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Neuromarketing empirical approaches and food choice: A systematic review

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ABSTRACT

Consumers' food choices are often driven by reasons of which consumers are not fully aware. Decision-making about food is influenced by a complex set of emotions, feelings, attitudes, and values that are impossible to assess simply by asking consumers their opinions. Indeed, traditional techniques, such as self-reports or interviews, mainly allow the measurement of conscious and rational reactions to a product or advertising. Recently, there has been a rapidly growing interest in the multidisciplinary field of "neuromarketing," which takes advantage of neuroscientific techniques to study consumer behavior.

This discipline applies neuroscientific methods and tools that allow the measurement of consumers' emotional and spontaneous reactions in a more objective and observable way. The aim of this paper is (a) to describe neuromarketing's underlying assumptions, techniques, and the advantages of this perspective, examining the scientific literature on the use of neuromarketing in food studies; and (b) to suggest best practices to apply this novel approach in the food marketing domain, with a specific focus on non-invasive methods.

Finally, although the perception of nutritional elements has already been explored, the health content of labels, the presence of additives, and the evaluation of the information conveyed by food packaging remain other possible elements of interest in future food neuromarketing research.

1. Introduction

To understand the increasingly complex consumer decision-making and consumption environment, modern marketing scholars have started to study drivers of consumers' purchasing decisions from a multidisciplinary perspective. The marketing discipline has changed considerably, adapting to the multidimensional view of consumers' preferences by extending and enriching concepts, theories, and methodologies derived from disciplines such as psychology, sociology, anthropology, and, more recently, neuroscience. For instance, concepts such as emotions, prejudices, and values are becoming increasingly important as intrinsic factors to understand consumers' choices.

The term neuromarketing was initially introduced by a Dutch organizational theorist and marketing professor, Ale Smidts, in 2002 and is defined as "the study of the cerebral mechanism to understand the consumer's behavior in order to improve the marketing strategies" (Boricean, 2009).

One year later, in 2003, scientists took advantage of fMRI brain imaging techniques to study and understand consumers' preferences about common beverage products such as Coca-Cola and Pepsi (McClure et al., 2004). On the one hand, interesting findings emerged

from the study. On the other, the unsuccessful attempt to provide complete clarification enabling our understanding of decision making in consumers opened the floodgates to seeking in-depth answers about this new research field. In the study, researchers asked to a group of American subjects to drink either Coca Cola or Pepsi while their brains were monitored by an fMRI machine. The study did show how some areas of subjects' brain may be differently activated according to knowing or not knowing the name of brand being consumed. In particular, it suggested that a well-known brand like Coca-Cola can elicit an area of the prefrontal lobes, considered the place of executive function, which manages attention, mediates short-term memory, and cover an important role in decision making and planning (McClure et al., 2004). The study argued that when subjects do not know which brand they are consuming, they report preferring Pepsi, and the orbitofrontal cortex on the left hemisphere is more activated when tasting Pepsi in comparison when they are tasting Coca-Cola. In contrast, when subjects do know what they are drinking, they report preferring Coca-Cola over Pepsi, and their dorsolateral prefrontal cortex is activated in a greater way together with the hippocampus in comparison to the situation where subjects drink Pepsi. From an evolutionary standpoint, the hippocampus is an old brain structure. It is located in the limbic system (in

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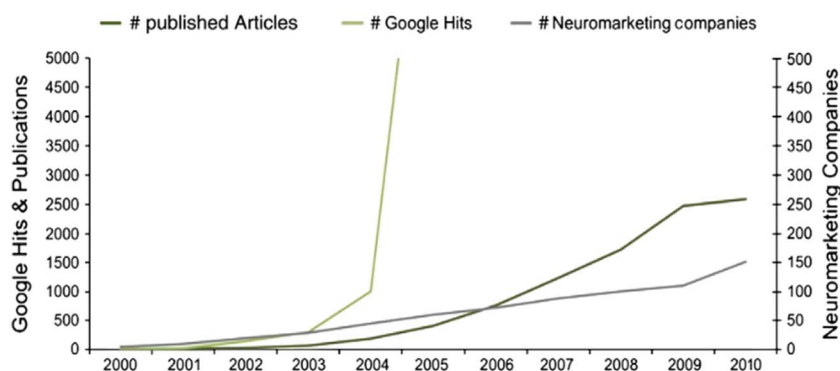


Fig. 1. Growth of research applying neuroscience to marketing over time (from Plassmann, H., Ramsøy, T. Z., & Milosavljevic, M. (2012). *Branding the brain: A critical review and outlook*. *Journal of Consumer Psychology*, 22(1), 18–36).
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the deep center of the brain) that is generally responsible for emotional and instinctual behavior. Since this study was published, new scientific articles have appeared in the literature reporting the growing interest in neuromarketing, proposing both new research directions and potential applications (Plassmann, O'Doherty, Shiv, & Rangel, 2007) in an attempt to introduce these innovative techniques to improve upon traditional studies based on self-reports and interviews.

