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From Engagement to Intention: Consumer Behavior in Augmented Reality Environments

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Abstract

Purpose

This study investigates the drivers of consumer engagement and behavioral intentions in augmented reality (AR) enabled e-commerce environments, with a specific focus on how cognitive and emotional mechanisms jointly shape consumer responses to AR features.

Methods

Grounded in the Stimulus-Organism-Response (S-O-R) framework, the study employs a dual-model, data-driven approach. A Partial Least Squares Structural Equation Model (PLS-SEM) using data from 312 active AR users is applied to examine linear cognitive-behavioral relationships influencing purchase intention. To capture nonlinear and subconscious effects, a Fuzzy Logic model based on the S-O-R framework is developed based on responses from 487 online consumers. In addition, cluster analysis is conducted to identify distinct consumer engagement profiles.

Results

The findings reveal that perceived usefulness ($\beta = 0.293$, $p < 0.001$), enjoyment ($\beta = 0.206$, $p < 0.01$), and AR engagement ($\beta = 0.142$, $p < 0.05$) are significant drivers of purchase intention, with the model explaining 41% of the variance. The Fuzzy Logic analysis further demonstrates that emotional satisfaction and interactivity mediate the effects of AR exposure on brand trust and loyalty, even among consumers with limited conscious awareness of AR use. Three consumer segments-AR Explorers, Skeptical Users, and Passive Observers - are identified, highlighting heterogeneity in AR driven engagement behaviors.

Originality/Value

This research advances the augmented reality and digital marketing literature by integrating SEM and Fuzzy Logic to simultaneously capture explicit cognitive evaluations and implicit emotional responses to AR. By revealing nonlinear engagement mechanisms and distinct consumer archetypes, the study offers a more comprehensive explanation of how AR technologies influence consumer engagement and behavioral intentions in digital retail contexts.

KeyWords: Augmented reality; Consumer engagement; Behavioral intention; Emotional

responses; Digital commerce; Brand trust

Introduction

1.1 Augmented Reality in Contemporary Digital Commerce

Augmented reality (AR) has emerged as a transformative interface in digital commerce by enabling consumers to interact with virtual product representations embedded within real-world contexts. By overlaying digital content onto physical environments, AR enhances product visualization, reduces perceptual uncertainty, and approximates aspects of in-store inspection within online settings (Javornik, 2016; Rauschnabel et al., 2024). Leading retailers increasingly deploy AR-enabled applications-such as virtual try-on tools and three-dimensional product visualizations-to improve consumer decision confidence and experiential engagement. Prominent examples include IKEA Place and Amazon AR View in home furnishing, as well as Lenskart and Nykaa in eyewear and beauty retailing, underscoring AR's growing strategic relevance in e-commerce.

The significance of AR has further intensified in the post-pandemic digital economy, particularly within emerging markets such as India, where rapid digital adoption coexists with heightened concerns regarding product fit, quality assurance, and transaction trust. In such contexts, AR functions not merely as a technological enhancement but as a behavioral interface that bridges the tactile and experiential gap inherent in online retailing. By simulating physical interaction, AR engages consumers across cognitive and affective dimensions, shaping evaluative judgments, emotional responses, and behavioral intentions (Rauschnabel et al., 2019; Yang, 2024).

1.2 Prior Research on AR and Consumer Behavior

Extant research on AR in marketing and consumer behavior has primarily focused on technology acceptance, system usability, and performance-related outcomes. Drawing largely on the Technology Acceptance Model (TAM), prior studies have emphasized perceived usefulness and enjoyment as key predictors of AR adoption and usage intentions (Davis, 1989; Venkatesh & Bala, 2008; Zhu & Wang, 2022). These studies demonstrate that AR enhances task efficiency, product comprehension, and hedonic value, thereby increasing consumers' willingness to engage with digital retail platforms.

Beyond adoption, recent work has begun to explore experiential and engagement-related outcomes of AR. Research indicates that immersive AR experiences can foster flow, emotional involvement, and heightened engagement, which in turn influence purchase intention and brand-related outcomes (Brodie et al., 2011; Hollebeek et al., 2014; Rauschnabel et al., 2024). However, much of this literature relies on linear analytical approaches and self-reported cognitive evaluations, offering limited insight into the non-linear, affective, and partially subconscious mechanisms through which AR exerts its influence.

1.3 Theoretical Foundations: From Stimulus-Response to Internal Processing

Early behavioral theories in psychology cautioned against simplistic stimulus–response assumptions, emphasizing that external stimuli do not directly translate into behavioral outcomes without internal cognitive and affective mediation (Thurstone, 1923). This insight later crystallized into the Stimulus–Organism–Response (S-O-R) framework, which conceptualizes behavior as the outcome of internal psychological processes triggered by environmental stimuli (Mehrabian & Russell, 1974; Donovan & Rossiter, 1982).

