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Hidden Influence of Dark Patterns on Online Shopping Behaviour

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Abstract:
The development of online shopping platforms changed the way consumers purchase products. It offers convenience, easy access, product variety, and attractive offers. However, some platforms use dark patterns such as fake countdown timers, misleading discounts, hidden charges, limited-stock messages, and pre-selected options to influence purchase decisions. Therefore, it is necessary to examine consumers' awareness and experience of different dark pattern practices and their influence on online purchase decisions and protective behaviour.
The study used primary data collected from 60 online shoppers in Kannur district using a structured questionnaire. Percentage analysis, weighted average, Mann-Whitney U test, and Spearman's Rank Correlation were used for data analysis. The findings revealed that limited-stock messages (76.67%) and hidden charges (71.67%) were the most widely used dark patterns. Hidden charges (68.33%) and misleading discounts (66.67%) were the most frequently experienced practices. Attractive discounts had the highest influence on purchase decisions (WA = 2.27) but the overall WA of 2.08 shows low level of influence. Consumer responses to such practices are also limited (WA=1.96). There is no significant difference in the influence of dark patterns on purchase decisions ($p = 0.205$) between males and females. The relationship between experience with dark patterns and purchase decisions was also insignificant ($\rho = 0.042$, $p = 0.751$). However, awareness of dark patterns had a significant positive relationship with consumer response ($\rho = 0.355$, $p = 0.005$). Therefore there should be strict action against misleading advertisements, regular consumer awareness programmes, and stronger consumer protection laws to ensure transparent and fair online shopping practices.
Keywords: Dark Patterns, Online Shopping, Shopping Behaviour, Online Purchase Behaviour, Manipulative Marketing.

1. Introduction

With the popularity of e-commerce platforms more and more digital marketing techniques are adopted by the marketers. they are very much beneficial to attract the consumers. At the same there are some manipulative techniques or dark patterns which may mislead the consumers. Dark patterns are manipulative design used by websites or mobile apps to influence the consumers to make purchases, though they are not actually wanting it. This study – 'Hidden Influence of Dark Patterns on Online Purchase Behaviour' examines consumers' awareness and experience of different dark pattern practices and their influence on online purchase decisions. It also analyses consumer responses towards such practices and identifies the protection measures preferred by them.

2. Literature Review

Bosch et al. (2016) analysed manipulative design strategies used to influence users' decisions. It explained how online platforms encourage users to disclose their personal information without understanding the consequences.

Mathur et al. (2019) examined various shopping websites and identified different dark pattern practices such as hidden costs, scarcity messages, and misleading promotional techniques.

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Di Geronimo et al. (2020) analysed 240 mobile applications. They found that 95% of the applications contained at least one dark pattern. They also identified that users can recognise dark patterns when they had prior information about them.

Luguri and Strahilevitz (2021) studied the effectiveness of dark patterns in influencing consumer decisions. They found that dark pattern practices increased the chances of subscribing unwanted services.

Singh et al. (2024) used the Analytic Hierarchy Process to prioritise different dark pattern practices in the e-commerce. They identified the relative importance and risks associated with different dark pattern practices.

Agrawal and Narayanan (2026) investigated how basket sneaking, false scarcity, and confirm-shaming influence consumer reactions to quick-commerce platforms in India. The study revealed that manipulative practices negatively affected consumer trust and increased negative word-of-mouth.

Statement of the problem and significance

The development of online shopping platforms changed the way the consumers are purchasing products. They provide convenience, easy access, variety products, attractive offers and much more. However some platforms use malpractices (dark patterns) such as fake countdown timers, misleading discounts, hidden charges, limited-stock messages, pre-selected options, and complicated cancellation procedures to influence consumers' purchase. It may result in quick purchase, spending more than the actually needed, or purchasing unwanted products etc.

Many of them are not aware about these practices and not ware about whether these practices influence their purchase decisions. Therefore, it is necessary to examine consumers' awareness and experience of different dark pattern practices and their influence on online purchase decisions and protective behaviour. It also analyses consumer responses towards such practices and identifies the protection measures preferred by respondents. Further, the study investigates the relationship between awareness and consumer response, the relationship between experience and purchase decisions, and gender-based differences in the influence of dark patterns.

