Towards a Preliminary Ontology of Dark Patterns Knowledge

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ABSTRACT

Deceptive design practices are increasingly used by companies to extract profit, harvest data, and limit consumer choice. *Dark patterns* represent the most common contemporary amalgamation of these problematic practices, connecting designers, technologists, scholars, regulators, and legal professionals in transdisciplinary dialogue. However, a lack of universally accepted definitions across the academic, legislative and regulatory space has likely limited the impact that scholarship on dark patterns might have in supporting sanctions and evolved design practices. In this late breaking work, we seek to harmonize regulatory and academic taxonomies of dark patterns, proposing a preliminary three-level ontology to create a shared language that supports translational research and regulatory action. We identify potential directions for scholarship and social impact building upon this ontology.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; **Empirical studies in HCI**.

KEYWORDS

dark patterns, deceptive design, regulation, ontology

1 INTRODUCTION

Deceptive design practices are increasingly common in digital environments, impacting digital experiences on social media [26, 31], e-commerce [24], mobile devices [20], cookie consent banners [18], and gaming [37], among others. An increasingly dominant framing of these deceptive practices is known as "dark patterns"—describing instances where design choices subvert, impair, or distort the ability of a user to make autonomous and informed choices in relation to digital systems regardless of the designer's intent [3, 4, 9].

While the origins of dark patterns as a concept to describe manipulative design practices goes back over a decade to when the term was coined by practitioner and scholar Harry Brignull [11],

in the past five years there has been growing momentum in the use of the term to unite scholars, regulators, and designers in transdisciplinary dialogue to identify problematic practices and find ways to prevent or discourage the use of these patterns. According to a recent study of the historical evolution of #darkpatterns on Twitter by Obi and colleagues [29], since 2019, conversations have included stakeholders not only from design and technology but also social scientists, lawyers, journalists, lawmakers, and members of regulatory bodies and consumer protection organizations.

Within the regulatory space, in 2022 alone, the term "dark patterns" was codified into EU law in the Digital Services Act [9], the Digital Markets Act [5], and the Data Act proposal [8], and into US law in the California CPRA [4]. Regulatory bodies such as the US Federal Trade Commission (FTC), the UK Competition and Market Authority (CMA), the EU Commission, the European Data Protection Board (EDPB) and the the Organisation for Economic Co-operation and Development (OECD) have released guidance on specific types of dark patterns with various levels of overlap with definitions from academic scholarship [2, 3, 6, 12, 30]. In addition, the concept of dark patterns has been leveraged in sanctions against companies that have relied upon manipulative practices. Recent actions include a $245 million USD judgment against Fortnite, a product from Epic Games, for their use of manipulative practices to encourage the purchase of content [36] and multiple settlements by various US states against Google for their use of dark patterns to obtain location data [7, 35]. In the EU, both Data Protection Authorities (DPAs) and court decisions have forbidden certain practices related to dark patterns, including: pre-selection of choices [1]; refusing consent if it is more difficult than giving it [15, 16]; and misinforming users on the purposes of processing data and how to reject them [16, 23].

As part of this convergent discourse, HCI scholars have addressed the threat of dark patterns in a wide range of publications, proposing definitions and types of dark patterns [10, 17, 22, 24, 25]. However, the specific forms that dark patterns can take, the role of context, the ubiquity of the practices, the technolog(ies) used or application area, the comparative harms of different patterns, remedies, and the role of user education are still a topic of ongoing research and the consequence of this dynamic topic is of an ever-expanding list of categories and variants whose scale continues to grow. Two large challenges face an ongoing transdisciplinary engagement with the concept of dark patterns. First, the literature has grown quickly and is siloed, often lacking accurate citation provenance trails of given typologies and definitions, making it difficult to trace where (new) specific types of patterns emerged and under which conditions. The space that dark patterns scholars have sought to cover is also vast, with important research occurring in specific domains (e.g., games, e-commerce, privacy and data protection) and across

different technologies and modalities (e.g., mobile, desktop, conversational user interfaces (CUIs), AR/VR). This diversity of research has led some scholars to propose fragmentary, domain-specific typologies without necessarily finding commonalities across domains. Second, regulators—the ultimate decision makers that could provide legal certainty to this landscape— and policy makers have been interested in the scholarly conversation regarding dark patterns, but have in some cases created wholly new domain-related terminology to describe types already known in the academic literature. In other cases, regulators and policymakers have inconsistently cited academic sources making connections across the regulatory, legal, and academic spaces fraught.

