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REVIEW ARTICLE

Flow and Continuance Intention in Augmented Reality (AR) Shopping: A Systematic Literature Review

Yitong Wang[1*], Ai Chin Thoo[2], Huam Hon Tat[3], Adaviah Mas'od[4]

[1]Faculty of Management, Universiti Teknologi Malaysia, 81310, Johor, Malaysia
Email: wangyitong@graduate.utm.my
[2]Faculty of Management, Universiti Teknologi Malaysia, 81310, Johor, Malaysia
Email: acthoo@utm.my
[3]Kuala Lumpur University of Science and Technology (KLUST), 43000, Selangor, Malaysia
Email: drhuamht@gmail.com
[4]Faculty of Management, Universiti Teknologi Malaysia, 81310, Johor, Malaysia
Email: adaviah@utm.my

CORRESPONDING AUTHOR (*):
Ai Chin Thoo
(acthoo@utm.my)

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ABSTRACT

Flow theory has been increasingly applied to explain user behavior in augmented reality (AR) shopping, yet existing studies remain fragmented. Despite the rapid growth of the AR shopping market, low user retention rates highlight the need to understand how flow fosters sustained engagement. However, consensus on its conceptualization is lacking, dimensional measures are inconsistent, and its link with continuance intention (CI) remains unclear. To address this gap, this study systematically reviewed 17 peer-reviewed articles published between 2016 and 2024 using the PRISMA protocol. Five core dimensions of flow were identified—concentration, enjoyment, control, time distortion, and curiosity. Among these, enjoyment and concentration consistently predict CI, control and time distortion show context-dependent effects, while curiosity, though underexplored, demonstrates strong potential. This study highlights theoretical and methodological gaps and suggests that retailers and developers should enhance enjoyment (e.g., engaging interactions) and concentration (e.g., seamless use), optimize control (e.g., intuitive navigation), and leverage curiosity-driven exploration (e.g., novel features) to strengthen user retention.

Contribution/Originality: This study contributes to the existing literature by systematically reviewing flow theory in AR shopping, identifying five core dimensions and their varying effects on continuance intention. It is one of very few studies which have investigated the theoretical and methodological gaps, offering evidence-based insights to enhance user engagement and retention.

1. Introduction

In recent years, augmented reality (AR) technology has been increasingly applied in the field of shopping (Nikhashemi et al., 2021). By overlaying virtual information onto the real

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environment, AR has transformed the way consumers experience products and services, enhancing both their confidence in shopping decisions and overall consumption experience (Gabriel et al., 2023; Hsu et al., 2021). Consequently, AR shopping has gradually become an important topic in consumer behavior research. Existing studies have extensively examined AR adoption behavior, but the majority focus on the pre-adoption stage, such as purchase intention (PI) and intention to use (Chetioui et al., 2020; Sahli & Lichy, 2024), while relatively little attention has been given to continuance intention (CI) in the post-adoption stage. At the same time, AR shopping platforms in practice often face low user retention rates, which makes the study of CI not only theoretically valuable (Jiang et al., 2023), but also a critical issue in determining whether AR shopping can achieve long-term success and contribute to the sustainable development of the digital economy (Ferreira et al., 2023).

To explain CI, scholars generally rely on theoretical frameworks. However, existing studies largely depend on behavior-oriented models such as TAM and SOR, whose explanatory power has clear limitations. The Technology Acceptance Model (TAM) emphasizes the role of perceived usefulness and ease of use at the pre-adoption stage (Chen et al., 2022), but its explanatory power significantly declines as users become more familiar with AR functions (Butt et al., 2022). The SOR model highlights the short-term influence of external stimuli (e.g., AR features) on users' psychology and behavior (Gabriel et al., 2023), but it neglects deeper mechanisms such as satisfaction, making it difficult to uncover the long-term drivers of CI (Kabir et al., 2024). This suggests that external incentives and utilitarian factors alone are insufficient to explain users' continuance behavior.

