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Beyond traditional consumer research - current adoption and next steps for neuromarketing

1. Introduction

In 2002, the term Neuromarketing was coined by Ale Smidts and since then it has been catching attention in the marketing and research domain (Fischer et al., 2010). Neuroscience used for conducting market research is called Neuromarketing or Consumer Neuroscience (Genco et al., 2013). It is the application of brain science to understand the response of customers to any marketing stimulus (Lin et al., 2018).

The global automotive manufacturing sector is one of the biggest industries worldwide. The automotive industry contributes around 3% of the world's total GDP output, and that share is higher in emerging markets such as China and India, where the automotive industry accounts for 7% of GDP. (azom.com, 2022). Globally, India ranks 4th in the automotive market (OICA, 2022). Indian automotive sector is becoming more dynamic with the entry of new global players like KIA, MG, Citroën, BYD, Triumph and technologies like alternate fuels, safety features like ADAS, etc. Hence it is important to identify the role of Neuromarketing in the Automotive sector.

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Neuromarketing is not new to the automotive sector. It was used by Daimler Chrysler to understand the customers' feedback for cars in 2002 (Hunt, 2008). "The Ultimate Driving Machine", the slogan of BMW, which explains the associations consumers will have with driving the car, has evolved from Neuromarketing research. Brands like Audi and Honda create their fragrances to positively influence consumers sitting in the car. Even the leading Korean brand Hyundai tests its prototypes using Neuromarketing techniques (Plakhin et al., 2018).

The total money spent by various companies globally on market research in the year 2022 was ~130 billion USD. In India, 2.7 billion USD were spent on market research. Automotive companies in India spend ~100mn USD on market research. ~70% of the total spending in India was on Quantitative research and ~10% on Qualitative research (ESOMAR, 2022). Though coined two decades earlier, the global research spent using Neuromarketing is very minuscule and estimated to be less than or equal to ~1% of the total research spent across sectors (Verified Market Research, 2021, Mordor Intelligence, 2021),

During literature reviews, the authors found multiple research gaps on this topic. The research on Neuromarketing is primarily spearheaded in the academic domain as compared to the corporate world. Many have expressed a need to bridge this gap (Lin et al., 2018). As the requirements of the business world are different, it is important to clarify the triggers and barriers to using Neuromarketing (Baños, et al., 2020). In terms of number of research papers published in Neuromarketing domain, top 3 countries are Spain, UK and US. As India ranks 11th, there is a need to dive deeper into this topic from the Indian context which is still at nascent stage.

Noble prize winner H.A. Simon introduced the term Bounded Rationality. According to the theory, decisions are partially irrational. A decision is made considering levels of conformity instead of maximum value (Simon, 1990). There is a need to clarify if this theory is applicable to the Adoption of Neuromarketing among automotive brands.

This research will answer the following questions:

1. What is the current state of adoption of Neuromarketing in the Automotive sector?
2. What are the reasons for its low/high adoption in the Automotive sector?
3. What is the future of Neuromarketing in the Automotive sector?

Objectives of this paper are as follows:

1. Identify the Adoption funnel (awareness, consideration, usage and recommendation) of Neuromarketing techniques among the Automotive companies.

2. Clarify the drivers and barriers of the Adoption of Neuromarketing.
3. Arrive at the solutions to bridge the barriers of Adoption.
4. Evaluate future potential of Neuromarketing in the Automotive sector.
5. Validate H.A. Simon's Theory of Bounded Rationality.

2. Methods

A three-step approach design as shown in figure 1 was followed for studying the role of Neuromarketing in Automotive. In the first step, researchers reviewed existing literature related to the Automotive landscape and use of Neuromarketing. Post the literature review, in the second step, the authors spoke to Automotive players to analyse their adoption funnel (awareness, consideration, usage and recommendation) including its advantages and limitations (Zhang, et al. 2021). Automotive players are the professionals working with Automotive brands in marketing and research roles. In the third step, the authors spoke to the Neuro experts to identify steps to overcome challenges of Neuromarketing clarified during the discussion with Automotive players. Experts consist of the neuroscientists and research companies undertaking Neuromarketing research across sectors. This research used Interpretive Phenomenological Analysis approach to decode individuals to deep dive into their personal experience (Mahmood & Arshed, 2023).

Though the systematic literature review is global, discussions with experts and Automotive players have been conducted in India. Since India is one of the top countries in Automotive sector, inputs from Automotive players in India is important and relevant. As it is an exploratory study, small sample is sufficient. The intention is not to accumulate evidence, but to get in-depth insights into a domain, which is at a nascent stage, and come up with future recommendations. (Swedberg, 2020).

Step 1. Literature Review and Theoretical Background

A detailed search was conducted using Scopus where we followed the PRISMA framework (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Alsharif *et al.,* 2022). Authors used various combinations of keywords like "Neuromarketing", "Consumer Neuroscience", "Automotive", and "Adoption". 1,015 records were identified in Scopus while using the keyword "Neuromarketing". In the next step, records were screened by using filters like - Open Access, Article, Conference paper and English language. After applying the screening criteria, 284 documents were shortlisted. We found that year on year the number of articles published on Neuromarketing has been constantly increasing. Spain, the UK and the US are the leading countries whereas India

Figure 1. Three step approach

Source: Author Compilation based on the approach followed

ranks 11. The top 5 subject areas are Psychology, Social sciences, Business Management, Neuroscience and Computer science.

When we further used the eligibility criteria of keywords "Automotive" along with "Neuromarketing, only 3 documents have been published so far. This shows the need for in-depth research on this topic.

