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Impact of Digital Neuro "Touchpoints" on Consumer Buying behavior

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Abstract:
Consumer buying behavior has been significantly transformed by digital neuro touchpoints, which leverage neuromarketing principles, cognitive biases, and personalized experiences to influence purchasing decisions. This research explores the impact of digital stimuli—such as visual and auditory cues, AI-driven recommendations, and interactive advertisements—on consumer engagement and decision-making processes. Studies indicate that emotional and sensory triggers activate the brain's reward system, enhancing brand perception and trust. Additionally, the use of personalization, social proof, and immersive experiences further drives purchasing intent. Neuroscientific insights, including fMRI and EEG studies, reveal that strategic digital touchpoints can optimize consumer engagement and conversion rates. This paper highlights the role of neuro touchpoints in digital marketing and discusses ethical considerations for future research.

Keywords: Digital neuro touchpoints, consumer behavior, neuromarketing, cognitive biases, personalization, AI-driven marketing, sensory triggers, emotional engagement, online purchasing behavior.

Introduction:

The field of neuromarketing research is rapidly developing. Marketers increasingly understand that a deeper understanding of consumer behavior and preferences may be obtained through brain and physiological research. (Fisher et al.,2010)

The US is one of the most important regions in the global neuromarketing market, despite the sector's rapid growth abroad. This is because end-user industries are investing heavily in digital marketing and there are an increasing number of US-based market vendors (Sengur & Goncalves, 2023). In this sense, a variety of industries, including consumer behavior and preferences, criminal justice, and market and marketing research, use neuromarketing techniques and applications.

Neuromarketing, as defined in this publication, is the scientific study of the neurological system in relation to marketing. In order to understand customer behavior, motives, preferences, and decisions, it measures physiological and brain signals. This information can then be used to inform creative advertising, product development, pricing, and other marketing domains. It circumvents the difficulties of relying solely on customer self-reports by using brain imaging, scanning, or other brain measuring technologies to gather consumers' responses to marketing stimuli. (Brenninkmeijer et al., 2020; Parrish et al., 2020)

The interaction between consumers and brands is a topic that both researchers and practitioners find relevant in marketing studies. In other words, customer experience and engagement are key factors that influence brand equity. In relation to the symbolic value of items, many consumers derive pleasure from genuine experiences that mirror their desires or present views (Molleda, 2010). All things considered, they favor products that they can recognize (Gambetti et al., 2012).

Objectives of Study:

2. Literature Review:

Consumer behavior in the digital age has become increasingly influenced by neuro touchpoints—specific stimuli that engage cognitive and emotional processes to drive decision-making. These digital touchpoints utilize principles from neuromarketing, behavioral psychology, and digital engagement to enhance consumer experiences and brand interactions (Plassmann et al., 2012). This section reviews relevant literature on the role of neuro touchpoints in digital environments and their impact on purchasing decisions.

Neuromarketing and Consumer Decision-Making

Neuromarketing is a growing field that combines neuroscience with marketing to understand how consumers respond to various stimuli (Ariely & Berns, 2010). Research has shown that brands leverage sensory and emotional triggers to create meaningful digital experiences, influencing memory retention and brand perception (Hubert & Kenning, 2008). For instance, **visual and auditory cues in digital advertisements** activate the brain’s reward system, increasing engagement and likelihood of purchase (Yoon et al., 2006).

Digital Touchpoints and Emotional Engagement

Digital environments offer numerous touchpoints—such as personalized content, AI-driven recommendations, and interactive ads—that create subconscious emotional connections with consumers (Liu et al., 2020). Studies have found that **emotional engagement in digital interactions** significantly influences brand loyalty and purchasing decisions (Schmitt, 2012). Particularly, the **use of neuromarketing strategies in e-commerce platforms** (e.g., tailored product suggestions and immersive AR/VR experiences) enhances consumer trust and engagement (Hsu & Chen, 2018).

The Role of Cognitive Biases in Digital Marketing

Cognitive biases play a crucial role in consumer decision-making, often manipulated through neuro touchpoints in digital marketing (Tversky & Kahneman, 1974). The **scarcity effect** (e.g., limited-time offers) and **social proof** (e.g., customer reviews, influencer endorsements) have been shown to trigger impulsive buying behavior (Cialdini, 2001). Furthermore, research suggests that **dopamine-driven decision-making processes** in online shopping environments lead to increased conversion rates when brands strategically utilize digital stimuli (Knutson et al., 2007).