Against this backdrop, researchers have increasingly turned to perspectives from psychology and the social sciences. Flow Theory (Csikszentmihalyi, 2000), which emphasizes immersion, enjoyment, and intrinsic motivation during activities, has been regarded as a potentially critical theory for explaining CI. In recent years, it has been widely applied in fields such as consumer behavior, management information systems, and human-computer interaction (Park et al., 2023; Wang et al., 2024b). Studies indicate that flow significantly influences both technology adoption and continuance intention (Poushneh, 2021). Compared with TAM and SOR, flow is more suitable for explaining long-term use behavior in contexts involving voluntary choice and potential technological alternatives, thus offering a unique perspective for understanding CI in AR shopping (Bölen et al., 2021).

However, although flow is widely regarded as a multidimensional construct (Chen & Lin, 2022; Habil et al., 2024; Yang & Lee, 2023), there is still no consensus in academia on its precise definition and measurement, particularly in the field of technology adoption. Bölen and Özen (2020) pointed out that the broad conceptualization of flow has led to ambiguity in its application, while Poushneh (2021) emphasized the need to reconceptualize and re-operationalize flow to address measurement uncertainty. This problem is particularly prominent in the context of AR shopping. Most existing studies tend to simplify the complex psychological processes into a single-dimensional measurement of flow (Nawres et al., 2024; Yuan et al., 2021), which not only deviates from the multidimensional construct originally proposed by Csikszentmihalyi (2000), but may also weaken measurement validity and result in an incomplete understanding of the role of flow in the formation of CI.

Although the systematic literature review (SLR) method has been widely applied in academia and has been used in AR shopping research (Yitong et al., 2024), to date, there

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has been no review specifically focusing on Flow Theory and its applicability in explaining CI. Existing reviews primarily center on mainstream theoretical paradigms such as TAM or ECM (Anastasya & Religia, 2025), while discussions of flow are often fragmented and lack systematic analysis (Riar et al., 2023). Therefore, the current body of knowledge remains incomplete, underscoring the need for a systematic review to clarify the role and contributions of flow in AR shopping CI research.

To fill this research gap, this study conducts a systematic review on AR shopping, with three specific objectives: RO1: To examine how flow has been conceptualized within the context of AR shopping research. RO2: To analyze how flow has been operationalized across empirical studies and to identify directions for future methodological improvements. RO3: To synthesize evidence on how the multidimensional structure of flow (e.g., enjoyment, concentration, control, time distortion, curiosity) influences users' continuance intention in AR shopping contexts.

2. Research Methods

Systematic literature review (SLR) is a standardized review method that has gained wide recognition in academia for its transparency, replicability, and rigor (Boell & Cecez-Kecmanovic, 2015). It is considered a reliable research approach that not only lays the foundation for developing new models or theories but also helps trace the intellectual development of a particular field (Kumar, 2022). Various types of SLR exist, including structured reviews, theory-based reviews, framework-based reviews, meta-analyses, and bibliometric analyses (Bölen et al., 2021). This study adopted a theory-based review approach, primarily because systematic investigations of flow theory in the AR shopping context remain scarce, leaving a significant knowledge gap. Although flow has been widely applied in consumer behavior research, few studies have advanced the theoretical understanding of the phenomenon itself and its relationship with continuance intention (CI). A theory-based SLR thus enables conceptual clarification and offers a critical reflection on the explanatory role of flow in AR shopping.

In conducting this review, the study strictly followed the PRISMA guidelines (Moher et al., 2009), which involve four stages: identification, screening, eligibility, and final inclusion. PRISMA is widely regarded as the academic benchmark for ensuring the quality of systematic reviews. Following this process, a total of 17 studies were included in the analysis. Details of each stage are presented in the subsequent sections.

