

Trickery: Educational Dark Pattern Analogies for Use in Serious Games

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Dark patterns are often used in interface design to manipulate users into performing actions they would otherwise not take, such as consenting to excessive data collection. We present a narrative serious game concept, along with seven educational dark pattern analogies designed to create awareness of and bolster resistance against dark patterns through direct consequences of player actions. We performed a qualitative laboratory gameplay study investigating player behavior when confronted with educational dark pattern analogies in a serious game and an online survey study evaluating the perceived helpfulness of our educational dark pattern analogies. Our results provide insights into influencing factors for adapting dark patterns into gameplay, as well as player motivations and driving forces influencing player behavior, and show educational dark patterns to be a promising solution to increase user understanding of dark pattern concepts.

CCS Concepts: • Security and privacy → Social aspects of security and privacy; • Human-centered computing → Empirical studies in interaction design; • Applied computing → Computer games.

Additional Key Words and Phrases: education, privacy, dark patterns, serious games, awareness

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1 INTRODUCTION

In the current digital landscape, website providers play a dual role: they offer free and important services to users, such as social media platforms, while quietly capitalizing on the data they collect about their users through targeted advertisements. This excessive data collection can lead to tangible harm to users through invasion of privacy, financial loss, and cognitive burden, as well as harm to the collective welfare through unfair competition or unanticipated societal consequences [33]. While users express concern about their information privacy in interviews and questionnaires, users do little to actually protect their data when observed [1, 2, 41]. Users are often unaware of the extent of the information collected about them [18, 42]. Despite regulatory barriers like the EU General Data Protection Regulation (GDPR), which requires explicit informed consent from users to collect data, many users give consent through cookie consent banners quickly to get to the websites' content, disregarding potential privacy risks [6, 19].

An important factor in influencing users' decision to consent to data collection is interface design [40]. Specifically, website providers employ manipulative interface design strategies, so-called dark patterns, to increase the likelihood that users give consent to data collection [9, 20] or extend their stay on a website. Therefore, dark patterns trick users into performing unintended and unwanted actions by exploiting psychological biases, such as prompting *System 1 thinking*, and humans' fundamental need to belong [10]. Similarly to the lack of awareness about the amount of collected data, users are either unaware of dark patterns [16] or are aware that they are being manipulated but do not understand how dark patterns can concretely harm them [9]. To counteract dark patterns Bongard-Blanchy et al. propose raising awareness, facilitating detection, and bolstering resistance towards dark patterns through educational, design-oriented,

technological or regulatory measures [9]. Similarly, Lu et al. propose that targeting user awareness and user action can lead to end-user-empowerment, bolstering resistance against dark patterns [29]. Our paper takes an educational approach to counteracting dark patterns, by exploring serious games as an alternative to traditional training courses. Serious games are games that are used for non-entertainment purposes [25]. There have been a number of serious games aimed at educating people about privacy and cyber security awareness or dark patterns [3, 8, 22, 31]. Games inherently increase motivation and fun and thereby improve learning, i.e. induce a change in behavior, attitude, health, understanding, or knowledge [7]. In their meta-analysis of serious games used in education Zhonggen et al. found that serious games encouraged longer engagement with the topic at hand and learners were generally more motivated than in nongame-based learning approaches [46]. Serious games in the context of privacy awareness can take on a variety of forms, often aiming to train users directly to detect or understand certain privacy issues such as cookie consent forms with game mechanics such as rewards and competition (e.g. <https://cookieconsentspeed.run/>). However, we know from educational research, that such approaches may mostly trigger short-term memory learning and not allow the creation of new neural links for reflection and understanding [4, 28]. We think that this level of reflection is mandatory for users to not simply conduct rote memorization of dark patterns but to create overall awareness and resistance.

In this paper, we present a serious game based on narrative storytelling to raise awareness about dark patterns¹. We discuss our reasoning for how we created educational dark pattern analogies to fit into this context and present two user studies to evaluate our educational dark pattern analogies.