The Effect of Personalization on Purchase Behavior

Personalization in digital marketing has been identified as a key neuro touchpoint that enhances consumer experiences. AI and big data analytics allow brands to create hyper-personalized content that aligns with individual preferences, increasing emotional resonance and consumer satisfaction (Tam & Ho, 2021). Studies indicate that **personalized marketing messages** lead to higher engagement and greater consumer trust, ultimately driving purchasing behavior (Kaptein et al., 2015).

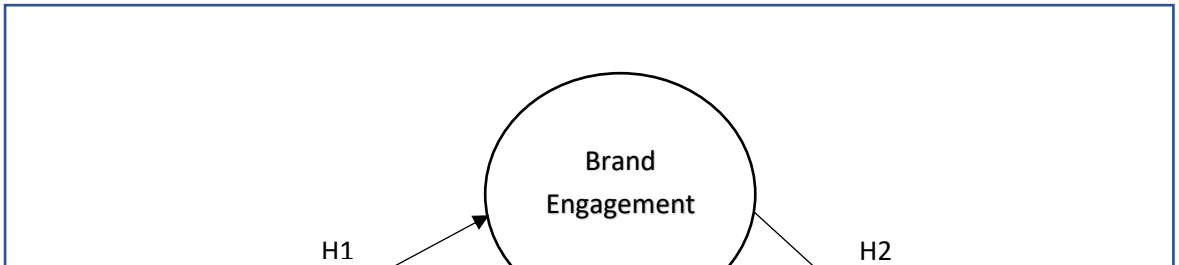
Neuroscientific Insights into Online Consumer Behavior

Emerging neuroimaging studies have provided insights into how digital stimuli affect consumer brain activity. Functional MRI (fMRI) and EEG studies reveal that digital advertisements with high emotional appeal activate the brain's limbic system, fostering stronger brand recall and purchase intent (Morin, 2011). Additionally, research suggests that **interactive and immersive digital experiences**, such as gamification and virtual try-ons, enhance cognitive engagement and influence buying decisions (Baumgartner et al., 2008).

The integration of neuroscience and digital marketing has led to the development of strategic neuro touchpoints that influence consumer behavior. Digital platforms utilize sensory, cognitive, and emotional triggers to enhance brand interactions, optimize engagement, and drive purchasing decisions. Future research should explore the long-term effects of digital neuro touchpoints on consumer loyalty and ethical considerations in neuromarketing strategies.

3. Conceptual framework:

Image 1: Conceptual model of the study



4. Research Methodology:

This study employs a mixed-methods approach to assess the impact of digital neuro touchpoints on consumer buying behavior. The research methodology integrates both qualitative and quantitative techniques to provide a comprehensive understanding of how digital stimuli influence decision-making.

Research Design

The study follows an exploratory research design, using surveys, neuroimaging techniques, and content analysis to investigate consumer responses to various digital touchpoints. The primary data sources include consumer surveys, focus groups, and EEG/fMRI experiments to examine subconscious reactions to digital marketing stimuli.

Data Collection Methods

1. **Survey Research**: A structured questionnaire is distributed to 500 online consumers to gather insights into their experiences with digital touchpoints. The survey includes questions on engagement levels, emotional responses, and purchasing decisions. A Likert scale is used to measure consumer perceptions and attitudes.
2. **Content Analysis**: Online advertisements, social media campaigns, and e-commerce interfaces are examined to identify recurring neuro touchpoint strategies. The study categorizes marketing techniques based on their psychological and emotional appeal.

Hypothesis of the study:

H01: There is no significant association between Neuro Touch points and Brand Engagement

H1: There is significant association between Neuro Touch points and Brand Engagement

H02: There is no significant association between Brand Engagement and Consumer Behaviour

H2: There is significant association between Brand Engagement and Consumer Behaviour

H03: There is no significant association between Neuro Touch points and Consumer Behaviour

H3: There is significant association between Neuro Touch points and Consumer Behaviour

Data Analysis

The data analysis for this study was conducted using Smart-PLS (Partial Least Squares Structural Equation Modeling) software, which is ideal for examining complex relationships between latent constructs. Smart-PLS was employed to analyze the associations between Neuro Touchpoints, Brand Engagement, and Consumer Behavior. The independent variables (Neuro Touchpoints) include mobile apps and websites, social media, and customer support channels, while Brand Engagement serves as a mediating variable, and Consumer Behavior as the dependent variable.

The measurement model was first evaluated for reliability and validity, followed by the structural model to test the hypothesized relationships. Path coefficients were assessed using bootstrapping, and the model's predictive power was evaluated through R-squared values. SmartPLS provided insights into the direct and indirect relationships among these constructs, helping to understand how Neuro Touchpoints influence Brand Engagement and ultimately Consumer Behavior.