2.1. Identification

The literature search for this study was primarily conducted through the Web of Science, Scopus, and ScienceDirect databases, supplemented by Google Scholar and EBSCO Host. These databases cover multiple disciplines and are widely regarded as authoritative resources for evaluating academic publications (Sarker et al., 2019). The search process began with the identification of keywords. Given that AR shopping remains in its early stage of development, the authors first conducted a preliminary review of 30 related articles. Based on this review, and after careful vetting by the co-authors, the following keywords were finalized: ("augmented reality" OR "AR" OR "mobile augmented reality" OR "AR mobile app" OR "online retail" OR "shopping" OR "e-commerce" OR "smart retail" OR "virtual try-on") AND ("flow theory" OR "flow experience" OR "flow state") AND ("continuance" OR "continuance intention" OR "continuous use" OR "adoption" OR "acceptance" OR "discontinuance" OR "switching" OR "abandonment" OR "termination").

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The search was conducted across titles, keywords, and abstracts, yielding an initial result of (N=169) articles.

2.2. Inclusion and Exclusion Criteria

To ensure methodological rigor, explicit inclusion and exclusion criteria were established. The inclusion criteria were as follows: (1) Studies published in peer-reviewed journals or conference proceedings and based on primary empirical data; conference papers were retained to mitigate the "file drawer" effect and reduce publication bias (Rosenthal, 1979); (2) No fixed starting year was set, and the search encompassed all records available in the selected databases up to 2024, ensuring comprehensiveness and systematic coverage; (3) Only studies published in English were included; (4) Studies needed to focus on the AR shopping context and adopt flow theory as a core construct to explain continuance intention (CI) or closely related behavioral outcomes.

The exclusion criteria were as follows: (1) Non-English publications; (2) Non–peer-reviewed outputs such as editorials, lectures, book chapters, or non-academic publications; (3) Studies without full-text access in the databases; (4) review papers without empirical evidence; (5) Studies outside the AR shopping domain; (6) Studies that did not incorporate flow theory as a theoretical lens or did not examine its relationship with user behavior.

It is important to note that this review did not restrict the scope exclusively to continuance intention (CI), but also considered closely related behavioral outcomes (e.g., adoption and behavior use). This is because research focusing solely on CI in AR shopping remains limited, and excluding related behavioral studies could lead to an incomplete understanding of flow mechanisms. By including all empirical studies that employed flow theory to explain user behavior, this review provides a more comprehensive basis for theorizing CI and identifying avenues for future research.

2.3. Screening Phase

The initial search yielded (N=169) studies. After applying the inclusion and exclusion criteria, (N=105) studies remained. Specifically, (N=46) were excluded due to publication type (non-empirical), (N=12) were excluded for being non-English, and (N=6) were excluded due to lack of access or restricted access. Next, titles and keywords were screened: studies that did not apply flow theory within the AR shopping context were excluded, while those addressing flow experiences in relation to user behavior were retained. This process was conducted independently by two authors, with disagreements resolved by a third reviewer (Qiu et al., 2025), resulting in (N=49) retained studies.

These 49 studies were then imported into EndNote for duplicate checking, where (N=13) duplicates were removed. Subsequently, two authors independently reviewed abstracts, introductions, methods, and results to further assess relevance, leaving (N=32) studies for the next stage. Finally, the full texts of these studies were independently reviewed by two authors to ensure objectivity, applying the following criteria: (1) Studies must focus on user behavior outcomes in AR shopping; (2) Studies must explicitly integrate flow theory; (3) Flow must be measured as a multidimensional construct; (4) Studies that treated flow as a single-dimensional variable or did not link it to behavioral constructs were excluded. This final step led to the exclusion of (N=15) studies, leaving (N=17) as the final sample (see Figure 1).