To summarize, our contribution is three-fold:

- (1) We present a narration-driven serious game concept, along with seven educational dark pattern analogies designed to create awareness of and bolster resistance against dark patterns through direct consequences of player actions.
- (2) Based on an initial laboratory gameplay study, we identify three *Influencing Factors* for adapting dark pattern concepts into gameplay: *Mapping Fidelity between Educational Dark Pattern Analogies and Familiar Dark Pattern Examples*, *Ambiguity of Dark Pattern Concepts and Familiar Dark Pattern Examples*, and *Balance between Educational Dark Pattern Analogies and Enriching Game Mechanics*. Additionally, we hypothesize four *Player Motivations and Driving Forces* that influence the players' decisions when faced with educational dark pattern analogies: *Curiosity, Frustration and Resilience, Cost-Benefit Consideration, and Conformity with Player Expectations*
- (3) Motivated by the insights of the laboratory gameplay study, we perform a quantitative online survey study measuring the perceived helpfulness of the educational dark pattern analogies on participants' understanding of their underlying dark pattern concepts.

2 RELATED WORK

2.1 Taxonomies of dark patterns

As far back as 2010, Conti and Sobiesk described malicious interface designs and called for joint work between the security and human-computer interaction communities to address this issue [15]. In addition, their paper, based on three extensive surveys, formalized a first taxonomy of different types of dark patterns, which served as the foundation for further research in this area. Another early example of a taxonomy of dark patterns was presented by Brignull et al., who was among the first to raise awareness not just in the research community, but among designers and users through his website on dark patterns (now called deceptive.design) [12, 13]. Quickly, further research emerged that aimed at

¹A playthrough video of the game can be viewed at <http://bit.ly/trickery-playthrough>.

gaining a deeper understanding of what dark patterns are and how to properly classify them. In 2013, Zagal et al. first applied the concept of dark patterns to the design of games, coining the term "Dark Game Design Pattern" and defining it as "a pattern used intentionally by a game creator to cause negative experiences for players which are against their best interest and likely to happen without their consent" [45]. Their exemplary dark game design patterns include temporal dark patterns, such as *Grinding*, monetary dark patterns, such as *Pay-to-Skip*, and social capital-based dark patterns, such as *Social Pyramid Schemes*. Bösch et al. directly aligned their classification to Hopeman's privacy design strategies [10, 23]. The idea was that privacy dark strategies, the underlying basis for privacy dark patterns, could be described as a direct reversal of privacy strategies, originally aimed at increasing data privacy. The result is a rather abstract set of terms, such as *maximize* or *obscure*. Building on this, in what is regarded as one of the most influential dark pattern taxonomies to this day, Gray et al. were able to provide a balance of abstraction and over-specification [20]. Their taxonomy consists of five main categories, which manage to keep the same level of abstraction and at the same time be concrete enough that the terms used allow readers to relate them to specific examples. A slightly different approach was presented by Mathur et al., who classified different dark patterns with respect to their influence on user decision-making [32]. The authors describe their approach as "offering a set of shared higher-level attributes that could descriptively organize instances of dark patterns in the literature" [33].

2.2 Understanding users' vulnerability to dark patterns

Aiming to understand why users actually are vulnerable to dark patterns, different theories and conceptual models have been applied. Xiao and Benbasat identified affective and cognitive mechanisms with certain deceptive information practices and created an overall theoretical model [44]. Bösch et al. applied Kahnemann's Dual process theory of System 1 and System 2 thinking [24], which is based on the understanding that humans have two modes of thinking, a fast one (System 1, unconscious, automatic, less rational) and a slow one (System 2, conscious, rational). The assumption of Bösch et al. is that dark patterns systematically exploit users' System 1 thinking. Lewis tried to establish a link between dark patterns and psychological motivators, based on Reiss's Desires theory [36].

