

Digital Platform

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EXECUTIVE SUMMARY

It appears that modern digital retail platforms leverage the idea of persuasive interfaces to exploit consumers in such a way that raises concerns about the use of dark patterns in digital retail contexts. Basically, dark patterns refer to any form of deceitful interface designs used to compel consumers to perform actions contrary to their preferences. While the topic of dark patterns has attained immense popularity all over the world, there is limited literature associated with its influence on consumers' behaviors in the context of the app-based retail market in India. Literature on dark patterns largely focuses on deception as a one-dimensional concept without considering the possibility of varied manipulations leading to different consumer behaviors.

This study highlights the occurrence of dark pattern exposure along with their dimensional structure and behavioral outcomes among Indian retail app users. A questionnaire survey has been conducted on 128 participants by taking a sample through the convenient sampling method. For analyzing the data collected through this survey, the researchers have used various statistical tests such as descriptive statistics, reliability test, exploratory factor analysis, Spearman's correlation test, and OLS regression. Two major dimensions of dark patterns were found after conducting the exploratory factor analysis. The first one is called Interface Manipulation and Psychological Pressure. This is because it includes the items of notification nudges, preselected add-ons, guilt tripping, and hidden costs.

According to the results of this study, dark pattern exposure is an extremely common phenomenon for Indian customers using retail apps. Results from regression analysis showed that Scarcity and Urgency Tactics were predictors of consumer's purchase regret, meaning that psychological manipulation based on pressure and the urgency of the offer leads users into impulse buying and their regret about those purchases. At the same time, it was determined that Interface Manipulation and Psychological Pressure were the best predictors of app abandonment behavior, meaning that prolonged usage of psychologically intrusive interfaces is likely to cause users to stop engaging with the platform entirely. However, no relationship between dark patterns exposure and consumer trust has been established.

It provides insights into the emerging body of research dealing with digital manipulation of consumers, behaviorally engineered interfaces, and ethical aspects of online platforms by demonstrating that various types of dark patterns utilize specific mechanisms of behavioral influence. This is important in terms of the implications for policymakers, platform developers, and consumer protection bodies who are interested in ethical interface behaviors.

Keywords: Dark Patterns; Retail Apps; Consumer Behaviour; Post-Purchase Regret; App Abandonment; Consumer Trust; Digital Ethics; Indian E-commerce; Interface Manipulation; Scarcity and Urgency Tactics

1. INTRODUCTION

1.1 Background

The increasing accessibility of the Internet, cheaper smartphones, enhanced logistics network, and usage of online payment platforms such as UPI, PhonePe, Google Pay, and Paytm have led to an increasing number of purchases through mobile apps in all parts of India. As per India Brand Equity Foundation (IBEF, 2020), India's eCommerce industry is expected to exceed \$200 billion by 2026, and at the same time, eCommerce apps including Amazon, Flipkart, Myntra, Meesho, Blinkit, Zepto, and Swiggy Instamart are a part of daily life. Additionally, the COVID-19 pandemic has reinforced this trend as it has made digital shopping an ordinary activity even for those consumers that used only offline purchasing options before (Singh et al., 2023).

Although the development of online commerce technologies has facilitated increased access and convenience, as well as provided more choices for consumers, it has brought up certain issues related to the protection and ethical aspects of digital consumers. Shopping apps have been heavily utilizing behavioral user interfaces that aim not only at improving usability and navigation experience but also at swaying purchasing decisions. One of such techniques is ¹³referred to as dark patterns.

Dark patterns is a term coined by UX designer Harry Brignull (2010) who defined them as user interface designs that are purposely created to influence, deceive, intimidate, or manipulate consumers to do what they wouldn't ordinarily do of their own volition. Unlike typical persuasion designs, which seek to influence consumer behaviour while ensuring the freedom of choice, dark patterns rely on psychological weaknesses and behavioural tendencies to direct consumer actions towards platform goals (Gray et al., 2018). According to research conducted by Mathur et al. (2019), dark patterns are not just mere design anomalies, but behavioural techniques employed on online shopping websites.

There are many ways that deceptive design can be seen in practice when it comes to retail settings. Countdowns such as "Only 2 left!" and low stock notifications create a feeling of urgency while making their purchasing decisions, thus putting pressure on customers to act quickly. Another trick

used is adding hidden fees at the point of sale, taking advantage of their sunk cost. Already selected items such as insurance plans, donation options, or premium delivery services rely on default settings by requiring active removal. Similarly, repeated push notifications, guilt-inducing prompts, confusing cancellation processes, and disguised advertisements attempt to keep customer engaged beyond the immediate transaction. These interface mechanisms use behavioural economics principles such as scarcity bias, loss aversion, anchoring, default bias, and cognitive overload, many of which are associated with Kahneman's (2011) dual-process theory of decision-making.

Existing information shows that manipulative interface designs can contribute to post-purchase regret, emotional discomfort, decision fatigue, perceived loss of autonomy, distrust toward digital platforms, and longer-term disengagement from applications (Luguri & Strahilevitz, 2021; Narayanan et al., 2020). But, the evidence remains fragmented as to how different categories of dark patterns influence consumer behaviour. Most studies have either examined dark patterns conceptually or treated them as a single construct without differentiating between different forms of manipulation and how their outcomes affect the consumers.

It is especially true for India because consumer behavior online is quite different in many aspects than what can be seen in the West. Indian consumers tend to keep using the same platforms despite being aware of various risks or manipulative tactics because of their convenience-oriented nature, price-sensitive tendencies, platform dependence, and fast-growing digital consumption habits (Mathew & Mishra, 2014). As the number of online transactions on e-commerce platforms continues to grow and become a part of consumers' daily lives, manipulative interface features may eventually become a norm instead of something to avoid. That is why the connection between manipulative interface design, trust, regret, and leaving platforms may also be viewed through a different perspective in India.

Legal attention toward dark patterns has also increased highly in recent years. ⁴ The Central Consumer Protection Authority (CCPA) introduced proper guidelines ⁴ to identify several categories of dark patterns as unfair trade practices, while the Advertising Standards Council of India (ASCI) has issued recommendations concerning misleading online practices advertising market. Internationally, the US Federal Trade Commission and European regulatory authorities

have similarly pointed out the risks associated with manipulative interface design. Despite all the action taken by the governing bodies, much of the existing policy debate continues to approach deceptive design as a broad unified category, with less evidence regarding whether different dark pattern dimensions generate different forms of consumer harm.

The current result checks dark pattern exposure among Indian retail app users and finds its relationship with consumer trust, post-purchase regret, and app abandonment behaviour. Unlike prior studies that treat manipulative interface practices as conceptually uniform, the present research investigates whether distinct categories of dark patterns emerges through factor analysis and whether these categories produce different behavioural outcomes. By focusing specifically on the Indian retail apps, the analysis contributes to the growing research on digital ethics, behavioural interface design, and consumer protection.

1.2 Problem Statement

The rapid expansion of e-commerce and retail applications in India has significantly transformed consumer purchasing behaviour, yet the increasing integration of manipulative interface practices within these platforms has created new concerns regarding digital consumer welfare, informed choice, and ethical platform design. Despite increasing academic interest in dark patterns across the globe, limited empirical work on the effect of dark patterns in shaping user behavior in the context of India's retail application ecosystem has been conducted.

Literature in dark patterns has generally revolved around attempts to understand, identify, and classify dark patterns from theoretical perspectives as well as via interface audits of websites in the international context (Gray et al., 2018; Mathur et al., 2019). Some scholars have studied online shopping behavior and risk perceptions among Indian consumers without linking dark patterns to these phenomena (Mathew & Mishra, 2014; Davis et al., 2021). The upshot is that there is not enough empirical evidence concerning consumers' experiences of dark patterns in India, and whether different dark patterns have differential effects on the psychology and behaviour of individuals.

Another limitation with the existing literature is that dark patterns have been largely conceived as an unidimensional construct. Theoretically speaking, different kinds of dark patterns can be seen

to operate on the basis of separate behavioural processes. For instance, the use of scarcity and urgency as tactics might cause consumers to make immediate decisions based on pressure, while psychologically intruding tactics, such as constant notifications, covert costs, or messages of guilt, can slowly lead to frustration and detachment from the platform. However, little empirical evidence exists for testing such theoretical assumptions.

In addition, the theoretical ambiguity surrounding the link between exposure to dark patterns and consumer trust cannot be overlooked in terms of the digital commerce space in India. However, contrary to the popular belief prevalent in most of the international literature regarding the fact that manipulative interface systems like this one would automatically create a condition where consumer trust will be lowered, it has been seen that consumers in India continue to use such systems despite all the inconveniences due to the ease and pricing factors.

This poses a major knowledge gap for academicians, policymakers, and digital product designers because there will be no clear understanding of different dark patterns and their effect on consumers.

1.3 Objectives of the Study

1. In order to find out the prevalence and rate of dark pattern exposure by Indian retail app consumers through a number of manipulation methods including those based on urgency, hidden costs, auto-added extras, perceived scarcity, guilt inducement, notifications, and price dynamism. Identify the underlying dimensional structure of dark pattern exposure through exploratory factor analysis and determine whether distinct categories of manipulative design practices emerge empirically from consumer responses.
2. Investigate the relationship between dark pattern exposure and consumer trust retail app pricing transparency and fairness.
3. Analyze the effect of dark pattern exposure and its underlying dimensions on post-purchase regret among India's app users.
4. Examine the influence of dark pattern dimensions on app abandonment and reduced platform usage behaviour.

5. The theoretical and managerial implications regarding digital consumer manipulation, platform ethics, and consumer protection in the Indian e-commerce ecosystem.