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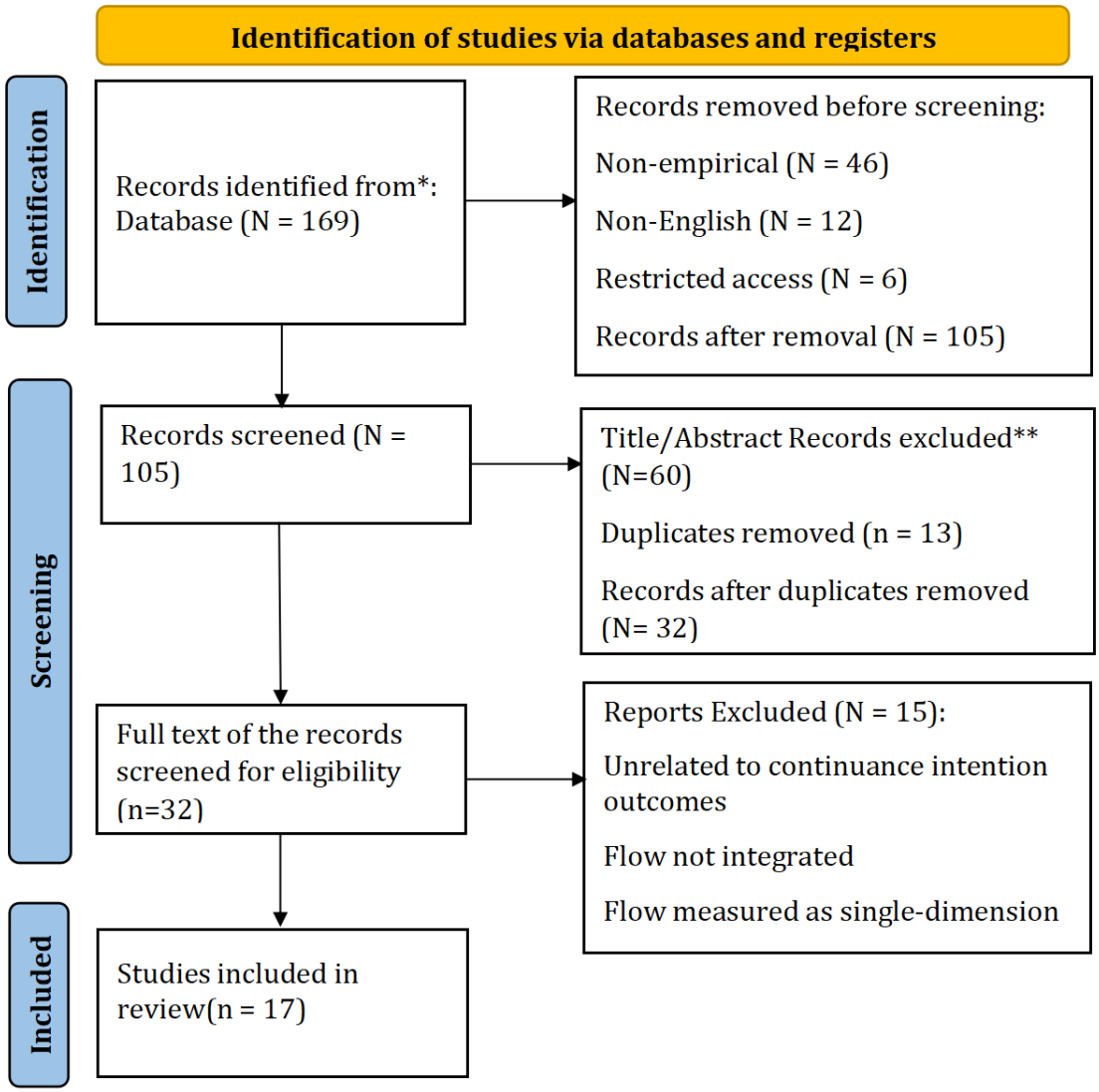
2.4. Data Extraction and Analysis

In the inclusion stage, the final set of studies was imported into Excel and systematically coded based on a predefined framework (Bandara et al., 2011). The coding framework captured the following information: (1) Bibliographic details, including title, authors, and year of publication; (2) Country or regional context; (3) Research method; (4) Theoretical framework employed; (5) Core variable design, including independent, dependent, mediating, and moderating variables; (6) The role of flow theory, whether examined as an antecedent, dimension, or outcome; and (7) The integration of flow theory with other theories or models. This classification not only ensured systematic data extraction but also enabled subsequent synthesis to directly address the research questions and identify gaps for future research.

