

Short Title: Neural basis of brand equity

Customer-based brand equity: Insights from consumer neuroscience

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Abstract

This review describes how insights from cognitive and behavioral neurosciences are helping to organize and interpret the relationship between consumers and brands. Two components of brand equity—consumer brand knowledge and consumer responses—are discussed. First, it is argued that consumer brand knowledge consists of multiple forms of memories that are encoded in the brain, including well-established forms of semantic (attributes and associations) and episodic (experiences and feelings) memory. Next, it is argued that there exist distinct forms of consumer responses that correspond to distinct behavioral systems—a goal-directed system that captures valence of attitudes and preference for a brand, and a habit system that captures previously learned values but no longer reflect ongoing preferences. Finally, a neuroscientifically-grounded conceptualization is proposed with the aim of ultimately improving measurement of brand equity and its effects on financial returns.

1. Introduction

Marketers have long appreciated the role of branding in guiding managerial decision making (Keller 1993; Aaker 2009; Gardner & Levy 1955). An understanding of how consumers feel and think about brands, for example, provides valuable guidance to developing marketing strategy in areas including advertising, pricing, and channel strategies (Aaker 2009; Rust, Zeithaml, et al. 2004). At the same time, however, consumer researchers have noted increasing dissatisfaction on part of practitioners with shortcomings in existing methods of measuring the impact of brand building activities (Feldwick 1996; Ambler & Barwise 1998; Berthon et al. 2001). As early as the 1990s, for example, researchers have noted that advertising's share of the marketing budget has shifted downward from over 60% to less than one-third (Shocker et al. 1994).

In particular, compared to marketing actions that yield more direct and immediate effects, the ability of marketers to measure returns on brand investment have lagged in key metrics such as revenue and profitability (Rust, Lemon, et al. 2004; Kamakura & Russell 1993; Knox & Walker 2001). Thus, although brands are often seen as one of the most valuable assets for firms, brand managers nevertheless face significant challenges to justify the impact of their spending. Moreover, existing theories of brand equity have tended to be largely based on folk psychological concepts such as image, loyalty, and value. In some cases, they are built on psychological models that have been superseded by more scientifically rigorous models based on our knowledge of the underlying neurobiology.

These challenges have only increased in recent years as branding has grown to more and more focus on abstract and intangible considerations, and managers are increasingly seeking to understand aspects of brands unrelated to the actual physical product or service specifications (Keller 2012; Aaker 2009). It is perhaps not surprising that some scholars have even called into questions the validity and managerial usefulness of the brand equity concept itself (Berthon et al. 2001).

This review describes how recent developments in cognitive and behavioral neuroscience of consumer decision-making can help to address these issues and organize the fragmented literature on brand equity. Importantly, a neuroscientific perspective has the potential to provide a rigorous scientific foundation toward understanding the core components of brand equity, how they are generated, and how they can be influenced by marketing actions (Yoon et al. 2006; Plassmann et al. 2012). Much like the way that classification of species by modern genetic methods are often consistent with those using more qualitative methods (Archibald 2009), this new science have thus far validated a number of the hard-won insights about brand equity, but at the same time organizes them in more rigorous and makes clear the how marketing action inputs ultimately translate to consumer response outputs.

First, a framework is put forward conceptualizing brand equity as the product of (i) the knowledge that customers possess regarding to a particular brand, and (ii) the actions that this knowledge leads to, which affect key metrics such as revenue and profitability. Second, neuroscientific evidence show that brand knowledge consists of multiple forms of memories that are encoded in the brain, which correspond to well-established forms of memory associated with semantic (facts and concepts), episodic (experiences and feelings), and instrumental (rewards and habits) types of memory. Third, these knowledge are associated with different forms of behavioral systems, including a goal-directed system that captures valence of attitudes and preference for a brand, and a habit system that captures previously learned values but no longer

reflect ongoing preferences. Finally, the review concludes by providing a new brain-based framework of brand equity and a discussion of the outstanding questions and possible future directions.

