FABRÍCIO ALANO PAMPLONA
Dr.; D'Or Institute for Research and Education
fabricio.pamplona@idor.org
fabriciopamplona@gmail.com

NEUROMARKETING: INSIGHTFUL, BUT NOT MIND READING

NEUROMARKETING: PERSPICAZ, MAS NÃO PROFÉTICO

RESUMO

O neuromarketing aplica métodos neurocientíficos para questões relevantes para o marketing. Embora esteja atualmente na moda, usando as ferramentas da neurociência para informar sobre cenários da vida real, não é uma indagação trivial. Avaliações de preferências de marketing por meio de entrevistas estruturadas permitem apenas uma perspectiva limitada, com baixa validade externa. A neurociência pode fornecer métodos que superam a necessidade de verbalizações através da mensuração de ativações cerebrais. Aqui nós discutimos o potencial deste campo emergente e as questões que limitam o nosso entusiasmo na fase atual. Muitas perguntas

ainda estão abertas e reivindicando para abordagens criativas que melhoram o conhecimento científico, criando valor real para os clientes.

PALAVRAS CHAVE

Neuromarketing. Neurociência. Comportamento do consumidor.

ABSTRACT

Neuromarketing applies neuroscientific methods to marketing-relevant questions. Although it is currently fashionable, using neuroscience tools to inform about real life scenarios it's not a trivial quest.Assessment of marketing preferences by structured interviews allows only a limited perspective,with low external validity. Neuroscience might provide methods that overcome the need for verbalisations through measurementof brain activations. Here we discuss the potential of this emerging field and the issues that limit our enthusiasm at the current stage. Many questions are still open and claiming for creative approaches that improve scientific knowledge, while creating actual value to customers.

KEYWORDS

Neuromarketing. neuroscience. consumer behavior.

1. INTRODUCTION

Neuroscience has made a genuine improvement in the way we understand brain structure and functionality, and has grown a sufficient body of knowledge and scientific tradition to tackle real-life questions. In the last years, marketing has been one of the fields claiming for neuroscientific-driven insights. The expectancy is to understand the consumer behavior, thoughts, beliefs and passions in order to forecast - and perhaps generate - brand awareness and loyalty. Accordingly, neuromarketing tries to apply neuroscientific methods to marketing-relevant questions. It has deep roots on psychology and behavioral economics, which have already dedicated a substantial amount of efforts to understand consumer behavior/decision

makingproccess (Perrachione and Perrachione, 2008). Notwithstanding, marketing professionals are thirsty for more information that could orient their campaigns and intimately wish that a putative "mind reading" device could help them accomplish the goal of designing a "killer ad campaign".

Although it is currently fashionable, using neuroscience tools to inform about real life scenarios (out of the controlled laboratory setting) is not a trivial quest. This mini-review article will address some relevant neuroscientific knowledge that underlie consumer behavior, discuss some of the interesting conclusions that can be drawn based on the currently available methods, as long as present the caveats that could limit our enthusiasm for neuromarketing at its current state of development. The paper does not intend to exhaust the topic, but rather, to provide useful references and inspire the reader to look further deep into neuromarketing. In the end of the day, the biggest issue from the marketing side is a matter of far-fetched expectancies or overly enthusiastic interpretations; on the other hand, skeptical neuroscientists tend to think that neuroscientific tools deserve a more "noble" objective than to be used to "sell more stuff". However, the scenario is evolving fast, and I believe that this knowledge crossroad can exert a positive pressure on how we understand one of the most intriguing aspects of modern urban people, which is how we associate ourselves with the things we consume and the brands underneath. We also recommend reading (Ariely and Berns, 2010).

