The Role of Artificial Intelligence in Transforming E-Commerce: Trends, Consumer Behavior, and Ethical Challenges

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Abstract
Artificial intelligence (AI) has become one of the most consequential forces reshaping global commerce in the current decade. From personalized product recommendations to conversational shopping assistants and predictive inventory systems, AI technologies are redefining how consumers discover, evaluate, and purchase goods online. This paper examines the current state of AI adoption in e-commerce, synthesizing recent academic literature to explore its effects on consumer behavior, trust, and decision-making. Using an integrative review approach grounded in the Stimulus-Organism-Response (S-O-R) model and the Expectation-Confirmation Model (ECM), the paper analyzes how AI-driven personalization, recommendation engines, and generative shopping assistants influence purchase intention, customer satisfaction, and long-term brand loyalty. The paper also addresses the ethical and governance challenges associated with AI-enabled commerce, including algorithmic bias, data privacy, and the erosion of consumer autonomy. Findings suggest that while AI substantially enhances convenience, personalization, and operational efficiency, it simultaneously raises unresolved questions about transparency, trust, and equitable access. The paper concludes with managerial implications for retailers and policymakers and outlines directions for future research, particularly regarding cross-cultural and longitudinal investigations of AI-consumer interactions.

Keywords: *artificial intelligence, e-commerce, consumer behavior, personalization, algorithmic trust, digital retail*

1. Introduction

Electronic commerce has undergone a profound structural transformation over the past five years, driven largely by the maturation of artificial intelligence technologies. What began as simple rule-based recommendation systems in the early 2000s has evolved into sophisticated machine learning and generative AI architectures capable of anticipating consumer needs, personalizing entire shopping journeys, and conducting natural-language conversations with customers in real time. Industry analyses indicate that AI is no longer a peripheral feature of online retail but has become a core driver of growth, operational efficiency, and customer experience across the sector (EComposer, 2025). Retailers that fail to adopt AI-enabled tools risk falling behind competitors who leverage these technologies to increase conversion rates, reduce operational costs, and build deeper customer relationships.

The commercial significance of this shift is difficult to overstate. AI-powered personalization engines, chatbots, and predictive analytics tools are increasingly embedded across the customer journey, from initial product discovery through post-purchase support. Recent scholarship has documented substantial gains in customer engagement and conversion likelihood associated with AI-based personalization, with some studies reporting engagement increases of over 40% when AI-driven recommendation and advertising systems are deployed effectively (Advances in Consumer Research, 2025). At the same time, this rapid integration of AI into commercial ecosystems has generated significant scholarly debate about its implications for consumer autonomy, data privacy, and algorithmic fairness.

This paper addresses a central and current research question: how is artificial intelligence transforming e-commerce, and what are the corresponding implications for consumer behavior, trust, and market governance? To answer this question, the paper draws on a synthesis of recent peer-reviewed literature published primarily in 2025, supplemented by industry data on AI adoption trends. The analysis is structured around four core objectives: (a) to map the primary AI applications currently used in e-commerce; (b) to examine how these applications influence consumer decision-making processes; (c) to critically assess the ethical and governance challenges associated with AI-driven commerce; and (d) to identify managerial and policy implications for stakeholders operating in this rapidly evolving environment.

The topic is particularly timely. Systematic reviews of the AI-consumer behavior literature report an exponential surge in scholarly publications since 2020, driven primarily by advances in machine learning and natural language processing (Riandhi et al., 2025). This growth reflects both the increasing sophistication of AI tools available to commercial actors and the growing recognition among scholars that AI is fundamentally altering the psychological and behavioral dynamics of online consumption. As generative AI shopping assistants and conversational commerce platforms become mainstream, understanding their effects on consumer psychology, satisfaction, and trust has become an urgent priority for both academic researchers and industry practitioners.

2. Literature Review

2.1 The Evolution of AI in Commercial Contexts

The application of artificial intelligence to commerce is not a wholly new phenomenon; recommendation algorithms have been used by major online retailers since the late 1990s. However, the scale, sophistication, and pervasiveness of AI applications in commerce have increased dramatically in recent years. Early AI applications in retail were largely confined to collaborative filtering systems that recommended products based on the purchasing patterns of similar users. Contemporary systems, by contrast, integrate deep learning, natural language processing, computer vision, and generative AI to create highly individualized and dynamic shopping experiences (Li et al., 2025).