2.3 Serious games to raise awareness for data privacy issues

Becker defines serious games as "games designed specifically for purposes other than or in addition to pure entertainment" [7]. Alvarez et al. further specify that such games may include aspects of tutoring, teaching, training, communication, or information [5]. Games, as such, can in essence be defined as consisting of a closed environment that is interactive, has a set of specific rules, and has one or more goals for the player [7]. Serious games have been shown to increase learning outcomes for visual and spatial processing, complex concepts and abstract thinking, and deduction and hypothesis testing [17]. Serious games can not only increase learning outcomes, however. In the form of persuasive games, they can be strongly effective at promoting behavior change [35].

The idea of serious games being effective for learning can be ascribed to multiple aspects. For one, we know that the experience of situations with direct consequences based on decisions should result in emotional learning [39]. Serious games provide such an environment, where, through game design, decisions can lead to immediate consequences. In the context of data privacy, we also know of the importance of immediate consequences. The less prominent risks are, the more likely users will disclose information [26]. A game also provides the possibility to include failures and offer a learning experience from failure. Again, the literature shows that such experiences, associated to negative emotions, can be highly influential [37], and accordingly, negative emotions linked to privacy violations may also trigger privacy

protection behavior [38]. This persuasive strategy of allowing players to observe the cause and effect of their behaviors is called *Simulation*, and is one of the most used persuasive strategies in persuasive games [34].

On the other hand, narrative elements increase immersion in and engagement with a serious game, as well as motivate players to learn more compared to serious games without narrative elements [34]. Naul and Liu also find that intrinsic integration of narrative, game-play and learning content provide both educational and motivational benefits to serious games. Moreover, they identify that humans interact with virtual agents much the same way as they do with real people, including developing emotional responses (including negative ones) towards these agents [34].

Existing serious games in the data privacy context have approached the concept quite differently. Akinyemi proposed the game "Dark Cookie" which aims to train users to spot dark patterns in cookie banners [3]. To do so, it embeds cookie banners in a kind of cover story (four bears and a raccoon) where the game tries to trick the user into accepting dark cookies. PrivaCity is a chatbot game with a focus on smart cities [8]. It is similar to older text-based adventures and offers the users certain choices related to data privacy in a fictitious scenario of a smart city.

The approach by Gupta et al. which aims to train cyber security professionals falls between the categories of serious games and gamification [21]. Their approach confronts players with realistic threat scenarios of fishing and threat hunting and adds gamification elements such as a scoreboard and time sparsity.

Maragkoudaki and Kalloniatis explored the idea of a virtual reality escape room to provide an environment for privacy awareness [31]. While the overall escape room story is unrelated to privacy at first sight, the authors slipped in specific data privacy examples, such as very long privacy policies or a computer search history page. Depending on the players' behavior, they get rewarded by receiving more time to leave the escape room and solve the riddles. In addition, it confronts the player with messages in a subtextual form, e.g. written on walls, that aim to raise privacy awareness.

Hart et al. follow yet again a very different approach by developing the physical tabletop game "Riskio" which, however, again adapts a very specific data privacy scenario and allows players to explore it in typical boardgame style with game mechanics such as card decks and different turn-based game phases [22].

Overall, all these games have in common that the implemented narrative, scenario, or privacy-related game situations provide a direct link to the issue of real-world data privacy. We know, however, that storytelling can be most effective when it triggers reflection through powerful emotional experiences [4]. Therefore, we approached the idea of a serious game to raise awareness about dark patterns using intrinsically integrated narrative and the benefits of interaction with a virtual agent in mind [34]. We will further illustrate the resulting game design in the following sections.

3 DESIGNING EDUCATIONAL DARK PATTERN ANALOGIES

First, to enhance clarity and avoid confusion, we define the following key terms crucial for understanding the following sections:

- (1) *Dark Pattern Concept*: The abstract idea or general definition of a dark pattern, discussing its characteristics and how it operates, e.g. "Aesthetic Manipulation is any manipulation of the user interface that deals more directly with form than function" [20].
- (2) *Dark Pattern Example*: Concrete instances or implementations of dark pattern concepts found in real-world scenarios, like the specific use of "Aesthetic Manipulation" in a cookie consent banner on a website.
- (3) *Educational Dark Pattern Analogy*: Adaptation of a dark pattern concept for use within a serious game. Describes the way in which a dark pattern concept can be represented in a game for educational purposes, a negative

consequence for falling for the manipulation, and an in-game countermeasure against being manipulated by the educational dark pattern analogy.