Figure 1: PRISMA Diagram of Article Selection Process



3. Findings and Discussion

3.1. How has flow been conceptualized in AR shopping research?

Flow was introduced by Csikszentmihalyi and defined as the optimal state individuals experience when they are fully absorbed in an activity (Csikszentmihalyi, 2000). Unlike traditional motivation theories that emphasize extrinsic rewards, flow highlights the

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interplay between intrinsic motivation and immersive experience (Csikszentmihalyi, 2014). Over the years, the concept has been widely applied in domains such as education, consumer behavior, and human–computer interaction (Bölen et al., 2021).

In its theoretical evolution, Csikszentmihalyi (2000) distinguished between antecedent conditions of flow (e.g., challenge–skill balance, clear goals, immediate feedback) and experiential characteristics (e.g., concentration, control, enjoyment, time distortion, and curiosity). However, this distinction has not been consistently applied in AR shopping studies. Some research has merged antecedents and characteristics into a single "flow score," while others have relied on holistic items to capture flow (Ameen et al., 2020; Arghashi & Yuksel, 2022). While such simplification facilitates empirical testing, it reduces construct validity and undermines the explanatory power of flow as a multidimensional experiential model.

A review of existing studies reveals both commonalities and divergences in conceptualizing flow within AR shopping (see Table 1). Concentration is consistently emphasized, underscoring its centrality in immersion and user engagement (Gu et al., 2023; Yang & Lee, 2023). Curiosity has recently emerged as a novel dimension, capturing users' exploratory motives and sense of novelty (Chen & Lin, 2022; Lin & Huang, 2024). In contrast, enjoyment, although theoretically central, is often underrepresented in empirical studies, leading to a systematic neglect of emotional mechanisms in explaining user retention (Hwang et al., 2024; Kowalczuk et al., 2021). Meanwhile, control and time distortion are frequently measured but lack consensus in theoretical positioning: some studies regard them as essential conditions of immersion, whereas others suggest their contribution is relatively marginal (Berlo & Stikos, 2023; Lin & Huang, 2024).

Table 1: Augmented Reality (AR) Shopping Flow Indicators

Indicators & Sources	Concentration	**Control**	**Enjoyment**	**Time distortion**	**Curiosity**
Yuan et al. (2021)	ü				
Brannon Barhorst et al. (2021)	ü				
Yang & Lee (2023)	ü	ü	ü		
Pathak & Prakash (2023)		ü			
Wang et al. (2022)	ü				
Chen & Lin (2022)	ü	ü			ü
Huang & Liao (2017)	ü			ü	
Yang et al. (2022)	ü				
Wang et al. (2024a)	ü				
Javornik (2016)		ü			ü
Gu et al. (2023)	ü			ü	
Javornik et al. (2019)	ü	ü			ü
Nawres et al. (2024)				ü	
Lin & Huang (2024)	ü			ü	ü
tom Dieck et al. (2023)	ü				ü
Serravalle et al. (2023)	ü			ü	

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Berlo & Stikos (2023)		ü			ü
Total	13	6	1	5	6

Taken together, the findings indicate that consensus has yet to be reached on how flow is conceptualized in AR shopping. Most studies adopt only two or three dimensions, producing an incomplete representation of user experience. To address RQ1, this review proposes a five-dimensional framework of flow—comprising concentration, enjoyment, control, time distortion, and curiosity—organized across cognitive, affective, and motivational domains. This framework not only clarifies theoretical boundaries in the literature but also offers practical implications: different dimensions of flow shape immersion through attention management, emotional reinforcement, and exploratory motivation, thereby providing actionable guidance for retailers and developers seeking to optimize AR shopping design.

3.2. How has flow been operationalized in AR shopping research, and what directions can guide future studies?

The operationalization of flow dimensions in AR shopping research shows substantial variation, reflecting inconsistencies in measurement tools and construct boundaries. The following subsections synthesize the current state, controversies, and future directions for the five key dimensions.

