Examining the Intersection of Marketing Research and Neuroscience

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Abstract: Due to the limitation of self-report research methods, the need for methodological innovativeness and development is acknowledged by social science such as marketing research. The emergence of neuromarketing offers a direction in this regard. This paper discusses several popular neuroscientific techniques that have been used by illustrating their functions and features. This paper also demonstrates how they might be employed by and contribute to marketing and consumer research. The author appeals for more future research on neuromarketing as such our extant knowledge about consumer may be extended.

1. Introduction

Marketing research heavily rely on self-report measures (e.g., interview, survey). However, self-reports suffer from validity issues, and which can potentially lead to biased findings because self-reports collect answers from respondents' conscious level. In self-reports, respondents may not know the answer, cannot recall the answer, or even do not want to give the true answer due to many reasons such as the consideration of self-image management. In this case, the reliability of research outcome from self-reports have been under questioned for decades.

To reveal respondents' true answer and find the "buy button" inside the customer brain, a growing number of marketing researchers today are using neuroscientific tools to supplement self-reports. Neuromarketing (alternatively, consumer neuroscience), a filed using neuroscientific methods to detect consumers' responses to marketing stimuli (Lim, 2018), arouses increasing attention. In comparison with self-reports, neuroscientific techniques are able to directly measure consumers' unfiltered cognitive or emotional responses to marketing stimuli, thereby assisting researcher to acquire an unbiased picture of consumers. Although neuromarketing can potentially contribute to the development of consumer research, marketing scholars may find it is an unfamiliar interdisciplinary field that require much information and knowledge. In this regard, this paper introduces four widely used neuroscientific methods, classify them into two categories based on their distinct functions (measuring activities inside the brain or outside the brain), and discuss their applications in marketing research.

2. Measuring Activities inside the Brain

Activities inside the brain (i.e., neural activities) reflect how consumers psychologically response to marketing stimuli. Two popular methods measuring neural activities are discussed in this section.

2.1 Electroencephalography (Eeg) / Event-Related Potentials (Erps)

EEG is one of the most commonly used neuroscientific approaches that employed by a great number of extant neuromarketing studies. When excitatory post-synaptic potentials created by pyramidal neurons in the cerebral cortex are added together, EEG could detect and capture electric potential differences that reach the scalp (Hari & Puce, 2017). Measuring these electric potentials is beneficial for researchers to understand how neurons in human brain communicate and interact with each other, and how they could be used to study a wide range of brain processing such as approach or avoidance, pleasure and even decision-making.

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EEG was of great use in many research fields and clinical medicine for decades. However, Researchers cannot build a causal link between a specific neural activity and a cognitive process by using such technology. To solve such problem, a special form of EEG, namely, Event related potentials (ERPs), have been widely used by researchers. ERPs are electric potentials acquired by averaging EEG from the repeated presentations of the same marketing stimulus (Bastiaansen et al., 2018). Due to its high tolerance of background noise, ERPs have been regarded as an effective indicator of real-time neural responses to an event or a cognitive work. By comparing ERPs that produced by old and new items, researchers could also examine where ERPs diverge, therefore providing information for investigating memories (Leynes et al., 2019).

Taken together, EEG and ERPs were regarded as popular neuroscientific methods for decades. EEG and ERPs feature high temporal resolution and relatively low cost (Morin, 2011). Therefore, they provide abundant information regarding the neural activities of cognitive operations such as brand recall and attitudinal change. In the meantime, they allow researchers to precisely detect the variation of cognitive and emotional states in brain regions that related to a changing marketing stimulus, which implies that EEG and ERPs are high compatible with research on dynamic marketing stimuli, such as consumers' real-time cognitive and emotional responses to a video ad.

2.2 Functional Magnetic Resonance Imaging (Fmri)

fMRI technique is a popular approach that has dominated neuromarketing research for decades to a great extent. Using magnetic resonance imaging (MRI) scanner, fMRI examined the change of blood oxygenation level dependent (BOLD) in the human brain, thereby measuring brain activities (Lee et al., 2017). Test subjects are required to lie on a bed and an MRI scanner is placed to trace hemodynamic changes in the brain that associated with neuronal activities based on neurovascular coupling mechanisms (Abreu et al., 2018). Due to changes in the concentration of paramagnetic deoxyhemoglobin relative to diamagnetic oxyhemoglobin, the magnetic susceptibility is different, and the net increase in blood oxygenation when the brain is activated leads to a large increase in BOLD signal, which is regarded as a proxy of neural activation (Abreu et al., 2018). Therefore, the increase of BOLD level in a specific brain area when participants are viewing a marketing stimulus represents that specific cognitive or emotional activities, which have been proved to be associated with that brain region, are evoked by the stimulus. In simple terms, BOLD signals in a brain areas could be regarded as a reliable indicator of the effectiveness of the presented marketing stimulus.

fMRI technique provides valuable information about brain activities because of, to a large extent, its excellent spatial resolution. Great spatial resolution enables researchers to detect changes in small and deep-stated brain areas, offering more comprehensive knowledge about how people react to marketing stimuli. Its high spatial resolution, therefore, gains itself great competitive advantage over many other neuroscientific tools such as EEG, and enables fMRI being suitable for studying arcane consumer decision-making mechanisms, such as information processing and memory.

3. Measuring Activities Outside the Brain

Activities outside the brain (i.e., biological activities) can reflect how marketing stimuli evokes changes in consumers' body reactions. This section also contains two widely used methods in this field.

