

## Manipulative Design in The Digital Age: Trends and Impacts of Dark Patterns On Social Media Users

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**ABSTRACT:** This study examines dark patterns in social media apps using bibliometric analysis and qualitative review of 32 Scopus-indexed articles (2015-2024). This study aims to identify research trends, key themes, and gaps related to manipulative interface designs that influence user behavior. The results of this study show that publication activity has increased since 2020, although citation impact remains low. Common dark patterns found include privacy zuckering, confirm shaming, and infinite scrolling-tactics that exploit cognitive biases and affect user decisions, privacy, and mental well-being. Children and adolescents are particularly vulnerable due to their limited ability to detect manipulation. Thematic mapping reveals dominant themes such as decision-making, privacy, and behavioral health, while areas such as digital well-being and user consent remain under-explored. Tools such as Bibliometrix and Biblioshiny were used to visualize trends, collaborations and keyword networks. This research contributes to understanding how dark patterns shape digital behavior and highlights the need for ethical design practices and regulatory frameworks in online environments.

**KEYWORDS:** Dark Patterns, Social Media, User Behavior, Privacy, Bibliometric Analysis

### INTRODUCTION

Social media apps have become an integral part of modern life, and behind them, manipulative design practices known as “dark patterns” or “deceptive patterns” are increasingly troubling. These patterns, which can be defined as “tricks used on websites and apps that make you do things you don't want to,” can be found in almost all popular mobile apps [1][2][3]. These dark patterns affect vulnerable groups such as children and adolescents the most, who may lack the ability to recognize and resist online manipulation [8][9]. Despite regulatory efforts, interface designers still struggle to balance ethical design practices.

This phenomenon is compounded by the “privacy paradox”, where users express social media users' concerns about privacy but disclose personal information anyway, often due to cognitive biases and the way benefits and risks are presented [4][5]. For example, unlimited scrolling on social media, which is designed to prolong usage sessions and trigger continuous regret, is a clear example of a dark pattern that keeps users trapped in a repetitive “loop”. Understanding the impact of dark patterns and user responses is important, especially as research shows that the type of content and recommendation algorithms can influence how users feel and prolong their sessions of using social media.

LQ1: How have publication patterns and research collaborations on dark patterns in social media applications evolved over time?

LQ2: What are the dominant themes and unexplored research areas in the literature on dark patterns in social media, especially with regard to the impact on user behavior and privacy?

### LITERATURE REVIEW

Dark patterns include a variety of manipulative tactics, ranging from simple to more aggressive. Types of dark patterns that are relevant in the context of social media apps include:

**Privacy Trickery:** Such as tricking users into sharing more personal information than they want. For example, one study found that children can be tricked into scanning their irises for “free gems” in games, potentially leaking their biometric data.

**Bait and Switch:** Users intend to do something, but other unintended actions can occur. An example would be a free item offer that redirects users to a fake website that could steal credentials.

**Confirm shaming:** Using language that makes users feel guilty or even ashamed if they refuse to perform a certain action. For example, messages that persuade users not to skip ads on

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YouTube.

Enforced continuity: Subscriptions that automatically continue after an app's free trial period without clear notice or easy cancellation options.

### A. Privacy Paradox

The phenomenon of the “privacy paradox” is one of the main impacts that can occur, where users express relatively high concerns about their privacy, but at the same time, they tend to reveal more personal information than expected. This happens even though users may feel they have little control over the data collected by companies. This paradox can be explained by cognitive biases such as optimism bias (tending to underestimate personal risk) and instant gratification bias (valuing immediate benefits over future risks [10][11]). In addition, the way information is presented [4][5] also affect disclosure decisions, as risks are perceived to be more psychologically remote.

### B. Vulnerability and Mental Health

Dark patterns can specifically exploit user vulnerabilities, especially in children. Children as young as 11-12 years old, while aware of online scams, tend to be overly vigilant and perceive even innocuous alerts as threats, which can lead to over-anxiety about online threats. Overuse of technology, driven by dark patterns, has been linked to negative impacts on mental health [12][13] and social interactions. Many users feel conflicted about the time they spend on their devices, especially during passive use.

### C. Excessive Use and Regretful Engagement

Features such as infinite screen scrolling are designed to keep users engaged in an endless “loop”, which often leads to regret as the time spent on the platform becomes excessive. These scrolling patterns can trigger “habit checks” and “feature tours” that divert users from their original goals, as seen in recommendation-based social media features that provide an infinite stream of content, which can trap users in a “rabbit hole [14][15]” and increase regret. In fact, the time spent on platforms like TikTok, which relies heavily on AI-based video recommendations, suggests that highly personalized and engaging content can make users spend more time in the “loop”.

