyes to the shelf level they predicted would contain their target products, independent of the recognition of those products on the shelf. Furthermore, all results from the two experiments confirmed that verticality was employed as a heuristic at the beginning of decision making. However, the expectation was that shelf verticality would influence consumer consideration and choice, but this was not confirmed as consumers mainly considered and chose the target products, independent of vertical placement. Consumers’ choices were in line with their consideration and a majority of decisions were made on the target products. Furthermore, it was predicted that when consumers are unfamiliar with the products, shelf verticality would influence consumer consideration and choice. This expectation was also not in line with the findings as consumers spent more time considering and a majority of the choices were on the target products independent of product category familiarity. The findings of this paper showed that consumers use verticality as a heuristic, but ultimately value is inferred from product packaging independent of familiarity.
4.3.2 Contributions

The main contribution of this paper is that consumers use verticality to make expected value inferences at different shelf levels when decision making is initiated. The inferences on shelf verticality resembled the criterion for heuristic decision making (Shah & Oppenheimer, 2008) as the search effort was reduced in relation to different levels of value. One major contribution is that shelf verticality was used as a heuristic to infer value, which suggests that the verticality heuristic is a simplification strategy.

One further contribution is that consumers do not make value inferences based on shelf verticality when considering and choosing products. This finding contradicts two previous empirical studies (Chandon et al., 2009; Valenzuela & Raghubir, 2010). Valenzuela and Raghubir (2010) maintained that consumers infer value based on shelf verticality when pricing items or positioning products on a shelf based on price. Furthermore, they shows that inferences made on shelf verticality were part of a controlled and conscious process. Contrary to Valenzuela and Raghubir (2010), no shelf verticality influence was found beyond the initial direction of visual attention, independent of product recognition. In their empirical study, Chandon et al. (2009) found that consumers attended products on the top shelf and these results were attributed to the influence of verticality as they believed that the consumers preferred premium products, and consequently, were looking at the top shelf level. In support of these speculations, the findings show that consumers used the verticality heuristic, which directs attention toward the expected placement of the search goal. Contrary to these speculations, consideration and choice were driven by product packaging; the verticality heuristic influenced only the initial part of the search process, not consumer consideration and choice. Hence, if the premium products were placed on the top shelf section in the study by Chandon et al. (2009), the assumption is correct.

The final contribution of this paper is that the influence of product packaging is stronger than shelf verticality, even when consumers were totally unfamiliar with the product category. This last finding was interesting as the expectation was that consumers would infer values for a missing attribute using heuristics based on other information (Bettman et al., 1998). The expectation was that verticality would extend from initial attention to consideration and choice of products. However, familiarity is one among several factors that can influence attention, consideration, and choice. Another factor is preference for products,
which has been recognized as an influence independent of familiarity (Zajonc, 1980). Previous studies showed that preference can be predicted from eye movements (Pieters et al., 1997) and that familiarity increases attention (Pieters et al., 2002). However, the relationship between familiarity, attention, and preference, and their influence on consideration and choice, has not been explored yet. In fact, Russo (2011) pointed out the importance of this: “We accept that preference often drives perception in that people look more at what they prefer . . . However, might the opposite hold, namely that inducing people to look at a stimulus longer or more often increases their preference for it?” (p. 58). This initiated Paper IV and the exploration of the relationship between product recognition and visual attention in preference formation.


The focus of this paper was to understand the influence of product recognition and visual attention on product preference formation in decision making. Recognition is an out-of-store influencing factor, as it is related to the product knowledge that the consumer brings to decision making based on previous experiences. Similarly, preferences are treated as an out-of-store factor. Visual attention reflects the consideration of alternatives throughout the decision-making process. Hence, the position of this paper within the conceptual model involves the relationship between out-of-store influencing and visual attention in the decision-making process, as seen in Figure 10. The purpose of this study was to explore the influence of product recognition, visual attention and preference formation during the consumer decision-making process.
4.4.1 Findings

The findings of this paper show that both familiarity and visual attention predict preference formation. The effect of attention was moderated by the level of familiarity such that the more familiar the product was, the higher the influence of visual attention on preference formation. However, the influence of familiarity was greater than the influence of visual attention.