A comparative analysis of AI-driven technologies in e-commerce found that personalization systems, recommendation engines, and chatbot interfaces have collectively reshaped how consumers discover, evaluate, and purchase products, with measurable effects on decision-making processes across multiple consumer behavior metrics (Li et al., 2025). This shift reflects a broader transition from AI as a back-end operational tool toward AI as a front-facing, consumer-interactive feature that actively shapes the retail experience.

2.2 Personalization and the Consumer Experience

Personalization is widely regarded as the most transformative application of AI within e-commerce. AI-driven personalization tools analyze vast quantities of behavioral data, including browsing history, purchase patterns, and demographic information, to tailor product recommendations, pricing, and marketing communications to individual users. Research indicates that AI is fundamentally transforming digital marketing through personalization tools that enhance consumer experience and strengthen engagement, functioning as a transformative force across multiple marketing functions (Anggraeni et al., 2026).

Beyond simple recommendation accuracy, scholars have begun examining the psychological dimensions of AI-driven personalization, including novelty-seeking behavior and continuance intention. A recent study exploring the transition "from personalization to novelty" found that AI applications increasingly serve not only functional purposes—helping consumers find relevant products—but also experiential purposes, generating a sense of discovery and engagement that encourages continued platform use (Anggraeni et al., 2026). This suggests that AI's influence on consumer behavior extends beyond transactional efficiency into the realm of emotional and experiential engagement.

2.3 Generative AI and Conversational Commerce

The emergence of generative AI represents perhaps the most significant recent development in AI-enabled commerce. Unlike earlier recommendation systems, generative AI shopping assistants can engage in open-ended, conversational interactions with consumers, answering product questions, offering styling or usage advice, and guiding users through complex purchase decisions. Recent research on generative AI shopping assistants highlights their capacity to reshape consumer motivation and behavior through interactive, conversational design that more closely resembles human sales assistance than static recommendation displays (Xie, 2026, as cited in Anggraeni et al., 2026).

Industry data corroborate the rapid growth of conversational commerce. Market projections suggest that the conversational commerce sector will expand dramatically over the next decade, growing from approximately $8.8 billion in 2025 to over $32 billion by 2035 (EComposer, 2025). Survey research further indicates that a majority of consumers have already engaged with conversational AI tools while shopping, with more than 60% of surveyed consumers reporting use of conversational AI for shopping-related tasks (EComposer, 2025). These findings suggest that conversational AI is transitioning from a novel feature to a mainstream expectation among online shoppers.

2.4 Predictive Analytics and Operational Applications

While much of the consumer-facing literature focuses on personalization and chatbots, AI also plays a substantial role in the operational infrastructure of e-commerce. Predictive analytics tools use machine learning and deep learning techniques to forecast consumer purchasing patterns, optimize inventory management, and inform marketing strategy. Research on AI's role in predicting consumer behavior in online retail emphasizes that such predictive capabilities allow retailers to tailor marketing strategies, manage inventory more efficiently, and ultimately increase sales performance (Zenodo, 2025). This operational dimension of AI adoption is often less visible to consumers but is nonetheless critical to the overall competitiveness of e-commerce enterprises.

2.5 Trust, Adoption, and Behavioral Models

A substantial body of research has applied established technology acceptance and consumer behavior frameworks to understand how consumers come to trust and adopt AI-driven commercial tools. The Expectation-Confirmation Model (ECM) has been used to explain post-adoption engagement with AI-powered e-commerce systems, emphasizing that consumers' continued use of AI tools depends on the extent to which the technology confirms or exceeds their initial expectations regarding convenience and personalization (Ghazali et al., 2023, as cited in Elsevier, 2025). Complementing this, the Stimulus-Organism-Response (S-O-R) model has been employed to explain how digital stimuli—including AI-personalized content—shape internal consumer states (the "organism" stage), which subsequently drive purchasing responses (Avinash et al., 2025).

Trust emerges consistently across the literature as a central mediating variable in AI-driven consumer behavior. A large-scale structural equation modeling study involving 600 online consumers found that AI-based personalization significantly enhanced perceived convenience and trust, which in turn increased consumer engagement and conversion likelihood (Advances in Consumer Research, 2025). However, the same body of research cautions that excessive automation and perceived intrusions on data privacy can undermine the positive effects of personalization, suggesting a delicate balance between beneficial customization and consumer discomfort (Advances in Consumer Research, 2025).