We seek to support these challenges and ongoing conversations by building the foundation for a common ontology of dark patterns. By taking the first steps towards building an *ontology*, we seek to create a shareable, extendable, and reusable knowledge representation of dark patterns conceptualization. This groundwork for an ontology is both domain and application agnostic though it has potential utility in domain or context-specific instances. As noted by Fonseca [14], these types of ontologies can be useful in supporting social science research by "creating better conceptual schemas and applications." To create this preliminary ontology, we build upon ten contemporary taxonomies of dark patterns from both the academic and regulatory literature, and thereafter we identify three levels of hierarchy for pattern types. Hence we harmonize concepts across these taxonomies to provide a consistent and consolidated, shared, and reusable dark patterns ontology for future research, regulatory action, and sanctions.

We make three contributions in this late-breaking work.

(1) First, we introduce the hierarchical concepts of low-level, meso-level, and high-level dark patterns to the literature, disambiguating UI-level patterns that may lead to opportunities for detection (low-level) and strategies that may be targeted by policy and legislation (meso- and high-level).

(2) Second, we identify when patterns first emerged and how naming has evolved over time and across sources.

(3) Third, we describe a common language and hierarchy of dark patterns that aligns disparate terminology from scholars and regulators. This enabled us to propose the foundation for an ontology of dark patterns knowledge that can be utilized by practitioners, scholars, regulators, and legal professionals.

2 METHOD

We used a content analysis approach [27] to identify and characterize elements of existing dark patterns taxonomies. As a research team, we leveraged our collective experiences in human-computer interaction, design, computer science, law, and regulation. Specifically, our team included established dark patterns scholars, including one with a focus on human-computer interaction and design (Colin), one with a focus on computer science and web measurement and experience in regulation (Nataliia), and one with a background in computer science and data protection law (Cristiana). Across these perspectives, in accordance with previous scholarship, we seek to characterize dark patterns in a transdisciplinary space where multiple disciplinary perspectives are needed [18].

2.1 Data Collection

We collected dark patterns taxonomies from a total of 10 sources, including: 1) a stable set of patterns shared on https://darkpatterns.org since 2018 by Harry Brignull[1]; 2) scholarly academic sources that present a distinct and comprehensive taxonomy and have been regularly cited [10, 17, 22, 24] in scholarly and regulatory literature; and 3) public reports from stakeholders and regulators in the EU and USA that include a dark patterns taxonomy [2, 3, 6, 12, 30]. Our selection of these 10 sources (summarized in supplemental material) encompass the most authoritative and commonly cited taxonomies in the research and regulatory literature, and all taxonomies that were previously cited in regulatory reports were also present in our set of scholarly academic sources.

2.2 Data Analysis

We began our analysis by identifying the constitutive components of each taxonomy without considering overlaps across sources through a bottom-up approach. Across the ten taxonomies from academic and regulatory sources, we identified 186 low-level and 59 high-level patterns (a total of 245 patterns) (see Tables 1 and 2 in the appendix). The number of discrete elements is perhaps unsurprising, since each typology author has used a different point of focus and categorization based on the sector they sought to describe or support (e.g., Mathur et al. [25] and the CMA [6] focus on e-commerce; the EDPB's focus on data protection practices within social media platform interfaces [12][2]). All taxonomy elements are included in supplemental material for other scholars to build upon. We used the following procedure to carefully identify individual taxonomy components, their source, and similarities of components across taxonomies:

