Comprehensive Journal of Science
Volume (11), Issue (41), (JUNE, 2026)
ISSN: 3014-6266

مجلة العلوم الشاملة
المجلد (11) العدد 41 يونيو 2026
ردمد: 3014-6266

The Impact of Dark Patterns versus Ethical Design in AI-Based Recommendation Systems
A Field Study on E-Commerce Users

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تاريخ الاستلام:2026/05/05 –تاريخ المراجعة:2026/05/28– تاريخ القبول: 2026/06/07– تاريخ للنشر: 2026 /06/21

Abstract
This study examines the influence of dark patterns versus ethical design in AI-driven recommendation systems on consumer choice, trust, and loyalty in e-commerce environments. The study is motivated by the increasing adoption of AI recommendation systems and the growing ethical concerns associated with persuasive and manipulative interface practices. A descriptive analytical approach was adopted, and data were collected through an online questionnaire with 35 valid responses. The questionnaire measured four main constructs: dark patterns, ethical design, consumer trust, and loyalty. The descriptive results show that dark patterns achieved a moderate overall mean of 3.41, indicating that practices such as false scarcity messages and countdown timers can influence purchase decisions. Ethical design achieved a higher mean of 3.84, while consumer trust recorded 3.77 and loyalty achieved the highest mean of 4.13. Reliability analysis showed strong internal consistency, with an overall Cronbach's alpha of 0.913. The findings suggest that while dark patterns may generate short-term behavioral influence, ethical design appears to be more sustainable in strengthening consumer trust and long-term loyalty. The study recommends that e-commerce platforms adopt transparent, explainable, and user-centered AI recommendation practices and reduce manipulative interface strategies that undermine consumer autonomy.

Keywords
Dark Patterns, Ethical Design, AI Recommendation Systems, Consumer Trust, Loyalty, E-commerce.

1. Introduction
In recent years, e-commerce has witnessed a remarkable expansion in the use of artificial intelligence technologies, particularly intelligent recommendation systems, which have become a central tool for directing consumers toward products and services that match their preferences. These systems rely on the analysis of user data, browsing history, previous purchases, and digital interactions in order to provide personalized recommendations that improve user experience and increase the effectiveness of digital marketing.

Despite the advantages offered by AI-based recommendation systems, they raise several ethical issues related to interface design and the way recommendations are presented. Some platforms may use design practices known as dark patterns, which are methods intended to influence user decisions by exploiting psychological and cognitive biases, such as time pressure, false scarcity, automatic additions, and difficulty reversing certain choices.

In contrast, ethical design emphasizes transparency, clarity, and respect for user autonomy, enabling consumers to make informed decisions without pressure or manipulation. This includes explaining why recommendations appear, presenting reviews honestly, allowing users to control their data, and making it easy to modify or cancel orders. Therefore, comparing dark

patterns and ethical design has become an important scientific and practical issue as reliance on artificial intelligence in e-commerce continues to grow.

This study provides a field analysis of this issue by measuring e-commerce users' attitudes toward dark patterns and ethical design and their impact on trust and loyalty. The importance of the study lies in combining two dimensions that are often examined separately in the literature: manipulative design practices and ethical design in intelligent recommendation systems.

2. Research Problem

The research problem lies in the limited scientific understanding of the comparative impact of dark patterns and ethical design within AI-based recommendation systems, particularly regarding their influence on consumer choices, trust, and loyalty toward electronic platforms. Although previous studies have addressed intelligent recommendation systems, dark patterns, or loyalty separately, studies that integrate these variables into a single model and compare them remain limited, especially in Arab contexts.

3. Significance of the Study

The scientific significance of this study stems from its contribution to the literature on digital marketing, AI ethics, and consumer behavior by analyzing the effect of two contrasting types of digital design: manipulative design represented by dark patterns and ethical design based on transparency and respect for the user. The study also provides practical value for e-commerce platforms and developers of recommendation systems by showing that strengthening trust and loyalty may be more sustainable than relying on pressure and urgency techniques.

