



# International Journal of Research Publication and Reviews

Journal homepage: [www.ijrpr.com](http://www.ijrpr.com) ISSN 2582-7421

## "Designed to Deceive: A Study of Dark Patterns in Indian E-Commerce Platforms"

*Dr. R.Pradeep Kumar Patnaik<sup>1</sup>, Ms.Vennela Medapati<sup>2</sup>*

<sup>1</sup> Assistant professor, BBA Department, KLEF

<sup>2</sup> Research Scholar, BBA Department, KLEF, 2400560015

[Vennelamedapati336@gmail.com](mailto:Vennelamedapati336@gmail.com), 9729918369

DOI : <https://doi.org/10.55248/gengpi.07.1026.3278>

### ABSTRACT:

E-commerce has grown rapidly and has changed the way consumers search, compare and buy products and services. Concurrently, e-commerce platforms increasingly are using designs for their interfaces that affect consumer choices in ways that are not obvious or consumer-favorable. This can be done through urgency cues, scarcity messages, hidden costs, confirmshaming, forced continuity, misleading visual hierarchies and difficult cancellation processes, and is known as dark patterns. This research investigates the effects of dark pattern on Indian consumers' purchase decision and perceived deception as a mediating construct. The design employed was quantitative, cross sectional and a structured online questionnaire consisting of 31 five point Likert items and seven questions related to demographic and shopping-behaviour data was filled out by 142 online shoppers. Descriptive statistics, Cronbach's alpha, Pearson correlation, chi-square tests, one-way ANOVA, multiple linear regression and bootstrapped mediation were used to analyse data. The frequency of exposure to dark pattern was high for all constructs (all construct means > 3.50 on a 5-point scale). Perceived deception was best predicted by dark patterns ( $R^2 = 0.54$ ) and the six dark-pattern dimensions were able to explain 67.6% of the variance in purchase influence, with the dimensions of interface interference and perceived deception being the top two predictors. The indirect effect of dark patterns on purchase influence was completely mediated by perceived deception (0.31; 95% CI [0.09, 0.53]), while perceived deception was a strong driver of purchase abandonment ( $R^2 = 0.38$ ). The age and education, occupation and income factors, shopping frequency and platform all had significant differences in purchase influence, but not gender. The results could impact ecommerce platforms, online marketers, consumer protection bodies, and policy makers looking to create more transparent and consumer-friendly digital markets.

**Keywords:** Dark patterns, perceived deception, consumer purchase decision, e-commerce, deceptive design, Indian consumers, digital marketing.

### 1.Introduction

The explosion of e-commerce has transformed the way people shop. Today, people tend to use online shopping websites for product research, comparison, price checking, reading reviews and making online purchases. Businesses can leverage on the convenience, personalization, and accessibility of the digital platforms to shape consumer behaviour in a significant way through the design of their interfaces. The same technologies that make things easier for the user, however, can also be leveraged to make choices for the user. A new trend is dark patterns, a method of user interface and user interaction in which items are designed so that the user is encouraged to make a choice that is not necessarily in their best interests or what they initially intended. Dark patterns work within the consumer's online environment where his or her choices are made, unlike regular advertising. They may be able to sway consumers through visibility, false information, urgency, opt-out options, lack of information or extra steps needed to refuse an offer. These can include things like "Only 2 left," "Show more products/service," "Hide charges until later," etc. etc., making it more difficult than it needs to be to cancel, or making the "accept" button bigger than the "rejected" button. These practices can limit the consumer's capacity to make autonomous and informed decisions. This is a significant concern in the Indian e-commerce landscape. With the rising penetration of Internet, smartphones, digital payments and changing customer behavior, there has been significant growth in online retail in India. Big ecommerce sites are in fierce competition for attention and conversions. Given the competitive landscape, interface optimization doesn't always mean making it more user-friendly – in some cases, it may mean exploiting some behavioral bias to drive conversions, basket value or customer retention. Dark patterns are thus an important topic to be discussed at the crossroads of digital marketing, consumer psychology, information systems and consumer protection. The distinction between persuasion and manipulation can be a problem with persuasive design when consumers are misled, coerced or denied the ability to make a free decision. Perceived deception is an important psychological effect of dark patterns. If the consumer believes the interface or seller has hidden information, an exaggerated sense of urgency, offered false options, or added unexpected fees, it could be seen as deceptive. If the person feels

deceived, then their buying decision may be impacted. An manipulated consumer might reject the purchase and re-think the product, look for other products, or be less willing to buy. But, sometimes it's not as simple as it sounds. Dark patterns can sway consumers even before they realize that the interface is manipulative. Manipulative elements may be recognized by some consumers still when purchasing items due to convenience, perceived scarcity, an attractive price, or by habit of frequent use of a platform. It's essential to understand the direct impact of dark patterns, as well as indirect impact via perceived deception. In the current study, dark patterns are explored as a multidimensional phenomenon and are related to consumer purchase decisions and perceived deception. Specifically, it focuses on understanding the factors that most effect consumer behavior in the form of dark patterns.

