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Branding the brain: A critical review and outlook

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Abstract

The application of neuroscience to marketing, and in particular to the consumer psychology of brands, has gained popularity over the past decade in the academic and the corporate world. In this paper, we provide an overview of the current and previous research in this area and explain why researchers and practitioners alike are excited about applying neuroscience to the consumer psychology of brands. We identify critical issues of past research and discuss how to address these issues in future research. We conclude with our vision of the future potential of research at the intersection of neuroscience and consumer psychology.

Keywords: Consumer neuroscience; Neuromarketing; Branding; Attention; Memory; Value

Introduction

The application of neuroscience to consumer psychology, and in particular to branding, has gained popularity over the past decade in academic research and business practice: in the last decade the number of publications in top marketing journals and Google references around this topic has grown exponentially and the same holds for the number of neuromarketing companies founded (see Fig. 1).

The birth of the field of consumer neuroscience has generated wide-ranging, ongoing debates of whether this hybrid field benefits its parent disciplines (consumer psychology and neuroscience) and, within them, what forms these benefits might take (Ariely & Berns, 2010; Kenning & Plassmann, 2008; Lee, Broderick, & Chamberlain, 2007; Plassmann, Ambler, Braeutigam, & Kenning, 2007). The goal of consumer neuroscience is to adapt methods and theories from neuroscience—combined with behavioral theories, models, and tested experimental designs from consumer psychology and related disciplines such as behavioral decision sciences—to develop a neuropsychologically sound theory to understand consumer behavior.

To appreciate the value of combining neuroscience with consumer psychology, it is important to understand the broad range of insights available from neuroscience. Neuroscience is the study of the nervous system that seeks to understand the biological basis of behavior. This range of insights is too broad for the study of consumer psychology, which is why in the following paragraphs we briefly clarify which areas within neuroscience are the most relevant for consumer neuroscience.

Neuroscience research ranges from studying single cells (cellular neuroscience) to studying how different brain areas or complex brain systems, such as the visual system, interact (systems neuroscience). Because of the complexity of consumer behavior,

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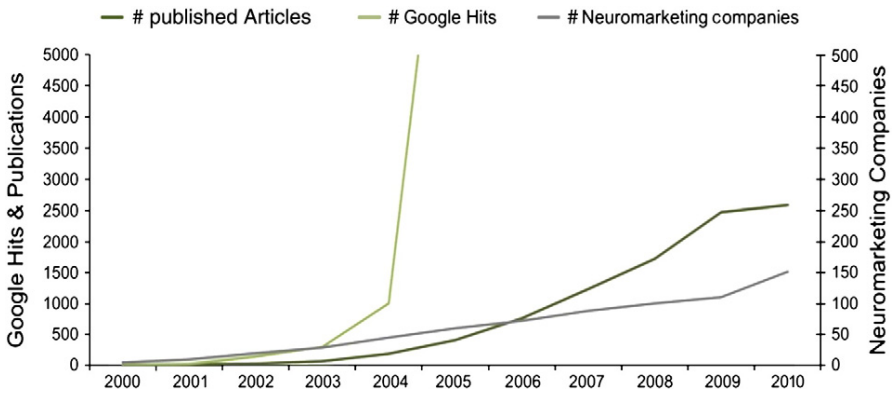

Fig. 1. Growth of research applying neuroscience to marketing over time.

insights from systems neuroscience are crucial for consumer neuroscience, whereas those from cellular neuroscience currently are limited.