3.2.1. Concentration

Concentration is consistently recognized as a core characteristic of flow in AR shopping. When users maintain focused attention during virtual try-ons or interactions, they are more likely to enter an immersive state and experience positive cognitive and emotional responses (Huang & Liao, 2017; Yang & Lee, 2023). As a result, concentration is often treated as the primary indicator of flow, capturing the degree of user immersion during shopping activities (Lin & Huang, 2024; Wang et al., 2022).

Nevertheless, disagreements remain regarding its conceptualization and measurement. Some studies regard "absorption" as a subdimension of concentration and employ items such as "completely immersed in the activity" (Chen & Lin, 2022; Yang & Lee, 2023). Others distinguish between concentration, which reflects task-related cognitive focus, and absorption, which emphasizes deeper psychological immersion (Javornik et al., 2019; Ouyang et al., 2024). These inconsistencies blur conceptual boundaries and suggest that existing tools may not fully capture multi-level attention states in AR environments.

This review highlights that concentration still lacks a unified standard of operationalization. Unless its relationship with absorption is clarified and more consistent instruments are developed, cross-study comparability and theoretical accumulation will remain constrained.

3.2.2 Enjoyment

The dimension of enjoyment is frequently marginalized in AR shopping research. Although Csikszentmihalyi (2000) originally defined flow as a deeply pleasurable state and emphasized the role of enjoyment in sustaining motivation and growth (Csikszentmihalyi, 2000; Ghazali et al., 2019), most empirical studies prioritize cognitive

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or behavioral characteristics such as concentration and control while downplaying emotional outcomes (Lin & Huang, 2024).

This neglect raises two major concerns. First, excluding enjoyment risks reducing flow to a mere state of "attention management," stripping it of its integrity as an optimal experience. Second, emotional drivers are particularly crucial for user stickiness and continuance in AR contexts. Evidence shows that enjoyment significantly enhances satisfaction and plays an irreplaceable role in motivating continuance intention (Hwang et al., 2024; Rankin et al., 2019).

This review suggests that the underrepresentation of enjoyment in operationalization reflects not only a theoretical gap but also a potential methodological bias. Future studies should systematically integrate enjoyment into flow measurement frameworks to uncover its unique contribution to emotional engagement and user continuance.

3.2.3. Control

Control is frequently examined in AR flow research, yet its importance remains contested. Some studies argue that control has limited influence, suggesting that even without a strong sense of mastery, users may still maintain concentration but show little improvement in cognitive or emotional outcomes (Chen & Lin, 2022). In contrast, other studies highlight that control substantially enhances flow and indirectly strengthens satisfaction and behavioral intentions, particularly in contexts such as virtual try-on (Yang & Lee, 2023; Pathak & Prakash, 2023).

These conflicting findings may result from contextual variation. In some AR applications, users value immersion and novelty more strongly, while in others, operational mastery is a prerequisite for immersion (Huang & Liao, 2017; Javornik, 2016).

This review concludes that the operationalization of control is highly context-dependent. Without distinguishing across application types, its explanatory value for flow will remain limited. Future studies should develop measurement frameworks that are both unified and flexible enough to capture the differentiated effects of control across diverse AR shopping scenarios.

3.2.4. Time Distortion

Time distortion is a classic dimension of flow, reflecting altered perceptions of time during immersion (Barta et al., 2021). In AR shopping, empirical findings indicate that users often perceive time as passing more quickly during interactions such as virtual try-ons, and this phenomenon is considered an important indicator of immersion intensity (Huang & Liao, 2017; Lin & Huang, 2024). Similar effects have also been observed in VR contexts, providing relevant insights for AR research (Han et al., 2020).

Despite this, the study of time distortion in AR shopping remains underdeveloped. Compared with traditional online shopping, research on this dimension is relatively scarce. Moreover, existing work often relies on single items or overly simplified measures, which fail to capture its multidimensional nature (Ghazali et al., 2019; Nawres et al., 2024).

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This review finds that current operationalization of time distortion is insufficient, limiting its explanatory power as an indicator of immersion. Future research should develop more systematic and multi-item tools to better reveal how altered perceptions of time influence user continuance intention.