2. Defining Brand Equity

Despite its intuitive nature, the definition of brand equity is surprisingly contentious. In particular, two perspectives on brand equity must be distinguished—firm-based and consumer-based (Christodoulides & de Chernatony 2010; Feldwick 1996; Baker et al. 2005). Under the former, brand equity is defined according to the financial benefits that a brand brings to a firm (Kamakura & Russell 1993; Reynolds & Phillips 2005). This could include price premium, net discounted cash flow brand, market share, and others, that are attributable to the brand.

In keeping with customer-centered perspective of modern marketing theory and practice (Keller & Lehmann 2006; Keller 1993), a customer-based definition of brand equity is used. Here, brand equity is defined as the added value, from the perspective of the customer, endowed by the brand to the product (Christodoulides & de Chernatony 2010; Keller 1993; Rust, Lemon, et al. 2004). This is done for two reasons. First, in contrast to firm-based brand equity, which tends to be well-defined, there remains substantial conceptual and methodological controversy regarding customer-based brand equity, ones which may particularly benefit from recent insights from consumer neuroscience (Rust, Zeithaml, et al. 2004; Keller 1993).

Second and more importantly, a customer-orientation provides a natural way to link these two concepts that define customer-based equity using models of customer lifetime valuation (CLV) (Rust, Lemon, et al. 2004; Reynolds & Phillips 2005; Aaker 2009). These models view firms' marketing efforts as competitive investment that attempt to shape customer perceptions, which then result in effects on customer acquisition and retention, leading to increased CLV (Srivastava et al. 1998; Rust, Lemon, et al. 2004). Return on marketing investment can then be calculated simply by subtracting the cost of marketing investment.

Conceptualizing brand equity in this way has provided a powerful framework for marketers to measure returns on brand investment, particularly in an age where customer acquisition and retention are increasingly observable. However, there remains little consensus regarding the middle ground between marketing actions and observed consumer responses. This essentially includes everything that is not under direct observation or control of the firm. In particular, there is poor agreement regarding (i) what are the constituent parts underlying consumer brand knowledge, and (ii) how this knowledge is ultimately translated into consumer responses. One reflection of this lack of consensus is the sheer number of frameworks that have been proposed for customer-based brand equity (Table 1). Although they all correspond to some intuitive notions of “knowledge” and “value”, they also differ in important ways from each other and could conceivably provide contradictory recommendations to a brand manager. One potential contribution of a neuroscientific approach to these issues is thus simply to ground these concepts in well-established scientific facts about how the brain stores information and make use of such information in decisions.

3. Brand Knowledge

Beginning with seminal works of Aaker (2009) and Keller (1993), conceptualizations of brand knowledge and their constituent parts have largely been based on ideas from cognitive psychology. In particular, drawing upon models of human memory developed in the 1970s and 1980s, these authors conceptualize

brand knowledge as a collection of thoughts, images, feelings, and experiences that consumers associate with brands, and stored in associative memory.

3.1. Brand Knowledge as Associative Memory Networks

In associative network models, information is stored in a set of nodes and connected by links that vary in strength. Information retrieval is then conducted via a “spreading activation” process where activation of one node can spread to other linked nodes in memory. When the activation of another node exceeds some threshold level, the information contained in that node is recalled (Collins & Loftus 1975; Keller 1993).

Such models have been highly useful at generating novel and sophisticated theories of mental processes and explain a number of important facts about brand associations and managerial implications, such as brand extension. In Hutchinson et al. (1994), it was shown that consumers brand and product name recall to the cue “beverage” is highly consistent with an associative memory model. In the particular example given in Figure 2, the consumer recalls first Coke, followed by a number of other sodas, before moving on to related product categories such as beer. Note also that in most cases, the brands and products used more frequently appeared to be “top of mind” more quickly than those that used were less frequently.

However, associative models have difficulty explaining non-cognitive phenomena, such as the effects of emotion and motivation, on memory. Mood effects on memory, for example, have been an important area of study for consumer researchers (Bettman 1970; Bettman et al. 1991). This has potentially important implications for understanding how vehicles of advertising, such as television, can influence memory for the advertisements themselves. In addition, studies of so-called implicit memories have shown that memory traces are possible even without conscious recall. In advertising, for example, implicit memories have been shown to be important in cases of high distraction, such that respondents do not possess explicit memories of advertising claims. Most importantly, a unitary model of consumer memory ignored the growing consensus in cognitive neuroscience that memory is not a monolithic faculty, but rather a collection of relatively independent systems characterized by different patterns of learning, unlearning, and biases (Milner et al. 1998; Squire & Wixted 2011).

