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Article · November 2015

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# Neuromarketing and consumer neuroscience: current understanding and the way forward

Sharad Agarwal · Tanusree Dutta

Published online: 18 November 2015  
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**Abstract** In the last decade, neuroscience has informed the marketing science in meaningful ways and the interaction between both of these sciences has helped in generating deeper insights into the consumer behavior. This has led to the emergence of a new field of study, termed as neuromarketing or consumer neuroscience. This article introduces the readers to this emerging field in marketing literature and practice. It gives an overview of the applications of neuroscience in addressing marketing and consumer behavior research. The article then discusses the role which neuromarketing and consumer neuroscience is expected to play in shaping the future marketing practices. It also introduces the readers to some methodological concepts of neuromarketing along with some progresses in fundamental neuroscience which are likely to advance this field in turn enhancing the rigor of the neuromarketing studies.

**Keywords** Neuromarketing · Consumer neuroscience · Neurobranding · Future of marketing

## Introduction

Scholars and practitioners of marketing and consumer research have been trying to uncover the mysteries behind the art and science of successfully marketing the products and services to the consumers. They also strive to understand their consumers' behaviour so as to provide them a delightful experience in the consumption process. Though there is decades of research in exploring various facets of consumer behaviour, we are still very distant from understanding how a consumer behaves in the way she behaves.

The brand managers continuously try to understand their consumers' needs and desires to create a unique delighting experience but the new products introduced in the market, most of the times, fail to attract the consumers' gaze, let alone attention. One of the reasons for the failure of the marketers' understanding of their consumer's behaviour is the fact that there is mismatch between the attitude and actual purchase behaviour of the consumer. Traditional market research methods try to measure the attitude of the consumers towards the brands which may not convert into the actual behaviour at point of purchase.

More than 90 % of the information is processed subconsciously in the human brain (Zurawicki 2010). This subconscious processing of information in consumer's brain plays a great role in consumer decision making. Traditional market research methods, used to understand the consumer behavior, fail to tap into the

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subconscious processes happening in the brain of the consumers. This leads to mismatch between the market research findings and the actual behavior displayed by the consumers at the point of purchase. Marketers and researchers, therefore, need to revisit their market research methods to better understand consumer behaviour.

In the following parts, we briefly introduce the readers to the emerging field of neuromarketing and consumer neuroscience. The readers can then expect to learn more about the applications of neuroscience in marketing and the way it is expected to unfold in future.

### **Emergence of neuromarketing and consumer neuroscience**

In the recent times, there has been a great quest to gain deeper understanding of human cognition and behaviour. This has led to the emergence of synergy between the biological and social sciences. These collaborative research efforts of the biological and social scientists have helped in fostering major advances along various fronts of social, behavioural, biological and managerial sciences. Neuroeconomics and decision neurosciences have provided valuable theoretical insights about human decision making that account for both individual choices and the neural mechanism underlying those choices (Shiv and Yoon 2012). Consumer neuroscience is an emerging interdisciplinary field that combines psychology, neuroscience, and economics to study how the brain is physiologically affected by advertising and marketing strategies (Lee et al. 2007). Over the past decade, the field of consumer neuroscience has made meaningful progress in generating insights related to marketing and consumer behavior (Plassmann et al. 2015). Though consumer neuroscience and neuromarketing are often used interchangeably in the marketing literature, the former refers to academic research at the intersection of neuroscience, psychology and marketing while the latter generally refers to practitioner or popular interest in neurophysiological tools—such as eye tracking, skin conductance, electroencephalography (EEG), event related potential (ERP) and functional magnetic resonance imaging (fMRI), which are used for conducting commercial market research (Plassmann et al. 2011). Consumer

neuroscience is therefore a more rigorous version of neuromarketing, findings of which are embedded in theory.

Neuromarketing and consumer neuroscience research reveal reality better than traditional methods of research based on questionnaires and interviews (Falk et al. 2012). It is also found to provide information about consumer preferences that are unobtainable through conventional methods (Ariely and Berns 2010). The neural measures are better predictors of population-level data than self-report measures. The ability of these neuroscience approaches to predict choices in real-world contexts has tremendous implications for marketers (Plassmann et al. 2015). Marketers can apply these tools to gain insight into the consumers' intention towards their products and services and it can help them test their branding and marketing strategies before actually implementing them in the target market. Marketers can choose best strategies for promoting their product such as celebrity endorsement or association with social or environmental cause (cause related marketing). This would help that particular brand save costs which might have otherwise been wasted on an inefficient campaign or failed celebrity endorsements.