1.4 Scope of the Study

Research specifically examine user experiences across major Indian and international retail platforms operating within India, including Amazon, Flipkart, Myntra, Meesho, Ajio, Blinkit, Swiggy Instamart, and Zepto. The current investigation investigates consumer exposure to various dark pattern practice embed within these applications and evaluates their relationship with behavioural and psychological outcome such as post-purchase regret, consumer trust, and app abandonment behaviour.

The research uses ¹quantitative cross-sectional research design based on primary data collected through an online questionnaire administered to 128 respondents. The questionnaire includes demographic variables, dark pattern exposure measures, behavioural response indicators, trust-related perceptions, and post-purchase outcome variables. Statistical techniques include descriptive statistics, ⁵reliability analysis, exploratory factor analysis, Spearman correlation analysis, and ordinary least squares (OLS) regression are employed for data analysis and interpretation.

The scope of this research is constrict due to self-reported consumer experiences and perceptions rather than direct interface audits or experimental behavioural tracking. Which means the findings establish statistical associations rather than causal relationships.

The study is confined geographically and contextually to the Indian environment for e-commerce. This is because the Indian approach to online shopping carries unique traits of trust, risk perception, platform dependence, and adoption that make generalizing the results to any other foreign market difficult. The study does not compare specific designs of dark pattern interfaces on each platform.

While there are disadvantages, the study offers valuable empirical data on the behavior implications of manipulation tactics used in interfaces in applications and is helpful for ethical considerations, platform management, customer information, and the development of policy.

1.5 Research Hypotheses

1.5.1 [H1](#)

Dark pattern exposure positively associate with post-purchase regret among Indian retail app users.

1.5.2 [H2](#)

Dark pattern exposure, positively associates with app abandonment behaviour among Indian retail app users.

1.5.3 [H3](#)

Dark pattern exposure, negatively associated with consumer trust in retail app pricing transparency.

1.5.4 [H4](#)

Scarcity and urgency-related dark pattern tactics notably predict post-purchase regret among Indian retail app users.

1.5.5 [H5](#)

Interface manipulation and psychological pressure- dark pattern tactics considerably predict app abandonment behaviour among Indian retail app users.

1.6 Conceptual Foundation of the Study

The theoretical foundation is informed by Choice Architecture Theory and Nudge Theory proposed by Thaler and Sunstein (2008) which explain how interface structures influence consumer choices without directly restricting alternatives. These deceptive design extend beyond ethical nudging by deliberately exploiting bias and behavioural vulnerabilities for commercial advantage.

The analysis also include Cialdini's Scarcity Principle, which explains how limited availability cues and urgency messages increase impulsive decision-making behaviour under perceived time pressure. On top of that, Cognitive Dissonance Theory provides, a understanding for post-purchase regret and emotional discomfort that may emerge after consumers recognize manipulative influences on their purchase decisions.

2. LITERATURE REVIEW

As online shopping has grown more competitive over the years companies have shifted their business strategies to prioritize their formatting over usability.

On the other hand, aggressive strategies have resulted in the deceptive digital practices that have become the primary focus of many academics and regulatory professionals. It is, through the sight of behavioral economics, human-computer interaction, digital ethic, and consumer psychology, that interface manipulation can have the extreme impacts on consumer buying behavior and understanding. ² Gray et al. (2018) and Mathur et al. (2019) examines these practices and Results show that in the field have yet to reach a consensus.

Some studies shows, declining trust and heightened vulnerability, whereas others reveal that consumers frequently continue using digital platforms despite detecting manipulative practices or potential dangers (Mathew & Mishra, 2014 [R1]).

This contradiction is particularly seen in India, where swift digital adoption, a strong emphasis on shopping convenience, and dependence on online platforms coexist with rising concerns over transparency and consumer protection. Another issue that is emerging is prior research is that dark patterns are frequently treated as a single broad construct rather than being examined as multidimensional behavioural systems. Relatively limited attention has been given to whether different category of dark patterns produce different forms of consumer harm, such as post-purchase regret, trust reduction, or app abandonment behaviour.

This research attempts to study t his gap by reviewing existing topics related to dark patterns, manipulative interface design, perceived risk, consumer trust, post-purchase regret, and online behavioural responses.

2.1 Dark Patterns

UX designer Harry Brignull explains dark patterns as web design that pushes user to make unintended decisions. Users, fall victim to designs that trick them into voluntary, unknowing purchases, subscriptions, and information sharing, and make it near impossible to unsubscribe or remove their accounts from websites.

Explorer started to understand them as deliberate strategies used by digital platforms to influence consumer behaviour and encourage actions that benefit platform commercially.

They came to be understood as deliberate strategies used by digital platform to influence user behaviour and increase commercial benefits. Gray et al. (2018) [R8] contributed significantly to this understanding by identifying different forms of dark patterns, including interface interference, sneaking, obstruction, forced action, and nagging. Their study explained that these practices are designed to take advantage of users' cognitive biases and behavioural weaknesses rather than simply improve the overall user experience.

Modern academic work has indicated that manipulation in interface design is increasingly carried out through behavioral triggers. Such behavioral triggers include but are not limited to messages of urgency, interference, default settings, and multiple notifications, all aimed at influencing decisions made under cognitive pressure. According to Vishwakarma (2026) [R6], behavioral triggers including fear of missing out (FOMO), urgency, and decision fatigue are common methods used by e-commerce interfaces to generate more interaction and conversions.

Dark patterns theories tend to be linked to behavioral economics and persuasive technologies. According to Thaler and Sunstein (2008), Nudge theory [R11] initially postulated that the environment could direct people towards desirable decisions without limiting their freedom to decide. Nevertheless, subsequent literature showed that many business digital platforms started applying behaviorist methods in order to maximize profits rather than improve customer's wellbeing. It is important to note that dark patterns do not force a person to do something. These tools change user behavior through subtle manipulation as they interact within the interface. This is why most users are typically not aware that the interface design affects their decision-making

process. Instead, manipulation frequently becomes visible only after consumers experience dissatisfaction, regret, or frustration later in the purchase process.

Apart from this, there is yet another important issue in modern literature in the area of research in question regarding the point that dark patterns should not be viewed as UI design issues alone but instead as an essential part of the digital marketplace competition structure [R7]. Such inference can be made by analyzing research done in Indian e-commerce ecosystems [R7].

2.2 E-Commerce Dark Patterns

The other form, which is well-explored, involves scarcity and urgency tactics. The examples of this kind include countdown timers, flash sale information, “Last one” signs, and stock signals that attempt to create an illusion of pressure on the buyer. The studies of behavioral economics have proven that scarcity generates impulses because people tend to fear losing something more than thinking rationally about their options. When the studies were conducted within the field of digital sale ecosystems, it was revealed that countdown systems dramatically decrease the buyer’s evaluation time [R3].

Nevertheless, on the other hand, the continuous process of urgency marketing in such a society will eventually become normalized by consumers in order for them to maintain their impulsive purchasing behaviors. This will be more relevant in cases of India, where festival discounts, flash sales, and mobile applications are commonly used for online marketing purposes.

Another topic that can be discussed in class is the concept of hidden charges or drip pricing. Drip pricing describes the technique of showing customers low prices first and adding further costs after the subsequent steps in making payment. Such extra charges can consist of handling costs, packaging charges, or even convenience fees which are usually not clearly communicated beforehand. It has been found that consumers do not generally stop shopping even when they know about such hidden costs because they have already invested efforts in their transactions [R3].

Similarly, sneak behaviors and pre-loaded add-ons utilize default bias by defaulting products or services into user baskets until the items are manually deleted. Insurance, premium shipping, and subscription add-ons can often employ this tactic. These tactics were grouped as “Sneaking”

behaviors by Gray et al. (2018) [R8], as consumers might not recognize the additional purchase until the point of payment.

The use of psychological pressure tactics has also gained more attention academically. The tactics mentioned here involve persistent push notifications, confirmation-shaming messages, guilt-inducing messages, and other similar tactics which motivate individuals to make transactions. While these tactics do not affect a single decision, but rather they are utilized for keeping users consistently engaged over an extended period of time. Porwal (2024) [R5], in a study on Indian teenagers, found that many users are exposed to these manipulative digital practices without fully understanding how they influence their behaviour.

Another commonly discussed category is forced continuity and difficult cancellation processes. Many online platforms make the process of subscriptions and recurring payments easy to start but the process of cancelling it is very difficult. These complicated cancellation procedures and subscription traps often discourage users from leaving paid services. Previous studies suggest that these practices can slowly reduce users' sense of control and also weaken trust in the transparency of digital platforms.

Although researchers have extensively identified different types of dark patterns, relatively fewer studies examine whether different categories produce different psychological or behavioural consequences. Most earlier studies continue treating dark patterns as a unified phenomenon rather than examining their multidimensional effects separately.

2.3 Consumer Trust and Perceived Risk

Trust has consistently been identified as one of the important variables influencing online consumer behaviour and nature. Since digital commerce environments operate under conditions of uncertainty and information asymmetry, consumers frequently depend on perceptions of platform reliability, fairness, and security while making purchasing decisions and any payment based decisions.

Several studies suggest that higher perceived risk negatively influences trust toward online platforms. Researches which are examining Indian online shopping behaviour found that concerns

regarding privacy, payment security, misleading information, and transaction reliability significantly affect the confidence of the consumer in the digital platforms.

Dulloo in 2024 pressurised on that trust becomes especially important within mobile shopping ecosystems because consumers remain weak and vulnerable to misleading transactions, misuse of personal data, and opportunistic platform behaviour and methods. Similarly, Davis et al. in 2021 [R4] found that trust significantly influences the online shopping behaviour and customer satisfaction among Indian consumers.