2. WHAT NEUROSCIENCE IS EXPECTED TO TELL ABOUT THE CONSUMER

Although, from the outside, human neuroscience can be seen as a kind of technology-coated psychology, modern neuroscience is a vast discipline that encompass knowledge of biochemistry, embryology,genetics, psychophysics (and a lot others) with the ultimate objective of understand, predict and modulate the brain responses. Its starts from understanding the neuron, how they fire and synchronize with other forming neuronal assemblies, how they interact with other non-neuronal brain cells, and surpass towards understanding the multiple transmission pathways within the brain from a systems' biology perspective and dares to speculate about the nature of the human mind(Cowan et al., 2000). For the purpose of this

paper, we will employ the broad term 'neuroscience' on a more reduced focus, encompassing non-invasive methods used to assess brain activity and infer about cognitive and emotional aspects of the human mind.

Assessment of marketing preferences by structured interviews allows only a limited perspective of the real impact of the brand experience, since it tends to measures the rational response to a given advertising, package, product, which limits the external validity of this approach (Lynch, 1982). Indeed, asking somebody to write or talk about its own perception may generate a strong bias, generating answers which are convenient and socially-accepted, and precluding potentially "awkward" responses, which may be insightful from a marketing perspective. Interestingly, this bias can be avoided with the eye-tracking technology (Kaminska and Foulsham, 2013). For example, an eye-tracking study has shown that a significant fraction of the masculine population tend to look at masculine genitals when facing sexually-stimulating pictures. There are strong reasons to believe that such answer would not appear in a traditional questionnaire-based marketing research, due to masculine prejudice (Rupp and Wallen, 2007). This is just one example describing why conventional marketing research is currently becoming outdated. Moreover, direct measures of marketing parameters may be biased if collected outside of the natural context of the consumer and/or requiring to engage subjects in unusual cognitive processes, like "thinking why you prefer Coke than Pepsi" (Mueller and Louviere, 2010). The most genuine answer is that no one really thinks seriously about its preference for similar products from competitors, and the research questionnaire will only capture a rational explanation that would sound convincing and appropriate for the moment. In the end, pure storytelling.

Neuroscience, in particular neuroimaging techniques, may provide methods that overcome the need for verbalisations and which can observe the brain structures and networks that support response to brand concepts (Santos et al., 2012). There is a general belief that neuroscience allows direct observation of the brain "in action", locating where and when underlying neuronal networks are activated during a given experience. This is unfortunately just a partial true; the methods have important limitations and generate indirect measures, which are relative to a given control group. These and other neuroscience tools used to investigate underlying consumer

behavior will be scrutinized in the next session, with the objective to provide a useful framework of advantages/disadvantages of each tool, when it comes to neuromarketing applications.

3. USEFUL TOOLS UNRAVEL UNDERLYING EMOTIONS DURING CONSUMER EXPERIENCE

Some of the most used techniques in neuromarketing studies are briefly explained below. We want to bring your attention to functional magnetic resonance imaging (fMRI), electroencephalography (EEG), galvanic skin response (GSR) and eye-tracking. Note that among them, just fMRI and EEG can really raise information about brain activity. We recommend(Kable, 2011) for a detailed review on the methods mentioned below.

Magnetic resonance imaging (MRI)is a neuroradiology technique used to investigate the brain anatomy. MRI scanners use strong magnetic fields to form brain images that are reconstituted in three dimensions by computers. The technique is widely used in hospitals for medical diagnosis to avoid exposure to ionizing radiation that occurs in tomography. The technique yields a good contrast in central nervous system images, allowing the distinction between grey and white matter, tissues made of neuronal bodies and axons, respectively. The quality of the image depends on the power of the magnetic field (normally ranging from 1.5 to 3.0 Tesla in commercial settings). Noteworthy, this is normally not the kind of magnetic resonance you will see in a neuromarketing study (unless it deals with brain plasticity, which can be observed in MRI, depending on the experimental manipulation).