4. Research Objectives

This study aims to examine the influence of dark patterns and ethical design in AI-driven recommendation systems on consumer choice, trust, and loyalty within e-commerce environments. Specifically, the study seeks to investigate the impact of dark patterns on immediate purchasing decisions, analyze the role of ethical design in enhancing consumer trust, explore the relationship between trust and customer loyalty, compare the effectiveness of dark patterns and ethical design in shaping consumer behavior, and evaluate the importance of transparency and user autonomy in AI-powered recommendation systems.

5. Research Hypotheses

Based on the theoretical framework and previous studies, the present study proposes four hypotheses. The first hypothesis assumes that dark patterns in AI-driven recommendation systems positively influence immediate purchasing decisions. The second hypothesis suggests that ethical design positively affects consumer trust. The third hypothesis proposes a positive relationship between consumer trust and customer loyalty. Finally, the fourth hypothesis assumes that ethical design has a stronger positive effect on customer loyalty than dark patterns.

6. Literature Review and Research Gap

The rapid growth of artificial intelligence (AI) technologies has significantly transformed e-commerce platforms, particularly through the widespread adoption of recommendation systems. These systems analyze user behavior, preferences, and purchase history to provide personalized product suggestions that enhance customer experience and increase sales performance. According to Adomavicius and Tuzhilin (2005), recommendation systems have become one of the most influential applications of AI in digital commerce due to their ability to support consumer decision-making and improve information filtering.

Despite their benefits, recommendation systems have raised growing ethical concerns regarding the methods used to influence consumer behavior. One of the most discussed issues is the use of dark patterns, which are interface design strategies intentionally created to

manipulate users into making decisions that may not align with their original intentions. Gray et al. (2018) described dark patterns as deceptive user experience techniques that exploit cognitive biases and reduce users' ability to make autonomous decisions. Similarly, Mathur et al. (2019) found that dark patterns are widespread across online shopping websites and frequently employ tactics such as false scarcity messages, countdown timers, hidden costs, and misleading interface designs.

Recent studies have shown that dark patterns can significantly influence purchasing behavior by creating a sense of urgency and encouraging impulsive decisions. However, while these practices may generate short-term commercial benefits, they can also reduce consumer trust and damage long-term relationships between customers and digital platforms. O'Neil (2016) argued that algorithmic systems designed primarily to maximize engagement and profit may unintentionally undermine fairness, transparency, and consumer autonomy.

In contrast, ethical design emphasizes transparency, explainability, user control, and informed decision-making. Ethical design aims to support users rather than manipulate them, allowing consumers to understand why recommendations are presented and how their personal data are used. Floridi and Cowls (2019) proposed a framework for responsible AI based on principles including transparency, autonomy, fairness, and accountability. Similarly, Shin (2021) demonstrated that explainable AI systems improve user trust, acceptance, and perceived reliability by providing understandable explanations for algorithmic recommendations.

Consumer trust is considered one of the most important determinants of success in e-commerce environments. Trust reduces perceived risk and increases consumers' willingness to rely on recommendations generated by AI systems. Previous research indicates that transparent recommendation mechanisms strengthen trust, satisfaction, and long-term engagement. Furthermore, loyalty is often viewed as the cumulative outcome of trust, positive user experiences, and perceived fairness. Customers who trust digital platforms are more likely to continue using them, make repeat purchases, and recommend them to others.

Although previous studies have extensively examined dark patterns, recommendation systems, ethical AI, and consumer trust separately, relatively few studies have integrated these concepts within a single conceptual framework. Existing research often focuses either on the persuasive effects of dark patterns or on the benefits of ethical and explainable AI systems. Limited attention has been given to directly comparing the influence of dark patterns and ethical design on consumer trust and loyalty within AI-driven recommendation systems.

Therefore, a significant research gap remains regarding the comparative evaluation of manipulative and ethical design approaches in intelligent recommendation environments. This gap is particularly evident in developing and Arab contexts, where empirical studies investigating consumer perceptions of AI-powered recommendation systems remain limited. The present study addresses this gap by examining how dark patterns and ethical design influence immediate purchasing decisions, consumer trust, and customer loyalty within e-commerce platforms through an integrated conceptual model.