Within digital and retail environments, the S-O-R paradigm has been widely applied to explain how technological and atmospheric cues shape emotions, cognitions, and subsequent consumer behaviors (Eroglu et al., 2003). In AR-enabled commerce, features such as interactivity, visual realism, and personalization act as salient stimuli that activate organismic states including satisfaction, trust, and engagement, ultimately influencing purchase intention and loyalty (Javornik, 2016; Söderström, 2024). The S-O-R framework is therefore particularly well suited to immersive technologies, where consumer responses extend beyond deliberate evaluation to include emotional and intuitive reactions.

1.4 Beyond Conscious Evaluation: Subconscious and Non-Linear Effects

Despite these advances, existing AR research largely assumes conscious, rational processing of technological stimuli. This assumption overlooks evidence from cognitive psychology suggesting that individuals rely simultaneously on analytical (verbatim) and intuitive (gist-based) processing when forming judgments (Reyna & Brainerd, 1995). Fuzzy-trace theory posits that behavior is often guided by imprecise, affect-laden representations rather than exact cognitive calculations-an insight that is especially relevant in immersive and visually rich environments such as AR.

Moreover, conventional linear modeling techniques may inadequately capture the ambiguity, gradation, and non-linearity inherent in experiential consumption. Soft computing approaches, such as fuzzy logic, have been shown to effectively model imprecise perceptions and subconscious evaluations in consumer decision-making contexts (Zadeh, 1965; Kahraman et al., 2006). However, their application in AR-enabled marketing research remains limited.

1.5 Research Objective and Contribution

Addressing these limitations, the present study adopts an integrated theoretical and methodological approach to examine consumer behavior in AR-enabled e-commerce environments. Drawing on the S-O-R framework and extending TAM, the study conceptualizes AR features as environmental stimuli that influence both cognitive and emotional organismic states, resulting in behavioral outcomes such as purchase intention and brand loyalty.

Methodologically, the study employs a dual-model design that integrates Partial Least Squares Structural Equation Modeling (PLS-SEM) with a fuzzy logic–based S-O-R framework. While PLS-SEM captures explicit, linear cognitive relationships among key constructs, fuzzy logic modeling enables the examination of non-linear and partially subconscious effects of AR exposure. In addition, cluster analysis is used to identify distinct consumer engagement profiles, acknowledging heterogeneity in AR-driven responses.

By doing so, this research contributes to the digital commerce and AR literature in three key ways. First, it extends AR research beyond adoption and usability by uncovering emotional and subconscious drivers of consumer behavior. Second, it demonstrates the value of combining linear and non-linear analytical techniques to capture the full spectrum of consumer responses to immersive technologies. Third, it provides actionable insights for digital retailers seeking to leverage AR as a strategic tool for enhancing engagement, trust, and loyalty in e-commerce contexts.

2. Theoretical Approach

2.1 Stimulus-Organism-Response (S-O-R) Paradigm

The Stimulus-Organism-Response (S-O-R) paradigm provides a foundational framework for understanding how environmental cues influence individual behavior through internal psychological processes (Mehrabian & Russell, 1974). According to this model, external stimuli (S) trigger cognitive and affective reactions within the organism (O), which subsequently

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shape behavioral responses (R). The S-O-R framework has been widely applied in retailing, services, and digital environments to explain consumer reactions to atmospheric and technological stimuli (Donovan & Rossiter, 1982; Eroglu et al., 2003).

In augmented reality (AR) enabled commerce, features such as interactivity, visual realism, and personalization function as salient environmental stimuli that enrich the shopping experience (Rauschnabel et al., 2019). These stimuli activate internal organismic states including satisfaction, trust, and consumer engagement, which ultimately influence behavioral outcomes such as purchase intention and brand loyalty (Figure 1). Given its ability to capture both affective and cognitive reactions, the S-O-R paradigm is particularly suitable for examining immersive and experiential technologies such as AR, where consumer responses extend beyond rational evaluation to include emotional and subconscious processes (Javornik, 2016).