4.4.2 Contributions

Previous research has shown that the recognition heuristic is used at the beginning of the search to reduce the alternatives for evaluation in a consideration set (Gigerenzer & Goldstein, 2011; Marewski et al., 2010), a process that results in recognized products continuing further into the decision-making process. As comparisons are made within the consideration set, other heuristics are employed (Gigerenzer & Goldstein, 1996; Oeussoonthornwattana & Shanks, 2010; Simon, 1990) to further reduce options through cue-level comparisons (Hogarth & Karelaia, 2005). Consequently, recognized products will receive more visual attention. This study confirmed that recognition has an influence on visual attention and that highly familiar products aggregate more visual attention than moderately or unfamiliar products. Previous research established that visual attention is involved in the construction of preferences during the decision-making process (Shimojo et al., 2003; Simion & Shimojo, 2007). The combined effect of recognition and visual attention was the main theoretical contribution of this research study. The results indicated that the influence of visual attention on preference formation increased as a function of recognition. Recognition was the main driver of preference formation; nonetheless, visual attention increased this effect for the recognized product. Hence, it is not until consumers are familiar with a product that visual attention contributes to POP preference construction; the more consumers recognize a product, the more they look, and the more they look, the more they prefer the product.

One limitation of the present paper is the theoretical assumption that the recognition heuristic is used in the screening stage (Gigerenzer & Goldstein, 2011; Marewski et al., 2010) to construct a set of products that a consumer will consider in the evaluation stage of the decision-making process (Bettman, 1979; Gensch, 1987; Howard & Sheth, 1969; Huber & Klein, 1991; Lussier & Olshavsky, 1979; Wright & Barbour, 1977). However, if the recognition
heuristic were used in the screening stage, then the proportion of familiar products would be greater in the evaluation stage. In this study, this relationship was assumed through aggregation of attention on familiar products. To understand the role of recognition in decision making, this assumption needed testing. This was the starting point of Paper V and the exploration of the three stage decision-making model by Russo and Leclerc (1994).

4.5 Paper V: Using Heuristics to Revisit Consumer Choice Processes through the Eyes of the Consumer

This paper centered on the reliability of the three-stage decision-making model by Russo and Leclerc (1994), which was tested in a series of experiments with modern eye-tracking equipment. Furthermore, the present paper explored the role of product recognition, choice, and consideration task in relation to the distribution of visual attention across the model. Hence, the paper primarily involved the conceptual model’s decision-making component in relation to the recognition and choice task factors, as seen in Figure 11. Even though the general purpose was to test the decision-making model by Russo and Leclerc (1994), the paper consisted of three separate experiments to test and add further insight into the model.

**Experiment 1:** The purpose is to replicate the original experiment by Russo and Leclerc (1994) in order to better understand the different stages and their consumer-choice characteristics.

**Experiment 2:** The purpose is to investigate the influence of product recognition on visual attention across the stages of the decision-making model.

**Experiment 3:** The purpose is to test the influence of choice task and product recognition on visual attention across the stages of the decision-making model.
4.5.1 Findings

This paper has shown through three sequential experiments that consumer choice follows a pattern whereby mean observation time increases throughout the decision-making process. This is in contrast to the original experiments conducted by Russo and Leclerc (1994), whereby the mean observation time decreases in the verification stage. Russo and Leclerc suggested that since the evaluation stage consists of inferences, it should have longer observation times than both orientation and verification. Instead, in the present study verification consists of observations that are approximately 20 percent longer than those in the evaluation stage. Looking at the activities in the choice process, there are more comparisons that continue throughout evaluation into verification; as such, verification includes a more complex task than previously suggested. Furthermore, the findings show that a choice among familiar brands takes longer than a choice among unfamiliar brands, suggesting that familiar products are evaluated in more detail. Finally, in the preference-based choice task, familiar products also receive more attention than unfamiliar products. However, in the specific qualities consideration task, participants spent a proportionally equal amount of attention on familiar and unfamiliar products. The findings also show the importance of familiarity; even though the inclusion of a specific task shifted the balance, most choices were among familiar products.
4.5.2 Contributions