3.2. Brand Knowledge: A Multiple Memory Systems View

Modern research on memory systems was inspired in part by neurological studies of amnesic patients, such as the famous patient HM (Schacter 1999; Milner et al. 1998). Following temporal lobe resection to treat his epilepsy, HM lost the ability to form new episodic memories but retained other forms of memory, such as existing factual knowledge and motor skills. Over the next decades, researchers using a variety of neuroscientific techniques, including brain imaging, lesion studies, and animal models, have confirmed and clarified the brain basis of these different forms of memory (Table 2).

More broadly, that multiple memory systems underlie brand knowledge is important for three reasons. First, substantial neuroscientific evidence suggest that these systems are associated with different patterns of learning and unlearning. These have important implications for behavioral expression. Episodic memory for example, are fast forming and context dependent. In contrast to episodic and semantic systems, however, Pavlovian systems, likely underpinned by reinforcement mechanisms, are slow in acquisition as well as extinction (Milner et al. 1998).

Second, different memory systems are subject to different forms of biases and distortions (Schacter & Slotnick 2004). For example, episodic memory is a recently evolved, late-developing, and early-deteriorating past-oriented memory system, more vulnerable than other memory systems to neuronal dysfunction, and probably unique to humans (Tulving 2002; Schacter & Slotnick 2004). In contrast, semantic memory appears widely distributed and robust to brain damage. Finally, habits and procedural memory appear to be robust even in late stages of Alzheimer's disease (Wood & Neal 2007). In the case of episodic memory, in particular, there has been much focus on the creation of "false memories" (Schacter & Slotnick 2004; Schacter 1999). There is now substantial evidence that each retrieval of an episode, in particular those that are highly memory charged, alters the memory in some significant way (Nader et al. 2000). Such mechanisms have now been exploited to "erase" debilitating fear associations, which are central to disorders such as PTSD (Schiller et al. 2010).

Finally, these systems are known to interact, alternatively compensate and compete under different conditions, and are differentially modulated by emotional processes and contextual factors (Milner et al. 1998). Compensatory effects, for example, have been witnessed in the case of amnesic individuals who use habit systems to "remember" to take their medication (Squire & Zola 1996; Squire & Wixted 2011).

3.3. *Multiple Memories System for Brand Knowledge*

In terms of brand knowledge, there are two lines of evidence suggesting that consumer brand knowledge engages multiple memory systems. The first is indirect, and comes from theoretical and empirical studies that attempted to decompose brand knowledge into their component parts. Aaker (1997), for example, provided a psychometrically validated scale to measure the set of human-like traits that consumers associate with brands. For example, Apple is often described as cool, imaginative, whereas Gucci is described as glamorous and feminine.

Other studies have sought to capture more experiential aspects of consumers' interactions with brands. The brand experience scale, for example, attempts to capture the degree to which brands engage consumers at the sensory, affective, intellectual, or behavioral dimensions (Brakus et al. 2009). Keller (1993) also distinguished included experiential benefits for users and tangible product attributes in his brand equity framework. Interestingly, because Keller relies on a single associative memory system, the organization of brand knowledge reflect much more of how a marketer might organize brand knowledge for managerial purposes, than how it is reflected in the mind of the consumers.

The second came from more recent neuroscientific studies of consumer brand processing. This is important given the possibility that previous evidence only reflects surface similarities between the relevant concept, for example brand experience with episodic memory, and semantic memory with brand associations. The addition of neuroscientific evidence thus promises to benefit consumer psychology models of brand knowledge in much the same way as it did for basic memory research.

In an early study modeled after the Pepsi Challenge, McClure et al. (2004) found that, when consumers knew that they were consuming Coke, a set of regions including the hippocampus and dorsolateral prefrontal cortex was activated, compared to when they did not know it was Coke. Because the actual consumption experience was identical in both cases with the exception of the knowledge of the brand, the study was able to isolate the set of associations that Coke triggered. Interestingly, Pepsi did not elicit

significant responses in these regions, and behaviorally elicited significantly lower preference ratings than Coke. In subsequent studies, similar effects were found when stimuli included automobiles and luxury products (Erk et al. 2002; Schaefer & Rotte 2007). Comparing a wider set of brands, Esch et al. (2012) found a similar activation in the hippocampus when comparing strong brands versus unfamiliar brands. In addition, a number of other cortical regions were activated with respect to brand strength and familiarity, including the lateral prefrontal cortex and insula.