Objectives

1. To understand the awareness of consumers in Kannur district with regard to various dark pattern practices in online shopping.
2. To examine consumers' experience with different types of dark pattern practices on e-commerce platforms.
3. To analyse the influence of dark patterns on consumers' online purchase decisions.
4. To examine consumers' responses towards manipulative online practices.

Hypotheses

$H_0$1: The influence of dark patterns on online purchase decisions does not differ significantly between male and female respondents.

$H_0$2: Experience with dark patterns does not significantly affect the consumers' purchase decisions.

$H_0$3: Awareness of dark patterns does not significantly influence consumers' responses towards such manipulative practices.

3. Methodology

The study used a descriptive and analytical method. The population of the study includes individuals in Kannur district who use e-commerce platforms for purchasing products and services. Primary data were collected through a structured questionnaire from 60 respondents selected using a convenience sampling method. Analysis of data were carried on through percentage analysis, weighted average, Mann-Whitney U test, and Spearman's Rank Correlation.

Discussion

Analysis of data collected from 60 respondents in Kannur district with respect to dark pattern practices are carried out.

Table 1: Personal Profile of Online shoppers

Particulars	**Classification**	**Frequency**	**Percentage**

Age	Below 20	7	11.67
	21–30	16	26.67
	31–40	15	25.00
	41–50	14	23.33
	Above 50	8	13.33
Gender	Male	29	48.33
	Female	31	51.67
Educational Qualification	Higher Secondary	4	6.67
	Diploma	4	6.67
	Undergraduate	23	38.33
	Postgraduate	22	36.67
	Professional	4	6.67
	Other	3	5.00
Occupation	Student	11	18.33
	Salaried Employee	26	43.33
	Self-employed	7	11.67
	Business	7	11.67
	Homemaker	7	11.67
	Other	2	3.33
Monthly Income	No personal income	11	18.33
	Below ₹25,000	14	23.33
	₹25,001–₹50,000	17	28.33
	₹50,001–₹75,000	9	15.00
	₹75,001–₹1,00,000	4	6.67
	Above ₹1,00,000	5	8.33
Total		60	100.00

16 respondents (26.67%) belong to the 21-30 age group followed by 15 respondents (25%) in the 31-40, and 14 respondents (23.33%) in the 41-50 age. Eight respondents (13.33%) are above 50 years, and 7 respondents (11.67%) are below 20 years.

Among 60 respondents, 31 (51.67%) are female and 29 (48.33%) are male.

In the sample, 23 respondents (38.33%) are undergraduates, followed by postgraduates (36.67%), Higher Secondary, Diploma and Professional qualifications (6.67% each). 3 respondents (5%) belong to other educational qualification.

Majority of the online shoppers are salaried employees (43.33%) followed by students (18.33%), self-employed, businesspersons and homemakers (11.67% each). Only 2 respondents (3.33%) belong to other occupations.

28.33% have monthly income between ₹25,001-₹50,000. 14 respondents (23.33%) earning below ₹25,000 and 11 respondents (18.33%) have no personal income. Nine respondents (15%) earn between ₹50,001 and ₹75,000 and 5 respondents (8.33%) earn above ₹1,00,000. Balance 4 respondents (6.67%) belong to the ₹75,001-₹1,00,000 category.

Table 2: Shopping Profile of Online Shoppers

Particulars	**Classification**	**Frequency**	**Percentage**
Shopping Frequency	Daily	3	5.00
	Weekly	9	15.00
	Monthly	28	46.67
	Occasionally	14	23.33
	Rarely	6	10.00
Duration of Online Shopping	Less than 1 year	5	8.33
	1–2 years	12	20.00
	3–5 years	7	11.67
	6–10 years	23	38.33
	More than 10 years	13	21.67
Main Reason for Shopping	Convenience	14	23.33
	Discounts and offers	17	28.33
	Wider product selection	9	15.00
	Time saving	9	15.00
	Home delivery	11	18.33
Main Product Category	Clothing and fashion	16	26.67
	Electronics	8	13.33
	Grocery	11	18.33
	Beauty and personal care	9	15.00

	Food	5	8.33
	Travel and services	6	10.00
	Other	5	8.33
Total		60	100.00

28 respondents (46.67%) shop online monthly followed by 14 respondents (23.33%) who shop occasionally and 9 respondents (15%) who shop weekly. Six respondents (10%) shop rarely. only 3 respondents (5%) make online purchases daily.