## II. METHODOLOGY

### A. Planning

This research method adopts a bibliometric study approach and qualitative content analysis to identify, analyze, and map developments and trends related to dark patterns on social media from scientific literature. The research methodology framework follows the steps in Figure 1.

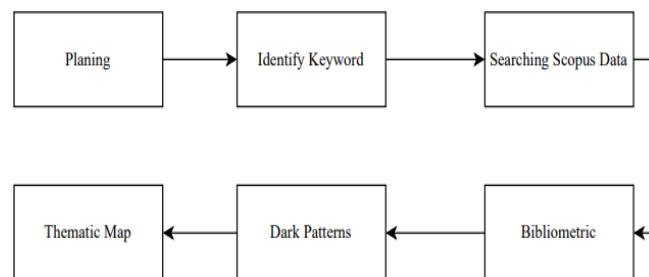


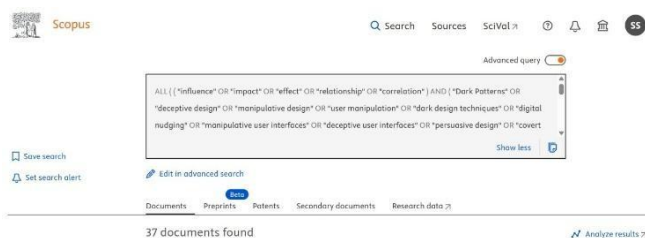
Figure 1 Methodology

The planning stage begins with determining the research theme, which is related to dark patterns on social media. This study focuses on analyzing literature published within a specific time frame (2015–2024). The research data will be obtained from the Scopus database, which was chosen for its high-quality scientific publications and frequent use in systematic reviews and bibliometric analyses. The objective of this stage is to clearly define the scope and objectives of the research.

### B. Keyword Identification

The keyword identification stage began with determining the focus of the research on the influence of dark patterns on social media on user behavior and decision making. Based on this topic, a series of relevant keywords in English were formulated to build a comprehensive search query. The complete query submitted to the supervising lecturer is as follows:

ALL ( ("influence" OR "impact" OR "effect" OR "relationship" OR "correlation" ) AND ( "Dark Patterns" OR "deceptive design" OR "manipulative design" OR "user manipulation" OR "dark design techniques" OR "digital nudging" OR "manipulative user interfaces" OR "deceptive user interfaces" OR "persuasive design" OR "covert design elements" ) AND ( "social media" OR "social networking sites" OR "social media applications" OR "social media apps" OR "social media platforms" OR "social networks" OR "online platforms" OR "social media usage" OR "digital platforms" OR "interactive platforms" OR "Instagram" OR "TikTok" OR "Facebook" OR "Twitter" OR "YouTube" ) AND ( "user behavior" OR "digital behavior" OR "online behavior" OR "user interaction" OR "user engagement" OR "technology use behavior" ) AND ( "decision making" OR "decision process" OR "choice behavior" OR "perceived choices" OR "decision making bias" OR "cognitive bias" OR "consumer decision making" OR "choice architecture" OR "judgment" ) AND ( "digital behavior" OR "online behavior" OR "digital actions" OR "internet behavior" OR "information-seeking behavior" OR "online interaction" OR "user behavior online" OR "digital engagement" ) ) AND PUBYEAR > 2013 AND PUBYEAR < 2025 AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( PUBSTAGE , "final" ) ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) ) AND ( LIMIT-TO ( OA , "all" ) )



**Figure 2 keyword Search in the Scopus Database**

This query was designed to systematically identify publications that explore the relationship between dark patterns and their impact on users' behaviour and decision-making on social media. Furthermore, the supervisor used this query to conduct the search and provide the initial data file.

### C. Data Search in Scopus

The initial data for this study was obtained from a bibliographic file (in Bib Tex/RIS format) containing literature search results from the Scopus database, provided by the supervisor. The file included a total of 37 articles relevant to the topic of dark patterns on social media. Next, a rigorous selection process was conducted where each article was reviewed based on its title and abstract. Only publications that explicitly addressed dark patterns or manipulative design in the context of social media were included. After this screening, 32 articles were selected and will be used for in-depth analysis in this study.

