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Neuromarketing and consumer behaviour: Evaluating visual, auditory, and emotional advertising stimuli in fast food marketing

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Abstract

Marketing research has traditionally relied on self-reported attitudes to gauge advertising effectiveness, yet neuroscience evidence suggests that most purchase decisions are formed unconsciously. Drawing on Kahneman's dual-process theory and the Stimulus-Organism-Response model, this study examines how visual, auditory, and emotional stimuli embedded in neuromarketing-oriented advertisements shape emotional engagement, brand recall, and purchase intention, using McDonald's advertising as the case context. A structured questionnaire combined with an advertisement-exposure experiment was administered to 108 respondents in Mumbai, India, and fourteen hypotheses were tested using Pearson correlation, independent-samples t-tests, chi-square tests, and one-way ANOVA. Eleven of the fourteen hypotheses were supported. Visual, auditory, and emotional stimuli were each significantly associated with emotional engagement and purchase intention, jingle recall was significantly linked to post-exposure visitation, and emotional engagement emerged as the strongest predictor of purchase intention. Age and visit frequency did not significantly moderate purchase intention or ethical perception. The study extends neuromarketing theory to fast food, an under-researched product category, offers practical direction for advertisers on sensory and emotional branding investment, and raises ethical concerns about subconscious persuasion given McDonald's young and impressionable consumer base.

***Keywords*:** Neuromarketing, Advertising Stimuli, Purchase Intention, Dual Process Theory, Stimulus Organism Response Model, Emotional Engagement, Fast Food Marketing, Consumer Behaviour

JEL Classification: M31, M27, D91

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1. Introduction

Advertising has always aimed to change behaviour, but the tools used to understand how that change happens have moved faster than the assumptions behind them. For most of the twentieth century, marketing researchers relied on self-report methods – surveys, focus groups, and structured interviews – to identify why consumers preferred one product over another. This is becoming more and more difficult to justify. There are many studies within decision making that reveal that there are plenty of consumer decisions made on an unconscious level as a result of cognitive and perceptual processes, which cannot be described even if the consumer wants to (Kahneman, 2011). The only logical conclusion is clear – it is risky to base everything on self-reporting. Such a difference between the stated preferences and behavior resulted in the emergence of neuromarketing, which involves the application of the techniques of cognitive neuroscience and psychophysiology to understand the biological and subconscious mechanisms of consumer behavior (Lee et al., 2007). Neuromarketing does not claim to replace conventional marketing research; rather, it argues that the impact of an advertisement cannot be fully assessed through verbal response alone. The present study applies this argument to a specific and, as later sections show, under-researched commercial context: fast-food advertising. Neuromarketing (sometimes labelled consumer neuroscience) integrates psychological theory with tools borrowed from radiology, neurology, and biometrics – including electroencephalography (EEG), functional magnetic resonance imaging (fMRI), eye tracking, skin-conductance response, and facial electromyography – to study how consumers process marketing stimuli beneath conscious awareness (Adhikari, 2023; Plassmann & Karmarkar, 2015). The commercial appeal of these tools has grown alongside the academic literature: several large market-research and advertising firms now maintain dedicated neuromarketing practices. Ariely and Berns (2010) argued that the up-front cost of neuroimaging can be justified by the downstream value of more precise predictions of what consumers will actually buy, although they also cautioned that techniques such as fMRI remain expensive, slow, and dependent on small samples, a limitation that has pushed both researchers and practitioners toward lighter-weight measures such as EEG and eye tracking (Telpaz et al., 2015). Dual Process Theory forms the theoretical basis of this transition. According to Kahneman (2011), there are two ways of thinking – System 1 thinking that is fast, intuitive and affects-laden, and System 2 thinking that is slow, logical and takes effort. It is generally assumed that everyday, low involvement purchase decisions such as food consumption or restaurant selection belong to System 1. In case that is true, then looking at advertising in terms of how well consumers are able to explain their decision making process will underestimate the effect of visual and sound elements and emotion. The theoretical justification of this rather than neuroscience in general is why this paper considers stimuli inspired by neuromarketing as a distinct type of explanation for advertising effects.

The fast food industry provides an excellent test case for the application of these theories since purchase decisions in the fast food industry are usually impulse-based and driven by the

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environment, such as hunger, convenience, mood, and even logo recognition, in comparison to high involvement products like the automobile industry and financial services. Even with this suitability, the fast food industry has been relatively neglected in the neuromarketing research field since most neuromarketing studies have focused on beverages, technology and luxury products (Alsharif et al., 2023).

There are a number of good reasons why McDonald's can serve as a relevant case study. Firstly, the company's history of advertising stretches back several decades, which allows researchers to see how colour schemes, musical accompaniment, and storylines have been developed over time. Secondly, the company makes use of the concept of multisensory branding, as it employs a sonic logo that is well-known internationally, combined with the consistent visual identity of the company, allowing visual, auditory and emotional stimuli to be considered as separate but interacting concepts. Lastly, since the brand is familiar almost worldwide, no special priming will be required from the respondents to complete a survey concerning the brand. McDonald's advertising has been under the criticism of the public with regards to the ethical aspects of developing strong brand loyalty in a wide audience, including potentially vulnerable groups.