However, findings across studies are not entirely consistent. A similar conclusion had been drawn earlier by Mathew and Mishra (2014) [R1], who found out that Indian customers frequently engage in e-commerce transactions even with the perception of high risks and uncertainties. This is because such findings would have relevance in scenarios wherein convenience, competition, and dependence take precedence over transparency and manipulation.

An interesting paradox emerges in such literature where although theory would generally state that employing deception would inevitably damage consumer trust, the reality is that consumers may continue to interact with the website despite being manipulated, making it ever more common within digital marketplaces.

As far as current research is concerned, this becomes particularly important due to the possibility of alternative ways through which dark patterns affect consumer behavior other than eroding their trust.

2.4 Regret and Consumer Outcomes

Regret after purchase refers to a psychological experience where the consumer feels regret on purchasing items that are perceived as unnecessary, manipulative, and not necessarily in line with his or her true desires. Post-purchase regret is increasingly being associated with manipulative interfaces in contemporary studies.

Urgency pressure, scarcity cues, and manipulative price strategies, according to various studies, contribute to the disruption of a rational decision-making approach and result in impulsive

purchases. Vishwakarma (2026) [R6] explained that dark UX creates conditions of greater cognitive exhaustion, less autonomy, and feelings of emotional disappointment with the product purchased.

Furthermore, the research carried out on manipulative pricing revealed that a change in the selling structure diminished fairness perceptions and feelings of openness, especially after the buyer encountered unexpected costs after spending considerable time in the buying process.

However, on the other hand, it is possible that there might be behavioral implications that go beyond simple emotional reactions. Various scholarly studies have found that the combined effects of psychological intrusiveness in interface designs ultimately cause platform fatigue, irritability, and disengagement from retail platforms. While consumers can bear one manipulative experience at a time, they might grow tired of consistent notification pressure or deception with prices.

Interestingly, not all studies report strong active resistance toward dark patterns. Porwal (2024) [R5] found that manipulative marketing practices often function as passive experiences among younger consumers rather than consciously resisted ones. One possible explanation is that digital consumers increasingly normalize manipulative online environments because of repeated exposure.

This area remains underexplored because many earlier studies do not distinguish between short-term emotional outcomes such as regret and longer-term behavioural outcomes such as app abandonment behaviour. The present study attempts to address this limitation empirically.

2.5 Indian E-Commerce Behaviour

The digital commerce market is one of the fastest growing worldwide, and while it is driven largely by the expansion of affordable smartphones, app-based consumption and integrated digital payment systems, online shopping has become an everyday habit for many people, particularly those in the younger generation who are digitally connected. Consequently, e-commerce has become a common part of consumers' daily lives.

Research consistently shows that Indian consumers exhibit behaviours that are different than those found in Western digital markets. Convenience, promotion price, social influence and platform familiarity are factors that strongly influence Indian consumers' online shopping behaviour.

In Davis et al. (2021) [R4], the authors found that convenience, trust, exposure to advertising and social influences were all strong indicators of customers' online shopping behaviours and customer satisfaction in the Indian market. Similarly, Singh et al. (2023) [R2], confirmed that perceived value, perceived risk and trust to a large degree determine Indian consumers' cross-platform shopping behaviours via social commerce applications.

An additional theme noted by researchers studying Indian e-commerce is that many Indian consumers continue to use online platforms even when they have concerns about their perceived level of risk or transparency from a given platform. Earlier research found that perceived risks did not necessarily prevent Indian consumers from intending to shop online in the future (Mathew & Mishra, 2014 [R1]). This behaviour may partly reflect growing dependency on digital commerce ecosystems where convenience and accessibility often outweigh perceived ethical concerns.

2.6 Regulatory and Ethical Concerns

The current world has brought the problem of manipulation through interfaces in the limelight. The increased knowledge amongst the policymakers, digital rights advocates, and consumer agencies about manipulation through interfaces is an important step to recognize how such manipulation may influence informed consent and consumer freedom.

As per the requirement, R7 suggests that under CCPA in India, there are some guiding principles that help in identifying thirteen different forms of dark patterns in online business practices. These are false urgency, subscription traps, hidden fees, masked ads, and forced actions.

There have been similar efforts internationally in regard to price deception, manipulation in consent mechanisms, algorithmic persuasion, and behavioral exploitation. An attempt to identify research concerning global literature regarding consumer confusion in e-commerce reveals that researchers have moved away from technical considerations into behavioral ethics, accountability, transparency, and consumer protection concerns [R3].

Nonetheless, the regulatory frameworks that already exist tend to describe the dark patterns based on insufficient empirical findings regarding what forms of manipulation lead to the greatest harm. The conversation related to policy is primarily conceptual, whereas concrete evidence about the links between the various dark pattern factors and behavioural outcomes is lacking.

2.7 Research Gap

1. Despite the increasing attention to these misleading digital architectures, much research still considers manipulative interfaces as one construct only. Little research is done on how the different types of dark patterns lead to distinct behavioural outcomes.
2. There is relatively sparse quantitative research conducted within the Indian mobile application environment even though India is considered ²³one of the world's fastest growing markets in e-commerce.
3. Current literature regarding Indian e-commerce concentrates largely on the aspects of risk perception, trust, convenience, and online purchase behavior without including any aspect of dark pattern exposure into the equation.
4. More emphasis has not been placed on users' app abandonment behavior as a result of being exposed to manipulative interfaces. Current research primarily concentrates on purchase intentions or trust without considering disengagement with retail apps.
5. Inconsistent results concerning the impact of trust indicate that manipulation techniques can be unsuccessful in undermining consumers' trust. The use of platforms by Indian consumers can persist despite knowledge about manipulation because of habituation and reliance on the convenience of the process.
6. The use of exploratory factor analysis along with behavioral outcome modeling is very rarely used to establish empirical factors related to dark pattern experience and how these factors affect various psychological and behavioral outcomes.

This paper also bridges the existing research gap by investigating the exposure to dark patterns among the retail application consumers in India, the dimensionality of dark patterns, and their impact on consumer trust, post-purchase regret, and app abandonment behavior.

2.8 Conceptual Foundation of the Study

The theory that forms the basis for this research has its roots in behavioural economics, consumer psychology and the ethics of digital communications. This work is based on the Choice Architecture Theory and Nudge Theory that have been put forward by Thaler and Sunstein (2008).

Moreover, the research also applies the principle of Scarcity formulated by Cialdini that discusses how lesser availability triggers and greater sense of urgency lead to impulsiveness and behavioral actions due to shortage of time. Also, Cognitive Dissonance Theory plays an important role in understanding emotional discomfort caused to individuals after recognizing that their decisions are made based on manipulative interface design.

The findings conceptualizes dark pattern exposure as a multidimensional construct consisting of:

- Scarcity and Urgency Tactics
- Interface Manipulation and Psychological Pressure

These dimensions are expected to influence:

- Consumer Trust
- Post-Purchase Regret
- App Abandonment Behaviour

3. RESEARCH METHODOLOGY

3.1 Research Design

The main objective of this research was to study the extent of dark pattern exposure in Indian retail app users and analyze the relationship between various types of manipulative interface designs and consumer trust, buyer's remorse, and app attrition behavior.

The survey technique was deemed fitting since the study aimed at measuring the consumers' perceptions, behaviors, and reactions to deceptive manipulation in interface use in retail. Prior studies that have explored consumer behavior in relation to shopping behavior, online trust, and behavioral interface design have used survey techniques to measure consumer perceptions in online business contexts (Mathew & Mishra, 2014 [R1]; Singh et al., 2023 [R2]).

3.2 Sampling and Participants

Convenience sampling has been widely used in studies examining online shopping behaviour and digital consumer responses, particularly where respondents are required to possess active experience with e-commerce platforms (Davis et al., 2021 [R4]).

The selected target population was comprised of people who were currently using retail and mobile commerce apps in India, which included companies such as Amazon, Flipkart, Myntra, Meesho, Blinkit, Zepto, Swiggy Instamart, among others.

Overall, there were 128 participants who gave valid data after analyzing the collected data. The participants mainly comprised those consumers who used digital media with most of them being in the young age group. A substantial number of the participants belonged to the 18-21 years of age group. This was attributed to the fact that the age group is the one highly active in using the app for shopping purposes in India.

The participants included people who had different degrees of how frequently they shopped through the mobile apps. As it was mentioned, the young generation comprises a fundamental part

of the emerging mobile commerce sector in India. Therefore, the participant selection was quite suitable for this research.

3.3 Instrumentation

This survey was specifically designed to fit the requirements of this research project and included questions on the usage of dark patterns, consumers' level of trust, behavioral responses, emotional responses, and abandonment of applications.

3.3.1 Demographic and Usage Information

Collected information regarding:

- Age group
- Frequency of online shopping
- Retail applications used most frequently
- Purchase categories
- Understanding of data collection practices

3.3.2 Dark Pattern Exposure

It measures exposure to seven major dark pattern categories commonly known as Indian retail applications:

- Urgency messages
- Fake scarcity indicators
- Price increases during checkout
- Hidden charges
- Pre-selected add-ons
- Guilt-inducing prompts
- Notification nudges

These categories were selected based on prior classifications proposed by Gray et al. (2018) [R8], Mathur et al. (2019) [R9], and recent Indian dark pattern discussions [R7].

3.3.3 Consumer Trust and Transparency

This section examined:

- Trust in retail app pricing
- Perceived transparency of discounts
- Awareness of dynamic pricing
- Perceptions regarding hidden costs

3.3.4 Behavioural and Emotional Outcomes

Measures:

- Emotional response toward manipulative prompts
- Post-purchase regret
- Reduced app usage
- Behavioural responses toward repeated notifications

A variety of questions had either four- or five-point Likert-type scales going from low agreement/frequency to high agreement/frequency. The survey was specifically constructed so that it would be brief but include many dimensions of manipulative interfaces and behavior towards them.