Neuroscience can add value to the current consumer research in many ways. Shiv and Yoon (2012) mention few areas where neuroscience is expected to provide tangible benefits, these are: providing opportunities and guidelines to facilitate theoretical development; facilitating new empirical tests of standard theoretical claims; explanations for observed heterogeneity within and across consumer groups; and novel mechanisms for considering the physiological context and the role of numerous biological factors, including hormones and genes, on consumer preferences and decisions (Shiv and Yoon 2012). Neuroscience can shape future theory and models in consumer decision making and suggest ways in which these models can be used for decision making research.

### **Tools and applications of neuromarketing and consumer neuroscience**

Consumer neuroscience has helped consumer researchers generate new insights into various facets of branding such as brand perception (Litt and Shiv 2012; Milosavljevic et al. 2012), brand evaluation

(Esch et al. 2012; Estes et al. 2012; Saad and Stenstrom 2012), brand relationships (Aggarwal and Larrick 2012; Reimann et al. 2012), brand preferences (Venkatraman et al. 2012; Berns and Moore 2012; Yilmaz et al. 2014), pricing (Plassmann et al. 2007), product packaging (Reimann et al. 2010; Stoll et al. 2008), brand naming (Hillenbrand et al. 2013), green consumption (Lee et al. 2014), store illumination (Bercik et al. 2015), advertising (Treleaven-Hassard et al. 2010; Vecchiato 2011), and new product development (Ariely and Berns 2010).

Consumer neuroscientists have a wide range of tools at their disposal for the methodological investigation of their research problems. These tools work by recording metabolic activities happening inside the consumers' brain or recording electrical/magnetic properties of the neurons in the brain or the other physiological activities of the human body. Tools working on the principle of recording the metabolic activities include functional magnetic resonance imaging (fMRI) and positron emission tomography (PET). Electrical activities recording tools consist of electroencephalography (EEG)/event related potential (ERP), magnetoencephalography (MEG), steady state topography (SST), and transcranial magnetic stimulation (TMS). Tools for measuring other physiological activities include eye tracking, galvanic skin response, facial coding, and facial electromyography. Detailed discussion on application of these tools in marketing is discussed elsewhere (e.g. Agarwal and Xavier 2015).

### Future of neuromarketing and consumer neuroscience

Human brain is a sophisticated network of one hundred billion neurons and we currently lack a deep understanding of how brain operates and how a brain's obscure operation produces the highly specialized human behaviour (Donoghue 2015) and human decision making patterns. This lack of knowledge of human brain, to some extent, currently restricts us to study the consumer behaviour at minutest level. The current non invasive neuroimaging techniques (EEG, MEG, fMRI, etc.) cannot capture the brain's activity to individual neuronal level; hence for a nuanced understanding of the complex cognitive processes happening in the consumer's brain, highly advanced methods of investigation are required. We are

currently in the midst of a neuro-technology revolution that is making it possible to measure and stimulate thousands and potentially millions of neurons simultaneously (Shenoy 2015). Fortunately, the last few years have seen few great projects aimed to address the knowledge gap in our understanding of the functioning of the brain. Some of these projects such as the European Union's Human Brain Project and the BRAIN (Brain Research through Advancing Innovative Neuro technologies) initiative, promises breakthrough advancements in fundamental neuroscience which would help consumer neuroscientist to fill current methodological gaps in consumer neuroscience research.

Though these research initiatives, as of now, are not directly focused on addressing neuromarketing or consumer neuroscience research questions, the knowledge of human brain anatomy and enhanced understanding of the cognitive abilities which will be available to the scientists from other research areas including the consumer neuroscientists would help them to generate deeper insights into the consumer behaviour, which are currently not possible to be addressed through the available technologies for example, the role played by each of the consumer's senses in creating their product preferences and purchase. We do have some insights into the role of senses, but it is mostly at the aggregate level, a combination of all of the senses and that too is at nascent stages. Consumer researchers certainly need more insights into how our senses help us in creating decisions for product choice for example, what is the best scent to be sprayed in the retail store targeted at senior consumers? or how the consumers' brain process the taste of food being served in an airplane flying at a height of 30,000 ft?, which forms a part of consumer experience with the respective airline and in turn leads to the consumers' satisfaction/dissatisfaction towards the airline brand. Advancement in our knowledge of processing of sensory inputs by the brain will certainly help the consumer neuroscientist to create products and service which would meet the consumers' conscious and unconscious demands.