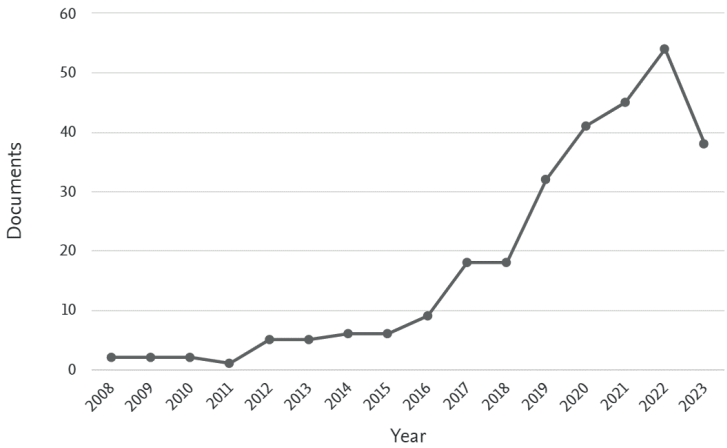


Figure 2. Documents published on Neuromarketing from 2008-2023

Source: Scopus Database

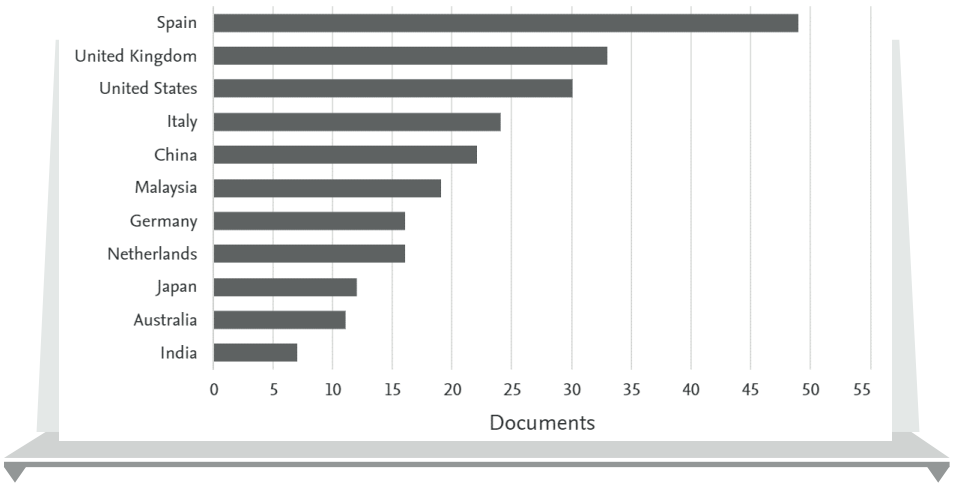


Figure 3. Top countries in published documents on Neuromarketing

Source: Scopus Database

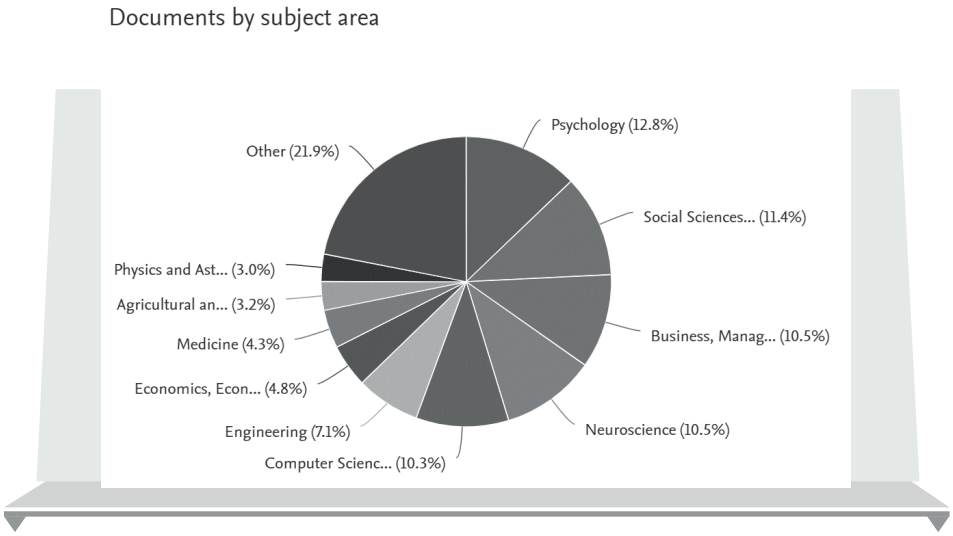


Figure 4. Documents by Subject Areas on Neuromarketing

Source: Scopus Database

Most of the articles which have been written on Neuromarketing discuss about its techniques and application in understanding emotion, perception, preference of brands or communication among consumers and its future usage. There is insufficient research conducted which focuses on the feedback of automotive organizations and companies who will ultimately use these techniques in marketing or market research. Also, limited studies have been conducted to provide solutions to the barriers to the adoption of Neuromarketing in the Automotive sector.

Our research builds on few articles mentioned in table 1 which have been written globally which focus on adoption of Neuromarketing from organizations point of view.

Table 1. Top articles on Neuromarketing among Organizations

Subject Area	Country	Key Findings and Future Scope
Adoption Neuromarketing in Advertising sector (Baños, et al,. 2020).	Spain	The unawareness of its true potential, the failure of research companies of Neuromarketing techniques in explaining the value they bring to the table, and their technicality. The perception of being expensive and time-consuming explains the current lower adoption in advertisement research.
Perception of Neuromarketing in the Fashion Industry (Kurtoglu & Ferman, 2020)	Turkey	Future potential to compare traditional research approach in fashion with Neuromarketing techniques.
Application of Neuromarketing in Real Estate in Egypt (Mohsen & Mostafa, 2020).	Egypt	The study found a correlation between the use of Neuromarketing & competitiveness.
Neuromarketing in Retail (Nilashi et al., 2020)	Vietnam	There is a future potential for Neuromarketing for sustainable product growth and promotion
Neuromarketing: Gap between Science and Application (Brenninkmeijer et al., 2019)	UK, Netherlands	Need to bring organizations and neuroscientists on the same page to increase adoption beyond academic research.

Source: Scopus Database

Neuromarketing tools and techniques which can be used in the Automotive sector In the literature review, we identified relevant Neuromarketing tools and techniques that can be used in the Automotive sector. Though in majority of the cases only one Neuromarketing technique is used, combining more than one technique can help get better results. (Lim, 2018).

Eye tracking (ET) uses fixation as one of the main measures. With the duration and frequency of fixation, analysis can be made on psychological response. Past researchers have found a good correlation between fixation and memory/ attention/ purchase (Garczarek-Bąk et al., 2021). It can be used for testing a print ad, new design or design of the vehicle. It can also be used to improve the websites and apps of the automotive companies.

Electroencephalography (EEG) checks and captures electrical action in the brain using electrodes put on the scalp of a respondent using a helmet (Aldayel et al., 2020). When the respondents are shown any stimuli like an advertisement or a concept, EEG captures the electric currents produced through brainwaves as a response to a stimulus. Though it is cheaper than fMRI (Functional Magnetic Resonance Imaging) and mobile in few cases, it is expensive over Eye Tracking. It also needs a lab setup and high technical knowledge to capture and analyse the data. EEG can be used in analysing and forecasting customer behaviour. (McInnes et al., 2023). In the Automotive sector, it is widely used to test video advertisements and designs of the new vehicle.

Functional near-infrared spectroscopy (fNIRS) uses near-infrared spectroscopy to analyse the neuro response. It captures brain activity by detecting changes in haemoglobin (Hb). It is the part of the brain which plays an important role in cognition and choice (Quaresima et al., 2012). One of its advantages compared to EEG and fMRI is its cost and mobility (Meyerding & Mehlhose, 2020). It can be used in automotive sector research where the respondent can't come to the lab.

Post the literature review, we identified there is limited literature available on how Neuromarketing is used in the Automotive space and solutions to the barriers of adoption. Hence we decided to conduct in-depth interviews with Automotive companies and Neuro Experts. Few authors have also pointed out the need to take it beyond the academic domain and clarify the point of view of the corporate world (Lin et al., 2018). As the requirements of the business world are different, it is important to clarify the triggers and barriers to using Neuromarketing (Baños, et al., 2020). Brenninkmeijer et al., 2019 have highlighted the need to bring organizations and neuroscientists on the same page to increase adoption beyond academic research.

Step 2 and 3. Discussion with Automotive companies and Experts

There are ~47 key automotive companies in India as mentioned in table 2. An introductory mail and then a follow up mail was sent to all automotive companies to speak with stakeholders in Consumer Research, Marketing and Product development divisions. 20 companies agreed for 45 min interview. Three well-known market research companies in India who conduct research using Neuromarketing techniques were also interviewed. Two neuroscientists with a Doctorate degree and several research papers on Neuromarketing to their credit, were also interviewed. They had deep knowledge of the science and have worked with market research companies, brands/organizations that use Neuromarketing techniques for market research.