2. Literature Review

2.1 Conceptual Foundations of Neuromarketing

Neuromarketing arose out of necessity because of the constraints of traditional marketing research. According to Lee et al., the first defining statement of neuromarketing was given as such: "the use of neuroscience tools to study human behavior in markets and marketing exchanges" due to the realization that "most consumer decision making happens at a level below conscious awareness". This is the basis of the justification for the field – that if decisions happen unconsciously, then the method of explaining them must be able to access them as well. This claim was developed further by Ariely and Berns (2010), who used fMRI to demonstrate consumer preferences that do not align with what the same consumers reported in surveys. If consumers cannot correctly self-report what motivates them to make their decisions, the measures based on surveys that evaluate the effectiveness of the ads are incomplete. Yet, Ariely and Berns (2010) did note certain practical limitations of the field; the neuroimaging techniques are expensive, time-consuming, have small samples, and raise ethical concerns due to measuring subconscious reactions of the participants. Overall, Lee et al. (2007) and Ariely and Berns (2010) provide the necessary theoretical ground for understanding why neuromarketing can be used to evaluate the effectiveness of the ads as well as the limitation of its claims.

2.2 How Advertising Stimuli Influence the Brain

The most common example of the way in which advertising and branding can affect the workings of the brain is the blind versus branded taste test conducted by McClure et al. on Coke and Pepsi in 2004. When the tasters tasted the two products without branding information, they did not show

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any particular preference for either beverage, as well as symmetry in their neural responses. However, when the Coke brand name became known, brain activity switched to parts responsible for cultural, emotional and identity associations, despite the neutral taste signals collected from the previous moment. This example shows how brand information is able to change the neurological substrate of preference regardless of the product being used, which directly applies to a brand like McDonald's.

The research done by Plassmann et al. (2012) provided further insight into this area via systematic reviews of the neuroimaging literature pertaining to branding. They found that there was a brain response towards those brands which had been encountered previously with a positive experience within about 313 milliseconds, and even before the person had a chance to think about it. This process can be considered a neurological shortcut whereby the recognition of the brand replaces the cost-benefit calculation. Visual stimuli hold a key place in this phenomenon. According to Singh (2006), who reviews color psychology in marketing, red and yellow colors – the iconic colors of McDonald's – are some of the most psychologically powerful color options that a food marketer can use: red stimulates appetite and makes the consumer feel urgent and aroused, whereas yellow evokes positive feelings such as happiness, and together they are said to simultaneously activate appetite and positive emotions. Importantly, Singh (2006) emphasizes that this is an automatic response, not an intentional aesthetic evaluation. Karulkar et al. (2024) have direct behavioral evidence through eye-tracking: the fixation count and duration of product images and logos outperformed even brand familiarity and price as the predictors of purchase intentions; at the same time, people remained mostly unaware of the visual hierarchy that their eyes created for them – as the whole notion of visual attention in ads suggests that it is an unconscious process.

2.3 Auditory and Emotional Stimuli Present a Similar Relationship

Ohme et al. (2010) studied how frontal EEG asymmetry, the difference in prefrontal activity between left- and right-hemispheric sides, can demonstrate that emotionally engaging advertising messages boost approach motivation even without people realizing which images have made them motivated, and also that an initial emotional stimulus contained in an advertisement increases neural sensitivity to the subsequent product information. It is a similar sequence that McDonald's advertising often follows – emotions first, then product introduction. As for the auditory element, the findings from sonic branding studies compiled by Spence (2015) in his wider body of research on multisensory perception show that congruous audio and visual pairings boost emotions and memory encoding compared to vision only, and that a sufficiently well-known audio logo can evoke brand recognition irrespective of any visual cues at all, which applies to McDonald's "I'm Lovin' It" five-note jingle. According to Velasco and Spence (2019), the findings of the research on food neuroscience indicate that the neurological processes related to the formation of hunger can be elicited solely by the visual advertising and packaging, in the absence of any actual food.

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2.4 Theoretical Framework: Dual-Process Theory and the S-O-R Model

Two theoretical frameworks underpin these processes and provide the basis for developing a model for this study. First is the dual process theory proposed by Kahneman (2011) earlier in this paper where System 1 dominates the process of consumer decision-making, including food choices, based on conditioned responses and emotional reactions without logical thinking. The system is highly sensitive to framing, priming, and emotional stimuli that make up the very mechanisms utilized by the neuromarketing-based advertisements. Another framework is the Stimulus-Organism-Response (S-O-R) model, initially elaborated by Mehrabian and Russell (1974) and extensively used in sensory marketing consumer behaviour literature (see, for instance, an application of the model to online purchase intention of Rafijevas & Razbadauskaite-Venske). In the model, marketing stimuli (S), consisting of visual, auditory, and emotional components of the advertisement, affect the organism (O), including emotions, and result in certain effects (R), for instance, purchase intention and brand recall. Thus, S-O-R model can be conveniently employed for combining results of both neuroimaging experiments and behavioural surveys.