### D. Bibliometrics

The author uses Bibliometric analysis used in R. And Biblioshiny software to facilitate the use of Bibliometrics through a graphical interface. To use it, users simply install R via RStudio, and then run the install. packages ("bibliometrix") command to install the package. Once installed, the library (bibliometrix) command is used to load the package, and biblioshiny [16][17] is run to open its web interface.

The data used is usually in. bib format, and then converted into data frames. Through the Biblioshiny interface, users can view analysis and visualization results based on four main categories: publication source, author, document, and clustering based on coupling. The analysis also includes three main knowledge structures, namely: conceptual, intellectual, and social.

There are seven main analysis menus in the app, each with submenus to support users, especially researchers, in easily running the main features of Bibliometrix. The interface can be seen in Figure 3.



**Figure 3 Biblioshiny Interface**

### E. Dark Patterns on Social Media Analysis

This stage involved an in-depth qualitative analysis of the selected literature to comprehensively understand the phenomenon of dark patterns in the context of social media. From a total of 37 articles initially obtained through bibliographic files from the supervisors, 32 articles underwent a rigorous selection process and were identified as the most relevant data for this study. Each article in this final dataset was systematically reviewed to extract crucial information about dark patterns.

The analysis includes the identification of different types of dark patterns implemented in social media interfaces and user experiences. In addition, the research will examine how these dark patterns affect users' behaviour, decision-making, privacy and digital well-being. Other aspects that will be explored are the methodologies used in previous studies to detect or analyze dark patterns, as well as proposed solutions, recommendations or regulatory frameworks for their mitigation. The aim of this analysis is to provide a comprehensive understanding of the landscape of dark patterns in social media, including their prevalence, mechanisms of action, impacts, and countermeasures.

### F. Thematic Map

A thematic map mapping the study of dark patterns was constructed based on two main indicators, namely density and centrality. The identified themes were then grouped into four categories: motor themes, niche themes, emerging/declining themes, and basic themes. Motor themes occupy a position in the first quadrant (top right), reflecting topics that are scientifically mature and play an important role in shaping the research framework. In the context of dark patterns, this can refer to issues such as user manipulation and ethics in interface design, which are a central focus in many publications. Niche themes, located in the second quadrant (top left), indicate topics with a high depth of study but not yet central to the research network.

Examples include nudging techniques and emotional designs that are specific and applicable. Meanwhile, themes in the third quadrant (bottom left) are categorized as emerging or losing relevance. Topics such as the misuse of gamification elements or friction design fall into this category. Finally, basic themes are in the fourth quadrant (bottom right), which are themes that are structurally important and frequently appear in various disciplines, but still lack in-depth exploration. In the study of dark patterns, topics such as digital wellbeing, privacy protection, and user consent control are included. Visually, the direction in which themes move from the bottom left to the top right represents increased attention and integration in future research, while the reverse movement indicates trends that are being abandoned or deemed less relevant in the academic landscape.