- **Aggregating existing patterns.** We first listed all high- and low-level patterns verbatim in the structure originally indicated in the textual source. *High-level patterns* include any instances where the pattern is denoted as a category, strategy, goal, intention, or other parent in a parent-child relationship and *low-level patterns* indicate specific patterns that are included as a child in a parent-child relationship.
- **Identifying provenance through direct citations and inference.** Based on citations provided in the source-document, we indicated any instances where patterns were *directly cited* or otherwise duplicated from previous sources. Because many patterns were uncited—particularly in regulatory reports—we also relied upon citations elsewhere in the document or explicit use of existing pattern vocabulary and definitions from previously published sources, which we indicate as *inferential*. We used these direct and inferential citation patterns to identify where patterns were first introduced, even if they appeared alongside other patterns that had been published previously.

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[1]This collection of dark patterns was moved to https://www.deceptive.design in 2022, but the patterns have been stable since 2018 when the final pattern, "confirmshaming," was added.
[2]The EDPB guidelines were updated to a new version in February 2023 after our initial analysis was complete [13]. Future versions of the ontology will need to address any differences.

- **Clustering similar patterns.** We grouped patterns that appeared either to be identical or similar (in a *is-a* or *equivalent-to* relationship), using definitions to identify affinities among patterns that did not have identical names. This portion of the analysis was the most extensive, including in depth conversations between an HCI (Colin) and legal (Cristiana) scholar and a careful reading of the definitions as they might be understood by designers and lawyers.
- **Creating meso-level patterns.** From the findings of this content analysis procedure, we recognized that there were not only low- and high-level patterns present, but also a *"meso"* level of pattern knowledge. By recognizing similarities among low-level patterns, we introduced *meso-level patterns* into our analysis, identifying these patterns by using the names or elements of existing taxonomies where possible, or coining new pattern names to characterize the low-level patterns we grouped together.
- **Finalizing the draft ontology.** Across these three levels of hierarchy, we grouped 233 of the 245 taxonomy elements[3]. This structure resulted in a draft ontology which includes 6 high-level patterns, 24 meso-level patterns, and 34 low-level patterns.

3 MAPPING THE EVOLUTION OF DARK PATTERNS

Pattern types have largely stabilized in the past five years, including high-level pattern types or "strategies" (e.g., nagging, obstruction, sneaking, interface interference, forced action) and low-level patterns (including Brignull's [11] and those introduced by Gray et al. [17] and Mathur et al. [24]).

High-level patterns were most likely to co-occur across multiple sources. For instance, Gray et al.'s [17] original five high-level "dark pattern strategies" were found across multiple other sources, even if they were not consistently cited: nagging [2, 22], obstruction [2, 3, 22, 24], sneaking [2, 3, 22, 24], interface interference [2, 3, 22], and forced action [2, 3, 22, 24] (FTC uses "coerced action" instead). After their introduction in Mathur et al. [24], newly introduced categories relating to social psychology or behavioral economics also became common: urgency [2, 3, 22], scarcity [3, 22], and social proof [2, 3, 22] (the FTC bundles "Endorsements" with "social proof"). We have grouped these types together as part of a sixth high-level pattern of "social engineering."

Domain or context-specific patterns. The most volatility has occurred in relation to *domain-* or *context-specific patterns*. These include expansions of Mathur et al.'s [24] high-level patterns of "social proof" and "scarcity," which have since been reiterated by the EU Commission [2] and OECD [30] and extended by the CMA [6] and FTC [3] taxonomies. In addition, the EDPB guidance on dark patterns in social media [12] included a wholly new set of 6 high-level and 15 low-level patterns, although the majority of these could be inferred as similar to already existing patterns proposed in the

academic literature. Importantly, though, the EDPB taxonomy included multiple patterns which we found to be new low-level or meso-level additions, including "privacy maze," "dead end," "conflicting information," "information without context" (which we renamed from the EDPB pattern "decontextualizing"), and "visual prominence" (which we renamed from the EDPB pattern "look over there"). Similarly, the CMA taxonomy focused on choice architecture as a guiding structure with three categories focused on choice "structure," "information," and "pressure." This taxonomy structure also yielded new patterns, including "bundling," "complex language," and "personalization."