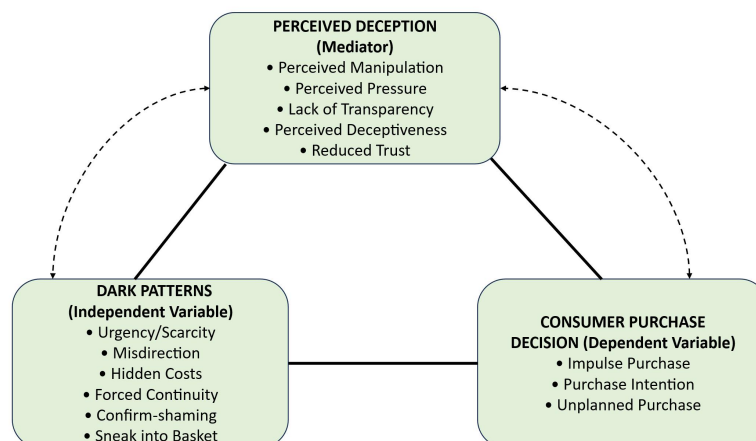
## 2. Review of literature

Research into dark marketing patterns in digital shows a vast amount of evidence for their common use in social media and e-commerce platforms to try and influence consumer behaviour by taking advantage of certain cognitive biases. Research shows that it has adverse consequences for users' autonomy, confidence and choices, and that the effectiveness of regulations differs from region to region. New research suggests a need for better tools for detection, better legal description, and better consumer protection, including in the case of AI-driven and personalized manipulations.

### Research gap

While the literature has confirmed that dark patterns exist and can have an ethical impact on consumers, there has been only a handful of empirical studies that have investigated the impact of multidimensional dark pattern practices on Indian consumers' purchase decisions via perceived deception. However, the present study rectifies this by proposing and validating an integrated model which connects dark patterns, perceived deception, and consumer purchase decision in the Indian e-commerce scenario.

### Conceptual framework



### Research objectives

To understand the effect of various Dark Patterns affecting Consumer Purchasing Behavior (purchase influence) and which of the dimensions have the highest influence on consumer purchasing behavior in the Indian e-commerce landscape. To examine the link between Dark Patterns and consumer deception. To examine the influence of perceived deception on purchase influence and how often it leads to abandonment of the purchase, as well as how it mediates in that process. To compare purchase influence and dark-pattern perception in demographic groups and on different e-commerce platforms and to test if the demographic profile correlates with purchase influence.

### Research hypotheses

- **H1:** Dark patterns significantly and positively impact perceived deception.
- **H2:** Consumer perceived deception has a negative significant influence on consumer purchase decision.
- **H3:** Dark patterns impact the consumers' purchasing decision to a great extent.

- **H4:** Consumer purchase decision is significantly mediated by perceived deception in the relationship between dark patterns and consumer purchase decision.
- **H5:** There is a significant joint effect between the dark-pattern dimensions (SU, PM, SP, HC, II, DEC) and purchase influence.
- **H6:** Deceptive sales practice is significant to purchase abandonment.
- **H7:** There is a significant difference in the mean of the purchase influence of the demographic groups (ANOVA).
- **H8:** The level of purchase influence is significantly related to the demographic variables (chi-square).
- *H1–H4 are the hypotheses of the proposed framework; in order to test the dimension-level, abandonment and demographic questions that the survey data supports, H5–H8 were added.*

### 3. Research methodology

The study is descriptive, cross-sectional and an online structured questionnaire was designed and administered to the Indian e-commerce consumers with experience of purchasing the product through e-shopping. There were a total of 142 responses ( $n = 142$ ). The questionnaire has two parts: (i) seven demographic and shopping-behaviour questions (age, gender, education, occupation, monthly income, frequency of online shopping and most used e-commerce platform) and (ii) 31 statements on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The 31 items were collapsed into eight constructs, with each construct score being the average of the items. Overall dark-pattern perception (DPP) is the mean of Q1–Q25, whereas the dark-pattern composite (DP) in the mediation analysis is the mean of the five dark-pattern dimensions SU, PM, SP, HC and II.

**Table 1. Constructs and items**

| Construct (code)                            | Items   | Role in analysis                                                |
|---------------------------------------------|---------|-----------------------------------------------------------------|
| Scarcity & Urgency (SU)                     | Q1–Q4   | Independent                                                     |
| Price / Discount Manipulation (PM)          | Q5–Q8   | Independent                                                     |
| Social Proof(SP)                            | Q9–Q11  | Independent                                                     |
| Hidden Costs (HC)                           | Q12–Q15 | Independent                                                     |
| Interface Interference (II)                 | Q16–Q19 | Independent                                                     |
| Perceived Deception / Bait-and-Switch (DEC) | Q20–Q25 | Independent (Model 1); mediator; dependent (Model 2, mediation) |
| purchase influence(PI)                      | Q26–Q28 | dependent (Model 1, ANOVA, chi-square, mediation)               |
| Abandonment on Deception (AB)               | Q29–Q31 | Dependent (Model 3)                                             |
| Overall Dark-Pattern Perception (DPP)       | Q1–Q25  | Dependent (ANOVA)                                               |