38.33% are shopping online for 6-10 years. 13 respondents (21.67%) have more than 10 years of experience and 12 respondents (20%) have 1-2 years. 11.67% have 3-5 years of experience and 8.33% are shopping online for less than one year.

Discounts and offers are the main reason for online shopping (28.33%). Convenience is the next (23.33%), followed by home delivery (18.33%), wider product selection and time saving (15% each).

Clothing and fashion are the most preferred online purchases (26.67%) grocery products rank second (18.33%), followed by beauty and personal care products (15%). Electronics account for 13.33%, travel and services 10% and food and other products 8.33%.

Table 3: Awareness on Dark Pattern Practices

Dark Pattern	**Aware (No.)**	**Not Aware (No.)**	**Aware (%)**	**Not Aware (%)**
Fake countdown timers	29	31	48.33	51.67
Limited-stock messages	46	14	76.67	23.33
Pressure messages	20	40	33.33	66.67
Unwanted products added to carts	22	38	36.67	63.33
Pre-selected options	29	31	48.33	51.67
Difficult cancellation	36	24	60.00	40.00
Misleading subscription offers	30	30	50.00	50.00
Hidden charges	43	17	71.67	28.33
Misleading discounts	39	21	65.00	35.00
Forced account creation	21	39	35.00	65.00
Disguised advertisements	26	34	43.33	56.67
Repeated promotional pop-ups	34	26	56.67	43.33
Fake customer reviews	37	23	61.67	38.33
Misleading popularity claims	18	42	30.00	70.00

Difficult opt-out options	21	39	35.00	65.00

Respondents have greater awareness of limited-stock messages (76.67%), hidden charges (71.67%) and misleading discounts (65%). Awareness of fake customer reviews (61.67%) and difficult cancellation procedures (60%) is also relatively high. Repeated promotional pop-ups are recognised by 56.67% and 50% are aware of misleading subscription offers.

Fake countdown timers and pre-selected options are reported by 48.33%. 43.33% are aware of disguised advertisements. 36.67% recognised unwanted products added to carts and 35% were aware of forced account creation and difficult opt-out options. Awareness was relatively low for misleading popularity claims (30%), pressure messages (33.33%) and forced account creation (35%).

Table 4: Sources of Awareness of Dark Pattern Practices

Sources of Awareness	Frequency	Percentage
Friends and relatives	22	36.67
Social media	34	56.67
Personal shopping experience	40	66.67
News and online articles	22	36.67
Consumer awareness programmes	9	15.00
Other	2	3.33

Note: Multiple responses were allowed

Majority of respondents (66.67%) gained awareness of dark pattern practices through personal shopping experiences followed by social media (56.67%). Friends and relatives and online news sources account for 36.67% each. Only 9 respondents (15%) reported consumer awareness programmes as a source and 2 respondents (3.33%) selected other sources.

Table 5: Experience with Dark Patterns

Dark Pattern Practices	**Experiencing**	**Not Experiencing**	**Not Sure**	**Weighted Average**
Fake countdown timers	26 (43.33%)	20 (33.33%)	14 (23.33%)	2.10
Limited-stock messages	36 (60.00%)	10 (16.67%)	14 (23.33%)	2.43
High demand / popularity messages	21 (35.00%)	26 (43.33%)	13 (21.67%)	1.92
Hidden delivery or handling charges	41 (68.33%)	8 (13.33%)	11 (18.33%)	2.55
Misleading discounts and price comparisons	40	15	5	2.42