3.2.5. Curiosity

Curiosity has only recently been integrated as a flow dimension in AR shopping, used to explain users' psychological drive for exploration and novelty (Lee et al., 2018; Yang et al., 2020). It is typically defined as interest in novel stimuli or gaps in knowledge, and often differentiated into perceptual curiosity and epistemic curiosity (Ji & Shin, 2019). In AR shopping contexts, perceptual curiosity is particularly salient, as visual, interactive, and immersive elements stimulate exploration and deepen flow experiences (Kim & Choo, 2023).

Evidence suggests that curiosity not only facilitates deeper interaction but also maintains a reciprocal relationship with flow: higher curiosity increases the likelihood of entering flow, while immersion itself further reinforces curiosity (Schutte & Malouff, 2023). However, research remains limited and inconsistent. Some studies rely on single-item indicators, while others propose refined subdimensions but lack cross-study validation (Chen & Lin, 2022; Javornik et al., 2019).

This review highlights that the operationalization of curiosity is still at an exploratory stage. Unless more robust and standardized tools are developed, cumulative evidence will remain fragmented. Future studies should systematically examine how curiosity operates across contexts and its role in sustaining continuance.

Overall, the operationalization of flow's five dimensions in AR shopping shows significant inconsistencies: some dimensions are oversimplified (e.g., time distortion), some are systematically underrepresented (e.g., enjoyment), and others are constrained by contextual dependency (e.g., control). These inconsistencies limit the comparability of findings across studies and weaken flow's explanatory potential in understanding AR shopping experiences and continuance intention. Responding to RQ2, this review underscores the need for greater theoretical clarity and methodological integration, which will enable more robust cumulative development of flow research in AR shopping contexts.

3.3. How do the multiple dimensions of flow influence users' continuance intention in AR shopping contexts?

This review shows that flow experiences exert a significant influence on continuance intention in AR shopping (Sarkar & Khare, 2019; Yang & Lee, 2023). The dimensions of flow do not operate in isolation; rather, they interact through cognitive, emotional, and motivational mechanisms to jointly shape immersion and drive continued use (see Figure 2).

First, enjoyment emerges as the most powerful predictor of continuance intention, consistently validated across studies. It stimulates positive emotions and enhances satisfaction with the shopping experience. For instance, Rauschnabel (2018) found that pleasurable experiences were strongly associated with users' intention to continue using AR smart glasses. Yet, enjoyment remains systematically underestimated in

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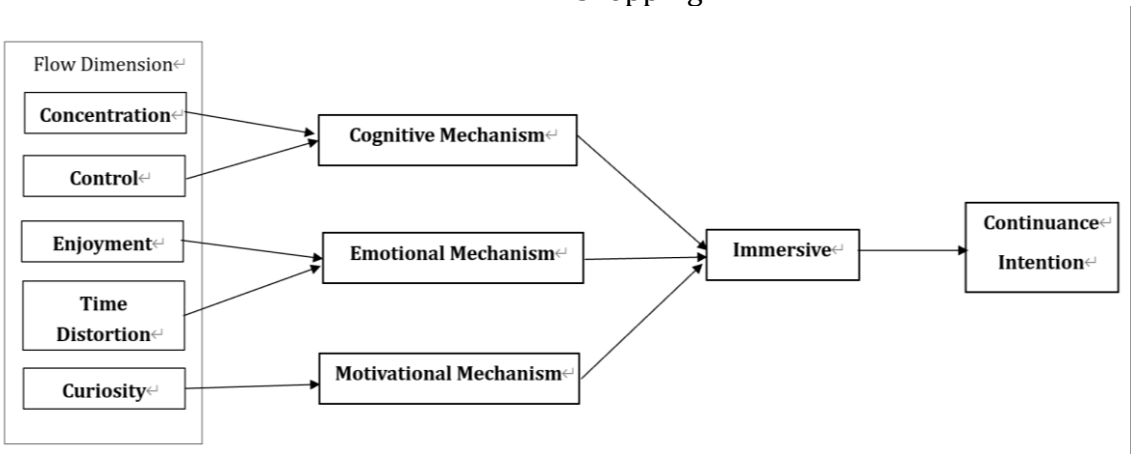
measurement, which has led to the neglect of emotional mechanisms in explaining continuance. This review highlights the need to place enjoyment at the core of flow research and underscores the practical implication that AR applications should prioritize emotional design to foster retention.