Functional magnetic resonance imaging (fMRI)measures signal changes in the brain that are proportional to shifts in brain activity. The difference to the MRI is that fMRI allows dynamic imaging of the brain, thus allowing inference about its function (and not only anatomy, like the MRI). This is the kind of magnetic resonance you will normally see in neuromarketing studies. Typically, the brain is scanned once every 2 seconds, with lower spatial resolution than MRI. Neural activity cause changes in the MR signal via a mechanism called the blood-oxygen-level dependent effect (BOLD). This is an indirect measure of brain activity. The rationale is that increased neural activity causes an increased demand

for oxygen, and the vascular system actually overcompensates for this, increasing the amount of oxygenated hemoglobin relative to deoxygenated hemoglobin. Because deoxygenated hemoglobin attenuates the MR signal, the vascular response leads to a signal increase that is related to the neural activity. The exact relationship between electrical brain activity and the BOLD signal is still a matter of debate, therefore fMRI scans shall not be interpreted as direct measurements of brain activity. Moreover, the images we see in research papers are the contrast between the BOLD map of the group of interest minus the control group. This means that the fMRI scan is re-created via a computer simulation, it's not an actual picture of a brain "lighting up" during the experiment. The equipment used to generate fMRI images is quite big and the experiments are normally run inside an hospital building,which brings an unusual context to the experiments. Other major disadvantages of fMRI are the noise (which is intrinsic to MRI scanner operations) and the extremely limited interaction with participant.

Electroencephalography (EEG) is the recording of electrical activity along the scalp. EEG measures voltage fluctuations resulting from ionic current flows within population of neurons in the brain. The apparatus record spontaneous electrical activity from multiple electrodes attached to the scalp, which is then converted to known frequencies bands via a power spectrum analysis. Common frequencies, from lowest to higghest, include delta (0.1 - 3 Hz), theta (4 - 8 Hz), alpha (8-13 Hz), beta (14 - 30 Hz) and gamma (30 -100 Hz). Another variation of EEG analysis are the event-related potentials (ERPs), which is based on the observation of a certain pattern of wave signal after a fixed amount of time. The biggest advantages of EEG are the portability and the temporal resolution within the timeframe of milliseconds; the biggest disadvantage being its limited spatial resolution.

Galvanic skin response is a method that measures the electrical conductance of the skin, which varies depending on the moisture of the skin, caused by sweat. Sweat is controlled by the sympathetic nervous system, so skin conductance is used as an indication of psychological or physiological arousal. Therefore, skin conductance can be used as a measure of emotional and sympathetic responses. Due to the response of the skin and muscle tissue to external and internal stimuli, the

conductance can vary by several microsiemens. When correctly calibrated, the device can measure these subtle differences. There is a relationship between sympathetic activity and emotional arousal, although one cannot identify which specific emotion is being elicited. Fear, anger, startle response, orienting response and sexual feelings are all among the reactions which may produce similar skin conductance responses. Oftentimes, the galvanic skin response is combined with the recording of heart rate, respiratory rate, and blood pressure because they are all autonomic dependent variables. External factors such as temperature and humidity affect GSR measurements, which can lead to inconsistent results. Lastly, galvanic skin responses are delayed one to three seconds after stimulation.

Eye-tracking is just that, an equipment that records the activity of both eyes as the viewer looks at some kind of stimulus. They may be head-mounted, similar to a glass, or a stand-alone device, more or less like a Microsoft Kinectic. The basis of the method are the corneal reflections created by non-collimated light. The vector between the pupil center and the corneal reflections can be used to compute the gaze direction. Sampling frequency is at least 30 Hz (30 times per second), but most modern devices use at least 10 times faster sampling rates. Eye movement is typically divided into fixations (eye gaze paused in a certain position) and saccades (gaze moving to another position). Fixations last between 200 to 300 miliseconds. Time of fixations, pupil dilatations, saccades and the paths between consecutive fixations are used for the analysis of interest and salience of stimuli. Eye-tracking applications include advertising, package design, shelf displays and softwares, among others.