2.6 Systematic and Bibliometric Reviews

Recent systematic and bibliometric reviews provide a broader lens on the trajectory of AI-consumer behavior scholarship. A PRISMA-guided systematic review synthesizing 117 Scopus-indexed articles published between 2009 and April 2025 found that consumer attitudes toward trust and privacy, along with behavioral intentions, function as the primary mediating variables linking AI adoption to consumer outcomes (Riandhi et al., 2025). This review also identified generative AI as a particularly disruptive technology, capable of enabling hyper-personalization while simultaneously introducing new authenticity concerns, as consumers increasingly struggle to distinguish AI-generated content and recommendations from human-curated alternatives (Riandhi et al., 2025).

Notably, this same review calls for stronger ethical governance frameworks and hybrid human-machine processes that balance innovation against the preservation of consumer trust (Riandhi et al., 2025). This recommendation reflects a broader consensus within the literature that unregulated or opaque AI deployment carries meaningful risks alongside its commercial benefits.

3. Theoretical Framework

This paper adopts a dual theoretical lens combining the Stimulus-Organism-Response (S-O-R) model with the Expectation-Confirmation Model (ECM) to structure its analysis of AI's influence on consumer behavior in e-commerce settings.

3.1 The Stimulus-Organism-Response Model

Originally developed within environmental psychology, the S-O-R model has been widely adapted within consumer behavior research to explain how external stimuli influence internal psychological states, which subsequently determine behavioral responses. Within the context of AI-enabled e-commerce, AI-generated stimuli—including personalized product recommendations, dynamically tailored advertisements, and conversational chatbot interactions—function as the "stimulus" component of the model. These stimuli interact with the consumer's internal cognitive and affective states (the "organism" component), such as perceived relevance, trust, and emotional engagement, which then shape the consumer's behavioral "response," including purchase intention, browsing duration, and repeat platform usage (Avinash et al., 2025).

This framework is particularly well suited to analyzing AI's influence because it explicitly accounts for the psychological mediating processes that translate algorithmic personalization into behavioral outcomes, rather than treating AI's effects as a direct, unmediated cause of purchasing behavior.

3.2 The Expectation-Confirmation Model

While the S-O-R model is useful for explaining initial behavioral responses to AI stimuli, the Expectation-Confirmation Model offers a complementary framework for understanding sustained, post-adoption engagement with AI-driven commercial platforms. According to this model, consumers form expectations about a technology prior to use; following initial engagement, they compare their actual experience against these expectations. When AI-powered systems meet or exceed expectations regarding convenience, accuracy, and personalization, consumers develop higher satisfaction and stronger continuance intentions (Ghazali et al., 2023, as cited in Elsevier, 2025). Conversely, when AI systems generate perceptions of intrusiveness, inaccuracy, or manipulation, consumer trust and continued engagement are likely to decline.

Together, these two frameworks provide a comprehensive theoretical foundation for understanding both the immediate behavioral effects of AI-driven stimuli and the longer-term dynamics of consumer trust and platform loyalty in AI-enabled commercial environments.

4. AI Applications Currently Shaping E-Commerce

4.1 Recommendation Engines

Recommendation engines remain the most ubiquitous AI application in e-commerce. These systems analyze historical purchase data, browsing behavior, and demographic characteristics to generate individualized product suggestions. Comparative research on AI-driven e-commerce technologies identifies recommendation systems as one of the primary mechanisms through which AI reshapes consumer decision-making processes, alongside personalization tools and chatbot interfaces (Li et al., 2025). The effectiveness of these systems has improved substantially with the integration of deep learning architectures capable of identifying complex, non-linear patterns in consumer preference data that earlier collaborative filtering approaches could not detect.

4.2 Conversational AI and Chatbots

AI-powered chatbots and virtual assistants now handle a substantial share of customer service interactions in online retail environments, ranging from answering basic product inquiries to guiding customers through returns and complaints. Research on human-AI interaction in e-commerce emphasizes that consumers who perceive AI-powered services as intuitive and effortless to use demonstrate greater willingness to adopt and continue using these tools (Murrar et al., 2025, as cited in Elsevier, 2025). This underscores the importance of usability and perceived ease of interaction in determining the commercial success of conversational AI deployments.