However, an important potential shortcoming of these above studies is that they rely on localization approaches which may fail to capture representations and processes that are not contained in any single set of brain regions, but rather emerge from the correlated activity across a network of brain areas (Kriegeskorte et al. 2006; Mitchell et al. 2008). That complex constructs such as conceptual knowledge emerge out of a distributed system has a long and distinguished history dating back at least to Lashley's search for engrams (Lashley 1950) and connectionist models of learning systems (McClelland & Rogers 2003; Hinton et al. 1986).

Recently, Chen et al. (forthcoming) took an important step toward addressing the possibility that brand knowledge is in fact distributed widely across the brain. Specifically, using newly developed machine learning approaches that has become increasingly popular in studies of basic perceptual and cognitive processes (Kay et al. 2008; Formisano et al. 2008), the authors used cross-validation techniques to consider what type of knowledge is contained in a distributed set or "pattern" of brain activity, possibly distributed across many regions. They found that, consistent with distributed accounts of semantic knowledge, a widely distributed set of brain region appeared to contain information regarding brand associations as hypothesized in the Aaker (1997) brand personality framework (Figure 4). In contrast, consistent with models of episodic memory, brand experience appears to be contained in a far more restricted set of hippocampal regions (unpublished data).

4. Customer Response: Translating Knowledge into Action

Given an eventual goal of every marketing program is to increase sales, no account of brand equity is complete without an understanding of how influence of consumer perception ultimately translates into consumer responses (Aaker 2009; Kamakura & Russell 1993). Whereas traditional marketing theories take it for granted that more favorable associations stored in consumer memory will result in increase customer acquisition and retention (Keller 1993), advances in decision and consumer neuroscience have provided a more nuanced understanding of conditions under which memory influences decisions.

Of central importance here is the existence of two interacting systems for decision-making: a more evaluative, deliberative goal-directed system, and a more automatic, reflexive habit system (Yin & Knowlton 2006; Kahneman 2011). Similar to consumer memory, these systems likely evolved to address different adaptive demands in our evolutionary history. As anyone who has held a conversation while driving a car can attest to, the two systems can operate independently but at interacting or interfering with potentially important consequences.

4.1. Goal Directed versus Habitual Decision-Making

First, the goal-directed system assigns values to actions by computing action–outcome associations and then evaluating the rewards that are associated with the different outcomes (Rangel et al. 2008; Hsu et al. 2005).

That is, using information stored in semantic and episodic memory systems, the goal-directed system makes decisions via a deliberative strategy. This system corresponds closely to the standard consumer decision-making models widely in marketing (Figure 5).

Human functional neuroimaging studies have shown that brain activity in the frontostriatal circuit, in particular the OFC, to be associated with behavioral measures of goals (Rangel et al. 2008; Sugrue et al. 2005; Schultz et al. 1997). Moreover, individuals with damage to the medial OFC are known to have a number of problems making consistent appetitive choices. In the context of branding, Koenigs & Tranel (2008) have shown that damage to this area abolishes the influence of brand, specifically Coca-Cola, on behavioral preference, consistent with the view that this region receives and integrates value-relevant information that drive choice behavior.

In contrast to the goal-directed system, habits are prepotent responses that are quick to activate in memory over alternatives and that have a slow-to-modify memory trace (Rangel et al. 2008; Yin & Knowlton 2006). For example, one study found that moviegoers who habitually eat popcorn in cinemas would eat even stale popcorn while satiated, but only in the context associated with past performance (Neal et al. 2011). Because of the low cognitive demand of such decisions, habit systems are likely evolutionarily ancient. Indeed, studies using a variety of rodent and nonhuman primate species suggest that the basal ganglia plays a crucial part in the control of habits. In particular, lesion studies using rodents have shown that damage to these regions disrupt the ability of rodents to establish and deploy habits (Faure et al. 2005; Yin et al. 2004).