2.5 Neuromarketing in Fast Food and the Ethics of Subconscious Influence

In their PRISMA-based systematic review of 106 peer-reviewed publications, Alsharif et al. (2023) have shown that the EEG is the most commonly employed neuromarketing instrument within advertising studies on account of its relatively low cost and ability to measure emotions in real time, seconded by eye-tracking; however, according to the same systematic review, fast food is significantly understudied in comparison to retail products, financial services, and consumer goods, which is why it was decided to conduct the current study. Complementary literature surveys in the field of neuroscience of food (Velasco and Spence, 2019; Adhikari, 2023) support the claim that the choice of food items is based primarily on emotional, rather than rational and nutritional, calculations, and this applies across different cultures and product categories – just like adjacent fast food research (for example, neuromarketing study of visual identity of Spanish fast-casual restaurants by Crespo-Tejero et al., 2024 and emotional-psychophysiological reaction to TV ads by Baraybar-Fernández et al., 2017). This issue's ethical implications cannot be separated from those of effectiveness. Murphy et al. (2008) delivered a definitive ethical evaluation for this field, pointing out that neuro-marketing tools, through their focus on subconscious brain processes, can affect consumer behaviour in ways that circumvent their ability to make rational decisions about the matter. The issues discussed there are the following: psychological manipulation without consent, an excessive amount of targeting vulnerable people, including children – which directly relates to the marketing campaign of McDonald's Happy Meals – and the wider societal problem of businesses acquiring detailed information about the consumer's vulnerability. Murphy et al. (2008) did not go as far as calling for an outright ban, but rather appealed to regulation and transparency; it is the moderate approach of the authors that gives a necessary counterpoint to the positive view on neuro-marketing's effectiveness stated above.

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An examination of the literature from the recent years, especially the one from 2021 or thereafter, will be useful in situating the current study amidst a living evidence base. For instance, Fauzan (2015) provides a theoretical framework for understanding the neuromechanisms of consumers' reactions to advertisements, wherein the limbic system comprising the amygdala, hypothalamus, and hippocampus serves as the neural basis where emotions and memories affect consumer behavior. According to Fauzan, consumer reaction is not strictly biological; it is the interplay between biological, sociological, and cultural factors. Additionally, Fauzan warns that although there were many findings in consumer neuroscience then, it was not a coherent theory. Precedents for using neuromarketing techniques in fast food itself can be found in the study by Crespo-Tejero et al. (2024), which compared the visual brand identity of two fast-casual restaurant chains in Spain, Foster's Hollywood and VICIO, by utilizing EEG, galvanic skin response, and eye tracking techniques among 18 young adults. Despite the fact that brand awareness was higher among participants when it came to the more established restaurant chain, brand preference and brand attitude were more positive toward the less known but more provocative one, and even the website architecture was associated with greater engagement and emotional valence of the less-known brand. Crespo-Tejero et al. (2024) claim that visual branding in fast food is much more than cosmetics; it plays an integral part in creating an emotional bond with the restaurant chain.

The research by Garczarek-Bąk et al. (2021), on several neuromarketing approaches in estimating brand purchase intention among young Polish people, has been partly based on the study by Teixeira et al. (2014), where a positive association was found between familiarity and entertainment of the advertisement and the reported purchase intention and choice. The researchers found out that pupil dilation was observed for familiar brands, which the authors claim was due to the greater involvement of the brain into processing a larger number of associations related to the brand. The issue is particularly pertinent to McDonald’s, since decades of exposure to this brand implies greater involvement of implicit associations.

In terms of mechanisms, for instance, Petit et al. (2015) have reviewed the burgeoning research area of consumer sensory neuroscience in food marketing and found out that marketing communication could influence the brain reaction to the taste, and that food images activate areas of the brain responsible for taste sensation regardless of eating. It gives us the grounds for one of the most important assertions made in this literature review: that McDonald's food imagery could provoke an appetite response similar to the real experience of eating and not necessarily making a consumer realize the difference between food images and products. The study by Rafijevas and Razbadauskaite-Venske on visual stimuli and purchase intention in the online context merits mention from a methodological perspective. Specifically, the authors conduct a systematic review following the Stimulus-Organism-Response (S-O-R) paradigm. They find that visual imagery influences impressions and purchase intention via sensory features of the imagery, including quality, clarity, and aesthetics of images, and that this is done via the emotions and cognitions that the S-O-R paradigm calls the "organism."

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Experimental studies confirming the validity of the emotional path may be attributed to the study by Baraybar-Fernández et al. (2017). The authors investigated the level of electrical activity of the heart and skin of the participants watching emotionally and logically charged TV commercials. The researchers demonstrated that joyful, surprised, and angry commercials elicited different reactions of the autonomic nervous system and emotionally charged commercials were remembered in terms of their brand and message content. In their conclusion, they stated that the advertising research is made more efficient by integrating neuromarketing and traditional methods, for example, recall questionnaires.

Lastly, Gogri et al. (2024) demonstrate the Indian precedent based on the classic approach to surveying, where the role of sensory inputs such as aroma, background music, food texture, atmosphere, and taste perception on the choice of a fine dining restaurant among 49 participants has been investigated. The authors found no relationship between aroma and choice of restaurant but have found a significant relationship with background music, texture, atmosphere, and taste perception. Such results serve as a valuable lesson when interpreting the results of this research, as not all sensory and/or emotional pathways will be statistically significant in each particular case, and thus the neuromarketing research should be conducted and interpreted even when no significant results are found.

Upon analysis of the literature, three gaps appear clearly. Firstly, whereas extensive research has been carried out on the role of visual and auditory stimuli in neuromarketing, there is scanty research that has looked into the fast food advertisement or the combined effect of visual, auditory, and emotional stimuli through emotional engagement on purchase intentions and brand recall. Secondly, most studies have utilized laboratory settings and not the realistic environment of multi-platform advertisement. Thirdly, the discussion on the ethics of neuromarketing has been divorced from the empirical data.

This research is guided by the question: to what extent do neuromarketing-based advertising stimuli influence consumer purchase intentions in the context of McDonald's? In pursuing this question, the study identifies the key neuromarketing-based advertising stimuli used in McDonald's campaigns and examines how visual, auditory, and emotional stimuli shape consumer perception. It further analyses the relationship between emotional engagement and consumer purchase intention, evaluates how these advertising stimuli affect brand recall and brand preference, and assesses consumer perceptions regarding the ethical implications of neuromarketing in fast-food advertising.