4.3 Generative AI Shopping Assistants

The most recent evolution in AI-enabled commerce involves generative AI systems capable of producing novel, contextually appropriate responses rather than relying on pre-scripted decision trees. These generative shopping assistants can synthesize product information, generate personalized style or usage recommendations, and engage in multi-turn conversations that more closely approximate human sales interactions. Emerging research suggests that these systems influence not only functional purchase decisions but also consumer motivation more broadly, potentially reshaping how consumers conceptualize the shopping process itself (Xie, 2026, as cited in Anggraeni et al., 2026).

4.4 Predictive Analytics for Inventory and Demand Forecasting

Beyond consumer-facing applications, AI plays an increasingly central role in the operational backbone of e-commerce enterprises. Predictive analytics tools leverage machine learning models to forecast demand fluctuations, optimize inventory allocation across distribution networks, and inform dynamic pricing strategies. Research on AI's predictive applications in online retail highlights the capacity of these tools to improve decision-making accuracy for retailers while simultaneously raising concerns about the risks of over-reliance on automated forecasting models, particularly during periods of unusual market volatility (Zenodo, 2025).

4.5 Adaptive Advertising

AI-driven adaptive advertising systems dynamically adjust marketing content, timing, and channel selection based on real-time consumer behavior signals. Structural equation modeling research examining AI-enabled personalization found that adaptive advertising, alongside recommendation systems and chatbot responsiveness, significantly influenced purchase intention and conversion rates among surveyed consumers (Advances in Consumer Research, 2025). This finding reinforces the interconnected nature of AI applications across the e-commerce value chain, wherein personalization,

communication, and advertising functions increasingly operate as an integrated system rather than as isolated tools.

5. Impacts on Consumer Behavior

5.1 Enhanced Convenience and Purchase Efficiency

Across the reviewed literature, convenience emerges as one of the most consistently reported benefits of AI-enabled commerce. AI-driven personalization reduces the cognitive burden associated with searching through large product catalogs by surfacing relevant options proactively. This reduction in search costs appears to translate directly into behavioral outcomes; research employing structural equation modeling found a statistically significant positive relationship between AI-based personalization and perceived convenience, which subsequently predicted increased consumer engagement and conversion likelihood (Advances in Consumer Research, 2025).

5.2 Trust as a Behavioral Gatekeeper

While convenience represents a clear behavioral benefit, trust functions as a critical gatekeeping variable that determines whether the benefits of AI personalization translate into sustained consumer engagement. Multiple studies converge on the finding that consumer trust mediates the relationship between AI-driven personalization and purchase behavior (Riandhi et al., 2025; Advances in Consumer Research, 2025). When consumers perceive AI systems as transparent and beneficial, personalization tends to enhance satisfaction and loyalty. However, when consumers perceive AI-driven personalization as intrusive, manipulative, or opaque, the same technological capabilities can generate resistance, skepticism, and reduced platform engagement.

5.3 The Personalization-Privacy Paradox

A recurring theme within the literature is what researchers describe as the personalization-privacy paradox, wherein the same data collection practices that enable highly effective personalization also generate consumer discomfort regarding privacy and surveillance. This paradox reflects a fundamental tension at the heart of AI-driven commerce: the technological capabilities that make AI personalization effective depend on extensive data collection, yet this same data collection is a primary source of consumer distrust (Advances in Consumer Research, 2025). Research applying the S-O-R model to this dynamic suggests that consumer traits, such as privacy sensitivity, moderate the strength of this paradox, meaning that the negative effects of privacy concerns are not uniform across all consumer segments (Avinash et al., 2025).

5.4 Novelty-Seeking and Experiential Engagement

Beyond functional and trust-related outcomes, recent research has identified novelty-seeking as an important behavioral dimension shaped by AI in e-commerce contexts. As AI systems become more sophisticated, particularly with the introduction of generative capabilities, they increasingly offer consumers not just efficient transactions but novel, engaging experiences that encourage exploration and continued platform use (Anggraeni et al., 2026). This suggests that the behavioral effects of AI extend beyond the traditional utilitarian dimensions of convenience and efficiency into more experiential and hedonic domains of consumption.