Table 2. Automotive Companies in India

4 Wheelers	2 Wheelers	Commercial Vehicles	Tractor
Hyundai	Hero	Tata Motors	John Deere
Maruti	Honda	Mahindra	Mahindra
Toyota	Bajaj	Ashok Leyland	Kubota
Kia	TVS	Atul	Escorts
MG	Yamaha	Piaggio	TAFE
Honda	Royal Enfield	Bajaj	New Holland
Renault	Suzuki	VECV	Sonalika
Skoda	Okinawa	Maruti	Swaraj
Volkswagen	Piaggio	Force	
Jeep	Ather	SML	
Citreon	KTM	Daimler	
Tata	Kawasaki		
Mahindra	Triumph		
Nissan	Ola		
Mercedes			

Audi			
JLR			
BMW			

Source: Google Search

Total 25 in-depth interviews were conducted with details in table 3. In depth interviews is one of the most effective techniques in qualitative research (Ullo & Mardones, 2017) and helps in deep diving into personal experiences instead of general observations or opinions and beliefs (King & Horrocks, 2010).

Table 3. Sample

Research Units	Number of Interviews
Companies (Automotive OEMs)	20
Market Research Companies	3
Neuroscientist	2

Source: Author Compilation

To begin with, researchers gathered information about the automotive companies to identify in which sector they operated, the types of research conducted by them and to know who the stakeholders are in deciding which type of research should be done and which methodologies should be used. We analysed the overall experience of the participants and the role they played in conducting market research. This information will help later to clarify if the awareness or adoption of Neuromarketing research varies with the sector, type of company or year of experience of the decision-makers.

It is important to study the purchase funnel (awareness, consideration, usage, recommendation) while studying the adoption of a new product or a technology (Zhang, et al. 2021). Hence participants were asked questions related to the purchase funnel for Neuromarketing research. This also helped to identify the drivers and barriers to its adoption. Questions asked to the automotive companies have been detailed in table 4.

Table 4. Questions asked to the participants of the research

Question type	Details
Company details	Background of the company, types of research conducted in the past, key stakeholders involved in the decision-making for conducting market research studies
Participant details	Years of experience, role in conducting research in the current company
Awareness of Neuromarketing	Their awareness on a 5 point scale. Detail discussions about what the participants knew about Neuromarketing
Consideration of Neuromarketing	Have they considered Neuromarketing research in the past (2 point scale)? Identify the reason for considering and not considering in detail
Usage of Neuromarketing	Clarify whether they used Neuromarketing research in the past (5 point scale). Deep dive into the reasons for using / not using the same
Satisfaction concerning Neuromarketing techniques	Capture satisfaction on a 5 point scale. Basis the level of satisfaction, identify the reasons for the same
Adoption of Neuromarketing	Discover the Potential of adoption in future on a 5 point scale and discuss reasons for using it and the type of research in which they will use Neuromarketing
Drivers and barriers to using Neuromarketing	Discuss in detail what will drive them to use Neuromarketing and what will be the limitation of its adoption
Neuromarketing Tools and Techniques	Which Neuromarketing tools and techniques are / can be used in the Automotive sector

Source: Author's Compilation

Discussion with Neuro experts focused on identifying the solutions to overcome the barriers of adoption of Neuromarketing found during the discussion with automotive companies

3. Data Analysis

First step of analysis was thorough literature review of relevant papers published in India and globally. We listened to interviews multiple times to analyse the views expressed on various parts of purchase funnel like awareness, consideration, usage, satisfaction, recommendation and likely to use in future using content analysis. The large wide variety of data collected from various interviews was put in a structured format and transcribed. Recording units were condensed and then subcategories were developed. Various subcategories were then clubbed into a category. Analysis of close-ended questions was also performed to numerically validate the direction of thinking of Automotive companies.

4. Results

The findings from the discussions with Automotive companies' representatives are as follows.

4.1. Awareness of Neuromarketing

The awareness of Neuromarketing among automotive brands in India is at a moderate level as mentioned in figure 5. Based on the discussions with automotive companies, the authors identified that awareness of Neuromarketing comes mostly from attending conferences, discussions with industry peers and research company presentations. It was understood that though the awareness of Neuromarketing among Automotive companies was moderate the in-depth understanding of tools and techniques, the process and output was lacking.

Table 5. Content analysis of Awareness among Automotive companies

Category	Subcategory	Recording units
Awareness of Neuromarketing	Conferences	"Got to know about this technique from the MRSI conference"
		"I attended the conference organized by a market research company and got to know about Neuroscience"
		"We attended the ESOMAR conference where the use cases of Neuromarketing were presented"
		"In one of the auto expos, I got to know about this technology"
Awareness of Neuromarketing	Research Companies	"Research companies presented their credentials to our team where Neuroscience was explained"
		"In one of the proposals, the research companies also suggested complementing traditional research method with Neuromarketing"
		"A leading market research company did a pilot study for us free of cost. From there we got to know about this technique"
	Industry Peers	"My colleague who moved from a research company to our company introduced me to this concept"
		"Industry peer from a leading car company talked to me about the study they conducted using Neuromarketing (EEG)"

Source: own study

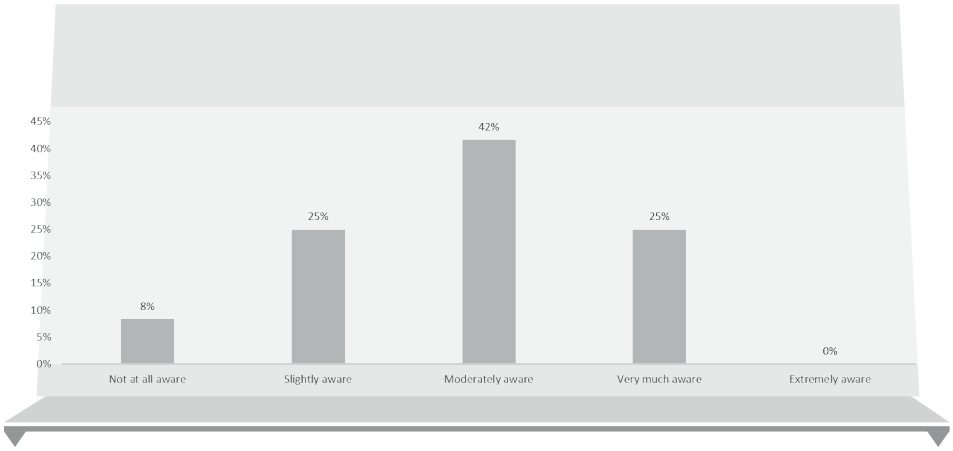


Figure 5. Awareness of Neuromarketing in Automotive companies in India

Source: Author Compilation from Interviews with Automotive companies

4.2.Consideration

The next stage of the purchase funnel after awareness is a consideration. When stakeholders from automotive companies were asked if they had considered using Neuromarketing in any of the research conducted in the past, more than half of them stated that they had considered it. This is detailed in figure 6. The reasons for considering Neuromarketing were to experiment with new technology, capture the response to a stimulus in much better way, remove interviewer bias and get more genuine response as consumer can't hide emotions. This is explained in table 6. A leading commercial vehicle company's representative, whom we met, also voiced, "Tractor or truck owners can't articulate much in traditional research. In such cases, Neuromarketing can help understand emotions and deeper nuances".

For those who did not consider it, the main reason was a lack of awareness among internal stakeholders as no research company had ever pitched it. The representative from new entrant in scooter segment said, "Most of the small and medium brands first start with basic and traditional research and then move to advance research like Neuromarketing, hence its adoption will be lower in such companies".