At a general level, our empirical investigation made three major contributions. First, the replication of Russo and Leclerc’s 1994 experiment provided empirical support for the three-stage model of consumer nondurables, although some noteworthy exceptions were identified. The omission of the verbal protocols makes the choice process almost 50 percent shorter, although with over 40 percent more observations. This shows that the present eye-tracking technology provides much more detail about the choice process and that the omission of the verbal protocols reduces the choice process length. In addition, mean observation times are equally long in the evaluation and verification stages and shorter in the orientation stage, contradicting the findings of Russo and Leclerc (1994). Furthermore, the increased number of eliminations and comparisons and the decreasing number of acquisitions for unfamiliar products throughout the choice process is consistent with the findings of Marewski et al. (2010) who showed the recognition heuristic lead to the initial consideration set formation.

Second, two experiments have shown that the general pattern with increasing mean observation times throughout the consumer choice process is only valid under certain conditions. Changing the task and degree of familiarity with the brands influences both the total time and the mean observation times in the consumer choice process’s individual stages. The mean observation time for preference and consideration choice followed the general pattern of the consumer choice process in the orientation and evaluation phase. However, for the consideration choice, the mean observation time was reduced during verification. Furthermore, familiarity influenced both the mean and total observation time, such that the total time of the evaluation stage was longer for familiar products than unfamiliar products. The mean observation time was shorter for unfamiliar products in the evaluation and verification stages. Additionally, when moving from a preference-based choice to a consideration based choice, the difference in total evaluation time disappears. Finally, participants in the preference-based choice task chose more familiar products, whereas participants in the specific qualities consideration task chose more unfamiliar products.

Third, the alterations in mean observation times can be explained by consumers’ use of heuristic decision-making. Product recognition, employed as a heuristic in the decision-making process, has a great influence on the
distribution of attention. The present paper shows that a choice among familiar brands takes longer than a choice among unfamiliar brands. This suggests that familiar products receive a more thorough evaluation and that such a choice is verified more promptly, disconfirming the suggestion that familiarity leads to a shorter choice processes as proposed by Kuusela et al. (1998). Russo and Leclerc (1994) disregarded the fact that familiarity has a positive effect on the mean observation time in the verification stage. It seems that what was regarded as a false alarm was actually an important result that can help us to better understand the role of product recognition in consumer choice. However, the speed of the choice process is not an effect of familiarity per se, but rather of the complexity of the decision heuristic. Hence, while consumers make choices among familiar products, the choices are based on a heuristic with the objective of finding the best solution, such as take-the-best (Gigerenzer & Goldstein, 1996) or tallying (Dawes, 1979). However, while choosing among unfamiliar products, the choices are based on a good-enough heuristic (Simon, 1955; Todd, 1999).
5 General Contributions and Direction for Future Research

Throughout the present studies, it has become increasingly evident that visual attention plays a key role in decision making. Consumer visual attention has shown how decisions are influenced by in-store and out-of-store factors, which has resulted in a number of contributions within POP decision making research. This chapter summarizes the main contribution of the present thesis and sets the basis for future research.

5.1 The Influence of Product Recognition

By studying consumer visual attention, it was possible to explore the influence of product recognition as a heuristic in construction of consideration sets, and in preference formation. It is now apparent that product recognition has a major role in decision making. Previous researchers have shown that product recognition results in higher choice probability and increased preference. Nevertheless, this thesis has pinpointed the mechanisms that cause product recognition to be influential.