Neuroscientists study species ranging from the primitive (such as sea snails, fruit flies, and leeches) to the complex (such as mammals and primates). Most consumer neuroscience studies investigate mental processes in human subjects, but a few selected studies also use non-human primates or small animals such as monkeys as subject populations.[1]

Another important distinction is between clinical and non-clinical research in neuroscience. Clinical research, known as neurology, studies how nervous system disorders, trauma, tumors and injuries affect cognition, emotion, and behavior in patients as compared to healthy subject populations. In general, consumer neuroscience studies consumer responses in healthy subject populations.[2]

A last critical distinction is between consumer neuroscience, which refers to academic research at the intersection of neuroscience and consumer psychology, and neuromarketing, which refers to practitioner and commercial interest in neurophysiological tools, such as eye tracking, skin conductance, electroencephalography (EEG), and functional magnetic resonance imaging (fMRI), to conduct company-specific market research. Neuromarketing has received considerable attention in the corporate world, and the growth of neuromarketing companies over the last decade has been impressive (see Fig. 1).

The goal of this paper is to shed light on what neuroscience can bring to the table to advance our understanding of the consumer psychology of brands. In particular, we aim to provide an overview of the current state of research in this area, identify critical issues of past research and discuss how to address these issues in future research. We conclude with our vision of the future potential of research at the intersection of neuroscience and consumer psychology.

What is currently done: toward an interdisciplinary understanding of consumer decision making

In this section, we review previous work in neuroscience pertinent to understanding underlying processes involved with brand decisions. We structure the review using a simple consumer decision-making framework based on prior work in consumer psychology (Fig. 2; Kahneman & Snell, 1992; Kahneman, Wakker, & Sarin, 1997; Rangel, Camerer, & Montague, 2008; Wirtz, Kruger, Scollon, & Diener, 2003). We also use this framework to integrate previous consumer neuroscience studies that are directly related to branding questions and to point the way for future applications in consumer research.

The framework divides the stages that are required for brand preference formation over time into four basic components: (1) representation and attention, (2) predicted value, (3) experienced value, and (4) remembered value and learning. Below we explain these basic components and review previous findings on the underlying neuropsychological processes of each of those components. The main brain areas involved with each component of the model are shown in Fig. 3.

Representation and attention

The amount of information consumers are exposed to is enormous, yet our processing capacity is limited. Each second we are exposed to an estimated 11 million bits of information that reach us through all our senses, yet humans are capable of processing only around 50 bits of that information, letting most of the input go by unnoticed (Wilson, 2002). How consumers represent, attend to, and perceive incoming information may have a profound influence on their behavior. In the current section, we discuss representation (i.e., brand identification) and attention.

[1] There are at least two major reasons to study non-human subjects in consumer neuroscience. First, studying animals allows consumer neuroscientists to make causal links between brain areas and specific behaviors. Animal work allows the application of more invasive methods to brain systems that animals and humans have in common. Second, if consumer neuroscience researchers are using evolutionary theories to explain phenomena in consumer behavior such as behavioral biases, using an animal model allows evolutionary inferences (i.e., going back in the evolutionary chain).

[2] However, there are several reasons to use patient populations in consumer neuroscience. The most prominent one is to use patients with brain lesions to establish causal relationship between brain regions and consumption behavior. At the end of this paper, we will discuss some of these aspects as potential future developments.