Thus, unlike semantic and episodic memories, habit systems specify actions in direct response to environmental contexts and are inseparable from habit memory. Because habits are acquired through trial-and-error learning, habit systems are believed to learn relatively slowly (Table 2). As a consequence, they might forecast the value of actions incorrectly, as anyone can attest after a home remodel or software user interface upgrade. Moreover, such actions can be highly specific, such as motor command programming when one is typing a password, but they can also be quite general, for example actions in approach or avoid. Finally, habits are not immune to deliberative processes. Habits are learned largely as people pursue goals in daily life, and habits are broken through the strategic deployment of effortful self-control (Wood & Neal 2007; Yin & Knowlton 2006). This is an important growth area in decision and consumer neuroscience and is still not completely understood.

In branding and marketing, the distinction between these two types of systems is rarely made but has a number of important implications. First, building consumer habits are critical for increasing customer retention. Consumers that develop habit of purchasing a particular brand, product or from a specific channel may be less likely to search for information for alternatives, deliberate about competing products, or delay purchasing for the future. Second, it makes clear that overt behavior such as customer loyalty may have multiple causes. A customer who makes repeated purchase might be doing so either because of the attractiveness of the offering or simply out of habit. Likewise, certain marketing strategies may have differential effects on these two systems, raising the possibility that marketers can optimize and target strategies for different goals or segments.

Finally, the presence of these two systems opens the possibility that CLV calculations can be improved by incorporating information about development and breaking of consumer habits. For example, branding and

marketing strategies that are ineffective may be so because they have not had sufficient time to break previous consumer habits, or because they are truly ineffective. Likewise, encouraging current retention statistics may belie weaknesses in future retention.

5. Conclusion

Taken together, this review highlights two areas where insights from cognitive and behavioral neuroscience can help to improve and guide managerial decision-making of customer-based brand equity. First, it helps to ground conceptualizations of customer-based brand equity on a firmer scientific footing. This is particularly important in the development and validation of brand equity scales. In contrast to the myriad of systems proposed in previous academic literature summarized in Table 1, a brain-based view of brand equity can be constructed by first distinguishing between memory and behavioral systems, with each containing subcomponents corresponding to different types of memory or behaviors (Table 3). For example, the fact that episodic memory is fast forming but easily distorted and semantic memory is slow forming but resilient also has implications for when and how often brand managers should measure these components of brand knowledge, and the types of brand building activities necessary to consolidate these memories.

Second, the fact that memory is often inaccessible to conscious recall opens the door to neuroscientific and implicit measures to supplement self-report measures, including fMRI, EEG, and implicit association test. This will be particularly important in cases where consumers are either unable, such as in the case of habits, or unwilling, such as personally sensitive information, to reveal to the researcher.

Finally, this framework makes clear the need to link two very different traditions of measuring brand equity. On the one hand are brand managers that deal primarily with recognition, recall, and awareness related to brand knowledge, whereas on the other hand exists those that focus on consumer responses such as acquisition and retention. A brain-based view of brand equity makes clear that each is incomplete by itself, as behavior depend on knowledge, but knowledge does not benefit the firm per se without it ultimately being translated into action. Although it is still far from clear how this relationship can be probed and measured at a scale necessary for practical usage, even a small step forward is a significant advance given the importance of brand equity to firms and their stakeholders.

6. References

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Figures and Tables

Figure 1: Brand knowledge and brand equity through a CLV framework. Adapted from Rust et al. (2004).

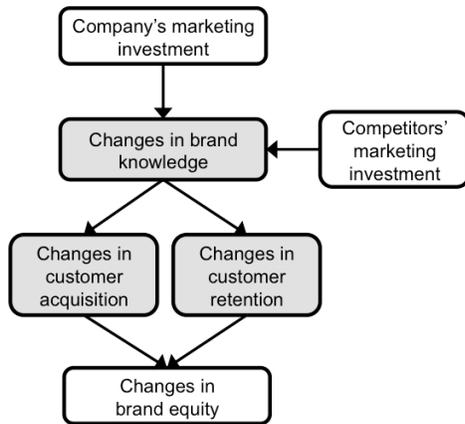


Figure 2: Clustering in brand name recall for a typical subject. In addition to influencing the recall of particular alternatives, the categorical structure of memory is likely to influence which brands co-occur in the consideration set. Brand names tend to be recalled in categorical clusters. Adapted from Hutchinson et al. (1983).