Note: Wording of the questions was made as simple as possible, so that it would focus more on behavior, and thereby improve clarity as well as prevent respondent fatigue while completing the survey.

3.4 Data Collection Procedure

Data collection process involved the distribution of questionnaires through online channels such as social media sites and networking among students. Participants took part voluntarily and were assured that the survey was purely academic in nature.

It was felt that the use of online data gathering method was apt for the target respondents who were regular users of apps for making their purchases. Online data gathering would enable quicker access to the respondents.

Before beginning ¹ the questionnaire, participants were informed about:

- Academic purpose of the study
- Voluntary participation
- Anonymity of responses
- Confidentiality of collected data

Warning: It is stated that no personally identifiable data such as contact information, email address, or financial information were included in the questionnaire process.

3.5 Data Preparation and Coding

Raw data collected through the surveys were exported into a CSV file format from Google Forms and then analyzed using Python (Version 3.x). These data were processed by importing into pandas before going through the preliminary steps of preprocessing.

Data preparation involves:

- renaming variables for analytical convenience,
- checking for incomplete responses,
- identifying inconsistencies,
- handling missing values where necessary,
- and converting categorical responses into numerical form.

Likert-scale responses were systematically encoded into numerical values for statistical analysis.

For example:

- “Never” = 1
- “Rarely” = 2
- “Sometimes” = 3
- “Often” = 4
- “Very Often” = 5

3.5.1 Dark Pattern Exposure Variables

Factors associated with the urgency message, perceived scarcity, price escalation, additional fees, bundled options, guilt, and alert notifications were coded numerically.

3.5.2 Trust-Related Variables

The factors associated with trust in pricing, perceptions of transparency, and discounts were categorized together in relation to trust behaviour.

3.5.3 Behavioural Outcome Variables

Post-purchase guilt behavior and application abandonment behaviors were deemed vital dependent variables within the regression model.

All data pre-processing and data transformations were carried out carefully to enable exploratory factor analysis and regression modeling.

3.6 Reliability Analysis

¹⁵ The internal consistency of multiple variables was measured using Cronbach’s Alpha. The reliability test was done to determine whether items that were meant to measure different but related constructs had good consistency before performing factor analysis and regression modeling.

This test entailed the following:

- Total ²⁹ Cronbach's Alpha computation,
- item-total correlations,
- and "alpha if item deleted" evaluation.

Because dark patterns represent behaviourally diverse interface practices rather than a single uniform psychological construct, moderate variations in reliability were anticipated. Literature also indicates that manipulative interface categories may use various behavioral pathways rather than representing a completely homogeneous scale (Gray et al., 2018 [R8]).

This meant that reliability assessment was considered in addition to conceptual relevance and exploratory purposes, rather than strict criteria-based exclusion only.

¹⁴ 3.7 Exploratory Factor Analysis (EFA)

An Exploratory Factor Analysis (EFA) was undertaken to uncover the dimensions of the construct under investigation – dark pattern exposure variables. Because of the prevalence in prior literature on the conceptual categorization of deceptive digital design, a factor analysis was conducted to see if distinct dimensions could be formed from the respondents' answers.

This was done by analyzing the seven principal dark pattern exposure items through:

- Principal Axis Factoring (PAF)
- with Varimax rotation.

Before ¹ factor extraction, the suitability of the dataset for factor analysis was evaluated using:

- Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy
- Bartlett's Test of Sphericity

Factors ³² were retained primarily using the Kaiser criterion (eigenvalues greater than 1.0) along with interpretability considerations.

This analysis, identified two major dimensions of dark pattern exposure:

1. Interface Manipulation and Psychological Pressure
2. Scarcity and Urgency Tactics

The factor scores thus identified were then employed for correlation and regression analyses in order to determine specific behavioral results in association with certain types of dark patterns.

This approach involving factor analysis can be justified by previous work conducted on behavior and interface designs that aim to empirically categorize the manipulative practices rather than considering them to be conceptually similar (Gray et al., 2018; Mathur et al., 2019).

¹⁰ 3.8 Statistical Analysis

All statistical analysis were performed using Python (Version 3.x) with libraries including:

- pandas
- numpy
- scipy
- statsmodels
- factor_analyzer
- matplotlib
- seaborn

The analytical process includes:

²¹ 3.8.1 Descriptive Analysis

Frequency distributions, percentages, means, and standard deviations were computed, to examine:

- Demographic characteristics
- Shopping behaviour
- Prevalence of dark pattern exposure

3.8.2 Correlation Analysis

Analysis using Spearman rank-order correlation test was conducted in order to establish correlations among dark patterns, trust dimensions, regret, and app abandonment behavior. The Spearman rank correlation test was chosen due to the fact that some variables under study were ordinal scaled and non-normally distributed.

3.8.3 Regression Analysis

Ordinary Least Squares (OLS) Regression was employed for exploring:

- The impact of dark pattern dimensions on regret after purchase
- The impact of dark pattern dimensions on abandonment from apps
- The association between dark pattern exposure and trustworthiness of consumers

The regression models were computed utilizing both:

- Aggregate dark pattern measures
- Extracted factor scores from EFA

The standardized beta coefficients, R-squared, significant figures, and diagnostics were analyzed to determine predictability relationships.

All the statistical tests were performed using two-tailed significance tests, where the significance figures were tested at :

- $p < .05$
- $p < .01$
- $p < .001$

3.9 Ethical Considerations

Taking part in the survey was completely voluntary, and the ⁹respondents were adequately informed about:

- The academic purpose of the research
- Anonymity of responses
- Confidentiality of collected information
- Their right to discontinue participation at any stage

Personal details were not ⁷collected from the respondents during the process of data gathering, and all the collected information was used solely for research purposes. It is noteworthy that the research did not employ any deception or use of financial inducements or psychological techniques on the subjects.

3.10 Conceptual Model ²⁸of the Study

Considering the purposes of this study and prior research studies, it was conceived that exposure to dark patterns is a multidimensional independent variable affecting various behavior-related outcomes.

3.10.1 Independent Variables

Dark Pattern Dimensions:

- Scarcity and Urgency Tactics
- Interface Manipulation and Psychological Pressure

3.10.2 Dependent Variables

- Consumer Trust
- Post-Purchase Regret
- App Abandonment Behaviour

The concept of the study was based on:

- Nudge Theory,
- behavioural economics,
- scarcity theory,
- cognitive dissonance perspectives.

Assumption: This model operates under the assumption that various types of manipulative practices in interfaces affect consumers differently, both psychologically and behaviorally, thus creating differential effects in the short and long run.

4. RESULTS AND ANALYSIS

The study attempts to analyze the following aspects: existence of dark pattern exposure; dimensional structure that characterizes various manipulative interface practices; and correlation between dark pattern exposure and consumer behavior, including levels of consumer trust, regret after purchase, and tendency to abandon applications.

The approach involved using descriptive statistics, testing for ⁸reliability, exploratory factor analysis, correlation analysis, and regression analysis. Given that previous studies have used the phenomenon of dark patterns as an overarching theoretical concept, the current study endeavored to explore whether various categories of manipulative design techniques result in different behavioral outcomes.

The analyses were carried out using Python and comprised both composite scores analysis and factor models, allowing for obtaining more behaviorally understandable outcomes.

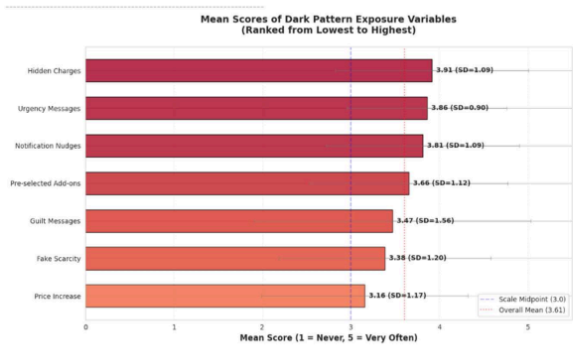
4.1 Descriptive Statistics

The analysis was done based on data obtained from 128 valid participants on the following issues: exposure to dark patterns, consumer trust, behavior, emotions, post-purchase regret, and application abandonment.

As observed from the results of the analysis, there was a great amount of manipulation from the interface used by the participants. There were many dark patterns which appeared among the participants when they were using the retail applications.

Among the seven types of dark patterns considered, hidden fees were the most popular manipulation tactics used ($M = 3.91$, $SD = 1.09$) followed by "Only 1 left" prompts and other types of urgency tactics ($M = 3.86$, $SD = 0.90$). Other frequently reported manipulative practices included pre-selected add-ons ($M = 3.65$, $SD = 1.12$), guilt-inducing prompts ($M = 3.47$, $SD = 1.56$), fake scarcity indicators ($M = 3.38$, $SD = 1.20$), and price increases observed during checkout stages ($M = 3.16$, $SD = 1.17$).

Figure 4.1: Mean Scores of Dark Pattern Exposure Items

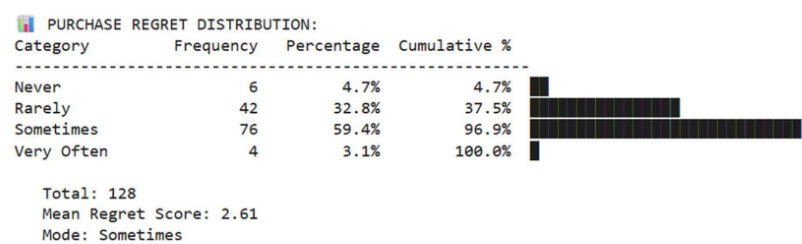


Source: Author’s Calculation using Python Output

Overall DPE score averaged out to a value of 3.61 (SD=0.62), indicating that manipulative interface exposure was not an exceptional phenomenon but rather an habitual part of online shopping experience for many participants.