Data were coded and analysed in Microsoft Excel (with formulas, along with a cross-check of the data using an independent statistical routine that generates SPSS output). The significance level ( $\alpha$ ) for all tests is 5%. The significance level ( $\alpha$ ) for all the tests is 0.05, or 5%. Cronbach's alpha was used as a test of reliability and Pearson correlation was used for the relationship testing. The chi-square test of independence was used to test association between demographic variables and the level of purchase influence; one-way ANOVA (with Levene's test, Welch and Kruskal-Wallis checks, and Tukey HSD post-hoc tests) was used to compare mean scores across groups; ordinary least squares regression was used to estimate the effect of the dark-pattern dimensions on purchase influence and abandonment; and a regression-based mediation analysis with a percentile bootstrap (3,000 resamples) was used to test the mediating role of perceived deception.

### 4. Cleaning of data and profile of samples

A total of 142 questionnaires were kept. There were no missing Likert items and all items were within the range of 1–5. Five respondents left blank the age question, which were only excluded from age based tests ( $n = 137$ ). The gender group “Below 18” was combined with 18–25, “46–55” with “Above 55”, “2–3 times a month” with “Monthly” and “Other” education with “Higher Secondary” education, with the exception of the chi-square test only, and the gender group “Prefer not to say” ( $n = 9$ ) was not included in the chi-square test. For chi-square, purchase influence was classified as Low ( $PI < 3.5$ ,  $n = 29$ ), Moderate ( $3.5$  to  $4.49$ ,  $n = 75$ ) or High ( $\geq 4.5$ ,  $n = 38$ ).

Table 2. The respondents (n = 142)

| Variable           | Category                              | Frequency | percent |
|--------------------|---------------------------------------|-----------|---------|
| Age                | Below 18                              | 4         | 2.8%    |
|                    | 18–25                                 | 79 55.6%  | 55.6%   |
|                    | 26–35                                 | 20        | 14.1%   |
|                    | 36–45                                 | 10        | 7.0%    |
|                    | 46–55                                 | 9 6.3%    | 6.3%    |
|                    | Above 55                              | 15        | 10.6%   |
|                    | No entry (not eligible for age tests) | 5         | 3.5%    |
| Gender             | Male                                  | 90        | 63.4%   |
|                    | Female                                | 43        | 30.3%   |
|                    | Prefer not to                         | 9         | 6.3%    |
| Education          | Undergraduate                         | 103       | 72.5%   |
|                    | Postgraduate                          | 20        | 14.1%   |
|                    | Higher Secondary                      | 15        | 10.6%   |
|                    | Other                                 | 4         | 2.8%    |
| Occupation         | Student                               | 78        | 54.9%   |
|                    | Self-employed/Business                | 34        | 23.9%   |
|                    | Homemaker                             | 20        | 14.1%   |
|                    | Private Employee                      | 10        | 7.0%    |
| Monthly income     | Below ₹20,000                         | 83        | 58.5%   |
|                    | ₹20,001–₹40,000                       | 15        | 10.6%   |
|                    | ₹40,001–₹60,000                       | 20        | 14.1%   |
|                    | Above ₹80,000                         | 24        | 16.9%   |
| Shopping frequency | Monthly                               | 89        | 62.7%   |
|                    | Occasionally                          | 33        | 23.2%   |
|                    | Rarely                                | 15        | 10.6%   |
|                    | 2–3 times a month                     | 5         | 3.5%    |
| Platform           | Amazon                                | 78        | 54.9%   |
|                    | Myntra                                | 20        | 14.1%   |
|                    | Ajio                                  | 20        | 14.1%   |
|                    | Flipkart                              | 10        | 7.0%    |

Respondents are predominantly young (55.6% aged 18–25), male (63.4%), undergraduates (72.5%) and students (54.9%). Over half (58.5%) earn below ₹20,000 a month, 62.7% shop online monthly and Amazon is the most used platform (54.9%). The sample is thus dominated by students, and the results mainly reflect the experiences of young consumers who shop online.

**Data-quality checks:** Five respondents responded to every 31 items (straight-lining) and were included as part of the sample (n = 142). Further, the 142 records show only 29 distinct response patterns (113 records are a duplicate of another record on all of the demographic and Likert items, suggesting multiple data entry). The results below are reported for the entire file as it comes; the results will be re-estimated on the 29 unique records prior to submission of the paper (see Limitations).