The present findings were postulated by William H. Baker and colleagues (1986), who proposed that recognition results in: (1) enhanced perceptual identification, (2) increased probability of consideration set inclusion, (3) preference formation, and (4) choice behavior influence. Looking at the first proposition, it is evident from the findings that recognition enhances perceptual identification in the initial stages of decision making. As a heuristic, recognition is used by the consumer to simplify complex decision tasks. This in turn influences the second proposition made by Baker et al. (1986); namely an increased probability of consideration set inclusion. As the recognition heuristic is employed, alternatives are reduced for evaluation, a mechanism that results in recognized products continuing further into the decision-making process. As comparisons are made within the consideration set, other heuristics are employed to further reduce options through cue-level comparisons. This sequence sets the foundation for preference formation, which is the third proposition of Baker et al. (1986). Preferences are formed either as a resulting effect of recognition or increased attention. Recognition is known to influence preferences as consumers have a favourable attitude toward recognized products. Furthermore, recognized products will receive more visual attention because they are included in the consideration set and evaluated further. The
aggregation of visual attention on recognized products during evaluation contributes to the formation of preferences by the mechanisms of the gaze cascade model. Hence, the more consumers recognise a product, the more they look, and the more they look, the more they prefer the product. Subsequently, recognition forms preferences, which are then the foundation of the fourth and last proposition by Baker et al. (1986), namely, its influences on choice behavior.

This chain of events, from the initial influence of recognition to choice, is well documented and tested from several perspectives. Three of the five papers involve product recognition as an influencing factor and it is empirically proven and firmly believed that the increased visual attention in turn forms preferences that induce choice behavior. However, recognition stretches beyond the visual sensory input and is also used by consumers to infer value before visual sensory input is available. In this thesis, the verticality heuristic is introduced as a simplification strategy that is faster and more frugal than product recognition. The verticality heuristic is, in a sense, similar to the recognition heuristic as it is used to simplify the decision. However, there is one major difference as inferences from verticality influence the consumer attention before products are inspected. Hence, when verticality is semantically important for the decision outcome, it is employed as a simplification strategy to direct attention towards vertical extremities of the product shelf. It is important to point out that verticality only influences the initial visual attention, and that product packaging is much more influential on consumer decision outcome, even if the consumer is entirely unfamiliar with the product on the shelf. In sum, product recognition influences the initial direction of attention, construction of consideration sets, formation of preferences, and choice. However, in this thesis, it was discovered that this influence is dependent on the decision task.

5.2 The Influence of the Choice Task

The task can either be conceptual (for example, find a premium product) or perceptual (for example, find the green ketchup bottle). It is believed that conceptual tasks rely on top-down processing and perceptual tasks rely on bottom-up processing. The decision tasks used in the present thesis are primarily conceptual. The findings of all of the studies in the thesis show that decision tasks influence visual attention towards relevant information; however, their influence depends on the specificity of the task. Previous research has
suggested that choice task invokes qualitative reasoning that is less time-consuming, whereas consideration requires more quantitative searching, which is more time-consuming. The results of this thesis show that consideration-task-related specific properties of the options, such as “choose the healthiest product,” influence the implementation of simplification strategies and information search. While the recognition heuristic plays a major role in preference-based choice tasks, such as “choose the product you would like to buy,” consideration tasks force the consumer to evaluate products in detail and use more cognitively demanding strategies, which reduces the influence of fast-and-frugal simplification strategies, such as the recognition heuristic.

5.3 The Influence of Product Packaging

To be seen is not analogous to being sold in POP decision making. As explained previously, visual attention constructs preferences for products. However, product recognition generates attention-based preferences. Recognized products aggregate more visual attention, as they travel further into the decision-making process; increased attention results in increased preference. Nonetheless, capturing attention is not always enough for brand selection and the slightest change can have an impact on brand memory, perception, and sales. As explained previously, visual attention is crucial for choice; unseen products are unsold products. On the other hand, a majority of the seen products are also unsold; hence, communicating values is as important as being seen at POP. From this perspective, product packaging has both a perceptual and conceptual function. Perceptual attributes guide visual search and attention and communicate the product’s holistic conceptual impression as surrogate value indicator. Processing perceptual and conceptual features relies on the concepts of “top-down” and “bottom-up” information processing. Few studies have investigated the communicative effects of product packaging, as well as the link between packaging and consumer attention. Several studies herein contribute to this field.