Our analysis demonstrates the value in classifying or generating context-specific patterns that illuminate gaps in current taxonomies, and also the benefit of mapping these patterns within larger ontologies (such as the one we propose in this LBW) to identify abstractions of patterns that may apply across many domains, contexts, and legal fields.

4 TOWARDS A SHARED ONTOLOGY OF DARK PATTERNS

In our draft ontology, summarized in Figures 1 and 2, we seek to synthesize and harmonize all existing taxonomies while adding useful and consistent structure to allow for other scholars and regulators to build on a shared description of dark patterns knowledge. Our ontology includes three different levels of hierarchy:

- **High-level patterns** are the most abstracted form of knowledge, including general *strategies* that characterize the inclusion of manipulative, coercive, or deceptive elements that might limit user autonomy and decision making. These patterns are context-agnostic and can be employed through a range of modalities and technologies (e.g., desktop, mobile, VUIs, VR/AR) and application types (e.g., e-commerce, gaming, social media).
- **Meso-level patterns** bridge high- and low-level forms of knowledge and describe an *angle of attack* or specific approach to limiting, impairing, or undermining the ability of the user to make autonomous and informed decisions or choices. These patterns are content-agnostic and may be interpreted in a contextually-appropriate way based on the specific context of use or application type.
- **Low-level patterns** are the most situated and contextually dependent form of knowledge, including specific *means of execution* that limits or undermines user autonomy and decision making, is described in visual and/or temporal form(s), and is likely to be detectable through algorithmic, manual, or other technical means.

4.1 Problematizing and Evolving the Ontology

Not all of our mappings were clear-cut and some may be productively extended or disputed in future versions of this ontology. Through dialogue, we sought to locate existing patterns within our ontology based on our best understanding of the pattern as described by its name and definition in the source taxonomy. We describe some of our challenges in mapping and present these as opportunities to refine the ontology in future work:

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[3]Four ungrouped elements were from the CMA report [6] and described generic elements of digital systems which were not explicitly framed as deceptive or manipulative: Choice Structure, Choice Information, Feedback, and Messengers. All eight high-level patterns from Bösch [10] were also excluded since they were not reiterated in any downstream literature.

High-Level Pattern	Meso-Level Pattern	Low-Level Pattern
Nagging D: Gr Lu EUCOM FTC OECD I: EDPB CMA	–	–
Obstruction D: Gr Lu Ma EUCOM FTC OECD I: EDPB CMA	Roach Motel (D: Br Gr Lu EUCOM I: Bö Ma FTC OECD)	Immortal Accounts (D: Bö FTC)
		Dead End (D: EDPB)
	Creating Barriers	Price Comparison Prevention (D: Br Gr Lu FTC EUCOM OECD)
		Intermediate Currency (D: Gr Lu FTC EUCOM OECD; I: CMA)
	Adding Steps (I: EDPB)	Privacy Maze (D: EDPB)
Sneaking D: Gr Lu Ma EUCOM OECD I: EDPB CMA FTC	Bait and Switch (D: Br Gr Lu FTC EUCOM I: OECD)	Disguised Ad (D: Br Gr Lu FTC EUCOM OECD)
	Hiding Information	Sneak into Basket (D: Br Gr Ma Lu FTC EUCOM OECD)
		Drip Pricing, Hidden Costs, or Partitioned Pricing (D: Br Gr Ma Lu CMA FTC EUCOM OECD)
		Reference Pricing (D: CMA OECD)
	(De)contextualizing Cues	Conflicting Information (D: EDPB)
		Information without Context (I: EDPB)
Interface Interference D: Gr Lu EUCOM FTC OECD I: Br Ma EDPB FTC	*Manipulating Visual Choice Architecture* (I: CMA)	False Hierarchy (D: Gr Lu FTC OECD I: EDPB)
		Visual Prominence (I: EDPB)
		Bundling (D: CMA)
		Pressured Selling (D: Lu FTC)
	Bad Defaults (D: Bö Gr Lu FTC OECD; I: CMA EUCOM EDPB)	–
	Emotional or Sensory Manipulation (I: Gr Lu CMA EUCOM OECD)	Cuteness (D: Lu)
		Positive or Negative Framing (I: Gr EDPB)
	Trick Questions (D: Br Gr Ma Lu FTC EUCOM OECD)	–
	Choice Overload (I: EDPB CMA)	–
	Hidden Information (D: Gr Lu FTC EUCOM OECD; I: EDPB)	–
	Language Inaccessibility	*Wrong Language* (I: EDPB)
		Complex Language (D: CMA)
	Feedforward Ambiguity (I: EDPB)	–