#### Data reliability and descriptive statistics.

Table 3. Constructs descriptive statistics and Cronbach's alpha Items

| Constructs                  | Items | Cronbach's $\alpha$ | Mean | Std. dev |
|-----------------------------|-------|---------------------|------|----------|
| Scarcity & Urgency          | 4     | 0.797               | 3.76 | 0.85     |
| Price/Discount Manipulation | 4     | 0.813               | 3.78 | 0.86     |

|                             |    |       |      |      |
|-----------------------------|----|-------|------|------|
| Social Proof                | 3  | 0.868 | 3.50 | 0.99 |
| Hidden Costs                | 4  | 0.826 | 3.67 | 0.80 |
| Interface Interference      | 4  | 0.851 | 3.53 | 0.99 |
| Perceived Deception         | 6  | 0.749 | 3.90 | 0.65 |
| Purchase Influence (DV)     | 3  | 0.771 | 3.91 | 0.83 |
| Abandonment on Deception    | 3  | 0.594 | 3.94 | 0.71 |
| Overall Perception (Q1–Q25) | 25 | 0.951 | 3.71 | 0.72 |

Overall the scale has a Cronbach's alpha of 0.75 to 0.87 for all independent constructs and a good alpha of 0.77 for the purchase influence and overall is acceptable to good. The model 3 results can be considered indicative, as the abandonment scale, which measures its reliability, is below 0.70 ( $\alpha = 0.59$ ). In general, respondents agree that they experience dark patterns (all construct: range 3.5 – 3.95). The means of perceived deception ( $M = 3.90$ ), abandonment ( $M = 3.94$ ) and purchase influence ( $M = 3.91$ ) have the highest means, while social proof ( $M = 3.50$ ) and interface interference ( $M = 3.53$ ) have the lowest means. The highest level of agreement is with Q25 – “platforms try to influence me without being transparent”,  $M = 4.28$ ; Q23 – “misleading use of information”,  $M = 4.16$ ; and Q28 – “more likely to complete purchase under urgency”,  $M = 4.07$ ; the lowest with Q9 – “X people are viewing this product”,  $M = 3.23$ .

**Table 4. Pearson correlation matrix**

|     | SU   | PM   | SP   | HC   | II   | DEC  | PI   | AB   |
|-----|------|------|------|------|------|------|------|------|
| SU  | 1    | 0.74 | 0.66 | 0.82 | 0.70 | 0.67 | 0.25 | 0.42 |
| PM  | 0.74 | 1    | 0.81 | 0.66 | 0.66 | 0.72 | 0.23 | 0.45 |
| SP  | 0.66 | 0.81 | 1    | 0.68 | 0.76 | 0.64 | 0.45 | 0.47 |
| HC  | 0.82 | 0.66 | 0.68 | 1    | 0.72 | 0.64 | 0.41 | 0.33 |
| II  | 0.70 | 0.66 | 0.76 | 0.72 | 1    | 0.59 | 0.63 | 0.34 |
| DEC | 0.67 | 0.72 | 0.64 | 0.64 | 0.59 | 1    | 0.52 | 0.62 |
| PI  | 0.25 | 0.23 | 0.45 | 0.41 | 0.63 | 0.52 | 1    | 0.54 |
| AB  | 0.42 | 0.45 | 0.47 | 0.33 | 0.34 | 0.62 | 0.54 | 1    |

$p < .01$ . SU = Scarcity & Urgency, PM = Price manipulation, SP = Social proof, HC = Hidden costs, II = Interface interference, DEC = Perceived deception, PI = Purchase influence, AB = Abandonment

All the constructs are positively and significantly correlated. The dark-pattern dimensions are highly inter-correlated ( $r = 0.59$  to  $0.82$ ) with each other, as they are reflections of the same phenomenon, and this is important to consider when interpreting the regression. The strongest correlations with purchase influence are with interface interference ( $r = 0.63$ ) and perceived deception is associated with abandonment ( $r = 0.62$ ).

## 6. Chi-square test of independence

**H<sub>0</sub>:** Demographic variable and the level of purchase influence are independent.

**H<sub>1</sub>:** they go together.

**Table 5. The results of the chi-square analyses: demographic variable x purchase-influence level.**

| Variable             | n   | $\chi^2$ | df | p     | Cramer's V | Cells E<5 | Monte Carlo p | Result          |
|----------------------|-----|----------|----|-------|------------|-----------|---------------|-----------------|
| Gender (Male/Female) | 133 | 4.356    | 2  | .113  | 0.181      | 0%        | .126          | Not significant |
| Age group            | 137 | 35.325   | 6  | <.001 | 0.359      | 33%       | <.001         | Significant     |
| Education            | 142 | 23.693   | 4  | <.001 | 0.289      | 22%       | <.001         | Significant     |
| Occupation           | 142 | 41.247   | 6  | <.001 | 0.381      | 25%       | <.001         | Significant     |
| Monthly income       | 142 | 14.282   | 6  | <.001 | 0.450      | 33%       | <.001         | Significant     |
| Shopping frequency   | 142 | 14.282   | 4  | .006  | 0.224      | 22%       | .008          | Significant     |

|                    |     |        |   |       |       |     |       |             |
|--------------------|-----|--------|---|-------|-------|-----|-------|-------------|
| Preferred platform | 142 | 44.416 | 8 | <.001 | 0.395 | 40% | <.001 | Significant |
|--------------------|-----|--------|---|-------|-------|-----|-------|-------------|

The Monte Carlo p-values (5000 permutations) are provided since the tables have between 22% and 40% of cells with expected counts less than 5, and in all cases the Monte Carlo p-values are consistent with the asymptotic p-values.