Table 6. Content analysis of Consideration of Neuromarketing among Automotive companies

Category	Subcategory	Recording units
Consideration	Experiment new technology	"Neuromarketing is an emerging technology. As the leading automotive company, we love to try such techniques which can complement traditional research methods".
		"Heard a lot about EEG and Eye tracking. We tested our video ad using this new method. Earlier we did it using quantitative research method".
		"Traditional research methods capture system 2 thinking. This technique captures system 1 thinking. Hence, we considered it".
	No Bias	"Output of traditional research can be sometimes influenced by the way interviewer asks the questions. Neuromarketing removes the interview bias as the brain responses using EEG are directly collected".
		"Sometimes customers are hesitant to talk about their choices or are ignorant of new technology. Still, they answer the questions which creates a bias. Neuromarketing techniques like eye tracking remove that bias".

Source: own study

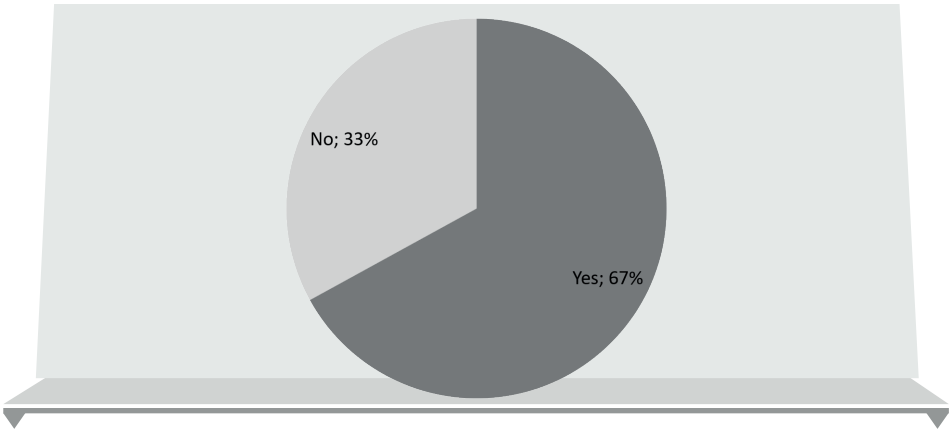


Figure 6. Consideration of Neuromarketing in Research in the past

Source: Author Compilation from Interviews with Automotive companies

4.3. Usage

As evident in figure 6, approximately two-thirds of the participants have considered using Neuromarketing. However, more than half of these have never or rarely used it for conducting market research. Many participants in this study revealed that they didn't use Neuromarketing because there was no proof of evidence that it would work, and it was expensive too. They preferred using traditional research as they have been doing it in the past and can predict the outcome. One of the domestic car manufacturers representatives mentioned, "We have been doing qualitative and quantitative research methods. Our team and top management are used to the output of the same. There is always a risk to try out a new technology which is complex to understand and interpret".

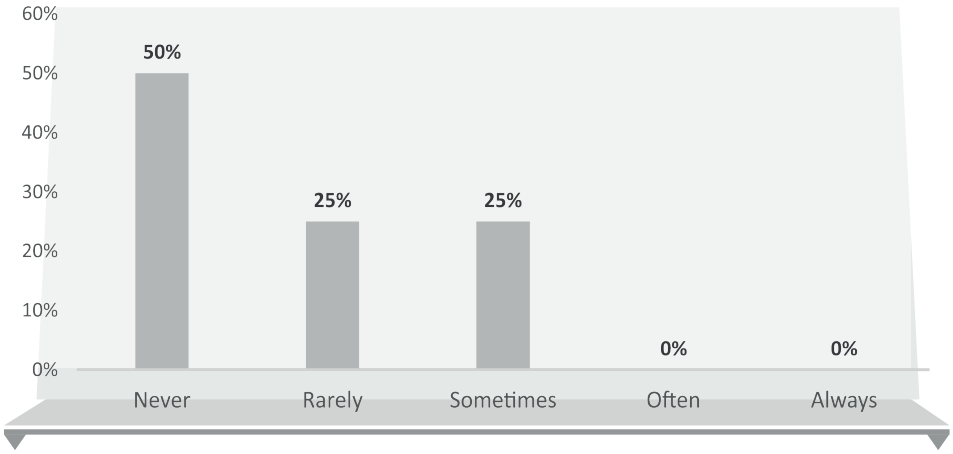


Figure 7. Usage of Neuromarketing in Research

Source: Author Compilation from Interviews with Automotive companies

The respondents who have used Neuromarketing, clarified how well it complements traditional research and it gives extra confidence for finalising the design of the car or an advertisement. Design is very crucial competitive edge for the brands (Kim & McGoun, 2022). They feel traditional research will help understand conscious mind (stated needs) and Neuromarketing will help in understanding subconscious mind (latent needs and emotions). This is explained

in table 7. Our study identified that the usage of this technique is higher among car brands as compared to two-wheeler, commercial vehicles and tractors. Also, we discovered that the people who have spent more time in market research were aware, have considered and used Neuromarketing in their career.

Table 7. Content analysis of Usage of Neuromarketing among Automotive companies

Category	Subcategory	Recording units
Usage	Advertisement	"We tried Neuromarketing technique (EEG) to test one of our new TV commercials for car. We were surprised to see the second-by-second analysis of the ad and understood which part was engaging and which was not. This helped us to improve the ad".
		"We had a 30 sec Bike ad. In the past we used our experience and input from a creative agency to reduce it to 15 sec ad. But this time we used Neuromarketing tool to shorten the ad. We were super impressed with its results and accuracy".
		"We used Eye Tracking to test the newspaper ad of our new Truck. It helped us to understand which section of the ad customers focused on more. We shifted our key message in that section. We were surprised to see other than actual truck, the driver and his appearance attracted lot of eyeballs and focus".
	Product / Design Testing	"We had shortlisted 7 colors in which our cars will be launched. We wanted to shortlist 5 out of them. We conducted quantitative research to understand which were the top 5 colors. We complemented it with Neuromarketing tool EEG. This helped us to understand which color were liked the most and closely associated with the persona of our new car".
		"Our new bike had 2 designs. We wanted to identify which had more global appeal. Neuromarketing helped us understand which design was more associated with a global image".