5.5 Human Laziness and Over-Reliance

Interestingly, recent scholarship has begun to examine potential negative behavioral consequences of AI convenience, including the concept of "human laziness" in decision-making, wherein consumers become increasingly reliant on AI-generated recommendations at the expense of independent product evaluation (Anggraeni et al., 2026). This raises important questions about the long-term cognitive and behavioral effects of pervasive AI mediation in commercial decision-making, an area that remains underexplored relative to the more commonly studied dimensions of trust and satisfaction.

6. Ethical and Governance Challenges

6.1 Algorithmic Bias

One of the most significant ethical challenges associated with AI-driven commerce concerns the risk that algorithmic systems may reinforce or amplify pre-existing biases present in training data. Scholars have highlighted the urgent need for governance frameworks capable of promoting ethical AI conduct within e-commerce, particularly given the risk that biased algorithms may generate inequitable outcomes for certain consumer groups (Ferrara, 2023, as cited in Elsevier, 2025). Because AI recommendation and pricing systems are trained on historical consumer data, they risk perpetuating

existing patterns of inequality, such as differential pricing or product access based on demographic characteristics correlated with past purchasing behavior.

6.2 Data Privacy and Consumer Autonomy

Data privacy represents a second major ethical concern within the AI-commerce literature. Growing unease among consumers regarding data collection and utilization practices has prompted increasing demand for transparency and accountability in AI-driven personalization mechanisms (Hardcastle et al., 2025, as cited in Elsevier, 2025). This concern is particularly acute given the opacity of many machine learning systems, which often function as "black boxes" whose internal decision-making processes are not readily interpretable even by the organizations that deploy them, let alone by the consumers whose data they process.

6.3 Authenticity and the Rise of Generative AI

The proliferation of generative AI tools introduces a distinct set of ethical challenges related to authenticity. As AI systems become capable of generating human-like conversational responses, product descriptions, and even marketing content, consumers face increasing difficulty distinguishing between human-curated and AI-generated commercial communications. Systematic review evidence identifies this authenticity challenge as a disruptive consequence of generative AI's hyper-personalization capabilities, warranting explicit attention within AI governance frameworks (Riandhi et al., 2025).

6.4 Governance Gaps in Current Research

Despite growing recognition of these ethical challenges, scholars note a persistent gap between technical and conceptual approaches to AI ethics in commerce. Much existing research either evaluates the technical performance of recommendation systems in isolation or discusses ethical risks in abstract, conceptual terms, without empirically linking specific consumer behavioral outcomes to concrete governance implications (Elsevier, 2025). This gap suggests a need for more integrated research designs that simultaneously measure behavioral outcomes and evaluate the effectiveness of specific governance interventions, such as algorithmic transparency disclosures or opt-in personalization controls.

6.5 Small Business and Market Equity Considerations

An additional and less frequently discussed dimension of AI governance concerns market equity between large and small commercial actors. Research examining AI adoption among small-scale businesses suggests that while AI tools offer significant potential benefits for smaller retailers, including improved customer targeting and operational efficiency, disparities in technical capacity and financial resources may limit equitable access to these tools across firm sizes (Sultan et al., 2025, as cited in ResearchGate, 2025). This raises important questions about whether AI-driven commerce may inadvertently widen competitive gaps between large, well-resourced retailers and smaller market participants.

7. Managerial and Policy Implications

7.1 Balancing Personalization with Transparency

For commercial practitioners, the reviewed literature suggests that the benefits of AI-driven personalization are contingent on maintaining consumer trust through transparent data practices. Retailers seeking to maximize the commercial benefits of AI personalization should consider implementing clear, accessible disclosures regarding data collection practices and providing consumers with meaningful control over the extent of personalization they receive. Given that excessive automation and perceived data intrusiveness have been shown to counteract the positive effects of personalization on engagement (Advances in Consumer Research, 2025), practitioners should approach AI deployment with careful attention to the threshold at which personalization begins to generate consumer discomfort rather than satisfaction.