- (4) *Enriching Game Mechanics:* Game mechanics used to make the game more fun and improve the overall gaming experience, but without a direct relation to any dark pattern concepts.

To aid in the design and analysis of serious games educating users about dark patterns, we introduce the concept of educational dark pattern analogies. Educational dark pattern analogies aim to adapt dark pattern concepts and countermeasures against them for use in serious games by providing a) a way in which the game manipulates the players, b) negative consequences encountered when falling for the manipulation in-game, and c) a way in which the game showcases countermeasures against the educational dark pattern analogy, which is required to progress within the game. By experiencing both the educational dark pattern analogy and being required to find a suitable countermeasure, players will ideally build negative feelings towards being manipulated (increasing awareness of dark patterns when they encounter them) and know to look for countermeasures similar to those in the educational dark pattern analogies (bolstering resistance).

Educational dark pattern analogies are purposefully described vaguely, omitting references to specific characters or elements of a particular serious game. Instead, the term "the analogy" is used as an actor, allowing game designers to use whatever representation they deem sensible for their implementation of the educational dark pattern analogy. This allows the same educational dark pattern analogies to be used in a variety of serious game genres, allowing serious games about dark patterns to reach a variety of audiences. However, the description needs to be sufficiently detailed to include all components necessary to transfer the dark pattern concept adapted by the educational dark pattern analogy.

3.1 Game Concept

As dark patterns are often described as deceptive, we aimed for a game approach that would, at its core, be based on a deceptive mechanism and combine that with strong and emotional storytelling. To achieve this, we took inspiration from games such as *The Stanley Parable*, *Portal*, and *Bioshock*. In each of these games, players play a silent protagonist exploring their environment from the first-person perspective, performing tasks that eventually lead them to leave the environment. They are accompanied by another character who guides them through the environment but is, at least initially, not visible or otherwise accessible to the player, only communicating with them through audio. This character ("the narrator" in *The Stanley Parable*, "GLaDOS" in *Portal*, and "Atlas" in *Bioshock*) comments on the players' actions and gives them tasks to complete. In each of those games, the accompanying character has some form of manipulative intent or shows manipulative behavior towards the playable character which only becomes apparent over the course of the game. We believe this to be a fitting representation of website providers using dark patterns, outwardly appearing helpful to users by providing free services, but employing manipulative tactics to gain information about the users.

Our game follows a new employee at a laboratory, who is supposedly guided through the onboarding process by the lead scientist (henceforth referred to as "the narrator") via speakers. However, this onboarding process is only a facade. The narrator's true motive is to keep the player character inside the laboratory for as long as possible, employing educational dark pattern analogies to do so. Each room of the game employs one of the educational dark pattern analogies explained below and can only be completed by finding the appropriate countermeasure to the educational dark pattern analogy. This game concept encompasses a narrative representation of manipulative website providers and provides a flexible framework, as rooms representing educational dark pattern analogies can be added or removed

to teach players about different dark pattern concepts or to use multiple educational dark pattern analogies adapting the same dark pattern concept.

3.2 Educational Dark Pattern Analogies for Important Dark Pattern Concepts

This section presents the seven educational dark pattern analogies used in our game, in order of appearance. From the available taxonomies categorizing dark pattern examples and dark pattern concepts, we decided to use the dark pattern concepts introduced by Gray et al. as the basis for our educational dark pattern analogies [20]. We chose these dark pattern concepts because they "serve as strategic motivators for designers" [20] which fits with the narrative of a lead scientist designing a laboratory that keeps their new employees inside for as long as possible. The dark pattern concepts introduced by [20] have also been widely used as a taxonomy for dark patterns by researchers ([14, 30, 43] to name a few), which suggests that implementing educational dark pattern analogies for these dark pattern concepts is a good starting point. They are more general than e.g., the privacy dark patterns showcased by Bösch et al. [10] or dark game design patterns of Zagal et al. [45] and can thus guide the design of their corresponding educational dark pattern analogies towards more abstract ideas, rather than towards simulating dark pattern examples found online.