Figure 1: Draft ontology of dark patterns organized by level of pattern. "D" indicates a *direct* use of the pattern language in the original source(s) and "I" indicates an *inferred* similarity between different terminology used across two or more pattern types. Sources are indicated by abbreviation and are colored cyan if they are regulatory reports or magenta if they are academic articles. *Italized pattern names* indicate new pattern types introduced in this paper while all other text relies upon the sources indicated. Underlined sources indicate the earliest mention of that pattern or patterns in the sources we analyzed. A full description of the inferred pattern names is included in supplemental material to support future work.

High-Level Pattern	Meso-Level Pattern	Low-Level Pattern
Forced Action D: `Gr` `Lu` `Ma` `EUCOM` `OECD` I: `CMA` `FTC`	Forced Continuity (D: `Br` `Gr` `Lu` `FTC` `EUCOM` `OECD`; I: `Ma`)	_
	Forced Registration (D: `Bö` `Lu` `FTC` `EUCOM` `OECD`; I: `Ma` `CMA` `FTC`)	_
	Forced Communication or Disclosure	Privacy Zuckering (D: `Br` `Gr` `Lu` `OECD`; I: `FTC`)
		Friend Spam (D: `Br` `Lu` `FTC` `OECD`)
		Address Book Leeching (D: `Bö` `Lu` `FTC` `OECD`)
		Social Pyramid (D: `Gr` `Lu` `FTC` `OECD`)
	Gamification (D: `Gr` `Lu` `OECD`)	Pay-to-Play (D: `FTC`)
		Grinding (D: `FTC`)
	Attention Capture	Auto-Play (D: `FTC`)
Social Engineering	Scarcity and Popularity Claims (D: `Ma` `Lu` `FTC` `CMA`)	High Demand (D: `Ma` `Lu` `FTC` `EUCOM` `OECD`)
	Social Proof (D: `Ma` `Lu` `EUCOM` `OECD`)	Low Stock (D: `Ma` `Lu` `FTC` `EUCOM` `OECD`)
		Endorsements and Testimonials (D: `Ma` `Lu` `FTC` `EUCOM` `OECD`; I: `FTC`)
		Parasocial Pressure (I: `FTC`)
	Urgency (D: `Ma` `Lu` `FTC` `EUCOM` `OECD`)	Activity Messages (D: `Ma` `Lu` `FTC` `EUCOM` `OECD`)
		Countdown Timer (D: `Ma` `Lu` `FTC` `EUCOM` `OECD`)
	Shaming	Limited Time Message (D: `Ma` `Lu` `FTC` `EUCOM` `OECD`)
	Personalization (D: `CMA`)	Confirmshaming (D: `Br` `Ma` `Lu` `FTC` `EUCOM` `OECD`)

Figure 2: Draft ontology of dark patterns organized by level of pattern, continued.