Conceptual Model:

The simulation was done (Image no.1) in smart-PLS 3.2.7 to calculate the observable factors' and latent constructs' influence on building quality. PLS-SEM is widely used in theory-building research. Generally, SEM permits numerous relationships to be analysed simultaneously rather than individually in a single model with multiple relationships. For analysing several latent constructs with varying manifest factors, Smart-PLS 3.2.7 was employed, which has advantages over regression-based techniques. The PLS approach includes assessing both the outer measurement model and the interior structural model. PLS-SEM is currently widely utilised in social science research for multivariate analysis. (Hussain et al., 2018)

Evaluation of Outer Measurement Model:

The outer measurement model seeks to assess the internal consistency, reliability, and validity of observable (questionnaire) and hidden variables. Convergent and discriminant validity are assessed using single observed and construct reliability tests.

Table No1: VIF, Outer Loadings and P-values.

	Factor	Factor	VIF	Outer loading	P-Value
Brand Engagement	Interaction with brands	BI1	3.998	0.819	0.259
	Brand Engagement through digital touchpoints-interactive content	BI2	3.475	0.793	0.15
	Brand Engagement through-personalized recommendations	BI3	4.532	0.889	0.111
	Impulsive purchase	BI4	4.937	0.857	0.482
	Trust on online advertisements featuring	BI5	2.959	0.973	0.000
Consumer Behaviour	Scarcity Effect	CB1	1.900	0.782	0.000
	Social proof (reviews, influencer	CB2	2.235	0.819	0.000
	Anchoring effect	CB3	2.589	0.846	0.000
	Personalization	CB4	2.878	0.858	0.000
	Brand Loyalty	CB5	4.112	0.892	0.000
	Long-term purchasing behaviour	CB6	3.383	0.864	0.000
Neuro Touch Points	Mobile app and websites	NT1	4.663	0.807	0.382
	Social Media	NT2	4.311	0.790	0.004
	Customer Support Channels	NT3	2.825	0.851	0.048
	Affect of sensory elements on engagement level	NT4	1.973	0.943	0.000

Convergent Validity:

To check the collinearity of formative construct we can check the VIF value, it should be less than 3. And if any value is between 3 and 5 then it is manageable value greater than 5 is not accepted. So for all the variables we can see that VIF value is less than 3 and only one value is greater than 3 but it's less than 5 as well, so it's manageable. This shows that, in our model there is no multiple collinearity present.

We will also check the significance of the construct with the p-value's of the outer weights. From the table we can see that p value is greater than 0.05 for various variables so we again

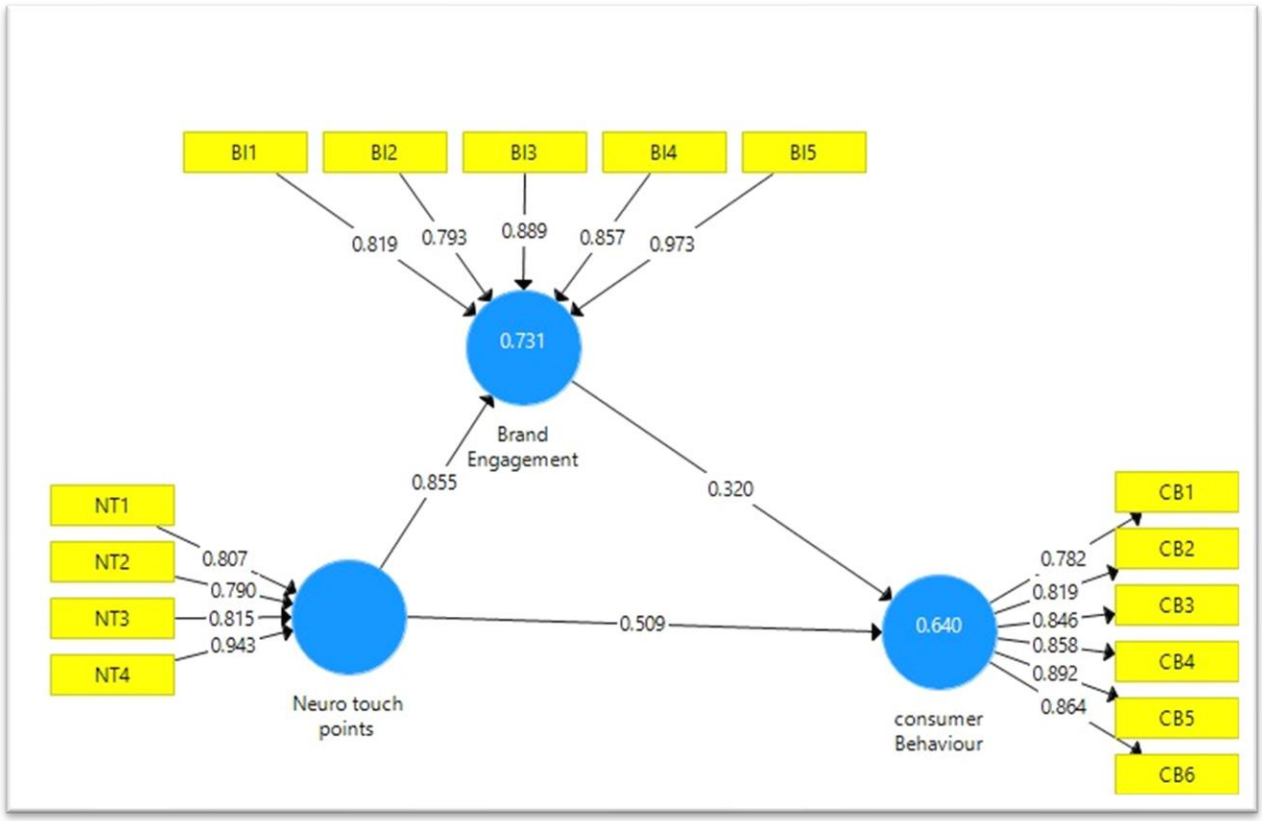
check the p value of the outer loading for the same variable if it is significant we will retain that parameter, if not we will check whether outer loading is greater than .50, if yes then also we will retain that variable and if not then we can delete those variables