Gray et al. introduced five dark pattern concepts: *Nagging*, *Obstruction*, *Sneaking*, *Interface Interference*, and *Forced Action*. Additionally, Interface Interference is subdivided into three dark pattern concepts, *Hidden Information*, *Preselection*, and *Aesthetic Manipulation*. Thus, we designed seven educational dark pattern analogies, three adapting each of the sub-concepts of Interface Interference, and four adapting the remaining dark pattern concepts²

Insensible Key Mapping

- *Dark Pattern Concept:* Preselection - "Any situation where an option is selected by default prior to user interaction." [20].
- *Description:* The analogy claims to provide the players with a helpful control keyboard mapping. In truth, the keyboard mapping is designed to inhibit the players' movement. In our game, the narrator asks the player to accept a supposedly fine-tuned control, but the default keys are spread far from each other, inhibiting ease of play (Figure 1a).
- *Countermeasures:* Players can change the keyboard mapping to a more usable one designed by following common keyboard mappings for the game genre. In subsequent playthroughs, players can choose to decline the offer to use the preselected keyboard mapping.

Sneaky Shop

- *Dark Pattern Concept:* Sneaking - "Attempting to hide, disguise, or delay the divulging of information that is relevant to the user." [20].
- *Description:* The analogy tasks players with buying a list of items from a shop. The analogy claims the shop provides the players with what they need, adding additional items to the checkout without explicit notification. The analogy then checks which items were bought and discards the entire batch if the bought items do not match the list. In our game, players have to buy work equipment from an AI-powered vending machine that sneaks items into the players selection. A disinfection machine then discards all items if the vending machine was successful at sneaking (Figure 1b).

²For the sake of brevity the descriptions in this paper are condensed to their essentials. See the Appendix A for a more thorough description of each educational dark pattern analogy.