Figure 2: Flow dimensions and psychological mechanisms driving continuance intention in AR shopping



Second, concentration has also been consistently shown to strengthen continuance intention (Chen & Mokmin, 2024). When users are fully absorbed in blended virtual–real shopping environments, their technological stickiness is reinforced. This finding underscores the importance of attention allocation. However, some studies conflate "concentration" with "absorption," introducing conceptual overlap and measurement bias. Concentration is therefore critical, but future research must provide clearer definitions and more precise operationalization.

Third, control remains the most contested dimension. Some studies demonstrate that perceived control enhances flow and indirectly promotes continuance (Hoque et al., 2024), whereas others find its impact marginal (Chen & Lin, 2022). Such divergence suggests that its role may be context-dependent: control is more salient in utilitarian scenarios such as virtual try-ons, but may be less relevant in hedonic or entertainment-driven settings. Consequently, the predictive power of control remains unstable, requiring systematic cross-context comparisons.

Fourth, time distortion reflects users' altered perception of time during immersion. Evidence indicates that this distortion enhances both immersion and enjoyment, thereby encouraging continuance (Huang & Liao, 2017; Lee et al., 2018). However, most studies rely on single-item or simplified measures, which are insufficient to capture its complex characteristics. While time distortion shows promise, its effects require further confirmation through more systematic operationalization.

Finally, curiosity represents an emerging but underexplored psychological mechanism. Curiosity motivates users to explore AR features and deepen their interactions (Yang et al., 2020). Existing evidence suggests that curiosity not only facilitates entry into flow but also reinforces continuance intention (Schutte & Malouff, 2023). Yet, studies remain scarce, and inconsistent measurement further limits theoretical generalization. This identifies curiosity as a growth point for future research and a practical lever for stimulating exploratory engagement.

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In synthesis, enjoyment and concentration appear to be the core drivers of continuance intention; control and time distortion show context-dependent effects; and curiosity represents a future research frontier with significant practical potential. For retailers and developers, understanding these multidimensional mechanisms of flow provides actionable insights for AR application design: enhancing users' enjoyment and curiosity may be particularly effective strategies for boosting retention.

4. Conclusion

The primary objective of this study was to provide a comprehensive overview of the current state of flow theory in AR shopping. To achieve this aim, we proposed three guiding questions and addressed them through a systematic literature review. A rigorous search of Web of Science and Scopus identified 17 studies that met the inclusion criteria, which were then evaluated across multiple dimensions.

The findings reveal that the conceptualization and operationalization of flow in AR shopping remain fragmented and inconsistent. Although this review advances a multidimensional perspective of flow, more empirical research is needed to explore its cognitive, emotional, and conative dimensions. Moreover, current scholarship has paid limited attention to continuance intention (CI), with most studies focusing narrowly on adoption or purchase intentions. Future research should therefore prioritize CI as a key outcome of flow in AR shopping.

Despite its contributions, this review has several limitations. First, the small sample size constrains the generalizability of the findings and reflects the early stage of this research domain. Second, the proposed integrative framework is based solely on secondary data and has yet to be empirically validated; longitudinal and experimental approaches are recommended for future studies. Third, the scope of this review was restricted to AR shopping, which reduces cross-contextual heterogeneity. Expanding the scope to include other flow-intensive contexts such as gaming and tourism may yield richer comparative insights.

Ethics Approval and Consent to Participate

This study did not involve human participants; therefore, ethics approval and informed consent were not required.

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Conflict of Interest

The authors report no conflicts of interest for this work and declare that there are no potential conflicts of interest related to the research, authorship, or publication of this article.

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