Neuromethod	Abbrev.	Physical measure	Applied measure	What it means?	Time window	Limitation
Magnetic resonance imaging	MRI	Change in energy state of hydrogen	Grey and white matter volume	Brain morphology (structure)	Static method	Does not measure brain activity
Functional magnetic resonance imaging	fMRI	Blood oxygenation level (BOLD)	Metabolic activity (O_2 consumption)	O_2 consumption in brain areas	Seconds	Temporal resolution
Electroencephalography	EEG	Electrical fields (scalp electrodes)	Electrical activity of populations of neurons	Activation of superficial areas of the brain	Milliseconds	Spatial resolution
Galvanic skin response	GSR	Electrical resistance (peripheral electrode)	"Arousal"	Indirect measure of emotional response (activation of sympathetic autonomous nervous system)	Seconds	Indirect emotional measure, non-specific signals
Eye-tracking	-	Corneal reflectivity	Spatial attention	Show what the person is looking at (eye gaze)	Milliseconds	Does not measure brain activity

Data based on Perrachione and Perrachione, 2008; Kable, 2011

4. INTERESTING EXAMPLES OF HOW NEUROMARKETING HELPS UNDERSTANDING THE CUSTOMER

Below you find a few examples on how neuroscience tools were used to get helpful insights on different situations and applications. The applications, methods and study designs used are quite scattered. The Advertising Research Foundation (ARF) has lead an interesting initiative to test homogeneity of results and standardize practices, as one can see in this white paper(The_Advertising_Research_Foundation, 2011). I have no idea about the concrete outcomes, so far, but initiatives like this are more than welcome and will likely have a positive impact on the field.

5. EXAMPLE 1: EEG AND PRODUCT EXPERIENCE

Frito-Lay is the company behind Cheetos, the bright orange snack found in convenience stores and supermarkets. The story tells that a few years ago they contracted Neurofocus to conduct a study on how customers felt about the snack, and it the Cheetos advertisements were aligned with what the customers felt while eating it (Penenberg, 2011). Using the EEG plus proprietary algorithms (their intellectual property treasure), the research report described that the orange residue left behind after eating Cheetos evoked a feeling of subversiveness, possibly related to enjoying a guilty pleasure. Don't ask my how they reached such conclusion, because the full report has not been made public. The company also reported to have identified a strong positive consumer response to an ad campaign that had been panned by traditional focus group. According to them, the study yielded the awarded campaign of "The Orange Underground" (The_Advertising_Research_Foundation, 2009), where a mysterious version of the Cheetos mascot encouraged people to commit subversive acts. It is quite surprising that people associated "subversive" with "Cheetos", isn't it?

6. EXAMPLE 2: FMRI AND MUSIC POPULARITY

This interesting case reports a study that used neuroscience to measure the pleasure caused by listening to music. The fMRI was the method of choice and the idea was to compare the research results with the popularity of the

music, obtained from the music industry. The study was conducted in the lab, measuring activation of ventral striatum while people listen to music, and this correlated positively with the industry sales (Berns and Moore, 2012). Interestingly, the authors asked how much did the participants like the songs they've listened to, and this measure did not correlate with the sales index. That means that the verbal answers did not predict music popularity, while the "brain signals" did. In fact, it is somewhat naive to expect a direct causality between a single measurement in the lab and sales, since there are an uncountable number of other variables that could affect the process. That shall not be the real expected outcome, and one must always remember the mantra "correlation does not imply causality", meaning that if two variables are observed to variate in the same direction, this does not necessarily mean that one explain the other. A lot of other non-observed variables may account for the observed effect. Nevertheless, this study is regarded as one of the strongest concrete evidence that using neuromarketing could be more effective than traditional marketing research in predicting sales. It's really quite interesting and I would like to see more cases like this coming up in the literature.