7. Theoretical Framework and Conceptual Model

The theoretical framework of the study links four main concepts: dark patterns, ethical design, consumer trust, and loyalty. Dark patterns refer to design practices intended to push users toward specific decisions by exploiting psychological biases such as fear of missing out or tendency toward default options. Ethical design, by contrast, focuses on empowering users to understand, choose, reject, and modify options without pressure or deception.

Consumer trust is a central element in e-commerce because of the absence of direct physical interaction between buyer and seller. The more consumers feel that a platform is honest, transparent, and respectful of their data and decisions, the more likely they are to rely on its recommendations and continue using it. Trust can therefore represent a bridge between design practices and behavioral loyalty.

Loyalty expresses the consumer's willingness to return to the platform and recommend it to others. It is a cumulative outcome influenced by trust, satisfaction, and clarity. Accordingly, the study assumes that ethical design enhances trust and loyalty in the long term, while dark patterns may influence immediate purchasing but carry potentially negative effects on trust and relationship sustainability.

8. Methodology

The study adopted the descriptive analytical approach because it is suitable for describing consumer attitudes and analyzing relationships between the study variables based on field data. This approach is appropriate for behavioral and marketing studies that seek to measure individuals' attitudes toward a specific phenomenon.

The study population consists of users of e-commerce platforms who interact with digital recommendation systems during online shopping. Data were collected through an online questionnaire, and the number of valid responses reached 35. The questionnaire included four main constructs: dark patterns, ethical design, trust, and loyalty. The items were measured using a five-point Likert scale.

The data were analyzed using frequencies and percentages to describe sample characteristics, means and standard deviations to analyze participants' attitudes, Cronbach's alpha to measure instrument reliability, and Pearson correlation coefficients to explore relationships between the main constructs. The correlation results are used to support the field analysis within the limits of the sample size and do not replace future studies using larger samples and more advanced causal models.

9. Results and Statistical Analysis

9.1 Description of the Study Sample

The number of valid responses was 35. The following tables show the distribution of respondents by age and monthly online shopping frequency.

Table 1. Distribution of Respondents by Age

Age Group	Frequency	Percentage (%)
Under 20 years	2	5.7
20–30 years	20	57.1
31–40 years	6	17.1
Over 40 years	7	20.0
Total	35	100.0

Table 2. Monthly Online Shopping Frequency

Online Shopping Frequency	Frequency	Percentage (%)
Rarely	7	20.0
1 to 3 times	19	54.3
More than 3 times	9	25.7
Total	35	100.0

The results indicate that the 20–30 age group represents the majority of the sample and that most participants engage in monthly e-commerce activities, which supports the suitability of the sample for the study topic.

9.2 Reliability of the Study Instrument

Cronbach's alpha was calculated to verify the internal consistency of the questionnaire constructs. The results show that all values exceeded the accepted threshold in social studies, indicating the reliability of the instrument.

Table 3. Cronbach's Alpha for the Study Constructs

Construct	Cronbach's Alpha
Dark Patterns	0.779
Ethical Design	0.871
Trust	0.715
Loyalty	0.783
Overall Instrument	0.913

9.3 Analysis of the Dark Patterns Construct

Table 4. Means and Standard Deviations for the Dark Patterns Construct

Item	Mean	Standard Deviation	Rank
False scarcity messages such as: "Only one item left"	3.49	1.48	1
Automatic addition of products or services to the cart	3.43	1.42	2
Countdown timers push me to buy without sufficient thinking	3.4	1.46	3
Difficulty cancelling recommendations or automatic subscriptions	3.34	1.39	4
Overall mean of the construct	3.41	1.42	—

The overall mean for the dark patterns construct was 3.41, which represents a moderate level tending toward high. False scarcity messages ranked first, indicating that the perception of product scarcity or near stock depletion is among the most influential techniques in pushing consumers toward quick purchase decisions. The results also indicate that automatic additions and countdown timers noticeably affect user behavior.