Purchase-influence level is significantly correlated with age group, education, occupation, frequency of shopping and preferred platform (all  $p < .01$ ) and it is not significantly correlated with gender ( $\chi^2(2, n = 133) = 4.36, p = .113$ ). The strength of association (Cramér's V) is medium to fairly large, with income being the strongest association ( $V = 0.45$ ), followed by preferred platform ( $V = 0.40$ ), occupation ( $V = 0.38$ ), age ( $V = 0.36$ ), education ( $V = 0.29$ ) and shopping frequency ( $V = 0.22$ ).

The cross tabulations reveal that the students as well as the respondents who earn less than ₹20,000 are in majority in the High category while no respondent earning between ₹20,001 and ₹60,000 is, and the respondents whose earnings are in excess of ₹80,000 are majority in the Low category. The percentage of users in the High category for Myntra and Ajio is 50% as compared to 23% for Amazon users and 0% for those using other platforms (of which 64% are Low). This means that the analysis accepts H8 for 6 of the 7 variables and rejects it for the variable gender.

## 7. One-way ANOVA

H0: All the groups of the factor have the same mean scores. H1: There is at least one group mean that is different.

**Table 6. (ANOVA) -Purchase Influence by Demographic factor**

| Factor             | df     | F      | p     | $\eta^2$ | Levene p | Welch p | Significant |
|--------------------|--------|--------|-------|----------|----------|---------|-------------|
| Age group          | 3, 133 | 15.628 | <.001 | 0.261    | <.001    | <.001   | Yes         |
| Gender             | 2, 139 | 0.851  | .429  | 0.012    | .632     | .264    | No          |
| Education          | 2, 139 | 8.307  | <.001 | 0.107    | .017     | .006    | Yes         |
| Occupation         | 3, 138 | 15.743 | <.001 | 0.255    | <.001    | n/a     | Yes         |
| Monthly income     | 3, 138 | 22.491 | <.001 | 0.328    | <.001    | <.001   | Yes         |
| Shopping frequency | 2, 139 | 4.330  | .015  | 0.059    | .003     | .060    | Yes         |
| Preferred platform | 4, 137 | 11.569 | <.001 | 0.252    | <.001    | <.001   | Yes         |

**Table 7. Overall Dark-Pattern Perception (DPP) ANOVA by demographic factors**

| Factor             | df     | F      | p     | $\eta^2$ | Levene p | Welch p | Significant |
|--------------------|--------|--------|-------|----------|----------|---------|-------------|
| Age group          | 3, 133 | 27.430 | <.001 | 0.382    | <.001    | <.001   | Yes         |
| Gender             | 2, 139 | 2.526  | .084  | 0.035    | .003     | .054    | No          |
| Education          | 2, 139 | 28.402 | <.001 | 0.290    | <.001    | <.001   | Yes         |
| Occupation         | 3, 138 | 14.151 | <.001 | 0.235    | <.001    | <.001   | Yes         |
| Monthly income     | 3, 138 | 23.901 | <.001 | 0.233    | <.001    | <.001   | Yes         |
| Shopping frequency | 2, 139 | 3.045  | <.001 | 0.256    | <.001    | <.001   | Yes         |
| Preferred platform | 4, 137 | 11.569 | .019  | 0.082    | <.001    | <.001   | Yes         |

Occupied on PI: Welch p; not available, as there is zero variance (all ten respondents score 3.67) for the Private Employee group, as confirmed by the Kruskal-Wallis test,  $p < .001$ .

**Table 8. The average number of "purchases" made by a group of people.**

| Factor | Group      | n  | Mean | Std.dev. |
|--------|------------|----|------|----------|
| Age    | 25 & below | 83 | 4.15 | 0.56     |
|        | 26–35      | 20 | 3.25 | 0.78     |
|        | 36–45      | 10 | 4.17 | 0.18     |

|                    |                         |     |      |      |
|--------------------|-------------------------|-----|------|------|
|                    | 46 & above              | 24  | 3.28 | 1.13 |
| Gender             | Female                  | 43  | 3.78 | 0.69 |
|                    | Male                    | 90  | 3.94 | 0.90 |
|                    | Prefer not to           | 9   | 4.11 | 0.53 |
| Education          | Higher Secondary/ Other | 19  | 3.44 | 1.00 |
|                    | Postgraduate            | 20  | 3.50 | 0.92 |
|                    | Undergraduate           | 103 | 4.07 | 0.71 |
| Occupation         | Homemaker               | 20  | 3.67 | 0.59 |
|                    | Private Employee        | 10  | 3.67 | 0.00 |
|                    | Self-employed/Business  | 34  | 3.29 | 1.09 |
|                    | Student                 | 78  | 4.26 | 0.58 |
| Monthly income     | Above ₹80,000           | 24  | 3.00 | 1.18 |
|                    | Below ₹20,000           | 83  | 4.25 | 0.56 |
|                    | ₹20,001–₹40,000         | 15  | 3.89 | 0.16 |
|                    | ₹40,001–₹60,000         | 20  | 3.58 | 0.56 |
| Shopping frequency | Monthly or more         | 94  | 3.99 | 0.75 |
|                    | Occasionally            | 33  | 3.92 | 0.89 |
|                    | Rarely                  | 15  | 3.33 | 0.98 |
| Preferred platform | Ajio                    | 20  | 4.42 | 0.28 |
|                    | Amazon                  | 78  | 3.79 | 0.88 |
|                    | Flipkart                | 10  | 3.83 | 0.18 |
|                    | Myntra                  | 20  | 4.50 | 0.38 |
|                    | Other                   | 14  | 3.02 | 0.77 |