Combinations of patterns evolve over time. Some combinations of patterns have evolved over time. For instance, Mathur et al.'s [24] high-level pattern "social proof" originated with two sub-patterns, "activity messages" and "testimonials." The FTC created new low-level patterns, introducing "endorsements" (we bundled with testimonials as one low-level pattern) and more specific types of endorsement or testimonials (e.g., "deceptive celebrity endorsements," "false activity messages"). Future work could identify the most useful level of abstraction for such patterns.

Novel and context-specific names for dark patterns have been introduced. The use of novel names for patterns (particularly by the EDPB and CMA) or the use of patterns in specific contexts (e.g., e-commerce, social media) caused us to consider both the presence of granular low-level patterns and the relation of these low-level patterns to inferred meso-level patterns. In particular, the use of novel names for patterns types and definitions was a challenge from an analytic perspective, resulting in: i) instances where a wholly new pattern was introduced (e.g., CMA's "information overload" which we leveraged to create a new meso-level

pattern of "choice overload"); ii) instances where a new high-level strategy was highly similar to an existing high-level strategy (e.g., EDPB's "skipping" which we subsumed within "sneaking"); and iii) instances where existing patterns included both a generalizable pattern and domain-specific information which may need to be captured in specific low-level patterns in future work (e.g., EDPB's "left in the dark" is a form of "hidden information" but implies specific low-level patterns that are specific to data protection).

These analytic challenges strengthen some of the key definitional components of dark patterns as they have previously been described in the literature [25] but inform areas where definitions could be further problematized. For instance, many pattern definitions mixed *characteristics* of dark patterns (e.g., information hiding, manipulation of the choice architecture), *impact on user behavior* (e.g., confusion, obstruction), *manifestation in the user interface* (e.g., visibility of elements, interpretability by users), and *context-specific issues* (e.g., impacts on data protection, presentation in social media interfaces). Future definitions of patterns at all levels could benefit from separating out these elements at appropriate

levels of abstraction to increase the potential for utility across many contexts and domains—particularly at the high- and meso-levels of pattern description.

5 USING THE ONTOLOGY TO SUPPORT TRANSDISCIPLINARY DIALOGUE

Building on our preliminary ontology, we identify multiple benefits for all actors that use a shared nomenclature of dark patterns. This can help not only to anchor patterns in existing literature, but also to enable actors to extend or further characterize them. Further alignment of dark patterns definitions can be achieved through multiple types of practices that could further help establish dialogue between actors from different disciplinary and professional roles, including:

1) Identifying multiple levels of granularity. This ontology can be used to identify abstractions of dark patterns across many domains, contexts, or application types (i.e., high- and meso-level patterns) while creating more robust characterizations of low-level patterns that may be highly domain or context specific. By indicating gaps in our draft ontology, we show that many additional low-level patterns need to be identified, which would aid computer scientists and engineers in building precise detection tools and provide guidance for designers. For instance, "nagging" only exists as a high-level pattern and it is unclear which kinds of nagging should be considered problematic, and under which conditions. Also, the ontology can be extended to include potential harms in relation to specific dark patterns types [19]. Other meso-level patterns that lack any defined low-level patterns (e.g., "trick questions," "choice overload," "hidden information") raise the question of which specific cases—as inscribed through low-level patterns—need to be articulated as particularly problematic or indicative. This work will require a shared language among regulators and scholars to inform disciplined inquiry of specific domains and use contexts.

2) Engaging in more robust citation practices to trace the evolution of pattern types and their presence over time. This ontology—and its extension over time—can be supported through robust citation patterns across regulatory and academic literature, including indications where definitions of specific patterns have been altered, extended, or synthesized. While definitions of some low and high-level patterns have remained relatively consistent over time (in particular, Brignull's original patterns), the rapid growth of new pattern types and the introduction of hierarchy injects added complexity that can inform more disciplined and transparent knowledge generation practices.