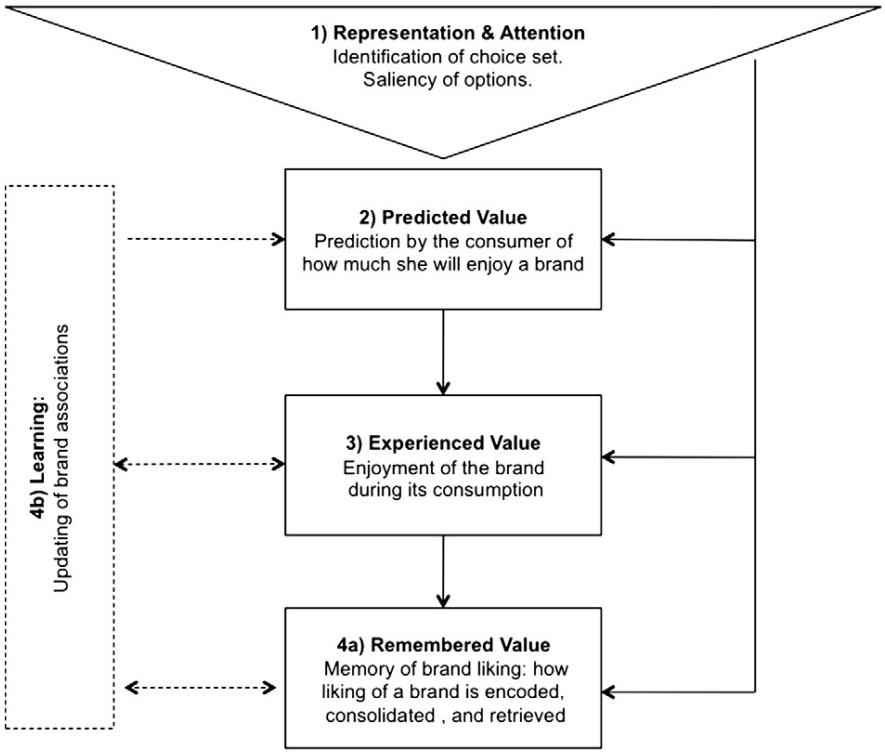

Fig. 2. Value signals important for brand decisions.

Representation The first process in brand decisions involves forming the representation of the choice alternatives—that is, brand identification. This entails processing the incoming information, so that different options for choice are identified (e.g., different beer brands). At the same time, the consumer needs to integrate information on internal states (e.g., thirst level) and external states (e.g., location, social context) that drive attention. For example, when faced with a choice between drinking Heineken or Beck's beer (an incoming information) a consumer's choice is likely to depend on her own level of thirst (an internal state) and what her friend chooses to drink (an external state).

Humans are predominately visual creatures, and most of the incoming information we receive is visual (Koch, 2004). Our visual system contains two cortical routes that are involved with visual processing (see Fig. 3). The dorsal visual pathway is involved with the spatial deployment of attention (the "where/how" pathway) and proceeds from the primary visual cortex V1 in the occipital lobe, through the posterior parietal cortex, to the dorsolateral prefrontal cortex (dlPFC). The ventral visual pathway is responsible for object recognition (the "what" pathway) and originates in V1, then continues to the inferotemporal cortex, and to the ventrolateral PFC.