Purchase influence differs significantly by age ( $F(3,133) = 15.63$ ,  $p < .001$ ,  $\eta^2 = 0.26$ ), education ( $F(2,139) = 8.31$ ,  $p < .001$ ,  $\eta^2 = 0.11$ ), occupation ( $F(3,138) = 15.74$ ,  $p < .001$ ,  $\eta^2 = 0.26$ ), monthly income ( $F(3,138) = 22.49$ ,  $p < .001$ ,  $\eta^2 = 0.33$ ), shopping frequency ( $F(2,139) = 4.33$ ,  $p = .015$ ,  $\eta^2 = 0.06$ ) and platform ( $F(4,137) = 11.57$ ,  $p < .001$ ,  $\eta^2 = 0.25$ ). Gender has no effect ( $F(2,139) = 0.85$ ,  $p = .429$ ). Levene's test is significant for most factors (group variances are unequal) and the Welch and Kruskal-Wallis results are similar, except for shopping frequency, which is marginally significant for Welch ( $p = .060$ ) and significant for Kruskal-Wallis ( $p = .024$ ); hence, the effect should be described as modest for shopping frequency.

Tukey HSD post-hoc tests show that: (a) respondents aged 25 and below ( $M = 4.15$ ) and 36–45 ( $M = 4.17$ ) score significantly higher than those aged 26–35 ( $M = 3.25$ ) and 46 and above ( $M = 3.28$ ); (b) undergraduates ( $M = 4.07$ ) score higher than postgraduates ( $M = 3.50$ ) and Higher Secondary/Other ( $M = 3.44$ ); (c) students ( $M = 4.26$ ) score higher than homemakers ( $M = 3.67$ ) and the self-employed ( $M = 3.29$ ); (d) the highest-income group (above ₹80,000,  $M = 3.00$ ) scores significantly lower than every other group, and the below ₹20,000 group ( $M = 4.25$ ) is higher than the ₹40,001–₹60,000 group ( $M = 3.58$ ); (e) frequent shoppers ( $M = 3.99$ ) score higher than rare shoppers ( $M = 3.33$ ); and (f) Myntra ( $M = 4.50$ ) and Ajio ( $M = 4.42$ ) users score higher than Amazon users ( $M = 3.79$ ) and users of other platforms ( $M = 3.02$ ).

With regards to overall dark-pattern perception (Table 7), all factors except gender are also significant. The 46-and-above age group ( $M = 2.83$ ) identifies significantly less dark patterns than all younger age groups ( $M = 3.80$  to  $4.00$ ), and the number of dark patterns perceived by rare shoppers ( $M = 2.71$ ) is significantly less than that of frequent ( $M = 3.76$ ) and occasional shoppers ( $M = 4.03$ ). Thus H7 is accepted for age, education, occupation, income, shopping frequency and platform, and rejected for gender.

## 8. Regression and mediation analysis

The following is a list of regression and mediation analysis models (after Plous and Cresting, 2016): This models the influence of purchase by dark-pattern dimensions, using multiple regression.

$$PI = b_0 + b_1(SU) + b_2(PM) + b_3(SP) + b_4(HC) + b_5(II) + b_6(DEC) + e$$

**Table 9. Model 1 summary and ANOVA**

| R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | Std. error | Durbin-Watson |
|-------|----------------|-------------------------|------------|---------------|
| 0.822 | 0.676          | 0.662                   | 0.480      | 2.557         |

| Source     | SS     | df  | MS     | F      | Sig.  |
|------------|--------|-----|--------|--------|-------|
| Regression | 64.944 | 6   | 10.824 | 46.929 | <.001 |
| Residual   | 31.137 | 135 | 0.231  |        |       |
| Total      | 96.081 | 141 |        |        |       |

**Table 10. Model 1: Coefficients (dependent variable: PI)**

| Predictor | B      | Std.error | $\beta$ | t     | p     | VIF  | 95% CI for B     |
|-----------|--------|-----------|---------|-------|-------|------|------------------|
| Constant  | 1.470  | 0.252     |         | 5.84  | <.001 |      | [0.972, 1.968]   |
| SU        | -0.452 | 0.096     | -0.468  | -4.73 | <.001 | 4.09 | [-0.642, -0.263] |
| PM        | -0.582 | 0.096     | -0.607  | -6.05 | <.001 | 4.18 | [-0.772, -0.392] |
| SP        | 0.160  | 0.082     | 0.191   | 1.94  | .055  | 4.05 | [-0.003, 0.323]  |
| HC        | 0.119  | 0.098     | 0.115   | 1.21  | .227  | 3.73 | [-0.075, 0.312]  |
| II        | 0.625  | 0.071     | 0.753   | 8.81  | <.001 | 3.04 | [0.485, 0.766]   |
| DEC       | 0.806  | 0.095     | 0.634   | 8.44  | <.001 | 2.35 | [0.617, 0.994]   |