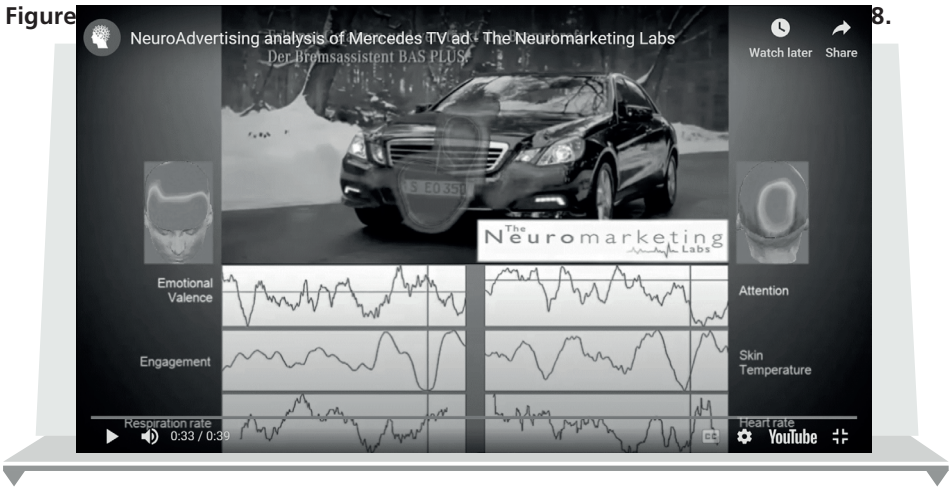
Usage	Branding	"We were working on a new logo. We had three options. We wanted to select the logo which was aligned with our new positioning. We thought it was very difficult to elicit this information by just asking the customers. Neuromarketing helped us to select one logo with maximum association with our brand positioning".
		"Neuromarketing helped us select the brand ambassador for our new line of electric vehicles. We shortlisted 3 but taking the final decision was very difficult. We wanted someone whose image matches with the DNA of our new electric models".
	Purchase Experience	"We had put cameras in our dealership which would capture the facial reactions of the customers. Traditionally, on the basis of our sales staff judgement, we followed up with customers and offered them discounts. Facial coding helped us shortlist the customer by analyzing their engagement and emotions through facial coding".

Source: own study

Our study identified that Neuromarketing research was used by automotive companies in various types of research such as ad testing (print, TV, Digital), brand image, product / concept, logo testing and purchase behaviour / experience in showroom. The highest application of Neuromarketing was in advertisement and product testing was clarified post discussion with automotive companies. Gountas et al. 2019 also talk about Neuromarketing's role to understand marketing communication by understanding content, way it is shown and configured. (Gountas et al. 2019)

Advertising – During our discussion with one of the car manufacturers, they were highly impressed with Neuromarketing capability to test the TV advertisement. "We got second by second analysis of a car video ad. We made few edits when we used Neuromarketing technique of EEG and Eye tracking. It helped the advertisement become more effective". As the output of the study was confidential, we used similar output available in the public domain to show the output of analysis of a video commercial. The figure 8 shows the second-by-second analysis of the Car advertisement in terms of emotions, engagement and attention. This was clarified in our discussion with automotive companies regarding the advantage of Neuromarketing in giving second by second analysis.

Figure 8.



Video ad analysis using Neuromarketing

Source: Pinterest (2014)

4.4. Satisfaction

It was identified that automotive companies who used Neuromarketing in the past were mostly satisfied. The same is represented in figure 9. Though none of them were dissatisfied they felt that there was room for improvement. Many voiced out "Neuromarketing helps in capturing richer finding about what is going on in mind along with capturing it real time by getting unfiltered response". One of the participants from an Indian car manufacturer mentioned "We want to test a new feature of the car, it is very difficult for customers to tell whether it is believable, likeable and will they pay extra for it. But Neuromarketing helped identify their emotions without any bias". One of the electric two-wheeler companies clarified "Customer responses are genuine; frank and they don't have to sound correct as compared to traditional research where the interviewer is listening to what they are saying".

The authors identified on the basis of the discussion that there are still many areas of improvement which the users of Neuromarketing mentioned. One of the commercial vehicle manufacturers mentioned "We felt outcome in terms of heat maps or word cloud were not so convincing and practical. In eye tracking,

we were not sure whether the customer was looking at the spot on the vehicle/ advertisement because he was happy, curious or was trying to understand what it is". Couple of participants mentioned, "We felt, Neuromarketing tells you what is happening, but it can't tell you why. Hence, the output must be complemented by open-ended answers after the Neuromarketing study".

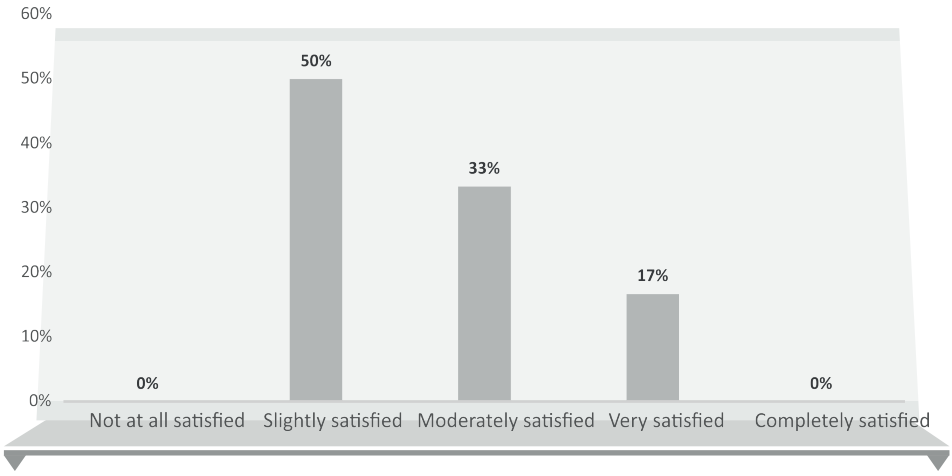


Figure 9. Satisfaction with Neuromarketing in Research

Source: Author Compilation from Interviews with Automotive companies

4.5. Adoption in future

Thus, we could identify that awareness and consideration of Neuromarketing is at a satisfactory level among automotive companies in India, but its usage is limited. Hence, is it important to clarify its future adoption. When asked about future adoption of Neuromarketing techniques in research, majority of them said they will moderately or quite likely use it. This is detailed in figure 10. Many participants mentioned "Neuromarketing is more scientific and after the Pandemic, customers and companies have adopted many new technologies. As a result, it will be easy to convince top management to try new technology like Neuromarketing". One of the tractor manufacturing company representatives mentioned "Neuromarketing helps to get a natural response and respondent

doesn't have obligation to sound smart or correct. This happens with our target customers who are farmers". One of the representatives from an international car manufacturer mentioned "As the responses are collected from brain, eyes, heart, face, skin, they can't be hidden or fudged". Some also said, "We use Neuromarketing only when the outcome of traditional research is not very conclusive".

When asked about recommending to someone else in the automotive sector, most of the participants were positive but with a word of caution. They would first want to use it, see the result, and then recommend it, only if they are convinced. Three participants, who had used neuromarketing in the past, mentioned, "We would recommend it to bigger companies who are already spending high on traditional research. We will also recommend it to companies coming up with new technologies (like electric / hydrogen vehicles), first in category new features or new colours".

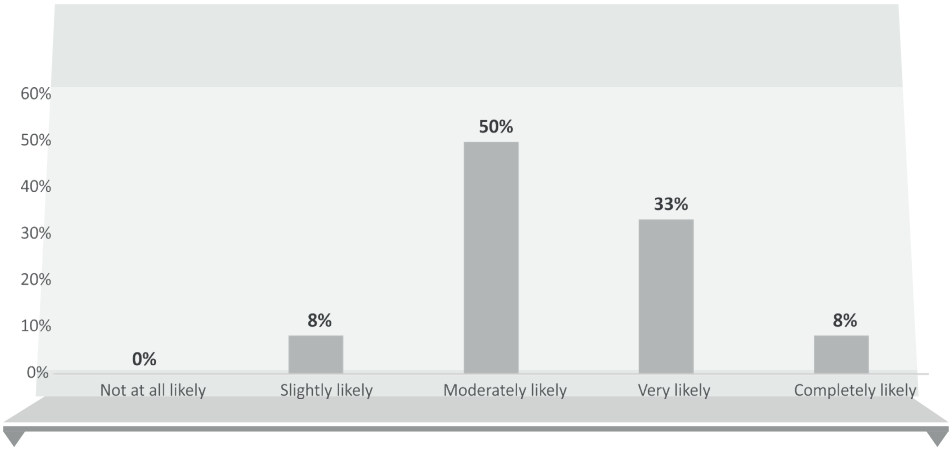


Figure 10. Future Adoption Neuromarketing in Research

Source: Author Compilation from Interviews with Automotive companies

Though the automotive company representatives were positive about adoption of Neuromarketing, it is important to know in detail the drivers and barriers to its adoption.