The behavioral outcomes also showed the psychological implications of such exposures. Around 59.4% of the subjects said that they had experienced purchase regret “sometimes,” whereas only 4.7% had not had any regret experience following their purchases from the apps. The Purchase Regret Scale was 2.61 with a standard deviation of 0.63.

Figure 4.2: Frequency of Post-Purchase Regret

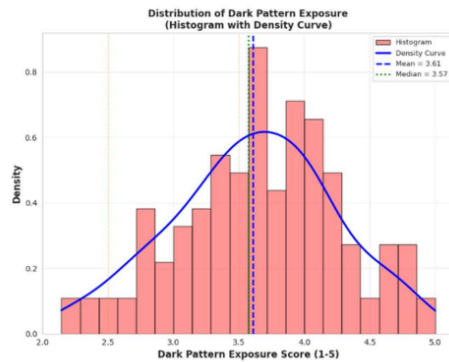


Source: Author’s Calculation using Python Output

Likewise, the average App Abandonment score was 1.48 (SD = 0.76) based on a scale of three points, thereby pointing to the possibility that there were many consumers who had either minimized their use of apps used by retailers or felt like withdrawing themselves from such apps owing to their deceptive interfaces.

Based on the above descriptive statistics, it becomes evident that there is considerable use of manipulative interface tactics in the retail apps of India.

Figure 4.3: Composite Dark Pattern Exposure Score



Source: Author's Calculation using Python Output

4.2 Reliability Analysis

Reliability analysis was conducted to evaluate the internal consistency of multi-item constructs before proceeding to factor extraction and regression modelling.

Cronbach's Alpha for the seven-item Dark Pattern Exposure Scale was found to be $\alpha = 0.568$. Through this value falls below the conventional threshold of 0.70 typically associated with strong internal consistency, the scale was retained for analytical purposes because these misleading digital architectures represent a heterogeneous set of manipulation strategies rather than a perfectly uniform psychological construct. Existing literature similarly suggests that manipulative interface practices operate through multiple behavioural pathways rather than reflecting a single unidimensional phenomenon (Gray et al., 2018 [R8]).

Item-total correlations ranged from 0.214 for price increase during checkout to 0.377 for pre-selected add-ons, indicating that each item contributed meaningfully to the broader exposure construct despite conceptual diversity among the tactics.

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The Cronbach's Alpha reliability score for the Trust Scale was calculated to be $\alpha = -0.055$ following the exclusion of the item measuring discount transparency due to inconsistency with other trust-related factors. Negative values of alpha suggest that the trust factors failed to form a unidimensional construct.

Such a conclusion acquires even more significance when applied to the Indian mobile application market for retail purposes since it implies that consumer trust for such digital channels could possibly not function via one singular process. This means that consumers can simultaneously doubt the legitimacy of prices while still using the platform.

Figure 4.4: Reliability Statistics

```
=====
RELIABILITY SUMMARY - ALL SCALES
=====
```

Scale	Items	Alpha	Verdict
Dark Pattern Exposure	7	0.5675	Review
Trust & Awareness (w/o Q17)	3	-0.0551	Individual
Q17: Discount Transparency	1	N/A	Individual
Q21: Purchase Regret	1	N/A	Individual
Q23: App Abandonment	1	N/A	Individual

Source: Author's Calculation using Python Output

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4.3 Exploratory Factor Analysis (EFA)

16

Figure 4.5: KMO and Bartlett's Test Results

```
MODEL FIT STATISTICS:
• KMO Measure of Sampling Adequacy: 0.600
• Bartlett's Test of Sphericity:  $\chi^2(21) = 86.69$ ,  $p < 0.0000$ 
• Factors Extracted: 2
• Rotation Method: Varimax with Kaiser Normalization
```

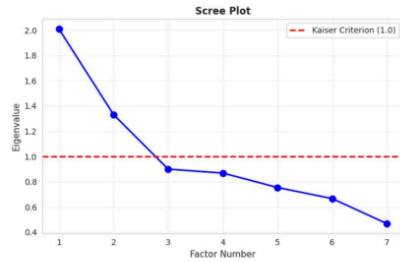
Source: Author's Calculation using Python Output

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An exploratory factor analysis was carried out to examine the latent dimensional structure within the seven dark pattern exposure variables. Given that prior research has tended to view dark

patterns in general terms ²⁴ as a theoretical construct, this study sought to explore the existence of behavioral dimensions based on respondents' experiences.

Figure 4.6: Scree Plot



Source: Author's Calculation using Python Output

Prior to extracting the factors, adequacy of data set for Factor Analysis was first established through ³ Bartlett's Test of Sphericity and Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy.

Bartlett's test of Sphericity was significant ($\chi^2(21) = 86.69$, $p < 0.001$), thus indicating that there were enough correlations between the variables to proceed with factor analysis.

The KMO statistic was equal to 0.600, which is quite a low value for exploratory research. However, the KMO figure is sufficient for this kind of exploratory research that is based on behaviour.

With respect to ²⁷ exploratory factor analysis and Principal Axis Factoring (varimax rotation), two-factor solution accounting for about 28.5% of variance has been obtained.

Figure 4.7: Rotated Factor Matrix

FACTOR LOADINGS (Varimax Rotation):			
Item	F1	F2	Communality
Urgency Messages	0.0671	0.5172**	0.2720
Fake Scarcity	0.0078	0.5922**	0.3507
Price Increase	0.1670	0.3380*	0.1422
Hidden Charges	0.4190**	0.1764	0.2067
Pre-selected Add-ons	0.4497**	0.2552	0.2673
Guilt Messages	0.4482**	0.0300	0.2018
Notification Nudges	0.7459***	-0.0250	0.5570

*** Strong (>0.60) ** Moderate (>0.40) * Weak (>0.30)

Source: Author’s Calculation using Python Output

4.3.1 [Interface Manipulation and Psychological Pressure](#)

Factor one was responsible for 16.7% of the variance observed and 58.4% of the common variance. The items that heavily loaded on this factor include:

- Notification nudges ($\lambda = 0.746$)
- Pre-selected add-ons ($\lambda = 0.450$)
- Guilt messages ($\lambda = 0.448$)
- Hidden charges ($\lambda = 0.419$)

This factor is an indication of manipulations that are built into the interaction systems. Rather than relying on explicit time pressure, these practices operate through emotional persuasion, interface defaults, repeated nudging, and obscured transactional information.

4.3.2 Scarcity and Urgency Tactics

Factor number two accounted for 11.9% of the total variance and 41.6% of the common variance.

The following variables heavily loaded on factor number two:

- Fake scarcity indicators ($\lambda = 0.592$)
- Urgency messages ($\lambda = 0.517$)
- Price increase signals ($\lambda = 0.338$)

This dimension reflects manipulative tactics designed to accelerate decision-making through artificial urgency, stock pressure, and fear of missing out.

4.4 Correlation Analysis

Correlation coefficients were determined for Spearman rank-order correlations between the variables related to dark pattern exposure and consumer outcomes.

The composite variable of Dark Pattern Exposure had positive correlation coefficients with:

- Purchase Regret ($r = 0.269$, $p = 0.002$)
- App Abandonment Behaviour ($r = 0.270$, $p = 0.002$)

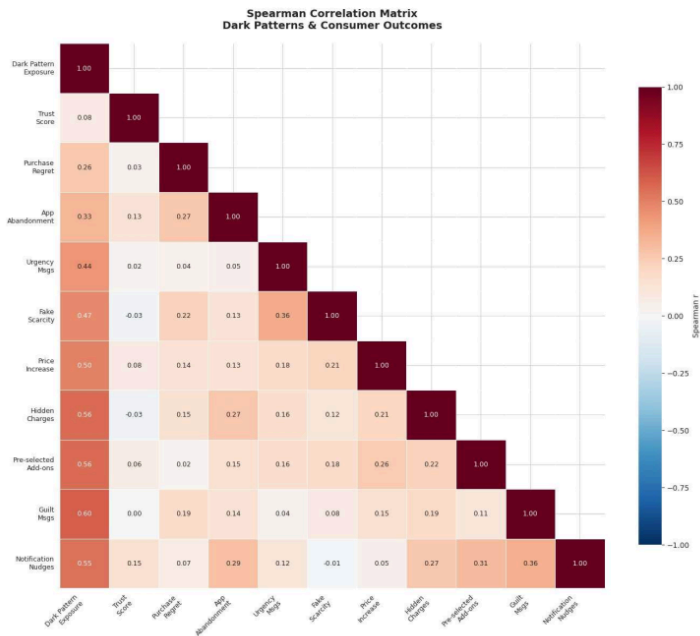
This implies that greater exposure to such manipulative user interfaces results in more emotional dissatisfaction and even the probability of decreasing the usage of such retail apps.

Of all individual dark pattern factors, fake scarcity signals correlated most strongly with purchase regret ($r = 0.224$, $p = 0.011$), while guilt-evoking messages had a positive correlation with the experience of regret ($r = 0.187$, $p = 0.035$).

Notably, the trust-related factors failed to show any strong or statistically significant association with either Purchase Regret or App Abandonment. This result implies that consumers might engage with retail portals while being aware of manipulative techniques, perhaps due to the fact that manipulation has been normalized in extremely competitive digital marketplaces.