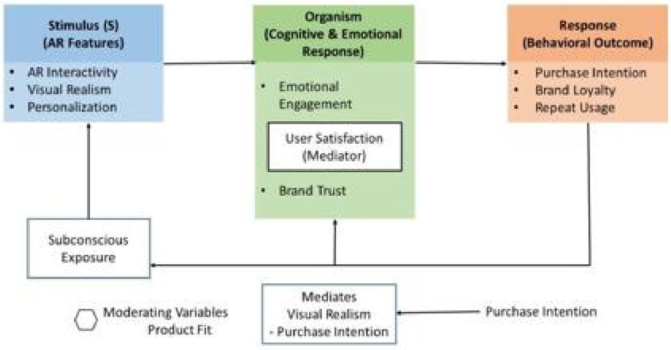

Fig. 1. Conceptual Model Based on the SOR Framework for AR Marketing

2.2 Technology Acceptance and Consumer Engagement

The Technology Acceptance Model (TAM) has been extensively used to explain consumer adoption of digital technologies, positing perceived usefulness and perceived enjoyment as central determinants of behavioral intention (Davis, 1989; Venkatesh & Bala, 2008). In AR-enabled shopping environments, perceived usefulness reflects the extent to which AR enhances product understanding, decision accuracy, and shopping efficiency, while perceived enjoyment captures the intrinsic pleasure derived from immersive interaction (Childers et al., 2001; Yang et al., 2024).

However, while TAM effectively explains initial acceptance, it provides limited insight into sustained engagement and emotionally driven post-adoption behaviors. Consumer engagement extends TAM by incorporating cognitive involvement, emotional attachment, and behavioral participation within interactive experiences (Brodie et al., 2011). In AR contexts, engagement manifests through flow, immersion, and perceived control, transforming functional technology use into emotionally resonant and meaningful consumption experiences (Hollebeek et al., 2014; Rauschnabel et al., 2024).

2.3 Integration of TAM and Stimulus-Organism-Response (S-O-R)

Integrating TAM and the S-O-R paradigm enables a more comprehensive explanation of consumer behavior in AR-enabled environments. While TAM focuses on cognitive and affective appraisals that drive technology usage, the S-O-R framework explicates the process through which environmental stimuli influence internal psychological states and subsequent behavioral responses (Eroglu et al., 2003). Within this integrated framework, AR features operate as stimuli, perceived usefulness and enjoyment function as evaluative mechanisms,

and consumer engagement represents a central organismic state linking cognition and emotion to behavioral outcomes.
This hybrid approach allows researchers to capture the multi-layered nature of AR-driven consumer behavior, encompassing rational decision-making, emotional resonance, and subconscious influence. By combining TAM's explanatory strength with S-O-R's process orientation, the integrated framework provides a robust theoretical foundation for examining how AR shapes engagement, trust, and behavioral intentions in digital commerce settings (Javornik, 2016; Söderström, 2024). The relationship between AR features and behavioral outcome, as analysed in this study, is viualized below in Figure 2 using the S-O-R model:

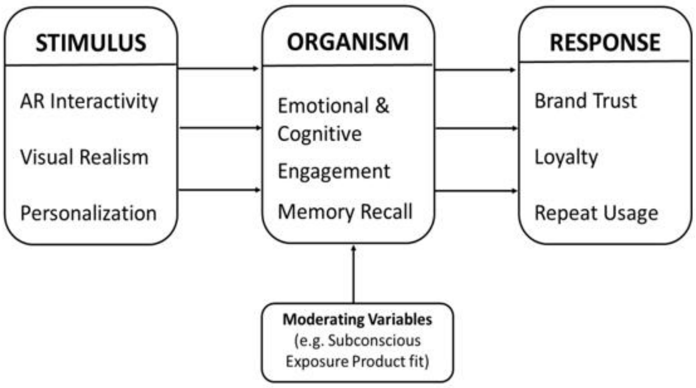

Fig. 2. Relationship between AR features and S-O-R model

3. Conceptual background and hypotheses

Despite the growing body of literature on augmented reality (AR) in digital commerce, several critical gaps remain. First, prior research has predominantly emphasized technological adoption, system usability, and functional performance, often treating AR as a utilitarian decision-support tool. This technology-centric focus provides limited insight into the emotional, experiential, and subconscious mechanisms through which AR shapes consumer behavior.
Second, empirical evidence from emerging markets-particularly India remains scarce. Given differences in digital maturity, risk perceptions, and trust formation processes across markets, findings derived largely from developed economies may not fully generalize to the Indian e-commerce context.
Third, existing studies have relied primarily on linear analytical techniques, such as regression-based or structural equation models, which may not adequately capture the nonlinear, implicit, and subconscious effects inherent in immersive AR experiences. The limited application of hybrid analytical approaches that integrate statistical modeling with soft computing techniques restricts a deeper understanding of complex consumer response patterns.