## III. RESULT AND DISCUSSION

### A. Research on Dark Patterns on Social Media by Average Annual and Publication

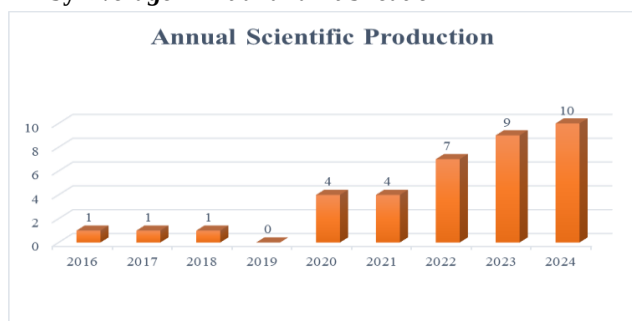


Figure 4 Research Development Based on Annual Scientific Production

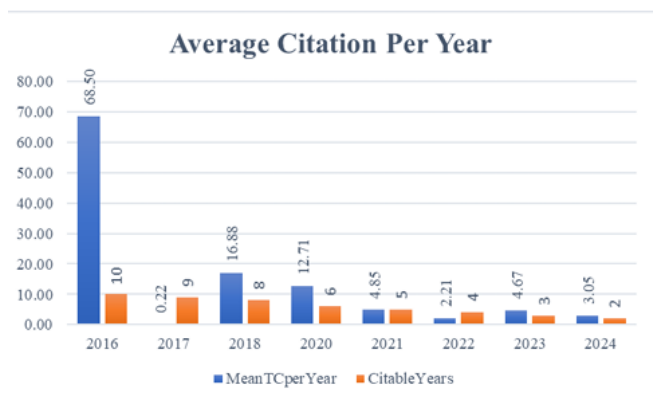


Figure 5 Research Development Based on Average Citation Per Year

Figure 4 shows the trend of Annual Scientific Production, which has increased significantly from 2016 to 2024. In the period 2016 to 2019, scientific production showed stagnation, with a relatively low number of publications, namely one publication per year, even zero in 2019. However, starting in 2020, there was a significant quantitative spike, with four publications which then consistently increased until reaching 10 publications in 2024. This increase indicates a positive shift in research activities and scientific publications, which may be influenced by increased human resource capacity, institutional support, or strategic policies in encouraging academic productivity.

Figure 5, Average Citation Per Year, shows that the highest average citations per year came from 2016 publications with a value of 68.5. This figure is significantly higher than the following years. This trend decreased dramatically in the following years, with the average citation being below 20 since 2017, and tends to continue to decline, especially in the latest publications (2022-2024) which show an average citation below 5. This decline can be attributed to two main factors:

- (1) Older publications have a longer time to acquire citations, and
- (2) Possible differences in the quality, relevance, or visibility of publications from year to year.

Overall, while there has been a significant increase in the

number of scientific publications in the last five years, the impact on citation performance has not shown a comparable increase. This indicates that quantitative growth in publications has not been fully matched by growth in quality or scientific impact. Therefore, strategies to improve the quality of publications, such as publication in reputable journals, international collaboration, and selection of relevant and high impact research topics, are needed to increase visibility and citations in the future.

### B. Research on Dark Patterns on Social Media Based on Relevant Journals

Table 1 Research Development Based on Relevant Journals

| Sources                                              | Articles |
|------------------------------------------------------|----------|
| Acm Transactions On Computer-Human Interaction       | 3        |
| Proceedings Of The Acm On Human-Computer Interaction | 3        |
| Ai And Society                                       | 1        |
| American Journal Of Preventive Medicine              | 1        |
| Behavioural Public Policy                            | 1        |
| Computer Law And Security Review                     | 1        |
| Computers And Security                               | 1        |
| Computers In Human Behavior                          | 1        |
| Cuadernos De Turismo                                 | 1        |
| Cyberpsychology                                      | 1        |

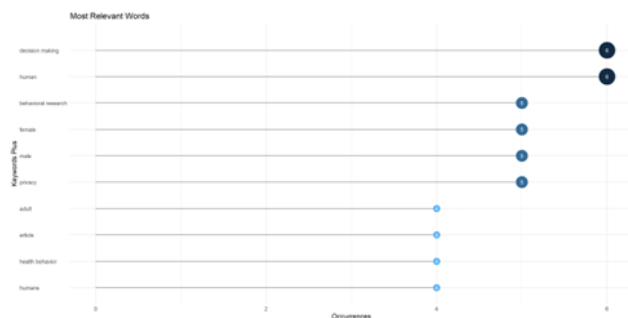
Based on the data presented in Table 1, the distribution of scientific publications based on sources or journal outlets shows a tendency of concentration in certain journals. It was noted that the highest number of articles were published in the ACM Transactions on Computer-Human Interaction and Proceedings of the ACM on Human-Computer Interaction journals, each with three articles. This indicates that the focus of research studies tends to lead to the field of human and computer interaction, especially in contexts relevant to information technology and user experience. Other publications are spread evenly across various journals with one article each. These journals cover a variety of disciplines, such as AI and Society, American Journal of Preventive Medicine, Behavioural Public Policy, Computer Law and Security Review, Computers and Security, Computers in Human Behavior, Cuadernos de Turismo, and Cyberpsychology. This diversity shows that the research topics are multidisciplinary, spanning the fields of public health, public policy, digital law and security, to tourism and cyberpsychology. This distribution reflects the breadth of issues studied and the openness to interdisciplinary approaches. However, the dominance of publications in the two main journals also indicates the specialization and depth of research in the field of human-computer interaction. This publication strategy can strengthen the author's scholarly identity as well as increase opportunities for academic visibility within a particular research community.

### C. Research on Dark Patterns on Social Media Based on Relevant Keywords

Figure 6 shows the most relevant keywords that appear in

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the analyzed publications. The words "decision making" and "human" have the highest frequency (6 times), indicating a major focus on decision making and human involvement in research. Other keywords such as "behavioral research", "female", "male", and "privacy" appeared five times, indicating a behavioral-based approach and attention to gender and privacy issues. Meanwhile, words such as "adult", "health behavior [32][33][34]", and "humans" also appeared frequently, reflecting the study's focus on adult behavior in social and technological contexts.