The model is highly significant ( $F(6,135) = 46.93$ ,  $p < .001$ ) and explains 67.6% of the variance in purchase influence ( $R^2 = 0.676$ ; adjusted  $R^2 = 0.662$ ). The fitted equation is  $PI = 1.470 - 0.452 SU - 0.582 PM + 0.160 SP + 0.119 HC + 0.625 II + 0.806 DEC$ . Interface interference ( $\beta = 0.753$ ,  $p < .001$ ) and perceived deception ( $\beta = 0.634$ ,  $p < .001$ ) are the strongest positive predictors: a one-point rise in either raises purchase influence by 0.63 and 0.81 points respectively, holding the other variables constant. Social proof ( $p = .055$ ) and hidden costs ( $p = .227$ ) are not significant at 5%.

Even though the simple correlation of scarcity & urgency with respect to PI is positive ( $r = 0.25$ ), it has a very negative coefficient ( $B = -0.452$ ). Similarly, price manipulation is also positive ( $r = 0.23$ ), but has a high negative coefficient ( $B = -0.582$ ). This reverse relationship is a consequence of the high correlation between the predictors: up to  $r = 0.82$ , with VIF ranging from 3.0 to 4.2, which is below the typical VIF cut-off of 5, and should not be interpreted as a discount or urgency effect decreasing the influence of purchase. The Durbin-Watson statistic (2.56) is near the value of 2, suggesting that there is no serious autocorrelation.

## 8.2 Model 2 – mediation: dark patterns → perceived deception → purchase influence

For test H1–H4, the five dark-pattern dimensions (SU, PM, SP, HC, II) were averaged and a single dark pattern composite (DP) was used to test the three regression paths of the standard mediation framework: the direct effect of the product was tested, and the indirect effect was tested by a percentile bootstrap (3,000 resamples).

**Table 11. Mediation Results (DP = dark-pattern composite; DEC = perceived deception; PI = purchase influence)**

| Path                                         | B     | t     | p     | R <sup>2</sup> | Result                             |
|----------------------------------------------|-------|-------|-------|----------------|------------------------------------|
| a: DP → DEC                                  | 0.604 | 12.89 | <.001 | 0.543          | Significant (positive)             |
| c: DP → PI (total effect)                    | 0.476 | 6.08  | <.001 | 0.209          | Significant (positive)             |
| b: DEC → PI (controlling DP)                 | 0.514 | 3.82  | <.001 | 0.284          | Significant (positive)             |
| c': DP → PI (direct effect, controlling DEC) | 0.165 | 1.49  | .137  |                | Not significant                    |
| a × b: indirect effect                       | 0.311 |       |       |                | 95% CI [0.091, 0.526]; significant |

Dark patterns strongly predict perceived deception ( $B = 0.604$ ,  $t = 12.89$ ,  $p < .001$ ,  $R^2 = 0.54$ ;  $F(1,140) = 166.13$ ), supporting H1. Overall, the influence of dark patterns on purchases is considerable ( $B = 0.476$ ,  $p < .001$ ). With the addition of perceived deception, the direct effect of dark patterns becomes non-significant ( $B = 0.165$ ,  $p = .137$ ) and the effect of perceived deception remains significant ( $B = 0.514$ ,  $p < .001$ ). The indirect effect (0.311; 95% bootstrap CI 0.091 to 0.526, excluding zero) is the predominant effect, accounting for approximately 65% of the total effect, which provides support for H4. But the path signs in b and c are positive, rather than negative as postulated in H2 and H3. But when consumers feel they are being deceived, and they are more likely to be deceived, they feel more, not less, influenced—this is a dark pattern, after all. When consumers think they are being deceived, and when they are more deceived, they feel more, not less, influenced—the dark, after all. H2 and H3 are thus not supported in the direction stated. One

logical conclusion is that “purchase influence” is not that they don't buy, but that they buy under the guise of a tactic—such as “under urgency” (Q28), which, one supposes, is both a tactic and a good price. Next, the outcome of the deception of reducing the purchase is considered: Abandonment.