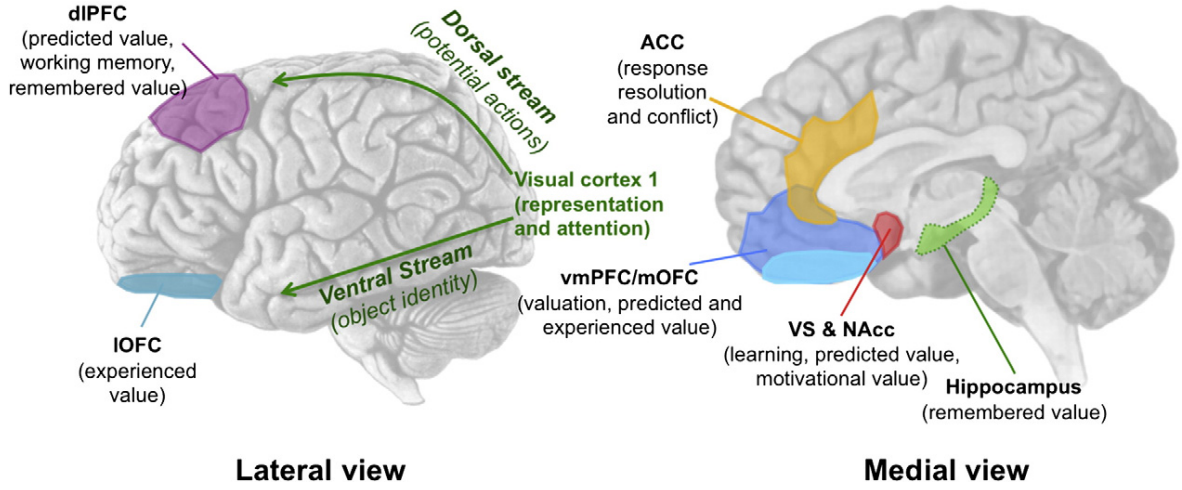

Fig. 3. Overview of prominent brain areas involved in brand decisions.Abbreviations used: ACC = anterior cingulate cortex; dlPFC = dorsolateral prefrontal cortex; lOFC = lateral orbitofrontal cortex; mOFC = medial orbitofrontal cortex; NAcc = nucleus accumbens; vmPFC = ventromedial prefrontal cortex; VS = ventral striatum.

The visual system allows for rapid brand and product identification. A recent magnetoencephalography (MEG) study showed that female participants viewing shoes (compared to motorcycles) had stronger activity in occipitotemporal regions between 130 and 180 ms after image presentation (Junghoefer et al., 2010). Similarly, Milosavljevic, Koch, and Rangel (2011) showed that consumers can identify two different food brands and make up their mind about which one they prefer in as little as 313 ms. Furthermore, processes involved in the representation stage need not even be conscious, as recent studies have demonstrated that unconscious processes also shape how we represent our decision-making situations (Chartrand, Huber, Shiv, & Tanner, 2008). One of the key questions at this stage, discussed next, is what consumers pay attention to (i.e., focus on) once they are exposed to a number of rapidly identified choice alternatives (i.e., brands).

Attention Attention is the mechanism responsible for selecting the information that gains preferential status above other available information. Recent review of attention in neuroscience indicates that four conceptual components are fundamental to attention: bottom-up or saliency filters, top-down control, competitive visual selection, and working memory (Knudsen, 2007). We will focus on the first three components and discuss their relevance for research on branding.

Bottom-up or saliency filters automatically select the most important information from all available information. This selection is based on the low-level features of the visual input: colors, luminance, orientation, size, shape, movement, etc. (Itti, Koch, & Niebur, 1998; Wolfe & Horowitz, 2004). Such bottom-up factors have a strong effect on the initial eye movements when consumers are exposed to marketing information: the first four eye-movements are made within the initial 2.5 s of exposure (Leven, 1991). Some higher-level factors are also capable of gaining automatic, preferential access to attention. These include faces, text, novelty, and one's own name.

All of these features are combined in the brain, and preattentional scan paths are created, making a saliency map of the regions in the visual field that are most important and thus most likely to be further processed.

Thus, at the outset of early attention, the decision maker is biased toward salient stimuli (van Zoest, Donk, & Theeuwes, 2004). The salient stimuli will attract the initial eye movements of consumers, and thus may have a profound effect on related consumer behavior.

For example, Pieters and Wedel (2007) showed that ensuring that consumers pay attention to the brand displayed in a print ad is the most effective way to ensure that they will transfer their attention to other elements of the print ad. Further, Milosavljevic and colleagues showed that salient features (i.e., the brightness of the food packaging) influence real food choices (Milosavljevic, Navalpakkam, Koch, & Rangel, 2011). Namely, at fast decision speeds a significant number of food choices were biased toward the food items with brighter packaging, even when subjects preferred the taste of alternative food options.

There are other automatic biases known to influence what people pay attention to (Glaholt, Wu, & Reingold, 2010). For example, people tend to look toward the upper visual field (Durgin, Doyle, & Egan, 2008) and the right visual field (Efron & Yund, 1996), which may be of importance in the consumer behavior context (e.g., at the point of purchase). In a famous experiment, when five identical stockings were displayed horizontally, subjects were biased toward choosing stockings on the outmost right (Nissbet & Wilson, 1977). Chandon and colleagues showed that only the top-shelf positions carry through to brand evaluation (Chandon, Hutchinson, Bradlow, & Young, 2009). Clearly, products can be placed in locations that are known to attract more attention and will thus be more likely to be chosen by a buyer (Pieters & Warlop, 1999).