As buying behavior is the reflective construct we will check its validity and reliability. So we have found Cronbach alpha 0.919, rho_A 0.9 and composite reliability 0.937 all are greater than 0.7 so all are significant. We have got Average Variance Extracted AVE which is 0.713 it should be greater than 0.5, so it's also significant.

Table No. 2: (Rho_a, and Cronbach alpha)

	Rho_a	Cronbach alpha
Brand Engagement	1	0.833
Neuro Touch Points	1	0.845
Consumer Behaviour	0.9	0.919

Image No. 2: Model showing path coefficients, Outer Loadings and R-square.



Convergent Reliability:

Reliability of the variable is seen from the weights/loadings of the variable if it is greater than 0.7 is greatly accepted. At various places we have got weights/loadings greater than 0.7

The latent constructs' discriminant validity was next. Any manifest variable in the path model is discriminant from other manifest variables if its cross-loading value in the latent variable is bigger than any other manifest variable. The Fornell and Larcker criteria determine discriminant validity. A construct should not have the same variance as another construct with a higher AVE score. To assess discriminant validity, all correlations were lower than the squared root of average variance along the diagonals (Table 3).

Table No.3: Fornell–Larcker criterion test.

	Brand Engagement	Neuro Touch Points	Consumer Behaviour
Brand Engagement	**0.889**		
Neuro Touch Points	0.765	**0.855**	
Consumer Behaviour	0.755	0.782	0.844

Evaluation of the Inner Structural Model:

The measuring model proved valid and reliable. The Inner Structural Model's outcomes were measured. This includes assessing the model's prediction value as well as its component relationships. The inner structural model is evaluated using the coefficient of determination (R^2), path coefficient (value) and T-statistic (value).

The coefficient of determination measures the structural model's prediction accuracy by estimating the endogenous construct's total effect size and fluctuation. In this study, the inner route model for buying behaviour was 0.64. This suggests that two latent components in the model account for roughly 64 percent of the variance in consumer purchase behaviour. A R^2 of 0.75 is regarded substantial, 0.50 is moderate, and 0.26 is weak. So the R^2 was moderate in this case.

Estimation of Path Coefficients (β) and T-statistics:

The path coefficients in the PLS and the regression analysis were identical. In this case, the hypothesis was significant. The expected variation in the dependent construct for a unit variance in the independent construct (s). The higher the value of each path in the hypothesized

model, the bigger the significant influence on the endogenous latent construct. The T-statistics test was employed to confirm the significance of the value. The hypothesis' significance was determined through bootstrapping. The path coefficient and T-statistics values were assessed using a bootstrapping method with 5000 subsamples with no sign changes.

Table No. 4: T-statistics and P value.