	(66.67%)	(25.00%)	(8.33%)	
Pre-selected paid services	21 (35.00%)	27 (45.00%)	12 (20.00%)	1.90
Unwanted products added to carts	10 (16.67%)	35 (58.33%)	15 (25.00%)	1.58
Repeated promotional pop-ups	38 (63.33%)	8 (13.33%)	14 (23.33%)	2.50
Difficult cancellation or refund	21 (35.00%)	25 (41.67%)	14 (23.33%)	1.93
Misleading subscriptions and free trials	12 (20.00%)	33 (55.00%)	15 (25.00%)	1.65
Offers with unclear terms	34 (56.67%)	20 (33.33%)	6 (10.00%)	2.23
Disguised advertisements	12 (20.00%)	28 (46.67%)	20 (33.33%)	1.73
Fear Of Missing Out (FOMO) messages	31 (51.67%)	19 (31.67%)	10 (16.67%)	2.20
Confirm-shaming messages	8 (13.33%)	37 (61.67%)	15 (25.00%)	1.52
Difficult opt-out options	16 (26.67%)	38 (63.33%)	6 (10.00%)	1.63
Fake or misleading customer reviews	24 (40.00%)	23 (38.33%)	13 (21.67%)	2.02
Forced account creation	25 (41.67%)	26 (43.33%)	9 (15.00%)	1.98

Hidden delivery or handling charges are the most frequently experienced dark pattern (68.33%). Misleading discounts (66.67%) and repeated promotional pop-ups (63.33%) are also frequently reported. More than half also reported experiencing limited-stock messages (60%), unclear offer conditions (56.67%) and fear of missing out (FOMO) messages (51.67%). 20% encountered misleading subscription offers and disguised advertisements. 12 respondents (20%) experienced misleading subscription offers, unwanted products automatically added to carts (16.67%) and 8 (13.33%) encountered confirm-shaming messages.

Table 6: Influence on Purchase Decisions

Statements	**Agree**	**Neutral**	**Disagree**	**Weighted Average**

Countdown timers encouraging quick purchase decisions	28 (46.67%)	14 (23.33%)	18 (30.00%)	2.17
Limited-stock messages influencing immediate purchases	33 (55.00%)	8 (13.33%)	19 (31.67%)	2.23
Attractive discounts encouraging additional purchases	31 (51.67%)	14 (23.33%)	15 (25.00%)	2.27
Repeated notifications encouraging product purchases	21 (35.00%)	22 (36.67%)	17 (28.33%)	2.07
Suggested products influencing additional purchases	25 (41.67%)	13 (21.67%)	22 (36.67%)	2.05
Pre-selected options leading to unwanted purchases	27 (45.00%)	17 (28.33%)	16 (26.67%)	2.18
Urgency messages discouraging product comparisons	20 (33.33%)	17 (28.33%)	23 (38.33%)	1.95
Promotional techniques encouraging unplanned spending	23 (38.33%)	11 (18.33%)	26 (43.33%)	1.95
Hidden charges influencing final purchase decisions	22 (36.67%)	11 (18.33%)	27 (45.00%)	1.92
Misleading offers affecting purchase decisions	24 (40.00%)	18 (30.00%)	18 (30.00%)	2.10
Dark patterns leading to impulse purchases	25 (41.67%)	17 (28.33%)	18 (30.00%)	2.12
Regret over purchases made under online pressure	24 (40.00%)	12 (20.00%)	24 (40.00%)	2.00
Overall Weighted Average				2.08

Attractive discounts were the most influential factor in online purchase decisions (WA = 2.27). Limited-stock messages (2.23) and pre-selected options (2.18) also showed considerable influence, followed by countdown timers (2.17). Impulse purchases (2.12), misleading offers (2.10), repeated notifications (2.07), and suggested products (2.05) showed lower levels of influence. Purchase regret obtained a weighted average of 2.00, while urgency messages and promotional techniques encouraging unplanned spending recorded 1.95 each. Hidden charges ranked lowest at 1.92. The overall score of 2.08 indicates relatively low influence of dark patterns on consumers' purchase decisions.

Gender and influence on purchase decisions

$H_0$1: The influence of dark patterns on online purchase decisions does not differ significantly between male and female respondents.

Table 7: Gender and influence on purchase decisions

Gender	Frequency	Mean	Standard deviation	Mann–Whitney U	p- values
Male	29	3.273	0.767	535.500	.205
Female	31	2.997	0.820		
Total	60				

Male respondents had a higher mean influence (M = 3.273, SD = 0.767) than female respondents (M = 2.997, SD = 0.820). But, the difference was not statistically significant (U = 535.500, p = 0.205). Thus, the null hypothesis accepted.

Experience with dark patterns and purchase decisions

$H_0$2: Experience with dark patterns does not significantly affect the consumers' purchase decisions.