Neuromarketing and consumer neuroscience are expected to play an increasing role in addressing the research questions of marketing science and consumer behavior. Consumer neuroscience apart from creating new theories would also be instrumental in revisiting the earlier established theories of marketing while

neuromarketing will be beneficial in enhancing the efficiency of marketing professionals. The current consumer neuroscience studies, particularly those using fMRI, are focused on reverse inference, i.e. reasoning backward from specific brain activations to particular mental functions (Poldrack 2006) or the correlational relationship between brain activations and specific consumer behaviour or experience—and makes no assumptions about the underlying causal relationship (Plassmann et al. 2015). For example, if the ventromedial prefrontal cortex (vmPFC) and the dorsolateral prefrontal cortex (dlPFC) are activated when participants are reporting their willingness to pay (WTP) for products, then the researchers can argue that there is an association between those brain regions and WTP calculations (Plassmann et al. 2007) or if researchers found activations in the brain region, the pallidum, which is associated with positive emotions and pleasure, for strong brands and activations of the insula, which is associated with negative emotions, for weak and unfamiliar brands then the researchers argue that there is association between these brain regions and consumers' preference for respective brands (Esch et al. 2012). However, recent evidence indicates that the vast interconnected network of the human brain is responsible for our advanced cognitive capabilities rather than a simple expansion of specialized regions of the brain such as the prefrontal cortex (Hawrylycz et al. 2015). The consumer neuroscientist themselves agree that advancement in neuroscience technology would help the consumer research as Esch et al. (2012) quotes, "Once technology allows for more detailed investigations of brain processes, it will be easier to advance and test more specific hypotheses and to map brain scanning results to specific results in experimental studies" (Esch et al. (2012) pp, 82).

Network neuroscience, a branch of neuroscience that works with brain networks, has made advancements which addresses the issue of 'reverse inference' in neuroscientific experiments. This branch of neuroscience studies the networks functioning in the brain, which are now believed to be responsible for cognitive processes in human beings rather than a specific brain location such as prefrontal cortex or pallidum. With the recent advances in technology, it would soon be possible to obtain a wiring diagram, or "connectome" of the brain at single neuron resolution (Zador 2015). The neuroscientific community is slowly realizing that

virtually all aspects of integrative brain functions depend on the action of networks, created by connections among neurons and brain regions (Sporns 2015). These connections are now considered vitally important for information processing and computations happening inside the human brain and are also responsible for all consumption-related activities pursued by the human beings as a consumer including their product preference, product choice, and decision making. We expect connectomics to play an inevitable role in the future developments of neuromarketing and consumer neuroscience which will unveil the biology that lies behind the mental and physical processes required to execute complex tasks and, ultimately, to reveal the neural basis of our cognitive behaviour.

The consumer neuroscience researchers currently study the consumer decision making process in phases and therefore, as of now, there is no unified model of the mind which shows how sub-processes such as attention, memory and reward/aversion processing are integrated and function concurrently for decision-making and problem solving (Block et al. 2015). There is a need to build an integrated model which helps us understand the consumer decision making in a holistic manner. It is expected that the future researches in this area will throw light upon the integrated model of information processing in the consumer's brain.

## Conclusion

The last decade has laid a solid foundation for neuromarketing and consumer neuroscience to emerge as a scientific discipline of study and research. There are several interdisciplinary groups, across the globe, which pursue this scientific field and are constantly working on more challenging marketing problems.

The field is also steadily gaining acceptance among main stream marketing academia. We see more and more consumer neuroscience articles appearing in internationally acclaimed marketing and consumer research journals. Many reputed marketing and consumer research journals have either announced special issues of consumer neuroscience or have already come up with such issues, e.g. one of the most esteemed marketing journal, *Journal of Marketing Research* (JMR) has just come up with a special issue on neuroscience and marketing, edited by Colin Camerer

and Carolyn Yoon (Camerer and Yoon 2015). This makes us to believe that consumer neuroscience has already started contributing to the main stream marketing literature in substantial manner. We expect to observe increase in such issues with other marketing journals as well as more articles with the applications of consumer neuroscience in the regular issues of the journals.

Consumer neuroscience would, in due course, integrate itself with the current main stream market research methods such as quantitative research and qualitative research. Thus the marketing discipline would be able to develop new theories, which would be based on multi-method evidences rather than just survey results or interview results or neuroscientific results. Overall, this would lead to create greater understanding of markets, consumers, their consumption behaviour and consumer decision making. Moreover, these marketing and consumer behavior models would also have the potential to be scalable to real-world outcomes that provide an opportunity to generate deeper understanding about consumers and to inform marketing decisions with practical and economically significant consequences. (Plassmann et al. 2015).

Like all other scientific disciplines, it is not that consumer neuroscience does not have critics, it has been criticized for its methodological shortcomings such as ‘reverse inference’, providing correlational evidences rather than causal evidences and for generalizability and reliability issues of neuroscience research (Plassmann et al. 2015). Critics of any scientific discipline help that particular discipline to evolve and build robust pillars for future researcher to develop upon that base. Fortunately, consumer neuroscience has been able to address all concerns of the critics, to a great extent, and promises to further emerge as a more rigorous scientific discipline of its own. With more fundamental research happening in neuroscience, consumer neuroscience shall, in future, be more interdisciplinary in nature to look beyond the current methods of EEG and fMRI.

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