9.4 Analysis of the Ethical Design Construct

Table 5. Means and Standard Deviations for the Ethical Design Construct

Item	Mean	Standard Deviation	Rank
Clearly explaining why recommendations appear	3.97	1.27	1
Ease of modifying or cancelling an order at any time	3.97	1.5	2
Displaying positive and negative reviews transparently	3.83	1.44	3
Providing a clear option to reject personal data tracking	3.57	1.58	4
Overall mean of the construct	3.84	1.45	—

Ethical design achieved an overall mean of 3.84, which is higher than the dark patterns construct. The items related to explaining the reason for recommendations and enabling easy modification or cancellation of orders obtained the highest means, confirming the importance of transparency and freedom of choice for consumers. This result suggests that users do not reject intelligent recommendations themselves; rather, they prefer recommendations that are understandable and free from pressure or deception.

9.5 Analysis of the Trust Construct

Table 6. Means and Standard Deviations for the Trust Construct

Item	Mean	Standard Deviation
I would not return to shop from a store that uses deceptive techniques	3.86	1.54
Dark patterns reduce trust in recommendations in the future	3.69	1.35
Overall mean of the construct	3.77	1.44

The overall mean for the trust construct was 3.77, indicating a clear awareness among participants of the effect of design practices on trust. The results confirm that discovering deceptive techniques may lead consumers not to return to a platform and that dark patterns reduce future trust in the integrity of AI recommendations.

9.6 Analysis of the Loyalty Construct

Table 7. Means and Standard Deviations for the Loyalty Construct

Item	Mean	Standard Deviation
Ethical design makes me a loyal customer and encourages me to recommend the platform	4.0	1.33
Willingness to pay a higher price for a more transparent and credible store	4.26	1.2
Overall mean of the construct	4.13	1.26

The loyalty construct recorded the highest mean among all constructs, with a value of 4.13. This result indicates that the effect of ethical design is not limited to improving immediate impressions, but extends to building long-term loyalty and consumers' willingness to pay more when dealing with a store characterized by clarity and credibility.

9.7 Comparison of Means and Relationships between Variables

Table 8. Overall Means of the Study Constructs

Construct	Mean	Standard Deviation
Dark Patterns	3.41	1.42
Ethical Design	3.84	1.45
Trust	3.77	1.44
Loyalty	4.13	1.26