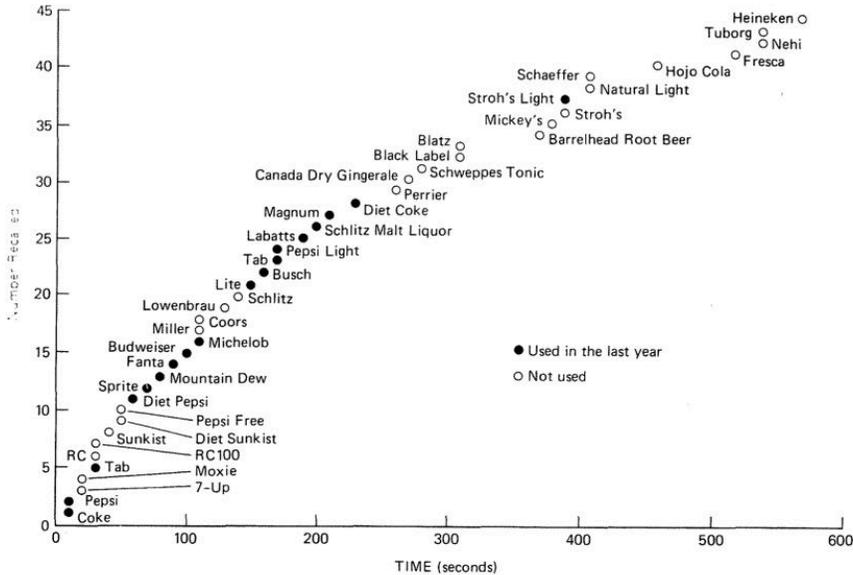


Figure 3: Multiple memory systems model of human long-term memory. Adapted from Milner et al. (1998).

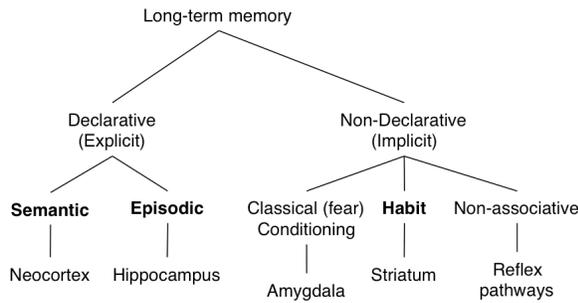


Figure 4: Brain regions that contain information about brand associations in the Aaker (1997) brand personality framework. Each panel shows clusters of at least 10 contiguous significant voxels. To make inferences about cognitive processes subserved by these regions, the meta-analytic tool Neurosynth (Yarkoni et al. 2011) was used to generate the probability that a specific cognitive process is engaged given activation in a particular brain region. For example, given specific voxel location of the observed activation in the dorsomedial prefrontal cortex (cluster c), there is a 0.85 probability that the term “personality traits” was used in a study given the presence of reported activation. Adapted from Chen et al. (forthcoming).