Table 8: Experience with dark patterns and purchase decisions

Variables	Mean	Standard deviation	Spearman's correlation coefficient (ρ)	p-value
Experience with dark patterns	6.93	2.72	.042	.751
Influence on purchase decisions	3.13	0.80		

There is a very weak positive relationship between experience with dark pattern practices and their influence on online purchase decisions (ρ = 0.042, p = 0.751). But the relationship was not statistically significant (ρ = .042, p = .751). Hence, the null hypothesis is accepted.

Table 9: Consumer Response to Dark Patterns

Statements	Agree	Neutral	Disagree	Weighted Average
I leave websites with manipulative designs	23 (38.33)	14 (23.33)	23 (38.33)	2.00
I check prices before purchasing	19 (31.67)	16 (26.67)	25 (41.67)	1.90
I compare products across websites	24 (40.00)	16 (26.67)	20 (33.33)	2.07
I read offer conditions carefully	18 (30.00)	14 (23.33)	28 (46.67)	1.83
I remove unwanted cart items	21 (35.00)	13 (21.67)	26 (43.33)	1.92
I avoid websites with difficult cancellation	18	21	21	1.95

	(30.00)	(35.00)	(35.00)	
I report misleading practices	20 (33.33)	18 (30.00)	22 (36.67)	1.97
I warn others about misleading websites	21 (35.00)	15 (25.00)	24 (40.00)	1.95
I stop using platforms with repeated manipulative practices	19 (31.67)	17 (28.33)	24 (40.00)	1.92
I support consumer awareness programmes	27 (45.00)	16 (26.67)	17 (28.33)	2.17
I support government regulations against dark patterns	20 (33.33)	15 (25.00)	25 (41.67)	1.92
Overall Weighted Average				1.96

The analysis reveals that supporting consumer awareness programmes was the most preferred response among respondents (WA = 2.17). Comparing products across different websites followed with a score of 2.07 and leaving websites with manipulative designs recorded 2.00.

Reporting misleading practices obtained a score of 1.97, while avoiding websites with difficult cancellation and warning others about misleading websites each recorded 1.95. removing unwanted cart items, discontinuing the use of manipulative platforms, and supporting government regulations, recorded 1.92 each. Checking prices before purchasing obtained 1.90, while reading offer conditions carefully recorded the lowest weighted average of 1.83. The overall weighted average of 1.96 indicates a relatively low level of consumer response towards dark patterns.

Awareness of dark patterns and consumer response

$H_0$3: Awareness of dark patterns does not significantly influence consumers' responses towards such manipulative practices.

Table 10: Awareness of dark patterns and consumer response

Variables	**Mean**	**Standard deviation**	**Spearman's correlation coefficient (ρ)**	**p-value**
Awareness of dark patterns	7.52	2.78	.355	.005
Consumer response	2.92	0.69		

A moderate positive relationship between awareness of dark patterns and consumer response ($\rho = 0.355$, $p = 0.005$). Therefore, the null hypothesis is rejected. It shows that Consumers with greater awareness tend to take more protective actions.

Table 11: Consumer Protection Measures against Dark Patterns

Consumer Protection Measures	**Frequency**	**Percentage**
Stronger government regulations	45	75.00
Clear disclosure of prices and charges	43	71.67

Consumer awareness programmes	38	63.33
Easy cancellation and refund facilities	48	80.00
Strict action against misleading advertisements	48	80.00
Clear information about subscription terms	40	66.67
Ban on fake countdown timers and false scarcity messages	40	66.67
Removal of pre-selected paid services	39	65.00
Simple opt-out and unsubscribe options	43	71.67
Transparent display of discounts and offers	46	76.67
Strict monitoring of e-commerce platforms	44	73.33
Easy complaint and grievance redressal facilities	50	83.33

Note: Multiple responses were allowed.

Grievance redressal facilities were the most widely preferred measure, selected by 50 respondents (83.33%). Cancellation and refund facilities and strict action against misleading advertisements had the second position (80%) each. Transparent discount and offer displays were supported by 76.67%. 75% favoured stronger government regulations and 73.33% strict monitoring of e-commerce platforms. Clear price disclosure and convenient opt-out facilities were supported by 71.67%. Measures relating to subscription transparency and restrictions on false scarcity messages received 66.67% each. The removal of pre-selected paid services and consumer awareness programmes received support from 65% and 63.33% respondents respectively.