Figure 1. Comparison of Mean Scores across Study Constructs

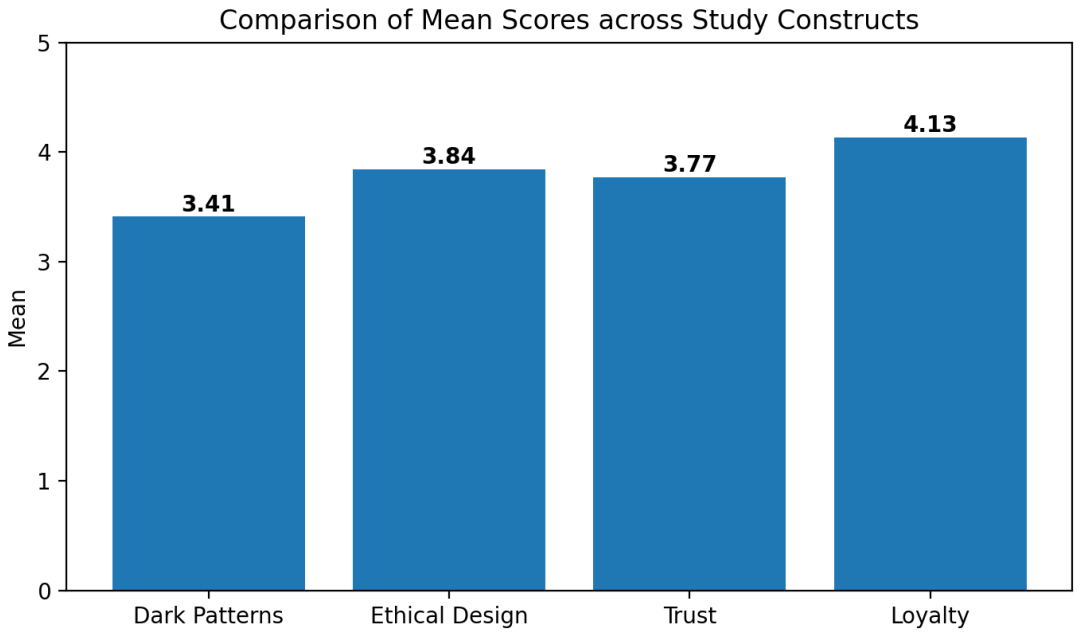


Figure 1 shows that loyalty recorded the highest mean, followed by ethical design and then trust, while dark patterns ranked last. This supports the conclusion that ethical design represents a more sustainable approach than dark patterns.

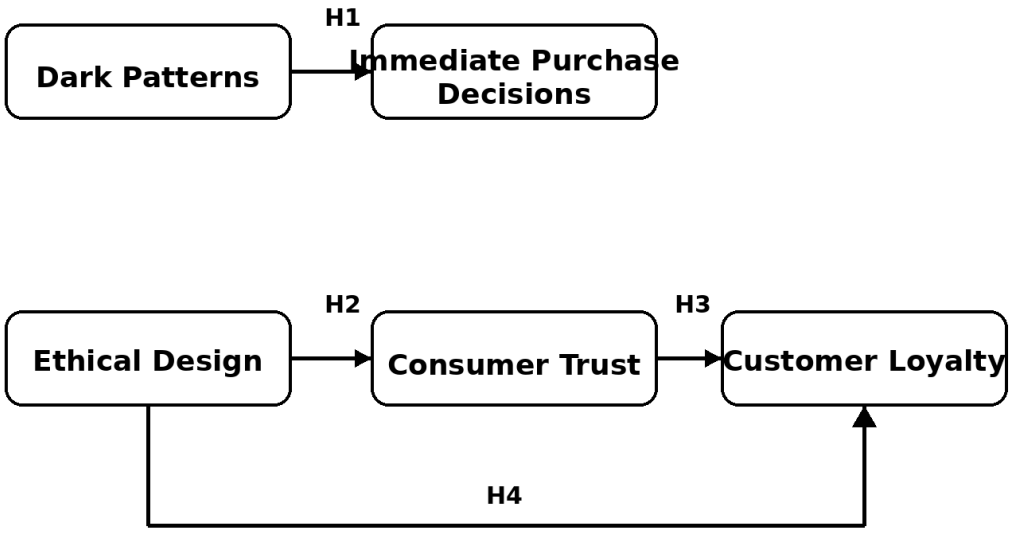
Table 9. Correlation Coefficients between the Main Variables

First Variable	Second Variable	Correlation Coefficient (r)	Significance Level (p)
Ethical Design	Trust	0.817	< 0.001
Trust	Loyalty	0.64	< 0.001
Ethical Design	Loyalty	0.675	< 0.001
Dark Patterns	Trust	0.635	< 0.001
Dark Patterns	Loyalty	0.408	0.015

The correlation analysis revealed a strong positive relationship between ethical design and consumer trust ($r = 0.817$, $p < 0.001$), indicating that transparency and user-centered recommendation practices contribute significantly to strengthening trust. In addition, trust showed a positive relationship with customer loyalty ($r = 0.640$, $p < 0.001$), suggesting that trusted platforms are more likely to retain customers over time.

Ethical design was also positively associated with loyalty ($r = 0.675$, $p < 0.001$), supporting the argument that transparent and explainable AI recommendation systems encourage long-term engagement. Although positive correlations were observed between dark patterns and both trust ($r = 0.635$) and loyalty ($r = 0.408$), these findings should be interpreted cautiously due to the relatively small sample size and the descriptive nature of the study. These correlations do not necessarily imply that dark patterns enhance trust or loyalty in a sustainable manner. Instead, they may reflect respondents' overall perceptions of their digital shopping experiences and should be examined further in future studies using larger samples and causal research designs.

