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Evaluation of Consumer Behavior Responsiveness to Neuromarketing with an Emphasis on Consumer Loyalty Based on Oliver's Model

Saeid. Farjam[1], HamidReza. Soleymani[2*], Neda. Ahmadi Goltepe[2], Masoume. Afkari Samareen[3], Ali. GolAmini[3], Hassan. Ansari[4], Ghafar. Kayani[3], Saeed. Yousefzadeh[3]

[1] Assistant Professor, Department of Business Administration, Payam Noor University, Tehran, Iran
[2] Department of Business Administration, International Affairs Center, Payam Noor University, Tehran, Iran
[3] Department of Business Management, International Affairs Center, Payam Noor University, Tehran, Iran
[4] Business Management Department, International Affairs Center, Payam Noor University, Tehran, Iran

*** Corresponding author email address**: soleimani.h55@yahoo.com

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A B S T R A C T

Objective: The aim of this study is to explore green research and development (R&D) in the home appliance industry.

Methods and Materials: This research is applied in nature, and the data collection method is descriptive-survey. Initially, by reviewing the literature and using qualitative content analysis, 30 factors were extracted as indicators for green development and formulation, categorized into five dimensions: green management, product and stakeholder performance, internal environment management, green innovation, and energy and resource consumption management. In the second stage, the fuzzy Delphi technique was employed, with a two-stage survey conducted among 15 experts selected through purposive sampling to achieve group consensus and filter the findings from the first stage. Finally, to assess the opinions of employees in the home appliance industry regarding green R&D indicators, a questionnaire was distributed among 170 employees, selected through Cochran's formula and simple random sampling. The results were analyzed using SPSS software and a one-sample t-test.

Findings: The findings showed that all these indicators were significantly identified as green R&D indicators in the home appliance industry at a 95% confidence level. Based on the results, the product design improvement indicator, with an average score of (4.18), received the highest rating from employees. This was followed by access to new markets and customers with an average score of (4.14), a green image of the company with an average score of (4.11), green product innovation with an average score of (4.10), and enhancing the company's green position with an average score of (4.02), respectively.

Conclusion: The findings highlight the significance of improving product design, accessing new markets, and promoting a green company image as crucial factors for achieving sustainable development.

Keywords: *Neuromarketing, Consumer Behavior, Consumer Loyalty, Cognitive Loyalty, Emotional Loyalty, Intentional Loyalty, Behavioral Loyalty.*

1 Introduction

Today, the world is rapidly changing, and modern humans are expanding their knowledge in many fields at a dizzying pace (Hamidi et al., 2022). Alongside the continuous growth of technology, the understanding of humans, as a key factor in these transformations, takes center stage. Marketing, like other sciences, has focused its development path on human emotions (Anjorin, 2024; Chang et al., 2021). It is clear that humans make purchasing decisions based on processes that occur in the brain. However, the brain deals with highly complex decisions and can conceal these decisions from the individual, so they may not know how they made such decisions (Al-Nafjan, 2022). Meanwhile, neuroscientists have attempted to apply their knowledge to marketing. The approach derived from this effort is neuromarketing (Wang, 2024).

Neuromarketing is an interdisciplinary science that is rapidly emerging in consumer research worldwide. It is also considered a creative field in marketing research, challenging traditional marketing models to improve the understanding of purchasing behavior processes (Ramadhani & Anggrainie, 2023). Neuromarketing is a method that examines the decision-making process of customers when purchasing (Behl et al., 2023; Singh, 2023; Vuković, 2023).

Neuromarketing studies can be pursued in various areas depending on the marketing objective. Market segmentation is a practical way to divide customers based on their needs and preferences. This is often done with demographic data, such as age, or psychological data, like excitability. However, it is also possible to categorize individuals based on brain differences that cannot be directly extracted through demographic or psychological data (Hamidi et al., 2022). Pricing strategy is one of the successful experiences of using neuromarketing (Dehghanpouri et al., 2016). Additionally, new product development and branding are other promising areas for applying neuromarketing. In one of the earliest studies on neuromarketing, McClure et al. found that brain activity in response to drinking Coca-Cola and Pepsi was influenced by the brands of these beverages. Studies like these have the potential to further investigate the brain's response to emotional data (such as taste) and brand information on labels (Alsharif et al., 2023; Bojić et al., 2021).