The correlations found above lend such credibility to the idea that manipulative interface practices can have greater effects on behaviour and emotion than trust in general.

Figure 4.8: Spearman Correlation Heatmap



Source: Author's Calculation using Python Output

4.5 Regression Analysis

To analyze the impact of different behavioral aspects of dark pattern dimensions, three Ordinary Least Squares (OLS) regressions were performed based on the extracted factor scores.

4.5.1 Predicting Post-Purchase Regret

The first OLS regression was done to analyze the effect of dark pattern dimensions on post-purchase regret.

The result was significant as follows:

- $F(2,124) = 3.81$
- $p = 0.025$
- $R^2 = 0.058$
- $\text{Adjusted } R^2 = 0.043$

Among the predictors, Scarcity and Urgency Tactics emerged as the only statistically significant predictor of Purchase Regret:

- $\beta = 0.157$
- $p = 0.039$

This finding suggests that artificial urgency, fake scarcity, and price escalation cues increase the likelihood of consumers later regretting their purchases. Manipulation via Interface and Psychological Pressures did not predict regret:

- $\beta = 0.110$
- $p = 0.107$

Such findings can be interpreted that manipulation based on urgency is likely to result in stronger emotional effects than psychological manipulation using an interface.

4.5.2 Predicting Consumer Trust

For the second model, we tested if dark pattern attributes were strong predictors of consumer trust.

¹⁷ This model turned out to be statistically insignificant:

- $F(2,124) = 0.684$
- $p = 0.507$
- $R^2 = 0.011$

Neither:

- Interface Manipulation and Psychological Pressure ($\beta = 0.053$, $p = 0.294$)
nor
- Scarcity and Urgency Tactics ($\beta = 0.023$, $p = 0.682$)

Highly predicted levels of trust.

This conclusion is especially significant since it implies that being exposed to manipulation techniques in user interfaces does not necessarily decrease consumer trust in an obvious way among Indian retail apps.

One possible reason could be that consumers consider such manipulations as common characteristics of online shopping systems.

4.5.3 Predicting App Abandonment Behaviour

The third regression analysis tested factors that influence the users' tendency to abandon the application, proving to be the most powerful model.

It had statistical significance:

- $F(2,124) = 9.50$
- $p < 0.001$
- $R^2 = 0.133$
- $\text{Adjusted } R^2 = 0.119$

Interface Manipulation and Psychological Pressure emerged as the strongest predictor:

- $\beta = 0.312$
- $p < 0.001$

Scarcity and Urgency Tactics didn't drastically predict app abandonment:

- $\beta = 0.124$
- $p = 0.160$

These findings suggest that psychologically intrusive interface mechanisms such as repeated notification nudges, guilt prompts, hidden charges, and pre-selected add-ons may contribute more strongly to long-term disengagement from retail applications than urgency-based tactics alone.

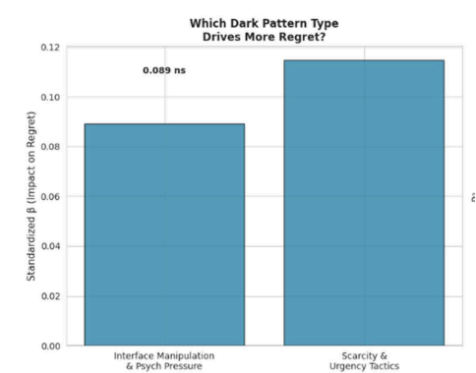
Unlike urgency communication, which impacts consumer behavior and purchase decisions directly, an interface that uses psychological intrusion will cause consumers to feel uncomfortable and eventually lead them to become exhausted from using the site.

Figure 4.9: OLS Regression Coefficient Output

	coef	std err	t	P> t	[0.025	0.975]
const	2.6063	0.055	47.505	0.000	2.498	2.715
Factor_1_Score	0.1095	0.067	1.622	0.107	-0.024	0.243
Factor_2_Score	0.1574	0.076	2.082	0.039	0.008	0.307
=====						
Omnibus:		6.059	Durbin-Watson:		2.229	
Prob(Omnibus):		0.048	Jarque-Bera (JB):		6.159	
Skew:		-0.537	Prob(JB):		0.0460	
Kurtosis:		2.893	Cond. No.		1.40	
=====						

Source: Author’s Calculation using Python Output

Figure 4.10: Comparative Impact of Dark Pattern Dimensions on Post-Purchase Regret



Source: Author’s Calculation using Python Output

5. Results of Research Objectives

5.1 Objective (a)

To measure the prevalence and frequency of dark pattern exposure among Indian retail app users across seven identified dark pattern types.

5.1.1 Result

The objective was achieved effectively.

It was discovered from the findings of the analysis that the use of dark patterns was highly prevalent among Indian customers who made use of the retail applications for their purchases. Respondents pointed out that they frequently found themselves experiencing multiple manipulative designs during online transactions.

The commonly observed dark patterns included:

- Hidden charges (Mean = 3.91)
- Urgency messages (Mean = 3.86)
- Notification nudges (Mean = 3.81)

Other commonly experienced tactics included:

- Pre-selected add-ons
- Fake scarcity indicators
- Guilt-inducing prompts
- Price increases during checkout

5.1.2 Interpretation

These results suggest that the misleading nature of these technologies is not uncommon but rather deeply rooted in everyday consumer practices on such platforms.

5.2 Objective (b)

To identify the underlying factor structure of dark pattern exposure among Indian retail app users through exploratory factor analysis.

5.2.1 Result

Goal was successfully achieved.

Through Exploratory Factor Analysis, the following two dimensions of dark pattern experience emerged:

5.2.1.1 Interface Manipulation and Psychological Pressure

Included:

- Notification nudges
- Pre-selected add-ons
- Guilt messages
- Hidden charges

5.2.1.2 Scarcity and Urgency Tactics

Included:

- Fake scarcity indicators
- Urgency messages
- Price increase signals

As can be seen from the factor structure, dark patterns are multidimensional behaviour systems and not one holistic concept.

5.2.2 Interpretation

Different dark pattern categories operate through different psychological mechanisms and so shouldn't be treated as conceptually identical.

5.3 Objective (c)

To find the relationship between dark pattern exposure and consumer trust in retail app pricing transparency.

5.3.1 Result

The hypothesis was not statistically significant.

The regression test for measuring trust was not statistically significant:

- $R^2 = 0.011$
- $p = 0.507$

Neither:

- Interface Manipulation and Psychological Pressure
nor
- Scarcity and Urgency Tactics

evidently predicted consumer trust.

5.3.2 Interpretation

The results show that the Indian population may normalize manipulative practices regarding user interfaces in e-commerce. Because of repeated exposure to dark patterns, this appears not to influence the level of generalized trust towards e-commerce apps.

This implies the possible presence of structural trust normalization.

5.4 Objective (d)

To examine the relationship between dark pattern exposure and post-purchase regret.

5.4.1 Result

The objective was partially achieved as follows.

Regression analysis revealed that:

- Scarcity and Urgency Tactics significantly predicted post-purchase regret:
 - $\beta = 0.157$
 - $p = 0.039$

However, interface manipulation and psychological pressure didn't significantly predict regret.

5.4.2 Interpretation

Dark patterns based on urgency lead to impulse buying, causing emotional dissatisfaction and regret in the future.

The above statement can be justified using the following theories from behavioural economics:

- loss aversion,
- fear of missing out (FOMO),
- and impulsive decision-making under pressure.

5.5 Objective (e)

To examine the relationship between dark pattern exposure and app abandonment behaviour.

5.5.1 Result

The goal was well-founded.

Statistical significance was established for the regression equation regarding app abandonment.:

- $R^2 = 0.133$
- $p < 0.001$

Interface Manipulation and Psychological Pressure significantly predicted app abandonment:

- $\beta = 0.312$
- $p < 0.001$

The use of Scarcity and Urgency Tactics was insignificant.

5.5.2 Interpretation

Manipulative psychologically intrusive methods like:

- repeated notifications
- hidden charges
- guilt prompts
- pre-selected add-ons

seem to be increasing platform fatigue and disengagement on the part of the users.

As opposed to urgency tactics, the manipulations mentioned above seem to have accumulative effects over time.

5.6 Objective (f)

To draw theoretical and practical implications contributing to digital ethics, Indian e-commerce behaviour, and consumer protection research.

5.6.1 Result

The objective was successfully achieved.

5.6.2 Theoretical Contributions

- The dark pattern was established as a multivariate behavioural system.
- Different types of dark patterns lead to distinct behavioural consequences.
- Trust normalisation became a behavioural finding in digital space.

5.6.3 Practical Contributions

The study emphasizes the need for:

- transparent pricing mechanisms
- ethical UX design
- restrictions on false urgency tactics
- simplified cancellation systems
- stronger consumer protection regulation.

6. RESULTS OF HYPOTHESES TESTING

Table 6.1 Hypothesis & Result

Hypothesis	Statement	Result
H1	Dark pattern exposure is positively associated with post-purchase regret.	Supported
H2	Dark pattern exposure is negatively associated with consumer trust.	Not Supported
H3	Dark pattern exposure is positively associated with app abandonment behaviour.	Supported
H4	Scarcity and Urgency Tactics significantly predict post-purchase regret.	Supported
H5	Interface Manipulation and Psychological Pressure significantly predict app abandonment behaviour.	Supported
H6	Interface Manipulation and Psychological Pressure significantly predict consumer trust reduction.	Not Supported
H7	Scarcity and Urgency Tactics significantly predict consumer trust reduction.	Not Supported

Source: Author's Calculation using Python Output

The table reveals that:

- Dark patterns are quite rampant within Indian retail apps.
- Manipulations through various approaches lead to various outcomes.
- Manipulation through urgency leads to emotions of regret.