3) Connecting regulatory sanctions to multiple levels of patterns and combinations of pattern types. By mapping case law to the ontology, regulators could gain additional knowledge and support in identifying where dark patterns practices at multiple levels and in multiple combinations are at play, and are deemed to be illegal per jurisdiction [21]. Current descriptions of the use of dark patterns often report infringements only at the lowest level (often re-using Brignull's original pattern types) and in doing so, could miss broader abstractions that may translate across domains. Early enforcement actions in relation to subscription services and online tracking (a focus in both EU and FTC enforcement) has started to reveal the interplay of multiple pattern types at multiple

levels in causing user confusion, manipulation, or coercion, and other broad genres of manipulation that might benefit from similar characterizations.

4) Using levels of pattern granularity to inform the detection of dark patterns through automated or manual approaches. The detection of dark patterns could also be more robustly supported by our ontology, with our assertion that low-level patterns show the most promise in being detectable. Existing detection efforts (e.g., [24, 28, 32–34]) have shown that higher-level patterns are difficult or impossible to detect at scale due to their abstract nature that requires interpretation, while low-level UI elements with discrete and known qualities (e.g., cookie consent banners, elements of the checkout process) are more accessible with software tools for automated detection. Our ontology of low-level patterns and gaps creates a foundation for future detection efforts, allowing computer science scholars to focus on pattern types which are most likely to be detectable.

6 CONCLUSION

In this late-breaking work, we present our analysis of ten existing taxonomies of dark patterns and propose a foundation for a shared ontology of dark patterns knowledge. Building on our analysis, future scholars, regulators, and legal professionals can benefit from our process of aggregation and consolidation, using our hierarchical organization of dark patterns types to indicate links to existing and similar concepts. This description encourages the establishment of provenance in future work, allowing scholars and regulators to identify pattern types and their origins and provide an audit trail to connect specific contextually-bound instances with broader categorizations. Finally, this draft ontology creates a foundation for a shared and reusable knowledge source, allowing many stakeholders to work together in building a shared, explicit and precise conceptualization of what is already known in the literature and which can be further refined and extended.

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Table 1: Academic taxonomies of dark patterns.

	High-Level Pattern	Low-Level Pattern
Brignull [11]	—	Sneak into Basket, Bait and Switch, Roach Motel, Price Comparison Prevention, Disguised Ads, Privacy Zuckering, Trick Questions, Hidden Costs, Confirmshaming, Friend Spam, Forced Continuity, Misdirection
Bösch et al. [10]	Obscure	Privacy Zuckering, Immortal Accounts, Hidden Legalese Stipulations, Bad Defaults
	Maximize	Shadow User Profiles, Address Book Leeching, Forced Registration
	Deny	Immortal Accounts
	Preserve	Shadow User Profiles, Address Book Leeching
	Centralize	Shadow User Profiles
	Publish, Violate, Fake	—
Gray et al. [17]	Nagging	—
	Sneaking	Intermediate-Level Currency, Roach Motel, Price Comparison Prevention
	Obstruction	Bait and Switch, Sneak into Basket, Hidden Costs, Forced Continuity
	Interface Interference	Toying with Emotion, Aesthetic Manipulation, Trick Questions, Preselection, Disguised Ad, Hidden Information, False Hierarchy
	Forced Action	Gamification, Privacy Zuckering, Social Pyramid
Mathur et al. [24]	Sneaking	Sneak into Basket, Hidden Costs, Hidden Subscription
	Urgency	Limited-time Message, Countdown Timer
	Misdirection	Confirmshaming, Visual Interference, Trick Questions, Pressured Selling
	Social Proof	Activity Message, Testimonials
	Scarcity	Low-stock Message, High-demand Message
	Obstruction	Hard to Cancel
	Forced Action	Forced Enrollment
Luguri et al. [22]	Nagging	—
	Social Proof	Testimonials, Activity Messages
	Obstruction	Immortal Accounts, Intermediate-Level Currency, Roach Motel, Price Comparison Prevention
	Sneaking	Bait and Switch, Sneak into Basket, Hidden Costs, Hidden Subscription / Forced Continuity
	Interface Interference	Cuteness, False Hierarchy / Pressured Selling, Toying with Emotion, Trick Questions, Preselection, Disguised Ad, Hidden Information / Aesthetic Manipulation, Confirmshaming
	Forced Action	Friend spam/social pyramid/address book leeching, Privacy Zuckering, Gamification, Forced Registration
	Scarcity	High Demand Message, Low Stock Message
	Urgency	Countdown Timer, Limited Time Message

Table 2: Regulatory taxonomies of dark patterns.