7. EXAMPLE 3: PORTFOLIO VARIATION WITH EEG

Successful companies tend to create variations of current products and/or launch accessories to increase the product's market life. However, when creating new products, a company has a difficult time trying to understand whether or not it fits with the brand concept, as perceived by the customers (Berger et al., 2007).But how can one know whether the various products offered by a given brand will positively affect the perception of that brand? How would one know whether these products still hold the brand's essence? A neuromarketing study using EEG did an interesting approach. They used the error-related negativity ERPs to measure when a given product deviate from the expected alignment with the brand (this is called expectancy-violation). The familiar brand was presented with the know products, followed by a novel product. According to their interpretation, the resulting ERPs indicated the extent to which customers found the novel product appropriate for the given brand, or not. Products that deviated significantly from those expected from a given brand (e.g., dish detergent from a soft-

drink company) elicited different ERPs than products more appropriate to brand extension (e.g., a new soft drink) (Ma et al., 2007). The criticism here is that what they measure might have nothing to do with the brand "essence" (my words). For instance, the subjects might have been surprised by a product in an unexpected category and, in this case, the measured EEG measure is more related to finding that a product is not aligned with the previous product, rather than aligned with the brand concept. If this could really measure product preference, a brand with a "linear" portfolio would always outperform a creative brand with a diversified portfolio. But that isn't always true in the real market, is it?

8. EXAMPLE 4: ONLINE ADVERTISING AND EYE-TRACKING

The giant of online advertising Google conducted an eye-tracking usability study to support placement of Google Ads, with positive outcomes. The study can be seen here (Google, 2009), since their own images tell more than words. In brief, by using eye-tracking they could understand whether the user reads the results search in sequence (like, from 1 to N), which is of high importance for their business of selling ad placements. Also, they tested whether the use of thumbnails would make the phrasal ads less attractive. Interestingly enough, it seems that people really read the words in sequence and the thumbnails / figures accelerated the used decision to click on the link or not. It's interesting to see how the eye-tracking could help defining product features in this case.

9. OPPORTUNITY FOR SCIENTISTS: THE FOUNDATIONS ON WHICH NEUROMARKETING STANDS

Scholars of marketing and consumer behavior should be aware that many neuroscientists are unlikely to realize that the marketing field is much broader than just advertising. Most probably, they have never heard of branding, and their labs don't even have logos. Fairly or not, such misperceptions are likely to place upon market researchers the additional onus of having to justify the relevance of applying neuroscience to its questions. Neuroscientists will surely be enthralled by interesting new ideas, but bringing them on board for productive and successful neuromarketing

endeavors will require framing projects in such a way that appeals directly to their interest in the structure and function of the brain (Perrachione and Perrachione, 2008).

One of the main issues against broad acceptance of neuromarketing by neuroscientists is that the tools are not yet developed to the point as to reach the kind of conclusions that marketers wish, i.e., neuroscientists knows that there is no such a "mind reading method" whatsoever. The prejudice comes from badly controlled studies and far-fetched conclusions, which might be interpretation flaws, but may also be intentional misuse of a "scientific stamp of approval". What is important, though, is that in the underpinnings of what we are calling 'neuromarketing', there are still essentially interesting neuroscience questions. This poses a big challenge, which is the cooperation between professional from these two diverse fields of knowledge; also, it offers a putative new field of work for neuroscientists that are flexible enough to apply it's fundamental neuroscience knowledge into questions relevant to product developers and marketing/branding professionals.

The most recent formal definition by the American Marketing Association states that ''marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large"(Keefe, 2008). Reading this formal definition is enough to understand how complex it is, and that it poses potentially interesting questions for the neuroscience community. Creating 'value' for the customer, in the strict sense, means creating something that somebody wish and is willing to pay for. Exchanging money for the satisfaction of having the access to the good or service. Buying pleasure, or, alleviating frustration as Renvoisé and Morin point out in one of the Neuromarketing best-sellers (Renvoise and Morin, 2007). To optimize value delivery, marketers should attend to the emotional responses of consumers to their products. Emotions can tell whether the suggested benefits of a product are in fact perceived as such (Meyvis and Janiszewski, 2002). This opens an opportunity to perform emotional tracking in order to predict the reaction of customers to a given product. It is also interesting to investigate how the attachment to a given brand develop over time. This is potentially similar to what occur when one decide for a given social group, sport team, spouse or religion; it's clearly not a simple rational decision. Moreover, interpreting marketing subjects also involves components of

multimodal perception, the interaction between emotions and cognition, affective system, decision making and social neuroscience, to say the least.