One of the most important areas of customer behavior research is the study and examination of customer loyalty. One of the key theories in marketing regarding loyalty states that a slight increase in loyal customers can significantly increase the profitability of a business (Iloka & Onyeke, 2020). Industry stakeholders are well aware of the numerous benefits of customer loyalty and strive to increase it through various means. However, most studies have only examined this factor in the context of repeat purchases, while its dimensions are far broader (Hsu & Chen, 2020; Javor et al., 2013). On the other hand, another field that has witnessed significant changes is advertising. It is clear that everyone views advertising as a crucial tool for reaching customers (Sarmast, 2017). One of the most important aspects of advertising is media advertising. Media advertising is defined as the channels through which messages are delivered to the audience. In this message transmission, the content is influenced by the communication medium. The sender must deliver their message in the form of text (books and newspapers), images (films or television), or sound (radio) (Hsu & Chen, 2020). In delivering the message, attention must be paid to qualitative aspects, as this is a key factor in the credibility of the media.

Many discussions have been raised regarding the effectiveness of media advertising, but the concepts of interactivity and media capacity are among the most important. These two concepts have gained a more prominent role with the expansion of modern communication technologies, challenging the simple communication model (the process of direct, one-way transmission of information) from the source to the audience. The possibility of receiving feedback and the capacity to analyze this feedback have become more significant (Hamidi et al., 2022; Mukherjee et al., 2023). Studies have shown that global media advertising costs have increased sharply, rising from $11.36 billion in 2013 to $17.74 billion in 2014, an increase of 56.2%. Any form of advertising imposes significant costs on companies. One of the best ways to reduce advertising costs is to gain loyal customers. It has been previously stated that loyal customers are highly beneficial to companies. They advertise for the company at no cost and are always considered strong supporters of the business (Pasaribu et al., 2023; Ramadhani & Anggrainie, 2023).

Loyalty is defined as the reuse of a product or the repeat purchase of a product or service. Given the intense competition and the various promotions and pricing strategies in the market, organizations are looking for strategies to enhance customer loyalty. It can be boldly stated that increasing loyal customers is the ultimate goal of all advertising processes; thus, various theories and models

IJIMOB
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of customer loyalty have been reported (previous source). Over the past decades, marketing studies have sought to explain and predict the effectiveness of advertising through various methods. In most cases, conventional techniques have not been able to achieve this. Since emotions are a powerful mediating factor in how customers process a message, understanding and modeling cognitive reactions to sales messages has been a methodological challenge (Akoglu & Özbek, 2022; Jain et al., 2018; Salem & Salem, 2019; Tabelessy, 2024).

For example, researchers initially attempted to study consumers' ability to report their feelings about a particular piece of advertising, both in confidential settings like one-on-one interviews and in group settings. Unfortunately, these methods have numerous limitations. First, they assume that people can explain their cognitive processes, which today's science shows to contain numerous unconscious components. Second, many factors may influence participants not to report their emotions accurately, such as personal motivations, time, peer pressure, etc. (Ramadhani & Anggrainie, 2023).

In such a challenging environment, the emergence of neuromarketing techniques has provided highly effective methods. These techniques allow marketers to study the customer's brain to gain valuable insights into explaining the success or failure of a message through unconscious processes. This technique succeeded in overcoming two critical human factors: the desire and ability of individuals to explain how they were influenced by an advertisement. Given the position and capabilities of neuromarketing, understanding the potential and extent of its influence on consumer behavior and the various aspects of the individual's relationship with the company can yield significant results. Identifying these effects is both important and necessary (Eivazi, 2016; Ramadhani & Anggrainie, 2023).

For many years, extensive efforts have been made to establish a specific structure for loyalty. Researchers have used attitudinal and behavioral measurement methods to define and achieve loyalty (Hamidi et al., 2022). Recently, loyalty has been viewed as repetition and support (Ramadhani & Anggrainie, 2023). Oliver states that "loyalty is a deep commitment to reuse or repeatedly become a customer of a particular product or service in the future," meaning repeated use of a brand despite situational influences and market efforts to change customer behavior (Mukherjee et al., 2023).

Given the points mentioned, it becomes clear that organizations do everything they can to attract and enhance customers. In this regard, the use of neuromarketing techniques is a tool, but it remains unclear to what extent it can influence consumer loyalty. Therefore, this study aims to examine the impact of neuromarketing on consumer behavior with an emphasis on consumer loyalty (based on Oliver's theory) in Samsung Corporation. Thus, the main research question will be: Does neuromarketing significantly influence consumer behavior and customer loyalty?

2 Methods and Materials

This research has practical objectives as it aims to develop applied knowledge in the field of neuromarketing, consumer behavior, and consumer loyalty. In terms of location, this research is a field study, as the data was collected through interaction with the population or the sample group using questionnaires. From the perspective of data collection, the research is experimental, employing a pre-test and post-test design with a control group.