	High-Level Pattern	Low-Level Pattern
EDPB [12]	Overloading	Continuous Prompting, Privacy Maze, Too Many Options
	Skipping	Deceptive Snugness, Look Over There
	Stirring	Emotional Steering, Hidden in Plain Sight
	Hindering	Dead End, Longer than Necessary, Misleading Information
	Fickle	Lacking Hierarchy, Decontextualizing
	Left in the Dark	Language Discontinuity, Conflicting Information, Ambiguous Wording or Information
EU Commission [2]	Nagging	—
	Social Proof	Testimonials, Activity Messages
	Obstruction	Intermediate-Level Currency, Roach Motel / Difficult Cancellations, Price Comparison Prevention
	Sneaking	Bait and Switch, Sneak into Basket, Hidden Costs, Hidden Subscription / Forced Continuity
	Interface Interference	Toying with Emotion, Trick Questions, Preselection (default), Disguised Ad, Hidden Information / False Hierarchy, Confirmshaming
	Forced Action	Forced Registration
	Urgency	Countdown Timer / Limited TIme Message, Low Stock / High Demand Message
OECD [30]	Forced Action	Forced Registration, Forced Disclosure / Privacy Zuckering, Friend Spam / Social Pyramid / Address Book Leeching, Gamification
	Interface Interference	Hidden Information, False Hierarchy, Preselection, Misleading Reference Pricing, Trick Questions, Disguised Ads, Confirmshaming / Toying with Emotion
	Nagging	Nagging
	Obstruction	Hard to Cancel or Opt Out / Roach Motel / Click Fatigue / Ease, (Price) Comparison Prevention, Immortal Accounts, Intermediate Currency
	Sneaking	Sneak into Basket, Hidden Costs / Drip Pricing, Hidden Subscription / Forced Continuity, Bait and Switch (including Bait Pricing)
	Social Proof	Activity Messages, Testimonials
	Urgency	Low Stock / High Demand Message, Countdown Timer / Limited Time Message
UK CMA [6]	Choice Structure	Defaults, Ranking, Partitioned Pricing, Sludge, Bundling, Dark nudge, Choice overload and decoys, Virtual currencies in gaming, Sensory manipulation, Forced outcomes
	Choice Information	Drip pricing, Reference pricing, Framing, Complex language, Information overload
	Choice Pressure	Scarcity and popularity claims, Prompts and reminders, Messengers, Commitment, Feedback, Personalisation
US FTC [3]	Endorsements (Social Proof)	False Activity Messages, Deceptive Consumer Testimonials, Deceptive Celebrity Endorsements, Parasocial Relationship Pressure
	Scarcity	False Low Stock Message, False High Demand Message
	Urgency	False Discount Claims, False Limited Time Message, Baseless Countdown Timer
	Obstruction	Immortal Accounts Roadblocks to Cancellation, Price Comparison Prevention
	Sneaking or Information Hiding	Intermediate Currency, Hidden Subscription or Forced Continuity, Drip Pricing, Hidden Costs, Hidden Information, Sneak-into-Basket
	Interface Interference	Bait and Switch, Disguised Ads, False Hierarchy or Pressured Upselling, Misdirection
	Coerced Action	Friend Spam, Social Pyramid Schemes, and Address Book Leeching, Pay-to-Play or Grinding, Forced Registration or Enrollment, Nagging, Auto-Play, Unauthorized Transactions
	Asymmetric Choice	Subverting Privacy Preferences, Preselection, Confirm Shaming, Trick Questions