Imagine the typical shopping center stroll: consumers with limited time and resources ('wallet share') must learn to navigate a plethora of options of products and services they are exposed to, and to behave optimally in an enclosed environment full of seductive showcases. It is tempting to suppose that the architecture of the human brain is already being shaped by what one could call 'consumer tasks' that replaced the naturally-evolved task of foraging for food and shelter, among others. Virtually everything we do these days involves interaction/negotiation with other people and/or exchange of products and services. Objects are symbols that serve for communication, and also signal social status. Yet, many of the principal aspects of the aforementioned activities have yet to be ascribed to particular brain networks, whose functioning remains to be investigated. While this might be due to the exceptional complexity of the behaviors observed in consumer activities, it is also because some of these topics are also on the forefront of modern neuroscience (Ochsner and Lieberman, 2001).

The most obvious field of study for neuromarketing is the reward system. Reward is an objective way to describe the positive value that an individual ascribes to an object, behavioral act or an internal physical state. Primary rewards include those that are necessary for the survival of species, (such as food and sexual contact) and secondary rewards derive their value from primary rewards (money, for example). In neuroscience, the reward system is a circuit of brain structures that regulates behavior by inducing pleasurable effects, impacting our cognitive processes (Pochon et al., 2002) and increases the occurrence of behaviors that induced that pleasure (this is called a reinforcer). The circuit includes dopaminergic neurons of the ventral tegmental area, the nucleus accumbens (ventral striatum) and part of the prefrontal cortex (White, 2011).Although the basic neural pathways responsible for generating sensations of pleasure have been widely described, they are mostly studied in a context of drugs and natural rewards, like food and sex. The study of abstract rewards like money, products and brand experience is far less developed. A full review of the reward system and brain networks supporting decision making is beyond the scope of the current article, for a detailed neuroanatomical description, see (O'Doherty, 2004). For the purpose of this article, what is important to keep in mind

is that, when activated, the reward system induces pleasure and tends to increase the occurrence of the associated behavior.

One interesting aspect of the reward system is that its activity is modulated by the absolute reward magnitude (i.e., how much you like, how much you receive), but also by the relative reward magnitude compared to the others. This means that the notion of reward is a social construct. A mid-class person may feel very rich if living among the poor ones; while a millionaire may feel depressed about its 'modest' earning, if living among billionaires (Fliessbach et al., 2007). This knowledge is useful to understand the neural basis of price perception: are the prices of products absolutely inexpensive to expensive? Probably not. Consumer's brain more likely perceive price as relative to the perceived value: "inexpensive for a BMW", "too expensive for a old-fashioned TV", "more cost-effective than the cheap version", and so on. Also, on the other way round, the prices of products can have a direct effect on the neural representation of their perceived reward, that is, the more you pay for something, the more willing you are to like/ value that thing (Plassmann et al., 2008).Given the substantial difference in individuals' preferences for brands and products (Berger and Health, 2007), one interesting research question would be to investigate if activity in reward pathways could predict individuals' unique hierarchies of brand preference.