Despite the initial skepticism (Murphy, 2008), the application of neuroscientific concepts and techniques in marketing (i.e., neuromarketing) has rapidly grown over the past few years in both academia (Plassmann, O'Doherty, & Rangel, 2010; Plassmann, Ramsøy, & Milosavljevic, 2012; Smidts et al., 2014; Yoon et al., 2012) and practice (e.g., Nielsen, GfK, Millward Brown) since the first study from McClure and his research team (2004).

This growing attention on neuromarketing in the past decade has led to an explosion of new insights and practical applications for the marketing domain. Plassmann et al. (2012) showed the increase of Google hits and publications about neuromarketing from 2004 forward (Fig. 1), and in a more recent article, she stated that the adoption of a neuroscience-based approach “holds the promise of setting the stage for conceptual developments offering potentially evolutionary insights about consumers” (Plassmann, Venkatraman, Huettel, & Yoon, 2015). The present paper reviews the empirical approaches of neuromarketing with a specific focus on food analyses and non-invasive methods, considering the latter as ideal solutions in the field of food studies, as they are often carried out in real places where people decide what to purchase, such as grocery stores or other food shops. This paper presents an integrated cross-analysis of literature on food preferences and neuromarketing techniques. On the basis of the extensive review of theoretical and empirical studies in this field, we propose food choice and neuro-marketing as increasingly integrated tools to increase consumers' data variance into economic studies focused on food preference analysis and choice prediction. In addition, the paper offers new knowledge by presenting a unique reference point for scholars working in this field who wish to apply neuromarketing techniques in food choice experiments.

Food choice is a complex phenomenon that is not yet well understood. The study of food decision making could greatly benefit from neuromarketing techniques to investigate the processes involved in food decision making, such as the influence of attitudes and emotions on choices, which traditional segmentation variables, such as socio-demographics, psychometrics, and stated preferences, do not cover.

There are many stimuli not directly related to a product that can drive consumers' food choices and purchase decisions, such as brightness (Milosavljevic, Navalpakkam, Koch, & Rangel, 2011), the colors and shape of the packaging (Itti & Koch, 2001; Mannan, Kennard, & Husain, 2009), and price (Oliver, 1999; Peng & Wang, 2006; Cheng, Edwin, Lai, & Yeung, 2008). In fact, a growing number of studies have applied a neuromarketing approach to investigate how the subconscious and emotional response to those features could influence consumers' preferences.

This paper represents a first attempt to present the state of the art of the empirical approaches and techniques in neuromarketing research that can be effectively applied for studying consumers' food choices in order to help advance the knowledge in this field. More specifically, this paper will first describe the link between neuroscience and consumer behavior, highlighting the key innovative elements of the neuromarketing approach. In the second part, the study will focus on the different neuroscientific techniques that are suitable for investigating food decision making and review the main studies available in scientific literature, with a specific focus on food studies carried out by means of less invasive methods in comparison to fMRI and PET techniques that require to ask participants to lie on a bed and stay still (not an optimal experimental context to study food choices). These techniques include eye-tracking, electroencephalography, skin conductance monitoring and automatic emotional facial expressions recognition.

In the final section, the main conclusions are drawn focusing on the current state of the art.

2. Consumer behavior and neuroscience

“Consumer Neuroscience is a new burgeoning field comprising academic research at the intersection of neuroscience, psychology, economics, decision theory, and marketing” (Plassmann, Yoon, Feinberg, & Shiv, 2011). Many researchers have acknowledged that affect plays a guiding role for information processing (Clore, Schwarz, & Conway, 1994; Mellers, Schwartz, & Ritov, 1999; Schwarz & Clore, 1988, Fortunato, Giraldo, & de Oliveira, 2014, Jordão, Souza, Oliveira, and Giraldo, 2017). According to the same author (Plassmann et al., 2012), consumer neuroscience has the goal “to adapt methods and theories from neuroscience, in combination with behavioral theories, models and tested experimental designs from consumer psychology and related disciplines such as behavioral decision sciences, to develop a neurophysiologically sound theory to understand consumer behavior.” The distinction between consumer neuroscience and neuromarketing should be addressed by the application: consumer neuroscience refers to academic research at the intersection of neuroscience and consumer psychology, while neuromarketing 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.” Conducting an additional exploration of food studies, in the opinion of the authors of the present paper, it is strategic to respect the “ecological validity” of food-related decision-making processes. For this reason, fMRI studies have been useful to understand which brain areas are enrolled in the decision-making process so that they can be proficiently applied for future research. However, the ability to develop solutions that at a minimum reduce the presence of suboptimal or unnatural experimental settings will enable the design of studies more prone to detect what is occurring when a person makes a decision. There are already reviews examining the adequate use of different brain imaging techniques such as fMRI or MEG (Vecchiato et al., 2011);

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