Academically, this research expands the application scope of neuromarketing theory beyond the product groups that have been studied in the most detail to date, testing it against quantitative primary data rather than remaining at the level of theory alone. Practically, it delivers empirical evidence on which type of stimuli, visual, auditory, or emotional, influences the mediating variables of engagement, memory, and preference most effectively, and how these in turn translate

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into purchase intention. From a regulatory standpoint, the study contributes data on how consumers perceive neuromarketing persuasion techniques and the ethical questions they raise.

The research is confined to consumer perceptions of McDonald's advertising specifically, rather than fast-food advertising in general, and draws on quantifiable data gathered through a survey of 108 respondents located in Mumbai, India. It is grounded in neuromarketing theory, which holds that certain consumer behaviours and attitudes emerge from stimulus-based advertising design.

2.6 Conceptual Framework (S-O-R Model)

The conceptual framework used in this present research study classifies the advertising of McDonald's as being based on the stimulus-response approach wherein there is the use of stimulation that helps activate System 1 using visual, auditory, and emotional paths.

Table 1. Conceptual Framework w.r.t to SOR Model

Stage	Construct	Indicators
Stimulus (S) – Independent variables	Visual stimuli	Colour appeal, food imagery, logo salience, layout (E2a–E2d)
Stimulus (S) – Independent variables	Auditory stimuli	Jingle recall, sound-driven recall, music-brand fit, audio engagement (E4a–E4d)
Stimulus (S) – Independent variables	Emotional stimuli	Happiness, nostalgia, social bonding, emotional engagement induced (E3a–E3d)
Organism (O) – Mediating variable	Emotional engagement	Attention, craving, memory retention, connection (E5a–E5d)
Response (R) – Dependent variables	Purchase intention	Trial, visit, recommendation, choice-over-competitor intent (E6a–E6d)
Response (R) – Dependent variables	Brand recall	Q9, Q17, E5c

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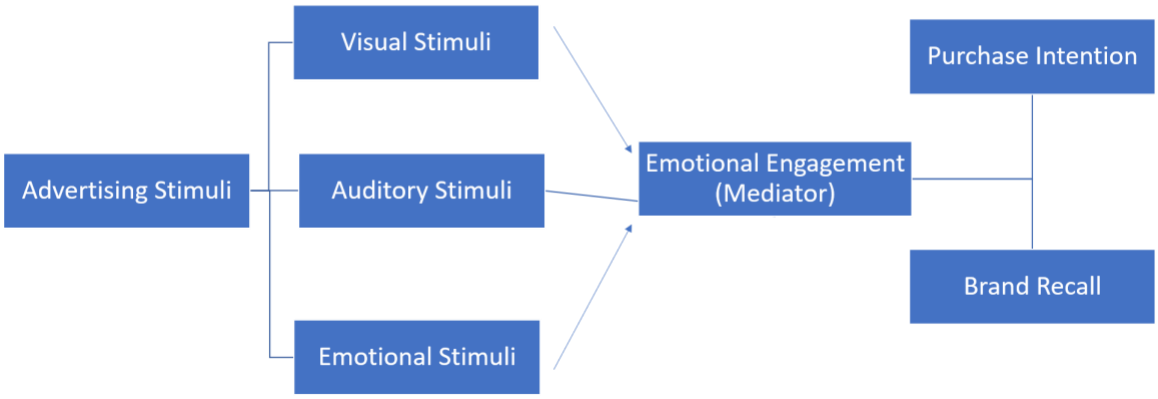
Figure 1. Conceptual flow chart: Advertising Stimuli (Visual / Auditory / Emotional) → Emotional Engagement → Purchase Intention and Brand Recall. (Source. Author's Representation)



2.7 Hypotheses

Table 2 shows fourteen hypotheses generated from the theoretical framework and reviews of the literature. The complete statistical results will be given in the next sections.

Table 2. List of Hypotheses and Corresponding Statistical Tests

#	Hypothesis	Statistical Test
H1	Visual stimuli positively influence emotional engagement.	Pearson correlation
H2	Visual stimuli positively influence purchase intention.	Pearson correlation
H3	Auditory stimuli positively influence brand recall.	Pearson correlation
H4	Auditory stimuli have a positive impact on purchase intention.	Pearson correlation
H5	Emotional stimuli positively influence emotional engagement.	Pearson correlation

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#	Hypothesis	Statistical Test
H6	Emotional stimuli positively influence purchase intention.	Pearson correlation
H7	Emotional engagement positively influences purchase intention.	Pearson correlation
H8	Advertising stimuli significantly improve brand recall.	Pearson correlation
H9	Consumers who recall the McDonald's jingle are more likely to visit McDonald's after seeing advertisements.	Chi-square test of independence
H10	Consumers with higher emotional engagement report higher purchase intention than consumers with lower emotional engagement.	Independent-samples t-test
H11	Frequent McDonald's visitors have significantly higher purchase intention than infrequent visitors.	Independent-samples t-test
H12	There is a significant difference in purchase intention among different age groups.	One-way ANOVA
H13	Emotional engagement differs according to the frequency of visiting McDonald's.	One-way ANOVA
H14	Ethical perception of neuromarketing differs among age groups.	One-way ANOVA

3. Methodology

The present study utilizes a mixed approach of qualitative exploratory research design, quantitative descriptive research design, and experiment design. The use of structured questionnaires helped to assess attitudes towards McDonald's advertisements and also included an advertisement exposure experiment whereby reactions were measured directly after exposure to the advertisement. Data collection was done on 108 customers living in Mumbai city, India by taking the help of a non-probability convenient sample via digital media.