Findings

1. Respondents aged 21-30 years is the largest group (26.67%), followed by 31-40 year old (25%). Out of 60 respondents 51.67% are females and 48.33% are males. Majority of the respondents are Undergraduates (38.33%) and postgraduates (36.67%). Most respondents were salaried employees (43.33%) and 28.33% of respondents had a monthly income of ₹25,001 and ₹50,000.
2. 46.67% of respondents purchased products online monthly and 23.33% occasionally. 38.33% had 6 to 10 years of online shopping experience. The main reason for online purchase is discounts and offers (28.33%) followed by convenience (23.33%). Clothing and fashion is the most frequently purchased products (26.67%)
3. The respondents are highly aware of limited-stock messages (76.67%) followed by hidden charges (71.67%), misleading discounts (65%), fake customer reviews (61.67%), and difficult cancellation procedures (60%). Awareness about misleading popularity claims (30%) and pressure messages (33.33%) are low.
4. The main source of awareness about dark patten practices is personal shopping experience (66.67%) followed by social media (56.67%), friends and relatives, and news and online articles (36.67% each).
5. The respondents had experienced hidden delivery and handling charges (68.33%), misleading discounts (66.67%), repeated promotional notifications (63.33%), and limited-stock messages (60%).
6. Among the different dark pattern practices, attractive discounts had the highest influence on consumer purchasing behaviour (WA = 2.27) followed by limited-stock messages (WA=2.23), pre-selected options (WA=2.18), countdown timers (WA=2.17), impulse purchases (WA=2.12), misleading offers (WA=2.10), and repeated notifications (WA=2.07). Overall weighted average of 2.08 shows a that dark patterns have low influence on consumers' purchasing decisions.

7. Male and female respondents did not differ significantly in their responses to dark pattern influences (U = 535.500, p = 0.205).
8. There is a very weak insignificant positive relationship between experience with dark patterns and their influence on purchase decisions ($\rho = 0.042$, $p = 0.751$). Thus, greater experience with dark patterns does not result in purchase decisions.
9. Consumer responses towards dark patterns show that awareness programmes had the strongest support (WA = 2.17), followed by comparing products across websites (WA = 2.07) and leaving manipulative websites (WA = 2.00) and reporting misleading practices (WA= 1.97). the overall WA of 1.96 shows that consumers have low level of response against dark patterns.
10. There is a moderate significant positive relationship between awareness of dark patterns and consumer response ($\rho = 0.355$, $p = 0.005$). Therefore, consumers who are aware of dark patterns take protective actions against misleading online practices.
11. Respondents required stronger consumer protection against dark patterns. majority of respondents supported easy grievance redressal facilities (83.33%), followed by convenient cancellation and refund procedures and strict measures against misleading advertisements (80% each). Transparent display of discounts and offers was supported by 76.67% of respondents.

Suggestions

- Websites should provide clear product information.
- Consumers should compare prices before purchasing.
- Consumers should avoid making hurried purchase decisions.
- Consumers should report misleading online practices.
- Strict action should be taken against misleading advertisements.
- Consumer awareness programmes should be organised regularly.
- Government authorities should strengthen consumer protection laws.

4. Conclusion

The study conducted among the online buyers in Kannur district reveals that, they are aware about the various dark pattern practices such as limited-stock messages, hidden charges, and misleading discounts mainly through their personal experience and social media. Hidden delivery and handling charges, misleading discounts, repeated promotional notifications, and limited-stock messages are experienced by large number of consumers. However, the influence of these practices on purchase decisions was relatively low (WA=2.08). They also suggested to have easy complaint and grievance redressal facilities (83.33%), easy cancellation and refund facilities and strict action against misleading advertisements (80%each). The relationship between experience with dark patterns and purchase decisions was found to be very weak ($\rho = 0.042$, $p = 0.751$). However awareness of dark patterns had a moderate positive relationship with consumer response ($\rho = 0.355$, $p = 0.005$). Therefore it is necessary to improve the awareness of consumers with regard to dark pattern practices in online platform.

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