Addressing these gaps, the present study adopts a dual-model analytical framework that integrates Partial Least Squares Structural Equation Modeling (PLS-SEM) and Fuzzy Logic–based S-O-R framework to simultaneously examine explicit cognitive evaluations and implicit emotional responses to AR-enabled shopping environments.

3.1 Research Models and Hypotheses

3.1.1 Model 1: Structural Equation Model (SEM)

Grounded in the Technology Acceptance Model (TAM) and consumer engagement theory, the first model examines the direct effects of key cognitive and affective determinants on purchase

intention in AR-enabled e-commerce. Specifically, perceived usefulness and perceived enjoyment represent consumers' rational and hedonic evaluations of AR, while AR engagement captures the depth of cognitive involvement and emotional immersion during interaction.
Accordingly, the following hypotheses are proposed:
H1: AR engagement positively influences purchase intention.
H2: Perceived enjoyment positively influences purchase intention.
H3: Perceived usefulness positively influences purchase intention.

3.1.2 Model 2: Fuzzy Logic Based S-O-R Framework

To capture nonlinear and subconscious consumer responses that may not be fully explained by linear models, the second research model applies a Fuzzy Logic–based Stimulus-Organism-Response (S-O-R) framework. In this model, AR features such as interactivity and visual realism act as environmental stimuli, internal psychological states-including emotional satisfaction and trust-constitute organismic responses, and purchase intention and brand loyalty represent behavioral outcomes.
This approach allows for the examination of implicit and partially conscious effects of AR exposure, including situations in which consumers may not explicitly recognize their interaction with AR features.
The following hypotheses are proposed:
H4: Emotional satisfaction mediates the relationship between AR exposure and purchase intention.
H5: Subconscious exposure to AR features increases brand trust and purchase likelihood.
H6: High visual realism enhances brand loyalty.
H7: Distinct behavioral segments exist based on emotional engagement and use intention.

4. Method and Measurement

4.1 Research Design

This study adopts a quantitative, cross-sectional research design to examine how augmented reality (AR) influences consumer engagement and behavioral intentions in e-commerce environments. Given the experiential and immersive nature of AR, consumer responses are shaped by both explicit cognitive evaluations and implicit emotional processes. To account for this complexity, the study employs a dual-model analytical framework that integrates Partial Least Squares Structural Equation Modeling (PLS-SEM) and a Fuzzy Logic–based Stimulus-Organism-Response (S-O-R) model.
PLS-SEM is particularly suitable for prediction-oriented research involving latent constructs and complex causal relationships (Hair et al., 2019). However, traditional linear models may fail to capture nonlinear and subconscious behavioral effects inherent in immersive technologies (Javornik, 2016). Therefore, Fuzzy Logic modeling is incorporated to complement SEM by enabling the analysis of imprecise, ambiguous, and partially conscious consumer perceptions (Zadeh, 1965; Kahraman et al., 2006).

4.2 Sample and Data Collection

Data were collected from Indian consumers with prior exposure to AR-enabled shopping tools, including virtual try-on applications and three-dimensional product visualization features. India represents a relevant empirical context due to its rapid growth in digital commerce adoption and increasing integration of AR technologies across retail sectors (Harshini, 2025).
Two independent samples were used to support the dual-model design. For the PLS-SEM analysis, 312 valid responses were obtained using purposive non-probability sampling to ensure

respondent familiarity with AR features (Refer Table 1). For the Fuzzy Logic analysis, a broader sample of 487 online consumers was used to capture latent and subconscious effects, consistent with prior research employing soft computing approaches to consumer behavior modeling (Kahraman et al., 2006).
Data were collected through a structured, self-administered online questionnaire. To reduce common method bias, respondents were assured anonymity, and the measurement items were psychologically separated across sections (Podsakoff et al., 2003).

Table 1: SEM & Fuzzy SOR Model

Parameter	SEM Model	Fuzzy–SOR Model
Sample Size	312 valid responses	487 valid responses
Sampling Technique	Purposive, non-probability	Convenience
Tools Used	SmartPLS 4.0	MATLAB (Fuzzy Toolbox), SPSS 27
Scale	5-point Likert (1 = Strongly Disagree, 5 = Strongly Agree)	Converted into fuzzy sets (Low, Medium, High)

4.3 Measurement

Measurement scales were adapted from prior validated studies in technology acceptance, consumer engagement, and digital commerce research (Davis, 1989; Brodie et al., 2011). All constructs in the SEM model were measured using multi-item five-point Likert scales ranging from 1 ("strongly disagree") to 5 ("strongly agree").
For the Fuzzy Logic model, Likert-scale responses were transformed into linguistic fuzzy sets (low, medium, high), enabling the representation of vague and nonlinear consumer perceptions (Zadeh, 1965). This transformation aligns with prior fuzzy-based consumer behavior studies that emphasize perceptual nuance over strict numerical precision (Kahraman et al., 2006).