Notably, the reward system is not only activated in response to pleasure. In fact, it is activated before, depending on the likelihood of receiving a reward. It's more or less like the shivers we feel before getting the first kiss, or the sensation we feel a few minutes before our team is going to win an important match. The higher the expected reward, the larger the electrical response in the reward system. Using the EEG, one could observea specific ERP associated with reward expectation (Hewig et al., 2007). This ERP is observed when one has to suddenly "re-evaluate" something due to a deviation in something that was predicted. The resultant electrical activity can indicate how unexpected the situation or event was. It is easy to see how this approach could be applied to comparing a consumer's expectation about a product to its actual performance, or customers' expectancy relationships between a product's price and perceived quality. Another interesting use of neuroscience knowledge into marketing, it's a study investigating the role of descriptive information on the expected value of a product. They concluded that more information does not necessarily imply

in more expected value. Indeed, irrelevant information tends to reduce the expected value of a product and negatively affect judgment (Meyvis and Janiszewski, 2002). In comparison to a baseline set of expectancy about a product, one could use EEG ERPs to understand whether a given set of information (say, an advertising) adds or not expected value to the product. In this way, this translational use of EEG could help optimize promotional messages or suppress information perceived as irrelevant (Petty et al., 1983).

Another relevant issue is whether is more rewarding to please yourself than pleasing others. If you have the choice, do you prefer to buy something to yourself or spend money on a nice gift for the beloved one? Social/ affective neuroscience have demonstrated that there are several regions of the brain that are "self-oriented"; that is, they appear to encode information specifically relevant to oneself. These regions respond preferentially to stimuli that evoke a sense of self, for instance, when making decisions for your own benefits versus to others (Gillihan and Farah, 2005). On the other hand, other brain areas are dedicated to altruistic behavior, i.e. actions oriented toward other people. This might have an interesting parallel with the consumer behavior of buying a gift for others and could provide interesting insights on how to communicate with buyers during Christmas promotions and, even more than that, to stimulate altruistic behavior in charity campaigns. The relation between donation and activation of the reward system is a question that may interest both neuroscientists and marketers, since social basis of altruism and generosity have just begun to be understood, within the affective neuroscience context (Berridge and Kringelbach, 2008).

10. LIMITATIONS & FUTURE DIRECTIONS -> IS THAT MIND READING?

The most important take-home message: it is not yet possible to take the data from a single individual (particularly for brain imaging) and use it as a post hoc description of what a person "actually" was thinking or feeling. That would be based on reverse inference, i.e. that because a brain area was activated, one could ensure what the person was doing / thinking / feeling. Rather, the state-of-the-art is being developed in the other direction: we are still trying to understand who-does-what inside the brain. On top of that, the methods used by neuroscience are valid for group comparisons, must have

enough statistical power to indicate differences only when the difference exist (i.e., without false positives) and are always relative to a control group / baseline. Making statements associating patterns of activation across brain regions with specific emotional responses on an individual basis exceeds the bounds of responsible, accurate interpretation of the data. The patterns of neural activity elicited under any given task are extremely complex, and attempting to interpret them in the absence of a particular hypothesis and appropriate control groups is not far away from guessing (Liberman, 2007).

Therefore, neuromarketing is "good to go" with group studies and may test different versions of product, packages, advertising, etc in order to guide product development, but shall not be understood as a mind-reading device. Sticking to the reverse inference strategy would be an impediment towards the development of the neuromarketing into a widely accepted method, from a scientific perspective. Putatively, extrapolation of individual data could be done using a 'standard curve' strategy. Standardized databases of cases would be used to create mathematical models, upon which single data points from individuals could be used to extrapolate an outcome of interest. This is commonly performed in other biological fields, like biochemistry, but it's hard to get, since it requires extreme standardization of equipments and methods across different experimental settings. Nevertheless, not every mental state signature has been tested and standardized, therefore, it is too easy to get flawed interpretation of results. Characterizing specific neural signatures it's in fact an opportunity for neuroscientists, at this point. Associating content to the signals obtained using neuroscience methods is an even harder issue. Although there are fairly good initiatives towards decoding of brain content (Kay et al., 2008, Nishimoto et al., 2011), this is still very far away from the application in the marketing field. This comes both as a warning for marketers and as an incentive for neuroscientist, suggestive a direction where more studies are welcome.