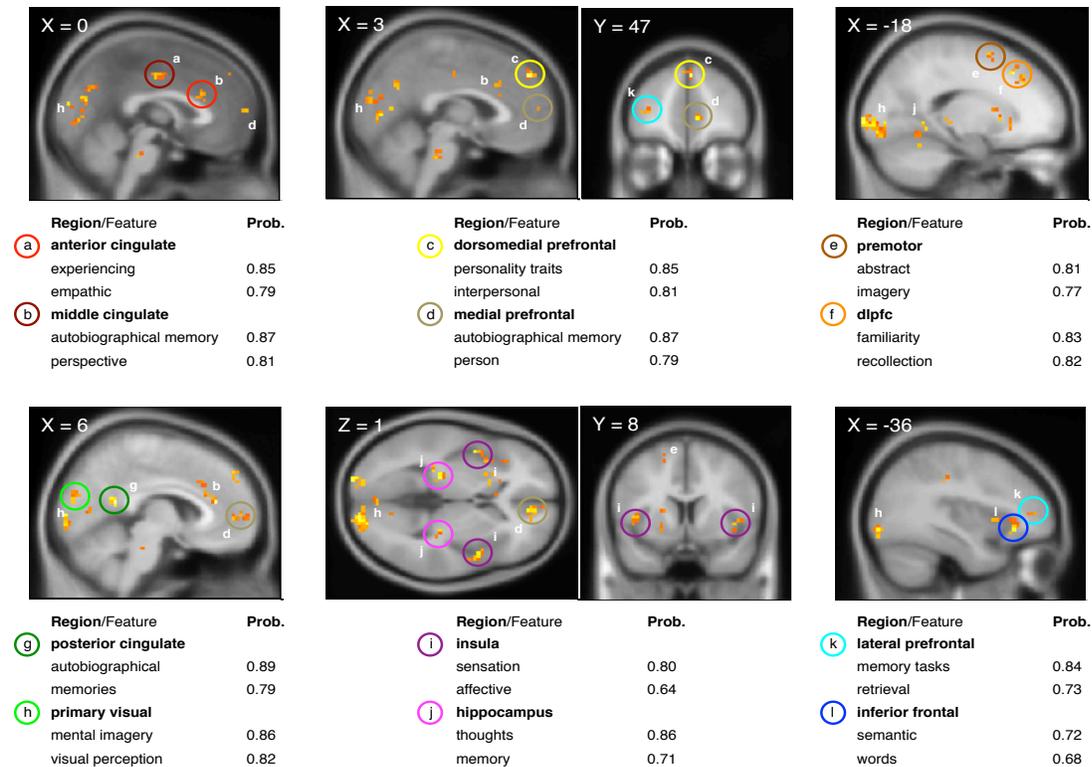


Figure 5: Typical consumer decision-making process. Adapted from Kotler & Armstrong (2010).

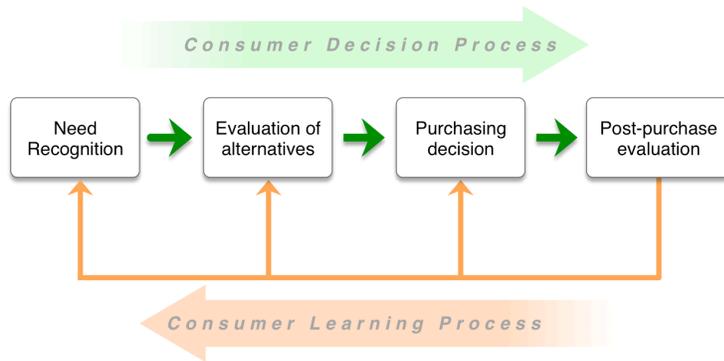


Table 1: Different conceptualizations of customer-based brand equity in academic literature.

Study	Dimensions of Customer-Based Brand Equity
Aaker (1991, 1996)	Brand awareness Brand associations Perceived quality Brand loyalty
Blackston (1992)	Brand relationship (trust, customer satisfaction with the brand)
Keller (1993)	Brand knowledge (brand awareness, brand associations)
Sharp (1995)	Company/brand awareness Brand image Relationships with customers/existing customer franchise
Berry (2000)	Brand awareness Brand meaning
Burmann et al. (2009)	Brand benefit clarity Perceived brand quality Brand benefit uniqueness Brand sympathy Brand trust

Source: Christodoulides and de Chernatony (2010).

Table 2: Memory systems of particular importance for consumer decision-making.

Memory System	Memory Type	Learning Rate	Neural Substrates
Semantic	Knowledge and facts	Slow	Neocortex, highly distributed
Episodic	Events and experiences	Fast	Hippocampus, localized
Instrumental	Rewards, habits	Fast for reward associations, slow for habits	Basal ganglia, orbitofrontal cortex, localized

Table 3: Customer-based brand equity according to consumer neuroscience.

Dimensions	Components	Correspondence To Previous Literature
Brand Knowledge	Semantic Episodic	Brand associations, Brand experience, Brand relationship
Customer Response	Goal-Directed Habit	Perceived quality, Brand benefit, brand trust Brand loyalty