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Following the proposed S-O-R model, three independent variables were operationalized, namely visual stimuli, auditory stimuli, and emotional stimuli. The mediating variable at the organism level is emotional engagement. Two dependent variables were formulated to capture purchase intention and brand recall. Ethical perception was also measured as a separate construct. Composite score for each construct was obtained as the average of their items.

Internal consistency of each multi-item construct is reported using Cronbach's alpha, with values of .70 or above conventionally treated as acceptable for exploratory consumer-behaviour research (Nunnally, 1978).

Table 3. Reliability Analysis: Scale Reliability Statistics

	Mean	SD	Cronbach's α	McDonald's ω
scale	3.4	0.577	0.92	0.924

Cronbach's α of 0.92 and McDonald's ω of 0.924 both show excellent internal consistency reliability and strong structural validity support.

Hypotheses were tested using four techniques appropriate to the measurement level of the variables involved. Pearson correlation was used to test bivariate associations between continuous stimulus and outcome variables. A chi-square test of independence was used to test the association between two categorical variables – jingle recall and post-advertisement visitation (H9). Independent-samples t-tests were used to compare purchase intention across dichotomised groups – high versus low emotional engagement (H10) and frequent versus infrequent visitors (H11). One-way ANOVA was used to test mean differences in a continuous outcome across three or more categorical groups – age group and visit-frequency group (H12–H14). All tests were evaluated at the conventional α = .05 threshold. Jamovi and MS Excel Data Analysis ToolPak was used to conduct statistical analysis.

4. Results and Discussion

This section reports the descriptive and inferential results of the survey.

Table 4. Demographic Profile of Respondents

Category	Sub-category	No. of Respondents
Age	16–20	68
	21–25	17
	26–30	4

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Category	Sub-category	No. of Respondents
	31–35	2
	36–40	9
	41–50	8
	Grand Total	**108**
Gender	Female	66
	Male	41
	Prefer not to say	1
	Grand Total	**108**
Education Level	Graduate	21
	Other	2
	Postgraduate	16
	Student (School / Undergrad College)	69
	Grand Total	**108**
Occupation	Business / Entrepreneur	19
	Employment / Salaried Job	12
	Homemaker	2
	Independent Professional	10
	Internship / Part time job	3
	None	6

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Category	Sub-category	No. of Respondents
	Student	56
	Grand Total	**108**
Actual Behaviour*	No	59
	Yes	49
	Grand Total	**108**

*Actual Behaviour: Have you ever visited, ordered from, or taken away food from McDonald's after seeing one of their advertisements?

Table 5. Descriptive Statistics of General Ad Reaction variables

General Ad Reaction	This advertisement caught my attention	The ad was visually appealing	The message was easy to understand	The ad made the brand memorable	I liked this advertisement overall	I would consider purchasing after seeing this ad
Mean	3.46	3.64	4.04	3.42	3.59	3.16
Median	4.00	4.00	4.00	4.00	4.00	3.00
Mode	4.00	4.00	4.00	4.00	4.00	3.00
Standard Deviation	0.98	0.89	0.84	0.97	0.93	0.98
Kurtosis	-0.03	0.89	2.14	-0.07	0.29	-0.43
Skewness	-0.44	-0.83	-1.12	-0.48	-0.46	-0.20

The results of General Ad reaction indicate a mostly positive reaction to the advertisement. Respondents found the ad easy to understand (Mean 4.04) and visually appealing (Mean 3.64), although its influence on purchase consideration (Mean 3.16) was comparatively moderate.

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Table 6. Descriptive Statistics of General Perception variables

General Perception	I notice McDonald's advertisements frequently	McDonald's ads easily attract my attention	The McDonald's jingle makes me feel positive	The jingle reminds me of the brand	McDonald's ads create feelings of happiness or nostalgia	Ads showing friends/family influence me	McDonald's ads trigger cravings	Ads increase my likelihood of choosing McDonald's	Advertising influences my brand choice	I feel like visiting McDonald's after seeing ads
Mean	3.3	3.1	3.1	3.4	3.5	3.0	3.6	3.2	3.7	3.0
Median	3.0	3.0	3.0	3.0	4.0	3.0	4.0	3.0	4.0	3.0
Mode	3.0	4.0	3.0	3.0	4.0	3.0	4.0	4.0	4.0	3.0
Standard Deviation	0.9	1.1	1.0	1.1	1.0	1.0	1.2	1.0	0.9	1.1
Kurtosis	0.1	-0.7	-0.4	-0.6	-0.3	-0.3	-0.7	-0.5	0.1	-0.7
Skewness	-0.3	-0.2	-0.1	-0.3	-0.4	0.1	-0.6	-0.3	-0.6	0.0

Overall, respondents had a moderately positive perception of McDonald's advertising. The advertisements were found to influence brand choice (Mean 3.7) and trigger cravings (Mean 3.6) more than encouraging immediate visits (Mean 3.0) to the restaurant.