Data collection and analysis in this research were conducted in three stages. In the first stage, the research involved a literature review, and tools such as note-taking and computer printouts were used. The second stage included the collection of field data. In this phase, efforts were made to gather information through questionnaires. The main tool in the second stage was the questionnaire. Two questionnaires were used for field data collection: Lerman's (2006) Consumer Behavior Questionnaire and Oliver's (1997) Consumer Loyalty Questionnaire. In the third stage of the research, the findings from the questionnaires were analyzed to answer the research questions and align them with theoretical foundations. For data analysis and statistical tests in the third stage, SPSS and Excel software were used.

The statistical population of the research consisted of two groups, each containing 150 customers of Samsung products in Qom Province. Due to the nature of the research, convenience and voluntary sampling methods were used. For the first group, various advertisements designed using neuromarketing techniques were presented, while the second group responded to the questionnaire without being exposed to any advertisements.

IJIMOB
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3 Findings and Results

The descriptive statistics of the study reveal that, in the control group, individuals with a master's degree or higher represented the lowest frequency at 13.33%, while those with a high school diploma had the highest frequency at 26.7%. In the experimental group, individuals with a master's degree or higher represented 15.33% (the lowest frequency), while those with an associate degree had the highest frequency at 26.7%. The findings regarding the employment status of the sample indicate that, in the control group, the unemployed had the lowest frequency at 6.7%, while those with self-employment had the highest frequency at 40%. Similarly, in the experimental group, the unemployed had the lowest frequency at 10.7%, and those with self-employment had the highest frequency at 40%. In terms of gender, the findings show that 70% of the control group were male and 30% female, whereas, in the experimental group, women represented the lowest frequency at 37.3%, and men the highest at 62.7%. The findings on the age of the respondents show that, in the control group, those under 25 years old had the lowest frequency at 13.3%, while those aged 26 to 30 years had the highest at 33.3%. In the experimental group, individuals aged 40 and above had the lowest frequency at 17.3%, while those aged 26 to 30 had the highest frequency at 34.7%. Regarding marital status, the findings show that 66% of the control group were married, and 34% were single, while in the experimental group, 72% were married, and 28% were single. Based on the demographic characteristics of the test groups, it can be concluded that there are no significant demographic differences between the experimental and control groups, which increases the generalizability and reliability of the research findings.

Research Hypotheses:

- The use of neuromarketing techniques affects customers' cognitive loyalty.
- The use of neuromarketing techniques affects customers' emotional loyalty.
- The use of neuromarketing techniques affects customers' intentional loyalty.
- The use of neuromarketing techniques affects customers' behavioral loyalty.
- The use of neuromarketing techniques affects consumer behavior.

The inferential statistical analysis for the research hypotheses is presented in three combined tables. The results for each hypothesis are summarized below.

Table 1

Interaction Between Experimental Conditions and Covariate (Pre-test)

Hypothesis	Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Sig
H1	Interaction of Pre-test Condition	28.07	1	2.07	0.261	0.621
	Error	7.50	297	0.22		
H2	Interaction of Pre-test Condition	51.48	1	6.19	1.94	0.171
	Error	31.49	297	1.41		
H3	Interaction of Pre-test Condition	79.11	1	3.49	2.314	0.182
	Error	34.15	297	1.61		
H4	Interaction of Pre-test Condition	19.401	1	2.43	2.37	0.310
	Error	11.09	297	1.08		
H5	Interaction of Pre-test Condition	67.16	1	7.44	1.16	0.399
	Error	29.33	297	2.03		

The interaction between the pre-test condition and the experimental condition for all five hypotheses did not yield significant results ($p > 0.05$). This indicates that the pre-test did not influence the outcomes of the experimental conditions across any of the loyalty or consumer behavior variables.

IJIMOB
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Table 2

Levene's Test for Equality of Error Variances

Hypothesis	Sig	Df.2	Df.1	F
H1	0.058	297	1	3.88
H2	0.551	298	1	0.418
H3	0.402	298	1	0.719
H4	0.344	298	1	0.161
H5	0.907	298	1	0.274

Levene's test showed that the assumption of equal error variances was met for all hypotheses ($p > 0.05$), indicating homogeneity of variances across the experimental and control groups for each hypothesis.