4.6. Drivers and Barriers to the Adoption of Neuromarketing

During our discussion with automotive companies, it was identified that though adoption looks promising in future, it comes with a mixed bag of Drivers and Barriers. The Drivers identified can be used by market research companies and Neuro experts to increase the depth of awareness and consideration among automotive companies. The Barriers identified in this research need to be worked upon, or if the solution already exists then it must be communicated through conferences and presentations.

4.6.1. Drivers of using Neuromarketing

Discussions with Automotive companies helped us to clarify the Drivers of using Neuromarketing techniques. The Drivers of using Neuromarketing are – it captures responses in real-time, overcomes the limitations of traditional methods, has no interviewer bias, has high predictability, and gets pure response from the subconscious mind. Using content analysis, a word cloud was generated to identify which triggers are more influential than others. Authors identified that the association of Neuromarketing with the subconscious mind, decoding emotions and pure response were the top 3.

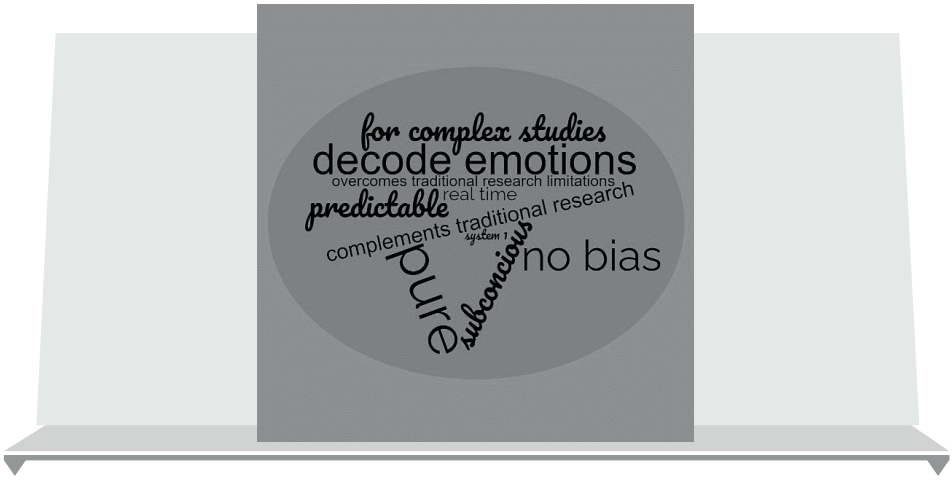


Figure 11. Driver of using Neuromarketing

Source: Author Compilation from Interviews with Automotive companies

4.6.2. Barriers of Neuromarketing

One of most important findings of our research is to identify the Barriers of adoption of Neuromarketing from the automotive companies. The key Barriers mentioned by the automotive companies - ethical concerns, techniques not mobile and limited to lab setup, time consuming, expensive, small sample covered, very complex/ black box in terms of analysis, no benchmarks and preference towards traditional research. Barriers are explained in table 8.

Table 8. Content analysis of barriers of using Neuromarketing among Automotive companies

Category	Subcategory	Recording units
Barriers	Ethics	"If you are reading the facial expressions of customers in a car showroom without informing them, it is not ethical".
		"When you are reading brain response through EEG, you can read the mind outside the scope of the study".
		"As Neuroscience reads subconscious mind, it infringes upon the privacy".
	Not mobile / Lab setup	"We have heard that for EEG test, customers must go the lab. Our customers who are farmers might be intimated with the same".
		"When you put Neuro cap on the head to understand the brain response, the customer might feel unusual".
		"In FMRI (Functional magnetic resonance imaging) technique of Neuromarketing is very scary as customers have to enter MRI machine".
	Lower Sample	"As Neuro is expensive and technical, the sample size covered is very limited. We are used to large sample size being covered in traditional studies".
		"We heard that a small sample of 30-60 is sufficient in Neuroscience. But how will you cover diversity in terms of geography, income, gender, etc.".

Barriers	A black box	"We are used to traditional methods of research. We know how data is collected, analyzed and interpreted. Neuroscience feels complex and is like a black box".
		"We conduct qualitative or quantitative studies for automotive research and when in doubt we know how to look at raw data or transcripts. I don't think we can understand raw data collected using Neuroscience".
	Time-Consuming	"We are used to finishing research studies even in a week. But we have heard Neuromarketing studies at least take a month which might be very long".
		"When we conduct interviews with our bike customers using traditional methods, we can do it in parallel at various centres, but when Neuromarketing companies were asked to work parallelly, they showed some resistance as the equipment is limited and expensive".
	No benchmarks	"When we do brand health studies or customer satisfaction studies, market research companies have benchmarks to be compared with the past and with other sectors. Neuroscience companies do not have benchmarks to be compared with, yet".
	Preference towards traditional methods	"Though we are aware of Neuroscience and its advantage, it is very difficult to convince top management as they are used to the outputs from traditional research".
		"We are a new entrant in the 2-wheeler sector. Our first preference is using traditional research methods because it is easy to understand and tried and tested".
		"If we use Neuroscience, it might be risky if something goes wrong, and unexpected results come. Faith on traditional research is high in our company as we are used to it".

Source: own study

4.7. Discussion with Neuro experts

After identifying the Barriers to using Neuromarketing from Automotive companies, we clarified the same with the experts and came up with the solutions. The outcome of these discussions with experts helped the authors conclude that maximum Barriers have possible solutions, and some are work in progress. The

details of the challenges and possible solutions which can be implemented are listed in table 9.

Table 9. Challenges and potential solution of Neuromarketing

Neuromarketing Challenges mentioned by Automotive companies	Possible Solutions / Explanations	Conclusion from Authors
Not completely ethical as it taps into the subconscious mind	"I think there's a perception that you hypnotize somebody while using Neuromarketing, but that is not true" Expert 4. "All the studies are done with consumer consent. So, there is no question of infringement of privacy" Expert 2. "Research companies need to follow Research guidelines which protect participant privacy. The same is true with Neuromarketing" Expert 1. "Facial coding without consent of consumers in public places should not be done. This is not ethical." Expert 3. "There is no buy button, like traditional studies, we limit our findings to the stimuli under research" Expert 4. "We can only understand the emotions of consumers but can't control their decision making" Expert 5. "When it comes to the analysis, we don't look at individuals we look at total data at group level" Expert 5. "All neuromarketing companies follow the ethical guidelines setup up organization like NMSBA (Neuromarketing Science & Business Association) to safeguard the participants" Expert 3 and 5.	Neuro Research companies follow all research protocols like traditional research. Neuromarketing cannot influence decision-making but helps understanding it. This must be explained to Automotive companies using it
It is costly compared to traditional research methods	"Yes, Neuroscience tools are expensive. But it gives you analysis of emotions using advanced technology which is the challenge in quantitative and qualitative studies. Hence that premium is valid" Expert 5. "With an increase in adoption and new methods along with AI, Neuromarketing is becoming affordable" Expert 4. "When you go to a specialist doctor for a problem which can't be detected by a general physician, you pay premium. Similar is the case of Neuromarketing which is an expert in understanding emotions and unstated needs" Expert 1. "Yes, it was expensive but now with new technology ,increase in adoption, it has become quite affordable. An ad test can be done in INR 7-10L using the Neuromarketing technique, which I feel is quite competitive to traditional methods" Expert 1.	Experts agree Neuroscience is expensive, but with new technology, the price gap is narrowing. It commands a premium as it overcomes the challenge of traditional methods in understanding the customer's emotions and unbiased response