Strong location effects were also found when consumers browse websites (Dreze & Hussherr, 2003). The influence of bottom-up factors may be especially strong online, as consumers engage in fast web surfing and often spend very little time on any given page. Systematically manipulating low-level visual features to "guide" viewers' eyes to a webpage's regions of interest is possible by utilizing insights from visual neuroscience. Milosavljevic (2009) used a computer simulation of visual attention to optimize banner ads, and the rest of a website, to make certain brands/banner ads visually salient. This manipulation resulted in an increased liking for the target banner ad, perhaps due to mere exposure effects (Milosavljevic & Cerf, 2008). Recently, a strong bias of looking toward the center of the viewing area (e.g., the center of the computer screen) has been reported (Tatler, 2007). Reutskaya and colleagues showed that an item in the center of the screen was almost 60% more likely to be chosen by a decision maker than similar items displayed at other locations (Reutskaya, Nagel, Camerer, & Rangel, 2011).

Top-down control depends on internal and external states, goals, and expectations. Hence, looking for a can of Coke will enhance processing of red areas in visual input by increasing the neuronal sensitivity for that particular color (Theeuwes, 2010; Treisman & Gelade, 1980; Van der Lans, Pieters, & Wedel, 2008). Expectation can modulate what consumers pay attention to via brain structures that include the dorsolateral cortex (Egidi, Nusbaum, & Cacioppo, 2008). The information that is relevant for goal attainment will be attended to more than irrelevant information. For example, when we are thirsty, we pay more attention to drinks than to other items (Aarts, Dijksterhuis, & De Vries, 2001; Dijksterhuis & Aarts, 2010).

Goals also exert a strong influence on eye-movements and can result in different eye-movement patterns when subjects are exposed to the same visual input (Glaholt et al., 2010; Pieters & Wedel, 2007; Yarbus, 1967). Rosbergen, Pieters, and Wedel (1997) identifed tendencies in how individuals scan marketing materials, such as print ads or store shelves. Their work was based on a well-established idea of visual scan paths, that is, the patterns of saccades and fixations across some visual input (Norton & Stark, 1971). They found three types of eye movements that are characteristic of people

huge...

the brain will subconsciously filter visual materials based on need at the time. This will allow for quicker solution choices to be made.

examining the ads: scanning (eyes move to headline and pictorial), initial (eyes move to headline, pictorial, and brand), and sustained (eyes move to headline, pictorial, brand, and text). As one might expect, the time spent viewing the ad, the level of involvement, brand attitude, and recall all improved from the first to the third type of viewing. Further, Pieters and Wedel (2007) showed that the informativeness of ads is contingent on the goals consumers pursue while viewing them. For example, in comparison with free viewing of the same ads, consumers spend more time on the text when asked to evaluate the brand, and less time on pictorial elements when asked to learn about the brand.

Visual selection occurs when the most important information from all the areas that are identified as potentially important in preattentive scans (based on the bottom-up input) is chosen. This means that attention is given to a particular location in space. It is believed that as the number of choice options increases, the decision maker becomes more selective in what information he or she encodes, that is, which locations in the scene he or she processes (Payne, Bettman, & Johnson, 1993).

Glaholt et al. (2010) showed that when asked to choose the most expensive of six items (6-alternative-forced-choice, or 6-AFC), subjects were more selective in the processing of stimulus information (i.e., they achieved greater differentiation between individual stimuli via more fixations, longer duration of total fixations, etc.) than when they were asked to choose which of the two sets of three items (2-AFC) was more expensive. Thus, gaze selectivity increases as the number of alternatives increases (Glaholt et al., 2010). Reutskaya et al. (2011) showed that time pressure induced people to shorten the duration of their fixations and to search somewhat longer so as to increase the number of options that are considered before making a choice.