Another major factor to be aware of in neuroscience research is the existence of a ''neuroscience effect,'' in which claims become more believable just by appealing to a neural explanation. This is a major bias that shall not be used intentionally to mask bad science or stratospheric extrapolation / distortion of data to fit somebody's argument, which will be mistakenly taken as 'scientific'. It was already shown that bad explanations of psychological phenomena became significantly more believable simply

by putting the explanation in a neural context. This effect was true for all participants except trained neuroscientists (Weisberg et al., 2007). It is more or less like "repeating a lie, until it becomes true" using "neuro" arguments. These observations bring an important ethical issue for neuromarketers: if supporting an advertising claim on brain research makes it "extra" believable, neuromarketing practitioners must be even more sure of the veracity of that claim before using it as a selling argument. Overinterpreting results because of an appeal to a brain-basis is not only a problem for the customers, but for the product developers as well, which may be misguided by its own research results.

I believe that marketing and neuroscience may make substantial contributions to one another's developments. However, merging such apparently disparate fields will probably not happen without efforts. The first obstacle is that neuroscientists display considerable skepticism toward the development of a neuromarketing subdiscipline (Lee et al., 2007). If neuroscientists see "neuromarketing" only as a tool advertisers intend to use to subvert consumers, tricking them into buying products by attempting to "short-circuit" their brains (regardless of whether this is even possible), it is no surprise that they recoil in ethical disgust (Perrachione and Perrachione, 2008). However, this attempt to say that neuromarketing is a subfield on its own may be the root cause of this controversy. The bottom line is that we are talking about an interesting application of already existing neuroscientific methods. In my eyes, the big question is broader than whether or not measuring brain signals can help we understand consumer behavior. In the end of the day, if one learn how to use neurotechnologies to optimize brand awareness, does it mean increased sales? Does more activation of emotion-related brain areas predict more intention to buy? Measuring brain activity in a laboratory environment really reflects what happen in the shopping context? Recent evidence from the classical "Dictator's game" suggest that, when it comes to money spent, what happens in a naturalistic context may have nothing to do with what was predicted in the laboratory simulation (Winking and Mizer, 2013). But, in the end, those are not exclusive questions from the neuromarketing, in fact, they affect marketing research as whole (Lynch, 1982). I believe that rather than a subfield of Neuroscience, neuromarketing shall be considered a subfield of marketing and be conducted by multidisciplinary teams, including neuroscientists. Although

the equipments necessary to conduct non-invasive human neuroscience have become increasingly available over the last years (particularly portable EEG and eye-tracking devices), they do not do the magic on their own. Well designed experiments conducted by experienced neuroscientists are still important pieces in this puzzle, if one aims to extract relevant information from the use of neurodevices.

Finally, one of the most critical questions facing prospective neuromarketers is: "do we really need to use neurotechnology to find our answer? Or can a behavioral task do the job just as quickly, accurately, and less expensively?" Naturally, there is considerable appeal in producing brain scans to accompany a behavioral claim; but,in many conditions, such images does not add anything new to the conclusion. In a direct comparison, when one company sought to use brain imaging to support a simultaneous behavioral study, the two methods came to identical conclusions (Halliday, 2007). In a case like this, the company would have been prudent to avoid the expensive neuroimaging approach and rely specifically on the behavioral results, since it is the consumers' behavior that they were really interested in. One should carefully consider whether neuroimaging is actually contributing meaningful data toward the project's goals. Neuroscience adds value to marketing by providing original insightful data - which depends on good experimental design - not by hanging beautiful images on top of an old refurbished conclusion.

11. CONCLUDING REMARKS

The neuromarketing research has more than one perspective, and engaging people towards this new field may be just a matter of asking the right questions. Marketing professionals may want to know "How does the price of a product affect its perceived quality?", while the underlying fundamental question for neuroscientists may sound more like "How is reward-related neural activity affected by cognitive factors independent of the stimulus?" (Perrachione and Perrachione, 2008). It is a matter of interest, but it's also a matter of language. A lot of questions that interest both sides are still open and claiming for creative approaches that will improve scientific knowledge, while creating actual value to customers.

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