Mostly it is the lab setup which can intimidate the respondent	"Now there is no need for participants to come to the lab. Devices for EEG and eye tracking can be taken to their house" Expert 2. "Earlier the EEG devices were intimidating but now they are just like wearing a Cap. Now with home testing, obviously we're much closer to a realistic environment." Expert 5. "I agree Neuromarketing techniques are different from traditional qualitative and quantitative interviews. Hence, we can first make the participant comfortable by familiarising them with the headsets and goggles, then we can calibrate their response by asking very basic general questions. Once Neuroscientist is sure that the participant is comfortable, we can show them the research stimuli".	With the advancement of technology Neuromarketing tools have become mobile and respondent friendly
UI / UX testing of the App on Mobile is a challenge	"EEG can work whether it is a laptop or mobile, but yes, Eye tracking has limitations to create gaze plots on Mobile" Expert 3. "We create a similar simulation of the app on Laptop. If it doesn't work on a big screen on a laptop, then it won't work on a mobile phone". "It is like watching a movie on TV or Mobile. We know that anything that doesn't work on a TV won't work on a mobile phone." Expert 1. "I agree, there is room to improve for testing any stimuli on mobile phones. I am sure there will be soon a solution to that. AI can also help" Expert 2.	Experts agree to the limitations of eye tracking on mobile, but that limitation can be solved by techniques like EEG and Facial coding. Also, the apps and website can be tested on the laptop to understand the customer experience
Smaller sample and hence lesser representation	"Emotionally we are very homogeneous. Our drivers and emotions are similar. Hence smaller sample of 30 is good enough." Expert 5. "Earlier when Neuro studies happened in lab, it was carried out in couple of cities only. But now as it is mobile, we can go to the participants' homes, hence diversity can be maintained." Expert 3. "If you're watching an ad with 32 sensors around the head and each sensor is taking brain activity about 250 times a second, for a 15-second ad you've got hundreds of thousands of data points for every person that comes in. If you've got a sample of 30, you're now into millions of data points that you've got to work with. I think that is sufficient" Expert 5.	Neuromarketing has come a long way in terms of advancement. As it has become mobile now, it can reach customer's homes to make sure of diversity. Also, the number of data points collected is so high that a sample of even 30 gives large data points to conclude

Outputs are difficult to understand and need experts to explain	"I agree Neuro is complex. It is like cars, when it fails, we go to an expert, and they explain what happened to it." Expert 2. "We have worked on it. We can have a kind of colour-coded database to explain the feedback of customers. We also scale everything between zero and 10 to give clear outputs, which clients are used to" Expert 4. "A lot of research companies can now a have commercial team and Neuro experts as well. So, outputs are presented in a comfortable manner like traditional methods and if some technical thing must be explained then Neuro experts do the job." Expert 1. "We can invite our clients to the place where interviews are taken, then explain in simple terms how the analysis is done, and output is made in a manner which the client is able to understand". "Now with multiple studies across the globe, we can develop benchmarks for testing an ad and compare its outcome like traditional research methods" Expert 3.	Experts have taken cognizance of this limitation and have made their output very similar to outputs when traditional methods are used. So, the clients don't become overwhelmed. Neuro experts can support you if there is a technical query.

Source: own compilation based on discussion with experts

4.8. Simon's bounded rationality model validation in adoption of Neuromarketing among automotive brands.

Noble prize winner H.A. Simon introduced the term Bounded Rationality. According to the theory, decisions are partially irrational. Decisions are made considering levels of conformity instead of maximum value (Simon, 1990). From our discussion with automotive companies, we validated this theory by comparing it with the behaviour of the automotive players. The details are explained in the following table 10.

Table 10. Simon's bounded rationality model validation

What does the theory say "When decisions are partly irrational"	How do Automotive players behave when adopting Traditional methods v/s Neuromarketing techniques for research
When difficulty of problem is high	Automotive players trust traditional research over Neuromarketing, for e.g., when they must decide on go or not go ahead with a video commercial. This is counter intuitive to the fact that Neuromarketing gives better analysis of a video commercial analysis which was identified in our research. Also, it has been clarified by Telpaz et al., that Neuromarketing by understanding neural activity is highly accurate in predicting the purchase behaviour (Telpaz et al., 2015).

Limited time available to make the decision	Through discussions with automotive players, we identified that when they have to make a quick decision they resort to traditional methods as these are tried and tested. Discussions with Neuro experts clarified that Neuromarketing techniques can also deliver output in 2-3 weeks i.e., as fast as Traditional methods.
Chose satisfactory rather than optimal	We identified that most of the automotive players are used to traditional research methods and its output. So, we discovered that they would prefer to go with satisfactory outcome of traditional research rather than solution by using Neuromarketing which is free from any bias. It has been also clarified by Page, G. that response in traditional methods is completely based on what the respondent says and expresses. It can bring out the personal or social bias. Neuromarketing can capture pure, unfiltered, and unbiased response from the unconscious mind. (Page, G. 2012).

Source: own study

4.9. Steps to increase the adoption among Automotive organizations in future

We identified that though awareness of Neuromarketing is high, its adoption in the Automotive sector in India is limited. There are multiple stakeholders who have a role to play to increase its adoption.

Research companies. The most important role is to be played by market research companies offering Neuromarketing research services. As the awareness of this technology is high, we identified there is a lack of in-depth knowledge. Hence, we propose research companies promote it by educating the senior stakeholders in the automotive companies by explaining its advantages, overcoming their concerns and conducting a pilot study as a proof of concept. We propose research companies make the introduction/marketing decks of Neuromarketing very easy to understand, believable and user-friendly. They need to explain each step-in terms of research planning, fieldwork, analysis and reporting of Neuromarketing technology and try to correlate the same with traditional methods which clients are used to.

We also suggest, research associations like MRSI (Market Research Society of India) to take up the client awareness campaigns like the one taken by AMFI (Association of Mutual Funds in India) to increase adoption of mutual funds. During the research, we identified that conferences are an important source of awareness for Neuromarketing, relevant case studies need to be presented during MRSI conferences to show a comparison of traditional and Neuromarketing

methods and what benefits the latter brings to the table. One of the participants suggested, "Research companies should conduct a common syndicated study either on vehicle features or colours and then present the findings to the clients and explain its advantages".

During the discussions with automotive companies, we found price was one of the concerns. We suggest research companies to provide a pilot research at lower cost to increase the adoption. During our interaction with Neuro experts, we found that currently the analysis, patents, reporting doesn't happen locally in India. Hence, the cost and time to present insights is huge. Research companies need to develop local expertise to make it quick and economical.