7.2 Investing in Conversational AI Quality

Given the demonstrated importance of perceived ease of use and intuitiveness in determining consumer adoption of AI-powered customer service tools (Murrar et al., 2025, as cited in Elsevier, 2025), retailers should prioritize the usability and conversational quality of chatbot and virtual assistant deployments. Poorly designed conversational AI systems risk generating frustration and diminished trust, undermining the broader commercial objectives of AI adoption.

7.3 Developing Internal AI Governance Frameworks

Organizations deploying AI-driven commercial tools should consider establishing internal governance structures dedicated to monitoring algorithmic fairness and mitigating bias risks. Given scholarly calls

for governance frameworks capable of promoting ethical AI conduct (Ferrara, 2023, as cited in Elsevier, 2025), practitioners have both an ethical and a commercial incentive to proactively address these risks, as consumer trust erosion resulting from perceived unfairness or opacity carries direct financial consequences through reduced engagement and loyalty.

7.4 Policy Considerations

From a policy perspective, the literature's consistent emphasis on the need for hybrid human-machine governance processes (Riandhi et al., 2025) suggests that regulatory frameworks should avoid purely technical approaches to AI oversight in commerce. Instead, policymakers should consider frameworks that mandate meaningful human oversight of high-stakes algorithmic decisions, such as those affecting pricing or product access, alongside technical standards for algorithmic auditing and bias detection.

8. Limitations and Directions for Future Research

The current body of literature on AI in e-commerce, while rapidly expanding, exhibits several notable limitations that constrain the generalizability of existing findings. First, systematic reviews note that longitudinal and cross-cultural investigations remain comparatively rare within the field, with the majority of empirical studies relying on quantitative survey methods conducted at a single point in time within specific geographic or cultural contexts (Riandhi et al., 2025). This limits researchers' ability to draw conclusions about how AI-consumer relationships evolve over extended periods or vary systematically across different cultural and regulatory environments.

Second, existing research has been criticized for insufficiently integrating technical and ethical analysis, with technical evaluations of recommender system performance and conceptual discussions of ethical risk often proceeding in parallel rather than being empirically linked within unified research designs (Elsevier, 2025). Future research would benefit from methodological approaches that directly connect specific algorithmic design choices to measurable consumer trust and behavioral outcomes, enabling more precise identification of which governance interventions are most effective at mitigating ethical risks without undermining commercial performance.

Third, the behavioral consequences of generative AI shopping assistants remain a nascent area of study, given the recency of widespread generative AI deployment within commercial contexts. As these tools continue to evolve rapidly, ongoing empirical research will be necessary to track their effects on consumer motivation, decision quality, and potential over-reliance, particularly given early evidence suggesting the emergence of "human laziness" dynamics in AI-mediated decision-making (Anggraeni et al., 2026).

Finally, questions of market equity between large and small commercial actors in AI adoption warrant further empirical attention. While preliminary research has begun to examine AI adoption among small businesses (Sultan et al., 2025, as cited in ResearchGate, 2025), more comprehensive research is needed to understand the structural barriers that may prevent equitable access to AI-driven commercial tools across firms of varying size and resource capacity, as well as the broader competitive implications of any resulting disparities.

9. Conclusion

Artificial intelligence has fundamentally reshaped the landscape of e-commerce, transforming not only the operational infrastructure of online retail but also the psychological and behavioral dynamics of consumer decision-making. This paper has synthesized recent academic literature to demonstrate that AI-driven personalization, recommendation systems, conversational chatbots, and generative shopping assistants collectively enhance consumer convenience, engagement, and purchase efficiency, while simultaneously introducing significant challenges related to trust, privacy, and algorithmic fairness. The theoretical integration of the Stimulus-Organism-Response model and the Expectation-Confirmation Model provides a useful framework for understanding both the immediate behavioral effects of AI-driven stimuli and the longer-term dynamics of consumer trust and platform loyalty.

The evidence reviewed in this paper suggests that the commercial success of AI adoption in e-commerce is not simply a function of technical sophistication but is critically dependent on maintaining consumer trust through transparent, ethically governed implementation. As generative AI technologies continue to advance and become further embedded within commercial ecosystems, the imperative for robust governance frameworks that balance innovation with consumer protection will only intensify. Future research addressing the current gaps in longitudinal, cross-cultural, and equity-focused investigation

will be essential to ensuring that the ongoing AI transformation of commerce benefits consumers, businesses, and the broader market ecosystem in a sustainable and equitable manner.

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