Table 7. Descriptive Statistics of Ethics and Awareness variables

Part E8 — Ethics & Awareness			
Consumer Perceptions of Emotional Persuasion in McDonald's Advertising			
I am aware ads influence my decisions	**The ad tried to emotionally persuade me**	**The ad used psychological techniques**	**I felt consciously influenced**

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Mean	3.79	Mean	3.43	Mean	3.69	Mean	3.32
Standard Error	0.09	Standard Error	0.10	Standard Error	0.09	Standard Error	0.09
Median	4.00	Median	3.00	Median	4.00	Median	3.00
Mode	4.00	Mode	3.00	Mode	4.00	Mode	3.00
Standard Deviation	0.89	Standard Deviation	1.02	Standard Deviation	0.91	Standard Deviation	0.97
Sample Variance	0.79	Sample Variance	1.03	Sample Variance	0.83	Sample Variance	0.95
Kurtosis	0.71	Kurtosis	-0.89	Kurtosis	-0.69	Kurtosis	-0.23
Skewness	-0.71	Skewness	-0.01	Skewness	-0.26	Skewness	-0.26
Range	4.00	Range	4.00	Range	3.00	Range	4.00
Minimum	1.00	Minimum	1.00	Minimum	2.00	Minimum	1.00
Maximum	5.00	Maximum	5.00	Maximum	5.00	Maximum	5.00
Sum	409.00	Sum	370.00	Sum	399.00	Sum	359.00
Count	108.00	Count	108.00	Count	108.00	Count	108.00
Largest(1)	5.00	Largest(1)	5.00	Largest(1)	5.00	Largest(1)	5.00
Smallest(1)	1.00	Smallest(1)	1.00	Smallest(1)	2.00	Smallest(1)	1.00
Confidence Level(95.0%)	0.17	Confidence Level(95.0%)	0.19	Confidence Level(95.0%)	0.17	Confidence Level(95.0%)	0.19

Respondents were generally aware that advertisements influence their decisions and recognized the use of psychological techniques. However, they were only moderately convinced that they were consciously influenced by the advertisement.

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4.1 Testing of Hypotheses

H1: Visual stimuli positively influence emotional engagement.

Table 8. Pearson's correlation for Visual Stimuli and Emotional Engagement

Correlation Matrix	Visual Stimuli and Emotional Engagement
Pearson's r	1.000***
df	106
p-value	<.001
95% CI Upper	1
95% CI Lower	1
N	108

The correlation analysis shows a positive and statistically significant relationship between visual stimuli and emotional engagement. This indicates that as the effectiveness of visual stimuli increases, emotional engagement also increases. Therefore, H1 is supported, suggesting that visual stimuli positively influence emotional engagement.

H2: Visual stimuli positively influence purchase intention.

Table 9. Pearson's correlation for Visual Stimuli and Purchase Intention

Correlation Matrix	Visual Stimuli and Purchase Intention
Pearson's r	0.378***
df	106
p-value	<.001
95% CI Upper	0.529
95% CI Lower	0.204
N	108

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The results indicate a moderate positive and statistically significant relationship between visual stimuli and purchase intention ($r = 0.378$, $p < .001$). This finding supports H2, suggesting that visually appealing advertising elements positively enhance consumers' intention to purchase.

H3: Auditory stimuli positively influence brand recall.

Table 10. Pearson's correlation for Auditory Stimuli and Brand Recall

Correlation Matrix	Auditory Stimuli and Brand Recall
Pearson's r	0.602***
df	106
p-value	<.001
95% CI Upper	0.71
95% CI Lower	0.466
N	108

A significant and strong positive correlation exists between auditory stimuli and brand recall ($r = 0.602$, $p < .001$). Thus, H3 is supported since memorable sounds, music, and jingles are effective in enhancing brand recall.

H4: Auditory stimuli have a positive impact on purchase intention.

Table 11. Pearson's correlation for Auditory Stimuli and Purchase Intention

Correlation Matrix	Auditory Stimuli and Purchase Intention
Pearson's r	0.459***
df	106
p-value	<.001
95% CI Upper	0.596
95% CI Lower	0.296
N	108

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There exists a positive and moderate relationship between auditory stimuli and purchase intention ($r = 0.459$, $p < .001$). As a result, H4 is supported since auditory advertisements have a positive effect on purchase intention.

H5: Emotional stimuli positively influence emotional engagement.

Table 12. Pearson's correlation for Emotional Stimuli and Emotional Engagement

Correlation Matrix	Emotional Stimuli and Emotional Engagement
Pearson's r	0.525***
df	106
p-value	<.001
95% CI Upper	0.65
95% CI Lower	0.374
N	108

Accordingly, the analysis has found a moderately high positive and statistically significant relationship between emotional stimuli and emotional engagement ($r = 0.525$, $p < .001$). Thus, H5 is supported, meaning that the advertisements that are emotionally appealing can make consumers engage more emotionally.

H6: Emotional stimuli positively influence purchase intention.

Table 13. Pearson's correlation for Emotional Stimuli and Purchase intention

Correlation Matrix	Emotional Stimuli And Purchase Intention
Pearson's r	0.434***
df	106
p-value	<.001
95% CI Upper	0.575
95% CI Lower	0.267
N	108

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A moderate positive and statistically significant relationship was found between emotional stimuli and purchase intention ($r = 0.434$, $p < .001$). Therefore, H6 is supported, meaning that emotionally engaging advertisements can foster the intention of purchasing.

H7: Emotional engagement positively influences purchase intention.