### 8.3 Model 3 – simple regression: effect of perceived deception on abandonment

$$AB = b_0 + b_1(DEC) + e$$

**Table 12. Model 3 results**

| R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | Std. error | Durbin-Watson |
|-------|----------------|-------------------------|------------|---------------|
| 0.619 | 0.383          | 0.379                   | 0.556      | 2.621         |

| Source     | SS     | df  | MS     | F      | Sig.  |
|------------|--------|-----|--------|--------|-------|
| Regression | 26.950 | 1   | 26.950 | 87.057 | <.001 |
| Residual   | 43.339 | 140 | 0.310  |        |       |
| Total      | 70.289 | 141 |        |        |       |

| Predictor | B     | Std. error | $\beta$ | t    | p     | VIF  | 95% CI for B   |
|-----------|-------|------------|---------|------|-------|------|----------------|
| Constant  | 1.322 | 0.285      |         | 4.64 | <.001 |      | [0.759, 1.884] |
| DEC       | 0.673 | 0.072      | 0.619   | 9.33 | <.001 | 1.00 | [0.530, 0.815] |

Perceived deception significantly and positively predicts abandonment ( $B = 0.673$ ,  $\beta = 0.619$ ,  $t = 9.33$ ,  $p < .001$ ;  $F(1,140) = 87.06$ ). It explains 38.3% of the variance ( $R^2 = 0.383$ ). A one-point increase in the perceived level of deception increases the probability of dropping out of a purchase by 0.67 points. This result is not definitive as the abandonment scale has low reliability ( $\alpha = 0.59$ ).

## 9. The following is a summary of the hypothesis tests

**Table 13. Hypothesis decisions**

| Hypothesis                                                               | Test                | Key result                                                                                                | Decision                   |
|--------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------|----------------------------|
| H1: Dark patterns → perceived deception (+)                              | Simple regression   | $B = 0.604$ , $t = 12.89$ , $p < .001$ ; $R^2 = 0.543$                                                    | Supported                  |
| H2: Perceived deception → purchase decision (–)                          | Mediation, path b   | $B = +0.514$ , $p < .001$ (positive, not negative)                                                        | Not supported in direction |
| H3: Dark patterns → purchase decision (+)                                | Mediation, path c   | $B = +0.476$ , $p < .001$ (not negative, positive)                                                        | Supported in direction     |
| H4: Deception mediates between DP and purchase decision (full mediation) | Bootstrap mediation | Indirect = 0.311, 95% CI [0.091, 0.526]; direct effect $p = .137$                                         | Supported (full mediation) |
| H5: Dimensions affect purchase influence                                 | Multiple regression | $F(6,135) = 46.93$ , $p < .001$ ; $R^2 = 0.676$ . II, DEC, SU, PM significant; SP, HC not                 | Supported                  |
| H6: Deception → abandonment                                              | Simple regression   | $B = 0.673$ , $t = 9.33$ , $p < .001$ ; $R^2 = 0.383$                                                     | Supported                  |
| H7: There is a difference in purchasing influence among groups           | One-way ANOVA       | Significant for age, education, occupation, income, frequency, platform but not for gender ( $p = .429$ ) | Supported (except gender)  |
| H8: Demographics associated with PI level                                | Chi square test     | Significant ( $p \leq .006$ ) for six variables ( $V = 0.22–0.45$ ) (except for gender)                   | Supported (except gender)  |

## 10. Findings, conclusion and limitations

### Key findings

- Consumers report frequent experience of dark patterns – all construct means are at 3.5 or above on a 5-point scale; purchase influence mean

is 3.91.

- Dark patterns significantly predict perceived deception ( $R^2 = 0.54$ ), and the perceived deception fully mediators the effect of dark patterns on purchase influence (indirect effect = 0.31).
- The six dimensions of the purchase influence are largely accounted for by interface interference and perceived deception (together they account for about 68% of the variance in purchase influence).
- There is also a high correlation between perceived deception and dropping out of a purchase ( $R^2 = 0.38$ ), meaning that platforms that are perceived as deceptive will be at risk of losing sales.
- The price of purchase influence is not the same across all age, education, occupation, income levels, shopping frequency and platform but is different for different ages. The most influenced group consists of students, low income shoppers, and Myntra/Ajio users, while the least includes respondents with the highest income and the older ones.
- The demographic profile is strongly related to the level of purchase influence (medium to large) with the exception of gender.

## Conclusion and implications

The findings reveal that the use of dark-patterns has a tangible effect on the decision to make an online purchase, that this effect is mediated by perceived deception, that perceived deception also reduces the likelihood of completing purchases and that the effect of susceptibility is limited to younger, student, and lower income shoppers. Therefore, e-commerce platforms should steer clear of confusing interface design and hidden fees, digital marketers should be aware that quick conversions achieved through confusion come with an abandonment risk, and consumer-protection agencies/policymakers should direct attention and regulation towards interfaces that interfere, and towards the most vulnerable groups.

## Limitations

- The sample size is small, non-probability and student focused and some groups are very small (e.g. ages 36-45, Private Employees, Flipkart users,  $n = 10$ ), making group comparisons approximate.
- The Monte Carlo p-values are in agreement with several chi-square tables, but the low number of counts in some of those tables is a source of concern.
- Straight-lining occurred with five respondents who answered all the items in exactly the same manner, but due to the sample size these respondents were kept.
- Individual regression coefficients in Model 1 are affected by strong inter-correlation of predictors ( $r$  up to 0.82).
- Abandonment scale has low reliability ( $\alpha = 0.59$ ), and purchase influence measures susceptibility to dark patterns and not an actual purchase.
- The relationships, including the mediation result, are associations and not causation; data are self reported and cross sectional in nature.

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