- Mental manipulation plays a bigger role in disengagement.
- And consumer trust may already be normalized despite repeated exposure to manipulative interface practices.

7. CONCLUSION

With data drawn from 128 customers of Indian retail apps, this research investigated the impact of such behaviors on consumer trust, post-purchase regret, and app abandonment behaviors within the fast-growing Indian digital commerce market.

Through analyzing the data gathered from the answers provided by 128 Indian retail application users, the study aimed to investigate the effect of these tactics on the users' levels of trust, regret after purchase, and application abandonment behavior in the fast-growing Indian digital commerce setting. The results show that dark patterns are very common among Indian retail applications. These tactics have been thoroughly embedded into their everyday usage. Hidden fees, messages of urgency, and notifications stood out as the most used manipulation techniques among the respondents.

Among the main contributions is the delineation of two dimensions of dark pattern exposure based on EFA. The first dimension was titled Scarcity and Urgency Tactics, which consisted of such variables as faux scarcity cues, urgency cues, and upward price cues. The second one was Interface Manipulation and Psychological Pressure, which comprised variables like hidden cost notifications cues, preselected add-ons, and guilt-trip prompts. Such a differentiation proves that these methods do not act as one coherent construct of consumer behavior, but rather work through various psychological processes.

It suggests that these methods produce unique types of consumer harm. Scarcity and urgency triggers predict post-purchase regret. This implies that creating artificial urgency and fear of losing an opportunity will drive consumers to act impulsively and eventually regret their decision. On the other hand, psychologically intrusive methods proved highly effective in predicting the decision to stop using apps.

In addition, the research revealed that there was no significant correlation between dark pattern experience and trust of consumers. The result is quite contrary to numerous previous works related to online shopping behavior of traditional websites. There is an indication that consumers have got used to such manipulative interfaces in the digital marketplace in India over time. In other words,

consumers do not seem to be deterred by such manipulative interfaces and continue using apps for shopping.

The implications of this study's findings will have considerable importance to the platforms themselves, policy makers, and scholars. In regard to retail platforms, the findings suggest that interface level manipulation poses significantly more risk to their businesses than urgency tactics in the short run, because disengagement from the platform itself would be the ultimate result rather than merely dissatisfaction. ⁹ In terms of policy makers, the results indicate the need for greater control of this kind of deception, especially concerning pricing and the experience of the user.

In a theoretical sense, the contribution that can be made by the study is two-fold; firstly, it contributes to the body of literature about digital ethics and behavior manipulation by showing the effects of each dark pattern. Secondly, it extends the Indian literature on online shopping in terms of behavioral impact.

8. LIMITATIONS OF THE STUDY

However, the present study is indeed an important effort towards expanding the extant literature body on dark patterns within retailing environments in India. This is owing to the fact that the present study aims to examine the link between exposure to manipulative user interfaces, consumer trust, regret following the purchase decision and abandonment of mobile applications. However, it is important to note some of the methodological, theoretical, statistical and contextual shortcomings of the study at hand. This is due to the exploratory nature of the research question formulated in the study.

8.1 Measurement and Construct Validity Limitations

The calculated Cronbach's ⁷ Alpha coefficient for the Dark Pattern Exposure Scale was 0.568, which is under the standard minimum of 0.70 required for ensuring good reliability. This limitation could have been predicted, considering that dark patterns are not instances of homogenous manipulative behavior but rather involve many different types of manipulations; nevertheless, this limitation affects the ability to interpret the resulting Dark Pattern Exposure Score as an objective measure on a single dimension.

In relation to Objective (a), it is important to understand that due to this drawback, it may be difficult to establish the frequency with which people have experienced manipulative designs since the different dark pattern categories do not appear to be equally effective at measuring the same behavioral construct. This is because while it was clear that there is a high prevalence rate of exposure to manipulative design, the reliability was moderate. However, the following factor analysis partly validates this theory, through empirical evidence of two different dimensions of behavior, although the statistical weakness is still relevant.

Just like that, Objective (b), whose aim was to determine the factor structure of dark pattern exposure, also faces some limitations related to low inter-item correlations within the data set. While the exploratory factor analysis resulted in the emergence of theoretically meaningful factors, one still needs to interpret the results of such an analysis carefully.

The other notable limitation pertains to the Trust scale. It was found that none of the items relating to trust were able to form any construct, and a negative Cronbach's Alpha coefficient was obtained even after eliminating an item that did not conceptually fit into the construct. Thus, the items of trust could only be analyzed separately.

It influences directly the achievement of objective (c), as well as the hypotheses relating to the examination of the correlation between the influence of dark patterns on consumer trust. Since consumer trust could not be operationally defined through its multidimensional aspects in a statistically valid way, the study could not cover the entire psychological range of trust formation in digital buying contexts..

8.2 Limitations Related to Exploratory Factor Analysis

Factor analysis model discovered through this study also holds certain limitations. The sampling adequacy of KMO measure was 0.600. This score is considered to fall on the borderline of acceptability based on KMO classification criteria. However, since ³⁰ **Bartlett's Test of Sphericity was significant and** behaviorally interpretable factors were found, the rather low value of KMO test shows that there were not very strong correlations among dark pattern variables.

Consequently, the two-factor solution identified in the study should be interpreted as exploratory rather than confirmatory. While the factors align conceptually with existing theoretical classifications proposed by Gray et al. (2018) [R8], the extracted structure may still be partially sample-dependent.

This drawback directly affects Objective (b), which sought to identify empirically distinct dimensions of dark pattern exposure. Through the study successfully identified two meaningful dimensions — Scarcity and Urgency Tactics and Interface Manipulation and Psychological Pressure, the factor solution can't yet be treated as a universally validated taxonomy for Indian retail app environments.

8.3 Regression and Explanatory Limitations

The regression models explained:

- 5.8% of variance in Post-Purchase Regret
- 1.1% of variance in Trust
- 13.3% of variance in App Abandonment Behaviour

Through such sizes aren't abnormal within consumer behaviour research — where behavioural outcomes are influenced by numerous situations, psychological, and contextual variables, they still indicate that substantial proportions of variance remain unexplained by the present study.

This limitation affects, the Objectives (c), (d), and (e), all of which attempted to examine behavioural consequences associated with dark pattern exposure.

For example:

- Post-purchase regret may on top of that depend on impulsivity, self-control, financial literacy, emotional buying tendencies, or mood states
- App abandonment may also be influenced by app usability, customer service quality, platform dependency, or availability of alternatives
- Trust may depend on brand familiarity, prior purchase satisfaction, peer influence, or platform reputation

The present study, intentionally focused, on dark pattern exposure as the central explanatory variable, but human digital behaviour operates through far more complex behavioural ecosystems than can be captured within a single survey instrument.

Therefore the findings shouldn't be interpreted as implying that dark patterns are the sole determinants. Instead they should be viewed as statistically significant contributors within broader multi-factor behavioural systems.

Future studies should incorporate:

- Impulsivity measures
- Digital literacy scales
- Personality variables
- shopping addiction tendencies

- Risk perception
- Socio-economic background
- Platform dependency variables
in order to build more comprehensive behavioural models

8.4 Design and Causality Limitations

This constraint impacts the following objectives (c), (d), and (e), which analyzed connections between exposure to dark patterns and behavioral measures like trust, regret, and uninstalling apps.

For example:

- Users already dissatisfied with digital shopping apps may interpret interface experiences more negatively
- Users with a predisposition towards regret may be able to spot manipulation attempts better
- Individuals planning to reduce app usage may also become more attentive to manipulative interface features

This is an opportunity for reverse causation and mutually interdependent behavioral relations.

Additionally, there might be behavioral adaptations that could take place over time instead of all at once. This current study considered the behavioral perceptions at just one particular point in time.

Further studies must therefore consider:

- Longitudinal designs
- Experimental interface simulations
- Behavioural tracking studies
- Panel-data approaches
to examine causal mechanisms more rigorously

8.5 Sampling Limitations and Generalizability

The study heavily relied on non-probability convenience sampling.

As a result, sample is likely skewed toward:

- Younger
- Digitally active
- Educated
- Urban or semi-urban consumers who are already highly familiar with retail applications

This shortcoming of the results directly affects the generalisability of findings across broader Indian population.

Objectives (a), (c), (d), and (e) are examined prevalence and behavioural consequences of dark pattern exposure, may reflect the behavioural experiences of strongly active digital consumers more strongly than those of older or less technologically savvy populations.

Importantly, underrepresented groups such as:

- Older adults
- Rural consumers
- First-time digital users
- individuals with lower digital literacy may actually be more vulnerable to manipulative interface tactics because they may possess lower awareness regarding deceptive design mechanisms.

Vishwakarma (2026) [R6] similarly suggested that lower digital literacy reduces consumers' ability to recognize and resist manipulative interface structures.

Consequently, although the current research offers useful information on dark pattern exposure through Indian retail apps, the results cannot yet be extended to all sections of the Indian society with certainty.

Further research must focus on:

- Stratified sampling
- Larger multi-city samples
- Rural-urban comparison frameworks
- Demographic segmentation analysis to improve external validity

8.6 Self-Report and Method Bias Limitations

Consumers may not necessarily be able to immediately notice manipulative interface tactics whenever they happen. There are many types of dark patterns which are specifically made subtle using certain behavioral defaults, cognitive biases, and emotions. This also implies that consumers may not actually report manipulation due to the reason that they do not recognize such manipulation.

Errors in retrospectively recalling information can influence behavioral accuracy. The subjects were asked to recall past shopping experiences, emotions, hidden fees, and behavioral choices over time. Retrospective evaluation by definition is open to distortion due to the fallibility of memory.