Visual selection and eye movement enhance the quality of incoming information. Gaze bias shows that people spend longer time examining (i.e., fixating on) options that they eventually choose (Glaholt & Reingold, 2009; Krajbich, Armel, & Rangel, 2010; Pieters & Warlop, 1999; Shimojo, Simion, Shimojo, & Scheier, 2003). For example, consumers spent 54% more time looking at the ads of businesses (in a phone directory) that they ended up choosing (Lohse, 1997). It is especially interesting to note that externally manipulating what people look at—for example, by displaying choice options one at a time while manipulating the exposure duration—biases the resulting choices toward the options subjects are exposed to longer (Armel, Beaumel, & Rangel, 2008).

Further, eye movements may be useful in evaluating the effectiveness of brand extensions. Stewart, Pickering, and Sturt (2004) showed that consumers spend 200 ms longer examining implausible brand extensions (they cause immediate disruption of visual processing) compared to plausible brand extensions. The authors propose eye-tracking as a useful tool for determining the extent to which consumers find different brand extensions plausible.

In sum, representation and attention are complex processes that influence all subsequent steps in our brand decisions framework. Theoretical and methodological insights from neuroscience can prove especially useful in allowing consumer researchers to better understand attention and its effects on branding-related behavior. However, research in this area has received little attention in consumer neuroscience, which offers a lot of potential for future research.

Predicted value

The predicted value of each brand that is available for choice (e.g., Heineken vs. Beck's) represents the consumer's belief about the experienced value of that brand at some time in the future. In other words, the predicted value involves the consumer's evaluation of how much enjoyment she will derive from consuming a Heineken or a Beck's beer.

Previous studies suggest that at least three brain structures might be of particular importance when consumers evaluate predicted values: the striatum, the ventral medial prefrontal cortex (vmPFC), and the dorsolateral prefrontal cortex (dlPFC; see Fig. 3). In the next sections, we first review these previous studies and then review studies that have investigated how branding influences predicted value signals in each respective brain region. For the latter we use Keller's customer-based brand equity framework to categorize the different studies (Keller, 1993). Applying Keller's framework, we distinguish between studies investigating how favorableness, type, and uniqueness of brand associations alter the neural signatures of predicted value (see Table 1). Fig. 4 visualizes the results of the studies listed in Table 1 and shows which brain areas are involved in representing Keller's framework in the brain.

Predicted value signals in the striatum Several studies have used functional magnetic resonance imaging to investigate the predicted value of products or other types of desirable objects such as money. Pioneering work by Knutson and colleagues showed that a structure within the ventral striatum (VS), the nucleus accumbens (NAcc), is involved in encoding anticipated rewards of monetary payoffs (Ballard & Knutson, 2009; Knutson, Adams, Fong, & Hommer, 2001; Knutson & Cooper, 2005; Talmi, Dayan, Kiebel, Frith, & Dolan, 2009) and branded products (Knutson, Rick, Wimmer, Prelec, & Loewenstein, 2007; Knutson et al., 2008).

Two studies investigated how favorableness of brand associations affects predicted value signals in the striatum. In the first one, Schaefer and Rotte (2007a) found that imagining a pleasant experience, such as driving a car of a brand that is linked to favorable brand associations, correlates with activity changes in that brain area. However, it remains unclear what exactly consumers were imagining and whether activity in the striatum is based on the difference in pleasantness of the predicted experience per se or the difference in brand information. This weakness of the study is further confounded by the fact that the more attractive car brands are also more expensive, and driving an expensive car might be a pleasurable experience by itself.

One problem with using a given brain activation (the striatum) to infer a mental process (a pleasurable experience) is the proposed one-to-one relationship between the brain activity and the mental process of interest. Such a "reversed inference" is problematic because one brain area is usually involved in more than one mental process (for a detailed discussion of the "reverse

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