4.4 Measurement Model Evaluation

4.4.1 Model Diagnostics

PLS-SEM analysis was conducted using Smart PLS 4.0, following established guidelines for measurement and structural model assessment (Hair et al., 2019). The measurement model was evaluated for internal consistency reliability, convergent validity, and discriminant validity using Cronbach's alpha, composite reliability, average variance extracted (AVE), variance inflation factors (VIF), and heterotrait–monotrait (HTMT) ratios (Henseler et al., 2015).
The structural model was assessed by examining standardized path coefficients and their statistical significance using bootstrapping procedures. Model fit and predictive accuracy were evaluated using standardized root mean square residual (SRMR), normed fit index (NFI), and the coefficient of determination (R^2), consistent with best practices in PLS-SEM research (Hair et al., 2019).

Convergent validity was examined using Average Variance Extracted (AVE). AVE values for all constructs were above the minimum criterion of 0.50, confirming that the indicators adequately represent their latent constructs (Fornell & Larcker, 1981). Furthermore, all indicator loadings were above 0.70, reinforcing the robustness and explanatory power of the measurement items.

Multicollinearity was assessed using Variance Inflation Factor (VIF) values, which were well below the conservative threshold of 3.3, indicating no significant collinearity concerns (Diamantopoulos & Siguaw, 2006). Discriminant validity was evaluated using the Heterotrait–Monotrait (HTMT) ratio. All HTMT values were below 0.85, confirming that the constructs are empirically distinct and measure conceptually different dimensions of augmented reality–based consumer response (Henseler et al., 2015). Refer Table 2 for the values.

Table 2: Reliability and Validity

Construct	**Cronbach's α**	**CR**	**AVE**	**Result**
AR Engagement	0.872	0.918	0.73	Reliable
Perceived Usefulness	0.841	0.894	0.67	Reliable
Enjoyment	0.821	0.87	0.63	Reliable
Purchase Intention	0.859	0.905	0.78	Reliable

Overall, the measurement model meets all recommended psychometric criteria and is suitable for subsequent structural model evaluation.

4.4.2 *Structural Model Evaluation and Predictive Accuracy*

The structural model was assessed using multiple goodness-of-fit and predictive relevance indicators, consistent with contemporary PLS-SEM evaluation practices (Hair et al., 2019). The following table 3 shows the analysis:

Table 3: Structural Model Evaluation

Fit Index	**Recommended**	**Achieved**	**Interpretation**
Standardized Root Mean Square Residual (SRMR)	< 0.08	0.072	Acceptable
Normal Fit Index (NFI)	≈ 0.90	0.891	Good fit
RMS_ theta	< 0.15	0.134	Acceptable
R^2 (Purchase Intention)	≥ 0.30	0.41	Moderate predictive power

The Standardized Root Mean Square Residual (SRMR) value of 0.072 falls below the recommended cut-off of 0.08, indicating acceptable model fit. The Normed Fit Index (NFI) value of 0.891 approaches the benchmark of 0.90, suggesting good comparative model adequacy, while the RMS value of 0.134 remains within acceptable limits, indicating well-specified residual correlations (Henseler et al., 2016).

The model explains 41% of the variance in Purchase Intention, representing moderate predictive power. In behavioral and marketing research, particularly in emerging digital contexts such as augmented reality, this level of explanatory power is considered meaningful and theoretically relevant (Rauschnabel et al., 2024; Yang, 2024).

4.4.3 *Structural Path Analysis*

The structural path analysis reveals differentiated effects of cognitive, affective, and experiential AR-related constructs on purchase intention. Perceived usefulness emerged as the strongest predictor ($\beta = 0.293$, $p < 0.001$), reinforcing the central proposition of the Technology Acceptance Model (TAM) that functional utility remains a dominant driver of technology-enabled behavioral intention (Davis, 1989; Zhu & Wang, 2022).