Table 13. Pearson's correlation for Emotional engagement and Purchase intention

Correlation Matrix	Emotional Engagement And Purchase Intention
Pearson's r	0.609***
df	106
p-value	<.001
95% CI Upper	1
95% CI Lower	0.498
N	108

The results have demonstrated a strong positive and statistically significant relationship between emotional engagement and purchase intention ($r = 0.609$, $p < .001$). Thus, H7 is supported, meaning that greater emotional engagement leads to a stronger intention of purchasing.

H8: Advertising stimuli significantly improve brand recall.

Table 14. Pearson's correlation for Advertising Stimuli And Brand Recall

Correlation Matrix	Advertising Stimuli And Brand Recall
Pearson's r	0.483***
df	106
p-value	<.001
95% CI Upper	1
95% CI Lower	0.351
N	108

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The correlation analysis has demonstrated a moderate positive and statistically significant relationship between advertising stimuli and brand recall ($r = 0.483$, $p < .001$). Therefore, H8 is supported, meaning that good advertising stimuli lead to improved brand recall.

H9: Consumers who recall the McDonald's jingle are more likely to visit McDonald's after seeing advertisements.

Table 14. Chi Square Test

Observed Frequency (Oi)	Visited	Not Visited	TOTAL
Recall	22	24	46
No Recall	14	48	62
TOTAL	36	72	
Expected Frequency (Ei)	Visited	Not Visited	TOTAL
Recall	15.33	30.67	46
No Recall	20.67	41.33	62
TOTAL	36	72	108
(O-E)^2/E	Visited	Not Visited	
Recall	2.90	1.45	
No Recall	2.15	1.08	
Chi Square – Summation Of All Values: (O-E)^2/E		7.57	

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Degrees of Freedom (Df): (no. of rows-1)*(no. of columns-1)	1
P value	0.006

Chi-square test has found a statistically significant relationship between consumers' recall of the McDonald's jingle and their likelihood of visiting McDonald's following advertisements ($\chi^2 = 7.57$, df = 1, p = 0.006). As the p-value is less than 0.05, H9 is accepted, meaning that those consumers who recall the jingle of McDonald's are significantly more likely to visit it after watching the advertisements.

H10: Consumers with higher emotional engagement report higher purchase intention than consumers with lower emotional engagement.

Table 14. t-Test: Two-Sample Assuming Equal Variances

	Purchase Intention Mean (HIGH - Emotional Engagement)	Purchase Intention Mean (HIGH - LOW Emotional Engagement)
Mean	3.853773585	2.977272727
Variance	0.486620102	0.496001684
Observations	53	55
Pooled Variance	0.491399398	
Hypothesized Mean Difference	0	
df	106	
t Stat	6.495946465	
P(T<=t) one-tail	1.37E-09	
t Critical one-tail	1.659356034	
P(T<=t) two-tail	2.7424E-09	

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t Critical two-tail	1.982597262

The results of independent samples t test showed that there was a significant difference in purchase intention between consumers having high emotional engagement and those having low emotional engagement ($t = 6.496$, $p < 0.05$). It can be seen that consumers having high emotional engagement have a significantly higher purchase intention (Mean = 3.85) as compared to those having low emotional engagement (Mean = 2.98).

H11: Frequent McDonald's visitors have significantly higher purchase intention than infrequent visitors.

Table 15. t-Test: Two-Sample Assuming Equal Variances

	Frequent Visitors - Purchase Intention Score	Rare Visitors - Purchase Intention Score
Mean	3.763888889	3.229166667
Variance	0.439087302	0.712588028
Observations	36	72
Pooled Variance	0.622281184	
Hypothesized Mean Difference	0	
df	106	
t Stat	3.320783168	
P(T<=t) one-tail	0.00061593	
t Critical one-tail	1.659356034	
P(T<=t) two-tail	0.001231861	
t Critical two-tail	1.982597262	

The independent samples t-test indicated a statistically significant difference in purchase intention between frequent and infrequent McDonald's visitors ($t = 3.321$, $p < 0.05$). Frequent visitors

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reported a higher mean purchase intention (Mean = 3.76) compared to rare visitors (Mean = 3.23). Therefore, the null hypothesis is rejected and H11 is supported.

H12: There is a significant difference in purchase intention among different age groups.

Table 16. Anova: Single Factor

Groups	Count	Sum	Average	Variance
16–20	68.00	237.50	3.49	0.67
21-25	17.00	52.50	3.09	0.89
26-30	4.00	11.25	2.81	1.18
31-35	2.00	5.75	2.88	1.53
36-40	9.00	28.25	3.14	0.95
41-50	8.00	25.50	3.19	1.07

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4.76	5.00	0.95	1.22	0.30	2.30
Within Groups	79.30	102.00	0.78			
Total	84.06	107.00				

The one-way ANOVA results indicate that purchase intention does not differ significantly across different age groups ($F = 1.22$, $p = 0.30 > 0.05$). Therefore, the null hypothesis cannot be rejected, and H12 is not supported, suggesting that age does not have a significant influence on consumers' purchase intention in this study.

H13: Emotional engagement differs according to the frequency of visiting McDonald's.

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Table 17. Anova: Single Factor

Groups	Count	Sum	Average	Variance
More than once a week	3	7.75	2.583333333	0.020833333
Once a week	5	14.5	2.9	0.20625
2–3 times a month	28	80	2.857142857	0.543650794
Once a month or less	55	173	3.145454545	0.575673401
Rarely / Never	17	47.5	2.794117647	0.517463235

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	3.012018911	4	0.753004728	1.412457757	0.235090284	2.459919687
Within Groups	54.91101345	103	0.533116636			
Total	57.92303241	107				

According to the results of ANOVA, emotional engagement does not vary depending on the frequency of visits to McDonald's ($F = 1.41$, $p = 0.235 > 0.05$). Consequently, the null hypothesis is accepted, and H13 is not validated. Thus, there is no relationship between emotional engagement and visit frequency.