Many research companies, under the name of proprietary models, don't share much information on analysis of the data. Hence, there are limited options to verify the same. (Brenninkmeijer et al., 2019). This was clarified during our discussion with automotive companies. We recommend research companies make efforts to make the entire process of capturing the data and reporting more transparent so that the automotive companies would also be more open to trying this science. They should invite clients to the labs or centres where the research is happening so that automotive players can experience it in person.

Research Scientists and academicians. The research on Neuromarketing is primarily spearheaded in the academic domain (Lin et al., 2018). There is a need to bring organizations and neuroscientists on the same page to take adoption beyond academic research (Brenninkmeijer et al., 2019). We suggest, the academicians and neuroscientists must acknowledge and recognise the Barriers identified in our research regarding the adoption of Neuromarketing. Investments must be made by bringing technology which is more mobile and needs lesser investment. During the discussion with a tractor manufacturer, they said "With the advancement of technology and better infrastructure, many experiments such as soil testing have become more affordable and are at the doorsteps of the farmer, whereas earlier, the samples used to go to the labs. Similarly, we suggest advancements must be made in Neuromarketing technologies in general and EEG in specific to go to participants place to conduct the research.

Organizations and brands. During the discussion with Automotive companies we discovered that there is some hesitation to use Neuromarketing and one of the reasons is internal dynamics. We suggest automotive companies especially those who have been conducting market research for decades to collaborate with academicians or research companies for pilot studies to bridge

the gap between this science and its real application. Traditional methods have limitations on providing more details about consumer mindset. The development in Neuromarketing can help understand the same (Singh & Jain, 2018). We suggest automotive companies try for hybrid approach to use both traditional and Neuromarketing techniques to compare and see the results. This has been validated by Kumar & Singh who mention, neuromarketing can be clubbed with qualitative and quantitative research to understand the consumer in a better way (Kumar & Singh, 2015).

5. Discussion

In the last 5 years, most of the papers published focused on the emergence, effectiveness, techniques, advantages and limitations of Neuromarketing. The intent of this research paper is to analyse the current adoption of Neuromarketing techniques, identify the Barriers to adoption and suggest steps to overcome them.

5.1. Current adoption of Neuromarketing

It emerged from the research that the awareness of Neuromarketing among automotive brands in India is at moderate level. Also, an in-depth understanding of Neuromarketing techniques, the process and output is needed. Those who had considered it were aware of its advantages over traditional methods of market research (qualitative and quantitative methods). The Drivers were experimenting with new technology, capturing the response in real-time rather than depending on the memory of the respondent and avoiding interviewer bias. Majority of the automotive companies never or rarely use this technology due to limitations like ethical challenges, cost, timelines, too technical, not mobile / lab setup and smaller samples. The current investigation validated Simon's theory of Bounded Rationality and highlights the reasons for using traditional research methods over Neuromarketing. Key reasons identified were difficulty in understanding the technology, limited time for decision making and selecting satisfactory rather than optimal.

5.2. Overcome the barriers of Neuromarketing

Automotive companies need to be made aware that the research using Neuromarketing techniques follows all research practices like traditional

research. Ethical guidelines set up by organizations like NMSBA (Neuromarketing Science & Business Association) are followed to safeguard the participants. Consent of the respondents is taken, and the entire process is explained to them before the research is conducted.

Another Barrier identified was Neuromarketing is expensive. The study revealed that cost of conducting Neuromarketing study have reduced the costs significantly with localization and new mobile technologies. As this is an advanced technology, which overcomes the limitations of traditional methods, some premium exists and can be explained. It is like using 2D vs. 3D ultrasound where premium is paid for 3D for more accurate results.

With advent of new technology, especially EEG, Eye Tracking and Facial coding, Neuromarketing tools have become mobile and respondent-friendly. There was no requirement for the research participants to visit a lab, which resulted in intimidation. Even the companies conducting this research can observe the process in person or online which in turn helps them understand the technology better. The study also provides a solution to barriers of smaller sample size and representation. With mobile devices, a more representative sample can be covered now. Also, with a limited sample, the capability of capturing millions of data points will help remove this concern. Our investigation reveals that earlier the output of Neuromarketing research was complicated to understand. Now it is possible to show the output very similar to the output of traditional methods. Neuroscientists can help companies understand technical aspects in easy management/business language.

5.3. Increase adoption of Neuromarketing

As the solutions to these barriers have been already identified in this research, Neuro experts need to make the automotive companies aware of the same through presentations and conferences. There are still some barriers e.g. UI / UX testing of App on which need to be overcome. Neuro experts need to accept these limitations and suggest studies to the companies where Neuroscience can be best used. We suggest, Neuroscience can be clubbed with traditional methods like qualitative research to overcome the barriers of identifying the 'why' behind the response of the participants. To increase the in-depth awareness of this technology which is effective but still at a nascent stage of adoption, we recommend presenting an actual case study during conferences / top management meetings and conducting free proof of concepts along with already awarded traditional studies.

6. Conclusion

This study tries to bridge the gaps observed in the earlier research. It attempts to bring together the views of organizations/brands and Neuro experts to increase the future use of Neuromarketing. Though Neuromarketing research is used by automotive organizations in India, primarily in advertisement and product testing, its overall adoption is limited. It is observed that Research companies and neuroscientists (academicians) must play a major role in increasing the adoption of Neuromarketing research by leveraging its strengths and overcoming the challenges identified in this research.

As the adaptation of Neuromarketing varies from country to country and sector to sector (Oliveira, 2014), the insights from this research paper further open more avenues for detailed research across countries and sectors. There is a further scope of quantification of the responses and conducting actual studies which compares the output of research studies using both traditional and neuromarketing methods.

Abstract

Purpose. Neuroscience used for conducting market research is called Neuromarketing. Though the effectiveness of Neuromarketing over traditional research has been proven, its adoption is very limited. The automotive sector is one of the biggest industries worldwide and due to lack of detailed research on the adoption of Neuromarketing in the Automotive space, authors have tried to bridge this gap. They have identified the current adoption of Neuromarketing and have suggested solutions to overcome barriers. This research will help Automotive brands, market research companies and Neuro experts to come up with relevant solutions to increase the usage of Neuromarketing

Design. The authors first reviewed any available literature related to the Automotive landscape. Then, in-depth discussions with Automotive players were conducted in order to clarify the Neuromarketing adoption in the current scenario. Finally, Neuro experts, viz. neuroscientists and research companies, were consulted for possible future solutions

Findings. Literature reviews and discussions with Automotive companies revealed that Neuromarketing adoption is limited as compared to traditional market research methods. Though the

majority are aware of Neuromarketing, limited companies have used it. It is mostly undertaken in advertisement and product testing, primarily using EEG and Eye tracking. Neuromarketing is perceived as being expensive and difficult to understand and having ethical concerns. It is also believed that Neuromarketing does not answer the 'why' behind the participants' responses
The paper also validated Simon's Bounded Rationality Theory where automotive organizations used conformity instead of maximum value in adoption of neuromarketing. Expert discussions clarified that most of the Neuromarketing limitations like ethics, cost, lower sample, lab setup, etc. mentioned by Automotive players can be overcome. Hence the next step is to take this science to maximum automotive players and make them aware of the development, conduct pilot studies, remove their inhibitions about Neuromarketing and complement it with traditional research methods.

Keywords: *Neuromarketing, Consumer Neuroscience, Automotive, Adoption.*

JEL Codes: M1, M5, M21, M31.

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