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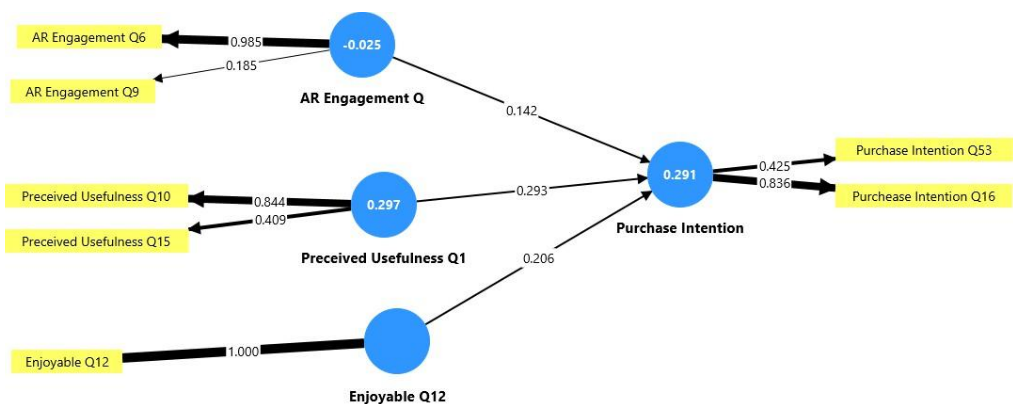
Enjoyment also demonstrated a significant positive effect on Purchase Intention (β = 0.206, $p < 0.01$), highlighting the importance of hedonic and experiential value in AR-enabled environments. This finding aligns with prior research suggesting that immersive and enjoyable AR experiences enhance emotional engagement and increase purchase likelihood (Rauschnabel et al., 2024; Sarkis, 2025).

AR Engagement showed a weaker yet statistically significant effect (β = 0.142, $p < 0.05$), indicating that engagement alone may not directly translate into immediate purchase behavior but acts as a reinforcing mechanism that strengthens cognitive and emotional evaluations over time. This result supports earlier findings that engagement functions as an indirect catalyst in digital experience-driven consumption (Du, 2022; Thakkar et al., 2023).

Collectively, these findings as mentioned in Table 4, suggest a hierarchical influence mechanism, wherein functional utility exerts the strongest impact, followed by affective enjoyment and experiential engagement. Further, the findings show that the functional and hedonic dimensions jointly shape purchase intention; perceived usefulness exerts the strongest influence.

Table 4: Structural Path Analysis

Structural Path	β	t-value	p-value	Effect	Result
AR Engagement→ Purchase Intention	0.142	2.06	< 0.05	Weak positive	Supported
Enjoyment→ Purchase Intention	0.206	3.14	< 0.01	Moderate	Supported
Perceived Usefulness → Purchase Intention	0.293	4.32	< 0.001	Strong	Supported



4.4.4 *Fuzzy Logic-Based Behavioral Modeling*

To complement the linear assumptions of SEM, a fuzzy logic–based Stimulus-Organism-Response (SOR) model (Figure 3)was employed to capture non-linear and subconscious behavioral effects (Young, G. 2016, Zadeh, 1965; Negm, 2025,). The fuzzy inference results indicate that emotional satisfaction and perceived interactivity mediate the relationship between AR exposure and behavioral outcomes, even when consumers are not consciously aware of AR influence. Consistent with Fuzzy-Trace Theory, (Reyna, V., & Brainerd, C.J. 1995)

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which suggests that individuals rely on gist-based as well as verbatim processing, augmented reality may influence consumer behavior through intuitive and subconscious evaluations in addition to rational analysis.

A Mamdani-type fuzzy inference system was developed using triangular membership functions (Low, Medium, High). Defuzzification was conducted using the centroid method to derive crisp behavioral predictions. Fuzzy regression analysis given in table 5, revealed a moderate relationship between AR feature interaction and purchase intention (r = 0.45), while a weaker yet statistically significant association was observed between AR exposure and perceived influence (r = 0.19). These results suggest that AR can exert subconscious priming effects through visual realism and interactivity, consistent with prior findings on immersive media and implicit persuasion (Söderström, 2024; Ernestivita, 2024).

Table 5: Fuzzy Descriptive Insights

Variable	Mean	Median	Interpretation
Use of Augmented Reality	0.72	0.75	
Purchase Influence	0.729	1	57% strongly influenced by AR

Fig. 3. Fuzzy Logic in Augmented Reality Behaviour Analysis

Further, cluster analysis identified three distinct consumer archetypes-AR Explorers, Skeptical Users, and Passive Observers, demonstrating heterogeneity in emotional receptivity, trust formation, and behavioral readiness (Table 6). This segmentation underscores the need for differentiated AR strategies tailored to consumer psychological profiles rather than uniform deployment. Following are the behavioral traits identified with these clusters (Figure 4).