3.1 Eye Tracking (et) Studies

Eye tracking is one of the most popular and effective neuromarketing approach to examine customer biological responses with the assist of eye trackers (Vidal et al., 2012). By placing an infrared camera and direct the light from which towards pupils and cornea, pupil centre corneal reflections (PCCR) are elicited and could be traced (Venkatraman et al., 2015). Therefore, eye tracking technique enables researchers to understand visual patterns of test subjects (i.e., where they look at) when they are viewing marketing stimuli. Eye tracking technique provides information regarding eye movement and fixation. Eye movement reveals the pattern or sequence of participants' gaze (i.e., where they look at first and afterwards). It is crucial for marketing practice, especially for

marketing campaign design (e.g., package or website design), as practitioners would like to insert the most important message on the place where customers initially look at. Eye fixation uncovers participants' visual attention. Visual attention is vital for researchers and practitioners because the duration and number of fixations on a marketing stimulus effectively reflect the content that audiences are most interested in, which is an important indicator of campaign effectiveness (Li et al., 2014).

One reason for ET has been widely used as a psychophysiological approach is that it can offer high temporal resolution (Plassmann et al., 2012). This is because automated dilation deconvolution enables researchers to assess the involvement of cognitive processes at a higher level of temporal resolution than which can be provided by examining slow pupillary response (Wierda et al., 2012). Moreover, in comparison of many techniques detecting neural activities, ET is a cost-efficient method and does not require extensive training for marketing scholars. Given these advantages, ET has been widely acknowledged as a supplementary research method to traditional approaches (e.g., interview and survey) by marketing researchers and practitioners. In general, ET technique allows researchers to accurately identify customers' visual attention, and with the help of other research methods such as self-reported survey and field experiment, questions such as how attention and memory are related to emotional and cognitive responses and even customer behaviour could be revealed to a large extent.

3.2 Facial Expression Analysis / Facial Electromyography (Femg)

Human emotional states and responses are hard to be obtained via self-reports as they could change quickly and unconsciously. However, facial expression analysis technique, namely the facial action coding system (FACS), can identify customers' facial expressions and classify them into six emotions (i.e., happiness, surprise, anger, sadness, fear, and disgust). Therefore, it provides accessible information about emotional states when customers are exposed to marketing stimuli. Although FACS offers opportunity to examine customers' emotional response to stimuli, its use in marketing research is limited as it can only examine fixed images and is unable to test beyond the aforementioned six basic emotions (González-Rodríguez *et al*., 2020).

To investigate real-time emotional change under the exposure of marketing stimuli, alternatively, more researchers today turn to use the fEMG technique, as which allows researchers to identify and examine varying and changing emotional responses to a marketing stimulus by capturing and analysing subtle changes in facial muscles (Lim, 2018). fEMG requires the placement of electrodes onto participants' faces, in particular, locations of major facial muscles which associated with expression change. When muscle fibres encounter these electrodes, electrical impulses would be generated (Lim, 2018). By recording and amplifying these tiny impulses, researchers are able to identify and record both voluntary and involuntary muscle movement, therefore making inference about consumers' emotional responses to a marketing stimulus (Sung *et al*., 2019). For example, Electrodes onto the zygomaticus major are activated when participants are smiling, while the activation of those onto corrugator reflects frowning.

Taken together, facial expression analysis and fEMG technique could identify both obvious and subtle facial muscle movements, thereby indicating customer emotional states when they are exposed to a marketing stimulus. Based on this information and with the assist of conventional self-reported methods, researchers can find connections between customer facial expressions and their emotional responses and even behavioural intentions, which are of significance for testifying existing theories or building new theories, as well as extending the boundary of extant marketing research.

4. The Application of Neuroscientific Methods in Marketing Research

It has to be noted that apart from techniques discussed above, there are many other techniques serve similar objectives (i.e., examining neural or biological activities). For example, many past studies used positron emission tomography (PET), magnetoencephalography (MEG), and stead state topography (SST) to test activities inside the brain in response to marketing stimuli (i.e., neural

activities), and many others leveraged skin conductance response (SCR) and electrocardiograph (ECG) to examine activities outside the brain (i.e., biological activities). Although many of these methods may not as popular as the four techniques discussed in this paper, they can also provide great insights into marketing and consumer research. In fact, it is a trend for marketing researchers to use two or more techniques in conjunction to meet multiple research objectives. Rather than detecting either neural activities or biological ones, a considerable number of researchers used multiple neuroscientific methods to detect and record activities inside and outside the brain simultaneously (e.g., using EEG and ET altogether). In this regard, researchers can form a more holistic picture of how customers response to marketing stimuli and can also understand the correlations between neurological and biological responses. This would not only improve the validity and reliability of research outcome, but also significantly benefit the development of marketing and consumer research and practices.

5. Conclusion

This paper endeavours to provide basic information about neuromarketing research to scholars who are interested in this field. Due to the word limit, this paper did not contain comprehensive discussions about all neuroscientific methods, but only focused on four widely used ones. Nevertheless, this paper discussed the compatibility between neuroscience and marketing research and demonstrated how neuroscience may assist researchers and practitioners to better understand the formation of consumers' cognition and emotion, which are essential parts of underlying mechanisms behind consumer behaviour and decision-making process. The author believes consumer neuroscience is a promising direction for marketing research and appeals for more effort to be made in this field.

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