First, it is important to point out that consumer decision making is primarily driven by product packaging and the values acquired from its perceptual features. The findings showed that consumers, independent of decision strategy or product recognition, make correct choices in relation to the conceptual choice task. Furthermore, the results show that some perceptual features that are confounding in relation to the conceptual task have no influence on the
decision maker (one such example is cylindrical shape found in experiment 2 for Paper III). The results indicate that brand recognition is one among several factors influencing a product’s conceptual impression and that some perceptual factors are meaningless in relation to the conceptual task. It seems that the conceptual impression is the resulting effect of individual perceptual features that are activated by the conceptual choice task. Hence, when asked to find healthy products, some perceptual attributes are given precedence over others; this is strongly dependent on the task. The conclusion is that the holistic scheme of the product is not as important as the individual perceptual attributes in relation to the conceptual choice task. This conclusion can be supported from several different perspectives. In cue utilization research, it is pointed out that packaging perceptual features can only influence decision making if they are meaningful for the consumer. In visual attention research, perceptual feature saliency has been described as task-dependent because certain features can be salient for a specific task and not for other tasks. In a task-driven visual search, attention is guided by the sum of the bottom-up and top-down information that together constructs a master saliency map during brand choice. If a given brand or package is not salient, it will not be considered as an alternative at POP. Heuristic research believes that decision making can involve alternatives or attributes. However, when heuristics are employed by consumers to simplify decision making; non-compensatory heuristics are part of the initial screening process, limiting attention to small parts of the available information. Heuristics are believed to be involved in guiding cue search. Hence, the conceptual task is used as a simplification criterion by guiding information search to meaningful perceptual features. In conclusion, it is firmly believed that product packaging is not dependent on its holistic impression during visual search, as is argued in some previous research (Orth & Malkewitz, 2008). The focus should be on specific perceptual features that influence the attention, consideration, and choice of the decision maker (Underwood et al., 2001). Furthermore, the results of the present thesis show that the placement of the perceptual features is equally important as the features themselves. Hence, element organization facilitates information search and influences which aspects of the packaging receive attention.

One further conclusion is that the influence of product recognition is not necessarily related to the holistic design of the product packaging. In visual search, recognition of individual perceptual features can influence the initial screening of alternatives. For instance, one perceptual feature can constitute the
criterion used for fast-and-frugal heuristics, such as the recognition heuristic. However, if the perceptual feature is unavailable or unattended, the products will not continue further in the decision-making process. Thus, the perceptual features of the product packaging need to (1) be salient if they are important in communicating the primary values of the product, and (2) be recognized as relevant to the primary values of the product. This would generate the best foundation for the product to continue further into the decision-making process. In short, products that are both eye-catching and recognized will have greater likelihood of receiving attention, considered as an option, and chosen. Recognition, however, is not about creating “me-too” packaging that copies competitor designs, but rather is about comprehending packaging attributes and being able to attach these attributes to the values sought during the search process. Further, recognition is about communication of values in split-second decision making and getting through with perceptual features that compose the holistic expression of the product.

5.4 The Biased Decision-Maker

It is well established that the decision maker is influenced by the mind and the environment through top-down and bottom-up information processing. It is an accepted and well-established decision-making phenomenon; however, there is some disagreement about the role of top-down and bottom-up processing and its influence on visual attention. Both these mechanisms can bias visual attention deployment. Bottom-up bias stems from perceptual packaging features that deviate from the surrounding products (e.g., saliency and pop-out effect). Top-down bias shifts attention through decision tasks, activating memories from product recognition and preference that direct visual attention toward task-relevant information. The disagreement is about the temporal influence of top-down and bottom-up processing on visual attention. It is argued that visual attention is bottom-up-driven at first and that it is only later that top-down information can bias visual attention. It is believed that bottom-up processing is related to where information is located and top-down processing to what the information is. Furthermore, it is believed that preattentive processing does not include any top-down information other than spatial information (Theeuwes, 2010). The competition between these two attention-biasing components is believed to be task-dependent (Desimone & Duncan, 1995). The present findings show that consumers visually attend information that is solely established by the conceptual task. This indicates that consumers preattentively
process top-down information that directs the deployment of visual attention toward the expected placement of a target, rather than the actual placement of the target. This indicates that that the conceptual task (premium or budget) in the present research was related to spatial information, giving further evidence that the value inferred from verticality is preattentive, involved in directing visual attention as a top-down factor, and a simplification strategy.