Table 6: Behavioral Segmentation

Cluster	Percentage of Sample	Behavioral Traits
AR Explorers	37%	High involvement, strong trust, high purchase intent
Skeptical Users	34%	Rational but trust-deficient, cautious buyers
Passive Observers	29%	Low awareness, latent future potential

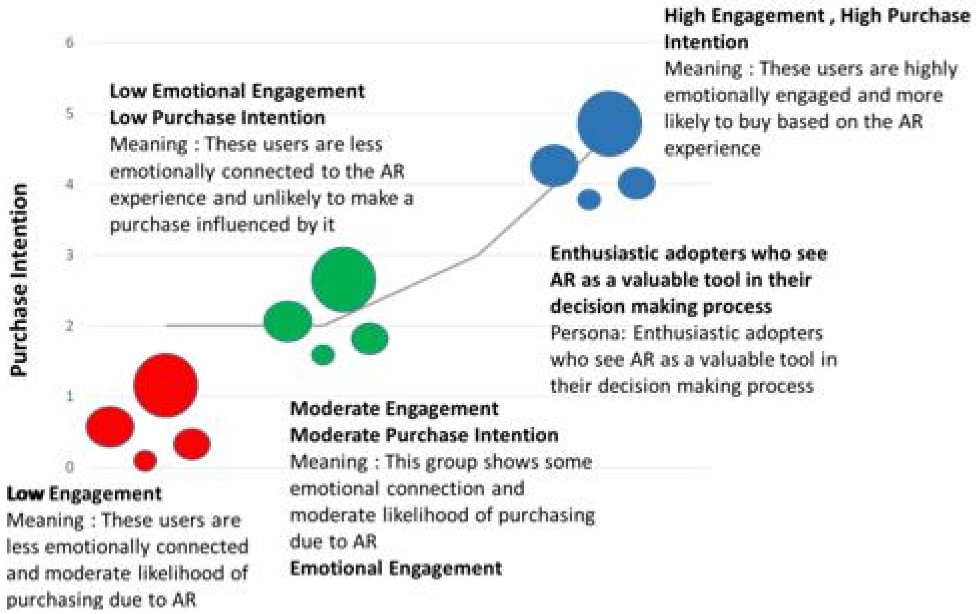

Fig. 4. Consumer Segmentation Based on Augmented Reality Behavior

5. Discussion, results, and future research directions

5.1 Theoretical Implications

This study demonstrates that augmented reality (AR) influences consumer purchase intention through a layered mechanism integrating cognitive, affective, and subconscious processes. The structural model explains a substantial proportion of variance in Purchase Intention ($R^2 = 0.41$), indicating that AR-related perceptions meaningfully shape consumer decision-making in digital commerce contexts.

At the cognitive level, Perceived Usefulness emerged as the strongest predictor of Purchase Intention ($\beta = 0.293$, $p < 0.001$). This finding reaffirms the Technology Acceptance Model proposition that functional utility remains central to behavioral intention. Consumers perceive AR as a decision-support tool that enhances product understanding, reduces uncertainty, and increases confidence in online purchasing.

At the affective level, Enjoyment exerted a significant positive influence on Purchase Intention ($\beta = 0.206$, $p < 0.01$), highlighting the importance of hedonic gratification in immersive environments. This result confirms that AR's experiential value strengthens emotional involvement, thereby amplifying purchase-related outcomes beyond purely rational evaluation. AR Engagement showed a weaker yet statistically significant effect on Purchase Intention ($\beta = 0.142$, $p < 0.05$). This suggests that engagement functions primarily as a reinforcing mechanism rather than an immediate driver of conversion, supporting the view that repeated interaction and experiential familiarity gradually contribute to intention formation.

Beyond conscious evaluation, the fuzzy logic analysis revealed non-linear and subconscious effects of AR exposure. A moderate relationship was observed between AR interaction and Purchase Intention ($r = 0.4504$; $R^2 = 0.2029$), while a weaker but statistically significant association was found between AR exposure and perceived influence ($r = 0.1919$; $R^2 = 0.0368$). These findings indicate that subtle AR cues—such as visual realism and interactivity—can activate emotional satisfaction and trust even without deliberate awareness.

Cluster analysis further identified three distinct consumer segments: AR Explorers (37%), Skeptical Users (34%), and Passive Observers (29%). This segmentation highlights heterogeneity in emotional receptivity, trust orientation, and behavioral readiness, reinforcing that AR effectiveness varies across consumer profiles.
Overall, the results support an integrated TAM-SOR perspective in which AR operates simultaneously at cognitive, affective, and subconscious levels to influence consumer behavior.