	T-statistics	P-values
Brand Engagement	2.917	0.028
Neuro Touch Points	3.571	0.000
Consumer Behaviour	3.683	0.000

Table no. 5: Path coefficient: (Beta Value)

	Brand Engagement	Neuro Touch Points	Consumer Behaviour
Brand Engagement			0.320
Neuro Touch Points	0.855		0.509
Consumer Behaviour			

The bigger the coefficient, the stronger the exogenous latent construct's influence on endogenous latent constructs. In this study, we found that personality and attitude have a greater impact on customer buying behaviour than other variables

Special Indirect effect:

Here also we het p-Value 0.032 is acceptable.

Table No 6: Special indirect effect.

	P values
Neuro Touch Points-> Brand Engagement-> Consumer Behaviour	0.032

Predictive Relevance of the Model (Q^2):

The PLS route model's quality is assessed using Q^2 statistics produced via blindfolding and cross-validation. The conceptual model should be able to predict endogenous latent constructs (Q^2). The SEM Q^2 values for an endogenous latent construct must be greater than zero. This research model's Q^2 values were 0.267, just below the threshold limit, showing modest predictive importance for the endogenous construct. If Q^2 is between 0.02 and 0.15, it signifies a weak effect, between 0.15 and 0.35, a moderate effect, and greater than 0.35, a large effect.

Table No: 7: Q^2 Predict

Factor	Q^2 Predict
BI1	0.444
BI2	0.409
BI3	0.518
BI4	0.468
BI5	0.686
CB1	0.440
CB2	0.435
CB3	0.410
CB4	0.430
CB5	0.450
CB6	0.347

Discussion and Conclusion :

This study has provided compelling evidence for the significant associations between Neuro Touchpoints, Brand Engagement, and Consumer Behavior using the SmartPLS model. The analysis reveals that neuro touchpoints not only shape brand engagement but also play a key role in influencing various consumer behaviors. The study has uncovered important insights related to **Scarcity Effect**, **Social Proof**, **Anchoring**, **Personalization**, **Brand Loyalty**, and **Long-Term Purchasing Behavior**.

1. **Neuro Touchpoints and Brand Engagement:** The findings confirm that neuro touchpoints, such as interactive digital content and personalized recommendations, significantly drive consumer engagement with brands. These touchpoints help create meaningful, emotional interactions, which foster deeper relationships with brands and encourage ongoing engagement.
2. **Brand Engagement and Consumer Behavior:** There is a strong relationship between brand engagement and consumer behavior. Consumers who are highly engaged with brands are more likely to be influenced by psychological triggers like the **Scarcity Effect** (limited-time offers driving urgency) and **Social Proof** (reviews and influencer endorsements boosting confidence). Engaged consumers are also more susceptible to **Anchoring**, where initial prices or offers influence their perception of value and subsequent purchasing decisions.
3. **Neuro Touchpoints and Consumer Behavior:** The study also found a direct link between neuro touchpoints and consumer behavior. Personalized interactions through digital touchpoints enhance **Brand Loyalty**, making consumers more likely to return for future purchases. Additionally, consumers exposed to tailored recommendations are more prone to **Long-term Purchasing Behavior**, indicating the importance of sustained engagement through personalization.

Practical Implications:

- **Marketers** should leverage neuro touchpoints, such as interactive content and personalized recommendations, to drive consumer engagement. Tailoring these touchpoints to trigger the **Scarcity Effect** and leverage **Social Proof** can significantly influence consumer purchasing behavior.

- **Brands** can enhance **Brand Loyalty** by using neuro-based marketing techniques to establish a deeper emotional connection, while also utilizing **Anchoring** strategies to make offers appear more attractive relative to initial reference points.
- **Advertisers** must focus on creating trustworthy online content and leveraging consumer **Social Proof** (e.g., reviews, influencer endorsements) to build credibility and trust, thus encouraging impulsive purchases and fostering long-term loyalty.

Future Research Directions:

While this study provides valuable insights, future research could explore how **Scarcity Effects** and **Anchoring** influence consumer purchasing in different industries, or examine the role of **Brand Loyalty** in the digital age. Additionally, investigating how **Personalization** can be further optimized through artificial intelligence and machine learning could provide more granular insights into consumer behavior.

In conclusion, the study underscores the importance of integrating neuro touchpoints into marketing strategies. These touchpoints not only enhance brand engagement but also influence critical aspects of consumer behavior, such as **Scarcity Effects**, **Social Proof**, and **Brand Loyalty**. As the digital marketplace becomes more competitive, brands that effectively use these strategies to create personalized, engaging experiences will be best positioned to influence long-term consumer behavior and loyalty.

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