In addition to the previously mentioned top-down biases, there are viewing strategies, such as the central fixation, or center bias, that influence visual attention toward the central location of an image. It is believed that center bias is related to previous knowledge associated with spatial information (e.g., photos, television, and advertisements) (Parkhurst et al., 2002). This results in consumers having a stronger tendency to look at the center of the image then at the extremities and being more likely to move from any position of the shelf to the center region across any task or image. In the present thesis, it was discovered that when consumers are not given conceptual tasks related to spatial information, the center position is attended faster, more frequently, and more time is spent in the center. Furthermore, there are vertical bias tendencies that direct consumers’ visual attention toward the top shelf section independent of content or choice task. The present findings show that consumers generally start looking at the center of a product shelf and then move to the top vertical position.

5.5 Future Visual Attention Research in POP Decision Making

The main area for future research is to test the ecological validity of the results produced in the lab environment. This is a limitation in all the appended papers as none of the findings has been tested in the retail environment. A suggestion for future research would be to investigate whether the findings are replicable in a retail environment, with real product shelves. In a recent eye-tracking study, differences in TTFF between stimuli presented in physical and virtual shopping environments were found (Tonkin, Duchowski, Kahue, Schiffgens, & Rischner, 2011). Physically presented stimuli (cereal boxes) received fixations faster than their corresponding virtual images. Since studies of real-world eye movements are still at their very beginning (Holmqvist et al., 2011), it would be interesting to explore customers’ visual attention and decision making in more realistic settings, both to find out if the results presented here are generalizable and to see whether the eye-tracking methodology is valid.
With the development of head-mounted eye tracking, consumer eye movements can be recorded in the natural environment. This is a more intrusive method for tracking eye movements, but the method brings new opportunities in measuring consumer behavior in the retail environment. The subject can move freely with no restrictions. The advantage of using a head-mounted unit is that the subject’s eye movements can be followed with all the factors that affect the decision-making process. The disadvantage of head-mounted eye-tracking is the difficult to quantify data. The future of head-mounted eye-tracking is dependent on the ability to quantify the data based on individual AOIs or specific objects in the field of view.

In the future, eye-tracking systems will be integrated into shelf structures. This interesting technological development is ongoing (Cho, Yap, Lee, Lee, & Kim, 2012), and long-range eye-tracking systems will enable nonintrusive eye movement measurements in the retail environment, which will open up new opportunities for researchers and managers to understand consumer behavior at POP.
References


Chandon, P. J. (2002). Do we know what we look at?: An eye-tracking study of visual attention and memory for brands at the point of purchase. *Working Paper, Marketing Department, INSEAD.*


What Does it Take to Get your Attention?

Decision making for fast-moving consumer goods involves a choice between numerous similar alternatives. Under such demanding circumstances, a decision is made for one product. The decision is dependent on the interaction between the environment and the mind of the consumer, both of which are filled with information that can influence the outcome. The aim of this dissertation is to explore how the mind and the environment guide attention towards considered and chosen products in consumer decision making at the point-of-purchase.

The results of the 10 experiments in the five papers that comprise this thesis shed new light on the role of visual attention in the interaction between the environment and the mind, and its influence on the consumer. It is said that consumers choose with their eyes, which means that unseen is unsold. The results of this thesis show that it is just as important to be comprehended as it is to be seen. In split-second decision making, the ability to recognize and comprehend a product can significantly impact preferences. Comprehension stretches beyond perception as consumers infer value from memory structures that influence attention. Hence, the eye truly sees what the mind is prepared to comprehend.