6. Implications and future

6.1 Theoretical Implications

This study extends the Technology Acceptance Model by empirically demonstrating that while Perceived Usefulness ($\beta = 0.293$, $p < 0.001$) remains the dominant driver of purchase intention, affective enjoyment ($\beta = 0.206$, $p < 0.01$) and experiential engagement ($\beta = 0.142$, $p < 0.05$) provide complementary explanatory power. This confirms that technology adoption in immersive contexts cannot be explained solely through rational evaluation.
The study also advances the Stimulus–Organism–Response framework by operationalizing emotional satisfaction and trust as organismic responses activated by AR stimuli. The fuzzy logic findings further extend SOR theory by showing that organismic responses may be triggered subconsciously, capturing behavioral dynamics that linear models typically fail to explain.

Methodologically, the integration of PLS-SEM ($R^2 = 0.41$) with fuzzy logic modeling ($R^2 = 0.2029$) represents a significant contribution by combining statistical rigor with sensitivity to perceptual ambiguity and non-linear consumer responses.

6.2 Managerial Implications

For marketers, the dominance of Perceived Usefulness underscores the importance of positioning AR as a functional decision-support tool rather than a novelty feature. Emphasizing accurate visualization, product fit, realism, emotional resonance and personalized storytelling can directly enhance purchase intention and enhance cognitive trust and emotional appeal.
For UX designers, the significant role of Enjoyment ($\beta = 0.206$) highlights the need to prioritize seamless interactivity and immersive flow. The study shows that fun and satisfaction are not by-products of aesthetics but are consequences of frictionless, intuitive engagement. Minor design disruptions can break emotional flow and weaken behavioral outcomes. Emotional satisfaction should be treated as a strategic design objective rather than an incidental outcome.
For brand strategists, consumer segmentation offers clear guidance. Employ fuzzy-based consumer segmentation. AR Explorers respond most to gamified, immersive content. Skeptical users need credibility signals, reviews, and functional transparency. With AR placements and awareness-oriented messaging, passive observers benefit from more subtle and subconscious exposure. Personalized AR journeys based on these clusters will lead to increased conversion and long-term loyalty.

6.3 Methodological and Policy Implications

From a methodological perspective, the study demonstrates the value of combining SEM and fuzzy logic-based SOR model to capture both conscious and subconscious mechanisms underlying consumer behavior. This hybrid approach is particularly suited to emerging digital technologies characterized by experiential complexity and perceptual ambiguity.

From a policy and industry standpoint, the findings suggest that as AR increasingly shapes subconscious consumer responses, ethical considerations related to transparency and persuasive design should be carefully addressed to maintain consumer trust and autonomy.

6.4 Limitations and Future Scope

Despite employing a comprehensive dual-model analytical framework, the study is subject to the following limitations.
The study employs a cross-sectional design that captures consumer perceptions and behavioral intentions at a specific point in time. Future research may extend this approach through longitudinal designs to examine how AR engagement, emotional response, and trust evolve with repeated exposure.
Cognitive and emotional responses were measured using self-reported instruments. While established scales ensured reliability and validity, future studies may complement survey data with objective or physiological measures, such as eye-tracking or biometric indicators, to enrich insights into affective and subconscious processes.
The empirical analysis focuses on Indian e-commerce consumers, offering contextual relevance. Future research across multiple cultural and market settings could enhance the generalizability of the findings and explore contextual influences on AR adoption.
The study does not explicitly distinguish between AR platforms or device capabilities. Subsequent research may account for technological variations across devices to better understand their role in shaping immersion and engagement.
Behavioral outcomes are assessed through perceptual and intentional measures. Future work may integrate real-time behavioral data, including usage logs or transaction records, to further validate AR-driven behavioral effects.
Finally, emerging advancements such as AI-enabled personalization and adaptive AR systems present promising avenues for future research to examine their influence on trust, satisfaction, and long-term consumer relationships.

7. Conclusion

This study demonstrates that the persuasive influence of augmented reality extends beyond functional utility, operating simultaneously at cognitive, affective, and subconscious levels. One of the key contributions of this study lies in integrating the statistical precision of PLS-SEM with the interpretive sensitivity of fuzzy logic modeling to offer a comprehensive framework for analyzing complex human-technology interactions in the immersive digital environments. The findings further establish visual realism and emotional satisfaction as critical psychological mechanisms that transform augmented reality from a visualization aid into a behavioral driver of trust, engagement, and loyalty. In conclusion, by empirically linking Technology Acceptance Model constructs with the Stimulus-Organism-Response framework, this research advances behavioral theory while providing a robust methodological pathway for future augmented reality marketing studies seeking to capture both explicit cognitive evaluations and implicit emotional processes in digital consumer behavior.

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