Moreover, social desirability might also have an effect on respondents. There will be individuals who would not feel comfortable disclosing information on impulsiveness, regret, and vulnerability to manipulation due to the fact that this might seem irrational.

This problem is significant in relation to Objectives (a), (d), and (e), which depended on self-reporting about the aforementioned aspects.

Further, the similarity in measurement of the predictor and outcome variables through the use of the same survey measure at the same point in time makes the study susceptible to common method variance. Common method variance can either overstate or understate relationships between variables.

Future research should combine the above approach with:

- Behavioural experiments
- Interface observation studies
- Clickstream analysis
- Digital ethnography
- App-usage tracking data to improve behavioural accuracy and reduce shared-method limitations

8.7 Limitations Related to Theoretical Scope

The manipulation through interfaces is part of a bigger picture involving other factors such as economic, legal, technological, and algorithmic systems that have not been considered in this current investigation.

Examples include the following:

- Platform recommendation algorithms
- Personalized pricing systems
- AI-driven behavioural targeting
- Consumer data profiling
- Algorithmic manipulation strategies

Also, the study focused specifically on Indian retail applications and didn't compare behavioural responses across countries, cultures, or platform types.

9. FUTURE SCOPE OF THE STUDY

However, despite the usefulness of the findings in the context of consumer exposure, regret after purchasing, app abandonment, and trust normalcy, there are certain matters which need to be explored further through more advanced approaches. With the rapid evolution of new systems of digital commerce, future research needs to take into account not only user behavior but also the ways to understand the psychological, technical, and legal implications of the manipulation mentioned above.

A final research path that should be explored in more detail is the use of longitudinal studies in the analysis. The present paper relied on a cross-sectional design, which meant that the response of consumers was examined at only one point in time. In reality, however, all the behavioral consequences associated with dark patterns – particularly those involving the normalization of trust and the development of platform fatigue – tend to develop gradually as a result of repeated exposure. It could be insightful to observe whether consumers grow accustomed to the manipulation or start developing resistance to the manipulation over time.

Another notable development concerns the application of experimental research designs. The current research is based on self-reported data collected from surveys, which precludes any possibility for the establishment of causation with regard to the influence of dark patterns on consumer behavior. Future research can conduct simulations of virtual retail app environments in which various types of dark patterns are incorporated, and then experimentally assess consumer reactions to such exposure. The experimental methods will also allow the testing of various behavioral theories on issues such as impulsiveness, cognitive load, default bias, and fear of missing out rather than indirectly deriving such theories from surveys conducted.

The two factor structure found in the study also presents a range of valuable possibilities for the development of scales and improvements in psychometric validity. It is essential that future studies carry out CFA on samples which are larger and more varied demographically in order to see if the same dimensions found in this study prove valid across different consumers and online platforms. Improved measurement models will aid in better understanding dark patterns research and will lead to the creation of behavioral scales for digital manipulation.

Future research should also take into account additional psychological and behavioral variables that were out of the scope of the current study. Such factors as susceptibility to impulse buying, emotional sensitivity, computer literacy, online shopping addiction, money awareness, reliance on the website, and consumer control over oneself may have considerable influence on consumers' response to such manipulations in design. They may account for the reasons why some customers are strongly affected by these manipulations while others do not react to them at all.

Another critical field of study to be pursued further is the issue of demographic heterogeneity among the users of Indian online retailing systems. While the existing sample primarily consisted of young, tech-savvy individuals, the increasing presence of more mature people, novice netizens, semi-urban and rural communities, and individuals having different digital skills cannot be overlooked as far as India's fast-growing world of online shopping is concerned. Such work would be particularly valuable for policymakers because behavioural susceptibility may not be evenly distributed across the population.

Further qualitative and mixed methods research designs can shed light on the cognitive processes of consumers with regards to manipulative design tactics. Although the current research was able to establish statistical associations between dark pattern manipulation and consumer behaviour, it failed to explain the emotional processing of the consumers at the very moment they experience such manipulations. Conducting qualitative interviews, group discussions, ethnographic research, and think-aloud sessions while using apps would show if the users become aware of being manipulated or accept that as a tradeoff for convenience.

Future research can also examine the differences in the use of manipulative interface tactics between platforms. Comparative analysis of large Indian e-commerce applications, including Amazon, Flipkart, Myntra, Blinkit, Zepto, and Meesho, can reveal whether particular platforms engage more in particular forms of dark patterns compared to others. Consumer surveys combined with interface audits will offer more relevant information about the use of various behavioral manipulations strategies across different business models.

A final issue that needs research attention is that of algorithmic manipulation and artificial intelligence. With the increasing reliance by online marketplaces on personalized suggestions,

dynamic pricing models, behavior prediction systems, and AI-led optimization of user interaction, future research needs to focus on the relationship between automatic behavioral targeting and dark pattern designs. The manipulation tactics used in digital retail are progressively moving away from simple manipulations of interface to data-driven behavioral systems that can adapt to individual users.

The cross-cultural comparative study holds much promise for the future as well. Studying the effect of dark patterns within such emerging economies as India, Brazil, Indonesia, or Nigeria might help determine whether the problem of trust normalization raised within this paper has anything to do with specific cultures or whether the problem exists in each and every developing economy that is entering the era of digitalization.

In any case, it will be important for future research of dark patterns to involve itself more in the discussion of ethical and governance-related issues that are associated with the Internet and social networks. It is not enough nowadays just to discuss manipulative interface design in the context of usability and marketing because the problem is gradually turning into one of the key aspects of the issue of behavioral governance in digital algorithmic spaces. Considering the ever-growing role of online shopping platforms, the following question should also become relevant: How.

10. CONCLUSION

Dark patterns have now developed from merely being anomalies in the UI to becoming behavioral techniques that are part of the design philosophy within the retail applications. This study was carried out in order to find out how Indian consumers perceive dark patterns and their influence on consumer trust and regrets.

Through primary data collection, was done by gathering data from 128 users actively using retail applications in India. There was an empirical examination of exposure to seven major kinds of dark patterns such as urgency messaging, artificial scarcity, hidden costs, automatic selection of extras, guilt trips, raising prices during checkout, and nudging notifications. With the use of ²⁵reliability analysis, exploratory factor analysis, correlation analysis, and regression models, it was established that there were certain behavioral trends pertaining to digital consumer manipulation.

Moreover, an important conclusion drawn from the research is that dark patterns should not be regarded as a unidimensional behavioral construct. On the contrary, two different dimensions of dark patterns in manipulative interfaces were distinguished. The first dimension was referred to as Scarcity and Urgency Tactics and comprised of false scarcity triggers, urgency notifications, and rising prices. The second dimension was called Interface Manipulation and Psychological Pressure and encompassed notifications, hidden fees, guilt messaging, and pre-selected additions. This difference is theoretically important because it demonstrates that different forms of manipulative design produce different behavioural consequences rather than affecting consumers uniformly.

The findings also showed that scarcity-based manipulation tactics significantly predict post-purchase regret. Consumers exposed, more frequently to urgency-driven prompts and artificial scarcity cues were more likely to report emotional dissatisfaction after purchases. This suggests that pressure of time, fear of missing out, and perceived scarcity reduce reflective decision-making and increase impulsive buying behaviour, which consumers later reassess negatively once the immediate urgency disappears. The findings support behavioural economics perspectives relating

to loss aversion, cognitive pressure, and impulsive consumer responses under constrained decision environments.

It shows that, psychologically intrusive interface manipulation exerts a different type of behavioural impact. The variables of notifications that nudge, concealed transactional information, preset add-ons, and emotional coercion all proved to be significant predictors of abandoning an application. Unlike the approach of urgency tactics that produce predominantly regret as an emotion, manipulating users through psychological interface is likely to cause long-term frustrations and boredom. This distinction highlights one of the core findings of the research, as manipulating the user interface creates a variety of psychological responses over time.

Contrary to most of the literature available on online retailing, manipulative design had little impact in terms of undermining the amount of trust that the subjects had. This study shows that certain customers from India may actually be used to the manipulative design tactics when making their purchases online. Instead of seeing these factors as different forms of violation of trust, consumers may see them as the norm within mobile commerce. Structural trust normalization could be seen as a theoretical output of this study.

There are numerous ³¹implications of the findings from this study for those involved in designing platforms, policy making, or research. In the first place, with regard to online shopping platforms, one of the implications of this study would be that psychological manipulation poses a bigger threat to the sustainability of an organization than urgent notifications because the most important impact of psychological manipulation in users would be disengagement from the platform itself.

For the regulators, the study findings suggest the requirement for structurally better regulatory frameworks that would regulate the manipulative schemes employed in the online market in India. Consumer knowledge may not be adequate when the manipulative schemes employed have fully become an industry standard. Regulatory schemes that focus on fair pricing schemes, simple cancellation, explicit consent, and prohibition of creating artificial urgency may become imperative in India's rapidly growing retail apps industry.

Contributions to the ongoing discussion about digital ethics, behavioral governance, and manipulation in interfaces are made by these Findings, as they illustrate how the use of dark

patterns forms a complex multi-dimensional system that produces various outcomes. Second, this paper adds a valuable contribution to the current research carried out in India about online shopping behavior through the modeling of manipulative interface exposure.

With India's steady growth towards being a country that will see digital commerce taking place via platform-based systems, the issue of ethical interface design is set to become more significant, not only because of the need to ensure consumers' wellbeing but also for many other reasons too. As per the research findings, it would no longer make sense to look at dark patterns as any form of marketing gimmick or usability issue. Instead, they are behavioral techniques that could affect consumer behavior.

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