Figure 2. Conceptual Model of the Proposed Research Framework



10. Discussion of Results

The results show that dark patterns have a moderate ability to influence purchasing behavior. This finding is consistent with Mathur et al. (2019), who demonstrated that dark patterns such as false scarcity messages and urgency cues are commonly used in online shopping environments and can significantly influence consumer decisions. It also agrees with Gray et

al. (2018), who argued that manipulative interface designs exploit cognitive biases and encourage impulsive behavior.

By contrast, ethical design achieved a higher mean than dark patterns, confirming that consumers prefer systems that explain the reasons for recommendations and allow them to control orders and data. This finding is consistent with Ricci, Rokach, and Shapira (2022), who emphasized the importance of transparency, personalization, and user control in recommendation systems for improving user experience and long-term engagement.

The trust results support Shin's (2021) conclusion regarding the importance of explainability and transparency in AI systems. The more users feel that a recommendation is understandable and trustworthy, the more likely they are to rely on it. Conversely, deceptive practices may weaken confidence in digital platforms even when they generate short-term effects on purchasing decisions.
The high loyalty mean is one of the most important results of the study. It indicates that consumers do not consider price or speed of purchase only; they also value credibility and transparency. Therefore, ethical design can represent a competitive advantage for e-commerce platforms, especially as consumer awareness of manipulative digital practices increases.

Table 10. Summary of Hypothesis Testing in Light of Descriptive and Correlational Results

Hypothesis	Result	Interpretation
H1	Descriptively supported	The dark patterns mean was 3.41, indicating a moderate influence on immediate purchasing.
H2	Supported	A strong correlation was found between ethical design and trust (r = 0.817).
H3	Supported	A positive correlation was found between trust and loyalty (r = 0.640).
H4	Descriptively supported	The means of loyalty and ethical design were higher than the mean of dark patterns.

The hypotheses should be interpreted within the limits of the sample size and the descriptive design of the study. The findings provide important field indicators, but they do not claim to prove final causal relationships. Future experimental studies or advanced statistical modeling are required.

11. Conclusion and Recommendations

11.1 Conclusion

The study concluded that dark patterns influence consumer decisions to a moderate degree, while ethical design achieves higher levels of trust and loyalty. The results confirm that consumers prefer platforms that provide transparency, explain the reasons for recommendations, and give them the ability to modify orders and control their data. The results also showed that loyalty recorded the highest mean among all constructs, indicating that ethical

practices are a more sustainable approach for building long-term customer relationships than relying on pressure and manipulation.

11.2 Recommendations

• Adopt ethical design principles when developing AI-based recommendation systems.
• Clearly explain why recommendations appear to users in a simple and direct manner.
• Enable users to control their personal data and reject unwanted tracking.
• Reduce the use of false scarcity messages, countdown timers, and unclear automatic additions.
• Make order modification or cancellation easy in order to strengthen consumer autonomy.
• Develop regulatory policies that limit misleading digital practices in e-commerce.
• Increase consumer awareness of dark patterns and digital manipulation techniques.

11.3 Study Limitations

The results of the study are limited to a sample size of 35 participants, which restricts the generalizability of the findings to all e-commerce users. The study also relied on the questionnaire as the only data collection tool, making the results linked to participants' self-perceptions. In addition, the study focused on a limited number of dark patterns and ethical design practices and did not examine all forms of manipulation or all types of recommendation systems. The relatively small sample size (n = 35) limits the generalizability of the findings and therefore the results should be interpreted with caution.

11.4 Suggestions for Future Research

• Conduct future studies on larger and more geographically and culturally diverse samples.
• Use experimental designs to compare interfaces containing dark patterns with interfaces based on ethical design.
• Analyze the mediating role of trust and satisfaction in the relationship between recommendation systems and loyalty.
• Compare consumer responses in Arab and Western countries toward intelligent recommendations.
• Study the effect of algorithmic awareness in reducing consumers' susceptibility to dark patterns.

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