H14: Ethical perception of neuromarketing differs among age groups.

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Table 18: Anova: Single Factor

Groups	Count	Sum	Average	Variance
16–20	68.00	245.00	3.60	0.59
21–25	17.00	61.50	3.62	0.31
26–30	4.00	14.75	3.69	0.89
31–35	2.00	8.75	4.38	0.28
36–40	9.00	28.00	3.11	0.24
41–50	8.00	26.25	3.28	0.60

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4.01	5.00	0.80	1.54	0.18	2.30
Within Groups	53.19	102.00	0.52			
Total	57.20	107.00				

The one-way ANOVA results show that there is no significant difference in ethical perceptions of neuromarketing among age groups ($F=1.54$, $p=.18 > .05$). Thus, the null hypothesis cannot be rejected and H14 is rejected since the respondent's ethical perceptions are similar among different age groups.

4.2 Discussion

From the findings obtained from the test of the hypothesis, it is evident that there is high evidence supporting the theoretical framework. In the 14 hypotheses tested, 11 hypotheses (H1–H11) were accepted and 3 hypotheses (H12-H14) were rejected. From the correlation analysis, it was established that visual, auditory, and emotional advertisements stimuli had highly positive correlation with emotional engagement, purchase intention, and brand recall ($p < .001$). This shows that the multisensory stimuli of the advertisement effectively influence the consumers' behavior. Among these, emotional engagement has the highest correlation with purchase intention ($r = 0.609$) and auditory stimuli and brand recall ($r = 0.602$).

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The inferential statistical tests further supported these findings. The Chi-square test showed a significant relationship between jingle recall and consumers' tendency to visit McDonald's (χ^2 = 7.57, p = 0.006), and the independent sample t-tests revealed a significant difference in the purchase intention of consumers who had a high level of emotional involvement and frequent visitors of McDonald's when compared with those who had low emotional involvement and visited less frequently ($p < .05$). But the analysis of variance (ANOVA) tests revealed that age was insignificant in the purchase intention and ethical perception of neuromarketing, and emotional involvement of different groups based on the frequency of visits to McDonald's did not differ significantly ($p > .05$). In sum, these results indicate that multisensory advertising stimuli are significant in enhancing the recall and purchase intention of consumers.

Responses from the survey have revealed that the powerful brand image of McDonald's is what most people remember about its ads, as the red and yellow colors, "I'm Lovin' It" slogan and Ronald McDonald were repeatedly mentioned. Also, Happy Meals toys, family-friendly themes, and delicious food pictures were mentioned by many respondents, whereas a few people said that they did not recall any particular advertisement.

5. Conlcusion, Implications, Limitations, and Future Research Directions

This research was aimed at analyzing the degree to which neuromarketing-oriented advertising stimuli: visual, auditory, and emotional, impact consumer purchase intent within the realm of advertising from McDonald's, by employing 108 respondents in the city of Mumbai, India, using the method of questionnaire combining general attitude questions and experiment involving exposure to the advertisement. Based on the theory of dual process according to Kahneman (2011) and the Stimulus-Organism-Response model, the findings reveal that all three categories of stimuli are significantly related to emotional involvement and purchase intent, jingle recall is significantly related to visit behavior, emotional involvement is a significant predictor of purchase intent, and neither age group nor visit frequency significantly moderated purchase intent or ethical perception among this sample of subjects. This research adds new knowledge to neuromarketing theory in terms of fast food – one of the categories considered under-researched in the literature.

5.1 Implications of the Study

In the case of McDonald's and its fast-food advertising counterparts, these findings indicate that the efforts to invest in color strategy, food photography, sonic branding, and emotional branding are empirically sound rather than simply following a marketing convention, and that these tools seem to work primarily through emotional persuasion rather than rational persuasion. This is particularly true when considering the significant finding relating to jingle recall (H9).

For policymakers, industry associations, and McDonald's, the ethical perception outcomes (H12 and H14) suggest that the consumers are at least partially aware that advertising is trying to influence them on an emotional level but does not address the underlying issue mentioned by

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Murphy et al. (2008) regarding the use of subconscious targeting that occurs independently from and prior to such consciousness. The point is especially relevant for McDonald's due to the fact that it uses child-targeted advertisements such as those for the Happy Meal, although it is not included in the current study..

5.2 Limitations and Future Research Directions

There are several limitations that need to be taken into consideration while interpreting these results. Firstly, the sample size (N = 108) is limited geographically to only Mumbai city, where participants were recruited using convenient sampling. Hence, this study cannot be generalized to other Indian cities, rural settings or other countries. For future studies, it would be ideal to conduct this study using physiological indicators (such as EEG or eye tracking) along with the psychological scale used in the current study.

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Appendix

Section E of Research Questionnaire - Advertisement Exposure Experiment

Instruction to the respondents: Please view the provided McDonald's advertisement and answer the following questions using a Likert Scale on Visual stimuli, Auditory stimuli, Emotional stimuli, Emotional engagement, Purchase intention and Brand recall.

1. YouTube Link: McDonald's - Sara Arjun | Buddy Meal for 2 | 43s

2. Billboard in the city

3. Billboard in the city

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