### Figure 6 Research Development Based On Relevant Keywords



### Figure 7 World Cloud

The world cloud can be seen in Figure 7, the world cloud shows that the most dominant keywords are "decision making", "human", "behavioral research", and "privacy", reflecting the main focus of research on human behavior and decision making in the digital context. Other terms such as "health behavior [32][33][34]", "social networking (online)", "male" and "female" also appear frequently, indicating attention to health, social media and demographic aspects. Overall, the research topics are interdisciplinary with an emphasis on human-technology interaction and privacy issues.

#### D. Research on Dark Patterns of Social Media by Country of Collaboration

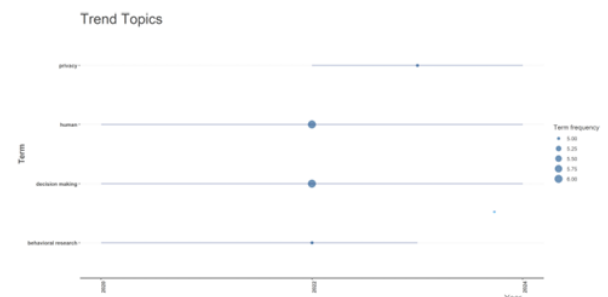
International cooperation between countries can be seen in Figure 8, which presents a map of international collaboration based on the involvement of countries in the scientific publications analyzed. It can be seen that the United States dominates international cooperation, shown in dark blue which reflects the highest intensity of contribution.

Significant collaboration also occurs between countries in the Western European region such as the UK, Germany and Italy, as well as countries from the East Asian region, Australia and India. The intercontinental connecting lines indicate cross-regional cooperation, particularly between the United States and European countries. This map shows that research in the fields studied has a global character, with contributions from various developed countries that are active in cross-border scientific collaboration [26][27].



**Figure 8 Research Development Based Country of Collaboration**

### E. Research on Dark Patterns on Social Media Based on Shared Event Networks



**Figure 9 Research Development Based on Trending Topic**

The circles in Figure 9 show the development of research topics from 2022 to 2024 based on the frequency of occurrence of certain terms. In 2022, the terms "human" and "decision making" are the most frequently appearing topics, with the size of the circle indicating a high frequency (about 6 times), indicating that in that period the research focus is more on behavior and decision making by individuals. Meanwhile, the term "behavioral research" began to appear from 2022 and continued until 2024, albeit with a lower frequency. The term "privacy" became prominent in 2023 and remained relevant until 2024, indicating increased attention to privacy issues in technological developments and digital interactions. From these trends it can be inferred that while initial attention focused on general aspects of human behavior, there has been a shift towards more specific and contextual issues such as privacy and behavioral research in the last two years. This reflects the dynamics of changing focus in scientific studies as digital and social challenges increase.

#### F. Research on Dark Patterns on Social Media Based on Shared Event Networks

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Based on Figure 10, which is a visualization of cluster analysis of research topics depicted in the form of a keyword network. Each color group represents a cluster of closely related topics based on the occurrence of keywords that often appear together in the literature. The largest cluster, marked in red and the size of the dominant keywords such as "human", "privacy", "decision making", and "health behavior [32][33][34]", indicates that research in this domain focuses heavily on human aspects, privacy, decision making, and health behavior [32][33][34]. The blue cluster indicates a focus on "behavioral research", "behavioral science", and "ubiquitous computing", highlighting the link between behavioral research and computing technology. Meanwhile, the green cluster emphasizes the issues of "data privacy" and "privacy risks", reflecting attention to privacy risks in system design. The orange and purple clusters highlight "social networking (online)", "social media platforms", and "wellbeing" and "digital wellbeing" respectively, indicating the existence of research subthemes related to social media and digital wellbeing. This visualization shows how research topics overlap and form a complex research ecosystem, with the theme of people and privacy at the center of the scientific discourse in this field.