Table 3

Effects of Experimental Conditions on Dependent Variables

Hypothesis	Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Sig	Eta
H1	Experimental Condition	297.61	1	15.61	112.14	0.0001	0.811
	Error	70.23	297	2.71			
H2	Experimental Condition	311.48	1	26.11	211.38	0.001	0.768
	Error	28.64	297	1.97			
H3	Experimental Condition	221.76	1	5.491	230.18	0.001	0.719
	Error	19.84	297	1.44			
H4	Experimental Condition	299.16	1	77.168	266.82	0.001	0.733
	Error	36.81	297	1.94			
H5	Experimental Condition	219.37	1	20.16	92.461	0.001	0.839
	Error	44.51	297	3.19			

The analysis revealed significant effects of neuromarketing techniques on all dependent variables. For Hypothesis 1, the use of neuromarketing had a significant impact on cognitive loyalty ($F = 112.14$, $p = 0.0001$, $\eta^2 = 0.811$). For Hypothesis 2, neuromarketing significantly influenced emotional loyalty ($F = 211.38$, $p = 0.001$, $\eta^2 = 0.768$). For Hypothesis 3, it significantly affected intentional loyalty ($F = 230.18$, $p = 0.001$, $\eta^2 = 0.719$). Behavioral loyalty was significantly influenced for Hypothesis 4 ($F = 266.82$, $p = 0.001$, $\eta^2 = 0.733$). Finally, consumer behavior was significantly impacted for Hypothesis 5 ($F = 92.461$, $p = 0.001$, $\eta^2 = 0.839$). The effect sizes (Eta) suggest a strong impact of neuromarketing techniques on all variables.

4 Discussion and Conclusion

The main objective of this research was to examine and evaluate the impact of neuromarketing on consumer behavior with an emphasis on consumer loyalty. The following hypotheses were proposed and tested using covariance analysis and T-tests. The results are as follows:

- **Neuromarketing techniques affect customers' cognitive loyalty.**
- Given the calculated F-value (112.14) and the corresponding significance level (Sig = 0.0001), the F-value is statistically significant at the 99% confidence level, indicating a difference in the effect of experimental conditions on the dependent variable of cognitive loyalty. Therefore, the hypothesis "Neuromarketing techniques affect customers' cognitive loyalty" is supported. With an Eta-squared value of 0.811, it shows that approximately 80% of the variance in cognitive loyalty is influenced by the experimental conditions (neuromarketing).
- **Neuromarketing techniques affect customers' emotional loyalty.**
- The calculated F-value (211.38) and significance level (Sig = 0.001) indicate that the F-value is statistically significant at the 99% confidence level. This signifies a difference in the effect of the experimental conditions on the dependent variable of emotional loyalty. Therefore, the hypothesis "Neuromarketing techniques affect customers' emotional loyalty" is supported. The Eta-squared

IJIMOB
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value (0.768) suggests that approximately 76% of the variance in emotional loyalty is influenced by the experimental conditions.

- **Neuromarketing techniques affect customers' intentional loyalty.**
- The calculated F-value (230.18) and significance level (Sig = 0.001) show that the F-value is statistically significant at the 99% confidence level, reflecting a difference in the effect of the experimental conditions on the dependent variable of intentional loyalty. Thus, the hypothesis "Neuromarketing techniques affect customers' intentional loyalty" is supported. The Eta-squared value (0.719) suggests that about 71% of the variance in intentional loyalty is influenced by the experimental conditions.
- **Neuromarketing techniques affect customers' behavioral loyalty.**
- The calculated F-value (266.82) and significance level (Sig = 0.001) indicate that the F-value is statistically significant at the 99% confidence level, highlighting a difference in the effect of the experimental conditions on the dependent variable of behavioral loyalty. Hence, the hypothesis "Neuromarketing techniques affect customers' behavioral loyalty" is supported. The Eta-squared value (0.733) suggests that approximately 73% of the variance in behavioral loyalty is influenced by the experimental conditions.
- **Neuromarketing techniques affect consumer behavior.**
- The calculated F-value (92.461) and significance level (Sig = 0.001) indicate that the F-value is statistically significant at the 99% confidence level, showing a difference in the effect of the experimental conditions on the dependent variable of consumer behavior. Therefore, the hypothesis "Neuromarketing techniques affect consumer behavior" is supported. The Eta-squared value (0.839) indicates that about 83% of the variance in consumer behavior is influenced by the experimental conditions.
- Based on the findings of the study, it is recommended that marketing managers and advertising program designers utilize neuromarketing techniques in their advertisements to enhance the effectiveness of their advertising and increase customer purchase actions.
- Comparative studies should be conducted on the differences between neuromarketing approaches and other marketing tools and methods.
- Components that shape consumer attitudes in neuromarketing should be identified, weighted, and ranked using hierarchical analysis tools such as AHP, ANP, or fuzzy AHP. These components can be modeled and optimized using neural networks, genetic algorithms, and other techniques.

The most significant limitation of this study is the lack of comprehensive research on neuromarketing design in the country. Since the assessment of neuromarketing components is not tangible and requires laboratory facilities, a control sample method was used, which has limitations and affects the generalizability of the study's findings.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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