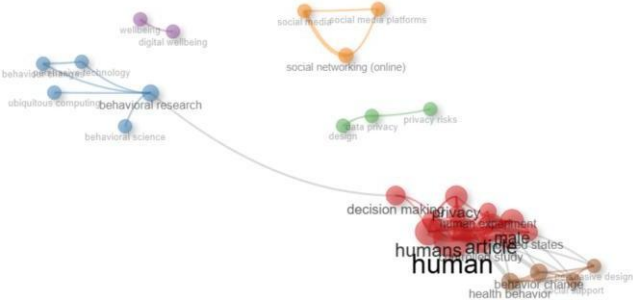


Figure 10 Research Development Based On Shared Event Networks

G. Thematic Map

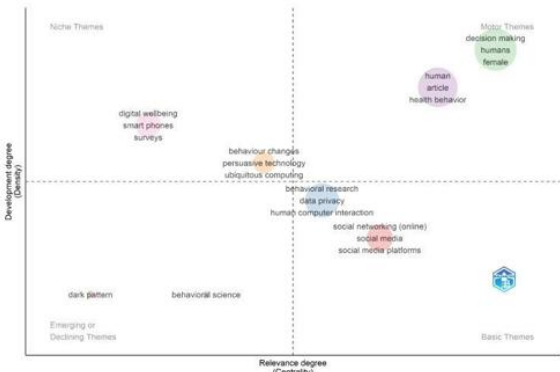


Figure 11 Thematic Map

Based on the analysis of the thematic map of in Figure 11, it can be seen that the research themes are divided into four quadrants based on the level of development (density) and the level of relevance (centrality). Themes in the upper right quadrant (motor themes), such as "decision making", "humans", and "health behavior", indicate topics that are very central and rapidly growing and are the main drivers in this research field. Themes such as "human", "article", and "health behavior" also have a high density, indicating a strong concentration of research in these areas. In the lower right quadrant (basic themes), themes such as "behavioral

research", "data privacy", "human computer interaction", and "social media" and "social media platforms" are found, which are the main foundations of research but with a relatively moderate level of development. Themes in the upper left quadrant (niche themes), such as "digital wellbeing", "smart phones", and "surveys", indicate topics that are developing specifically but are less central to the research network.

Themes in the lower left quadrant (emerging or declining themes), such as "dark patterns" and "behavioral science", indicate topics that are emerging or declining in relevance. Overall, the mapping shows that issues related to human decision-making and behavioral health are front and center, while issues of data privacy and human-computer interaction remain important foundations in the analyzed research ecosystem. The "Decision Making" and "Human" clusters have the highest Rank Centrality and Rank Density values, indicating they are central and highly developed in the research network. In contrast, the "Dark Pattern" and "Behavioral Science" clusters have the lowest values, indicating a limited and underdeveloped role. Other clusters such as "Social Networking (Online)", "Behavioral Research", "Behaviour Changes", and "Digital Wellbeing" are in an intermediate position, which means they are quite important but not yet a major hub in the research network as can be seen in Table 2.

Table 2 Visual Interpretation Based on Thematic Map Clusters

| Clusters                   | Rank Centrality | Rank Density |
|----------------------------|-----------------|--------------|
| Social Networking (Online) | 6               | 3            |
| Behavioral Research        | 5               | 4            |
| Decision Making            | 8               | 8            |
| Human                      | 7               | 7            |
| Behavior Changes           | 4               | 5            |
| Dark Pattern               | 1               | 1.5          |
| Digital Wellbeing          | 2               | 6            |
| Behavioral Science         | 3               | 1.5          |

IV. CONCLUSIONS

LQ1: How have publication patterns and research collaboration on dark patterns in social media applications evolved over time? Dark patterns in social media applications have shown rapid growth since 2020, with the number of publications skyrocketing and reaching a peak in 2024. However, the average number of citations per year has actually declined, indicating that the increase in quantity has not been matched by an increase in quality or impact of research. Collaboration among researchers has also grown stronger, as evidenced by the proliferation of publications in reputable journals such as ACM Transactions on Computer-Human Interaction and Proceedings of the ACM on Human-Computer Interaction. LQ2: What are the dominant themes and under- explored research areas in the literature on dark patterns in social media, particularly regarding their impact on user behavior and privacy? Existing studies have extensively addressed themes such as user behavior manipulation, the privacy paradox, and the exploitation of

vulnerable groups (children). The types of dark patterns frequently analyzed include privacy zuckering, bait and switch, confirm shaming, and forced continuity [20][21][22]. On the other hand, research remains limited in addressing mitigation strategies, effective regulatory frameworks, and the long-term impacts of dark patterns on mental health and digital well-being. Topics such as user consent controls and design-based protection mechanisms have also not been extensively explored.

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