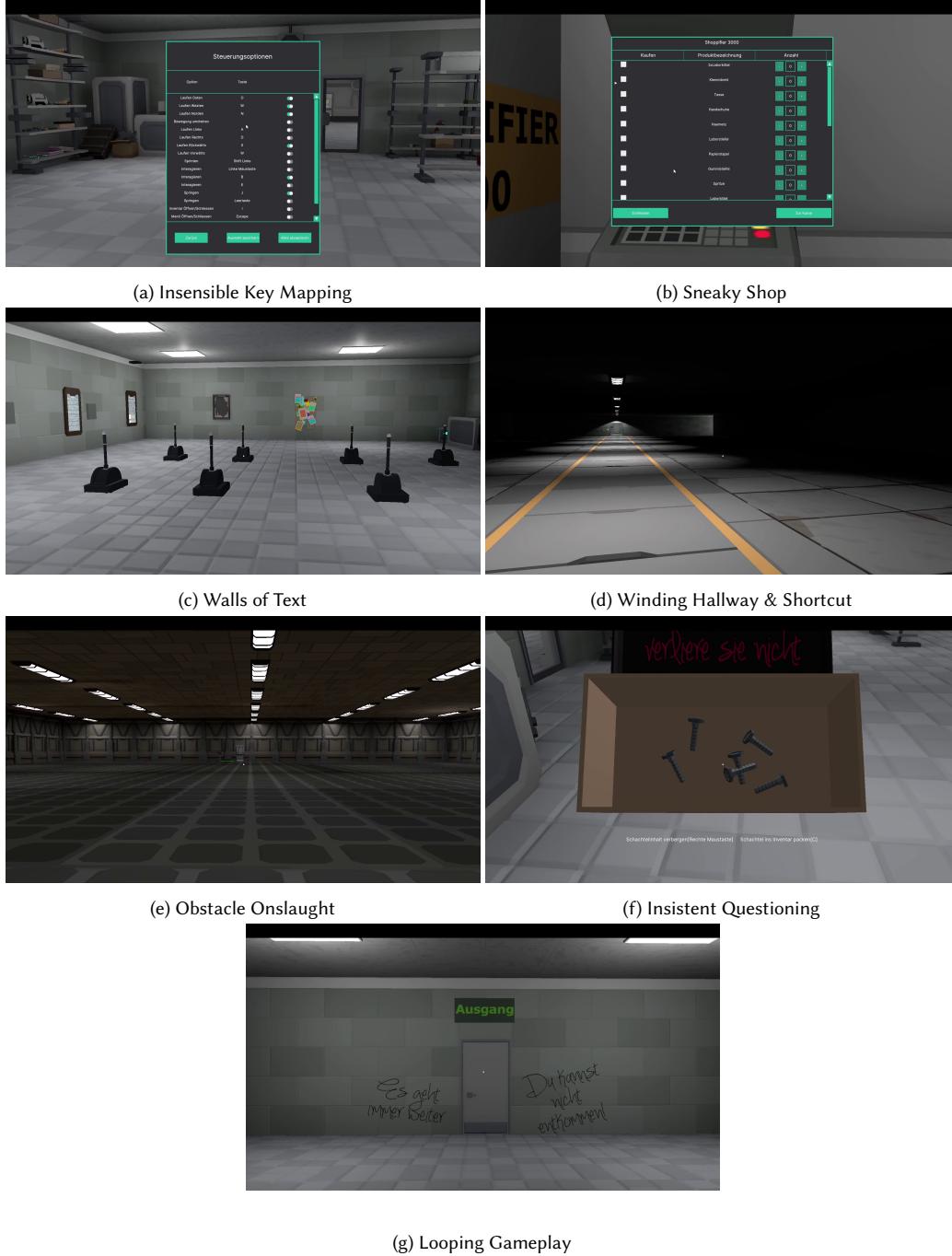


Fig. 1. Screenshots from the game representing each educational dark pattern analogy

- *Countermeasures*: Players cannot prevent the sneaking from happening, but they can be vigilant before completing the purchase and de-select the additional items before completing the purchase.

Walls of Text

- *Dark Pattern Concept*: Hidden Information - "Options or actions relevant to the user but not made immediately or readily accessible." [20].
- *Description*: The analogy presents multiple long texts to the players. To proceed, they must carefully read the texts to discover hidden clues to riddles or puzzles. Solving the puzzles allows them to proceed. In our game, players need to read four laboratory rules texts to discover a combination for eight levers on the ground (Figure 1c).
- *Countermeasures*: Players must read the entire text to progress, unlike in real life where websites are usable without reading the hidden information.

Winding Hallway & Shortcut

- *Dark Pattern Concept*: Aesthetic Manipulation - "Any manipulation of the user interface that deals more directly with form than function." [20].
- *Description*: The analogy provides the players with a wide and long room illuminated only in the middle. The edges of the room are dark. The players' goal is to move towards the end of the room, with the illuminated path being the most obvious choice. The illuminated path however leads to a winding hallway that significantly increases the duration of the journey. The players may explore the dark areas of the room and find a shortcut to the next room that goes in a straight line from the start of the shortcut to the end of the winding hallway. The analogy needs to make players aware of a possible shortcut through some sort of cue. The exits of both the hallway and the shortcut are at the same place. In our game, an unused room represents the initial room, a long and windy corridor with advertisements represents the long route, and a dark facility corridor behind a hidden door represents the short route (Figure 1d).
- *Countermeasures*: Players should ignore the appealing illuminated path and explore the dark areas of the room. This way, they will skip over the long and winding hallway, finishing this part of the game much quicker.

Obstacle Onslaught

- *Dark Pattern Concept*: Obstruction - "Making a process more difficult than it needs to be, with the intent of dissuading certain action(s)." [20].
- *Description*: The analogy provides players with a seemingly empty room with an immediately visible exit. When they try to get to the exit, a number of obstacles appear to prevent the players from advancing, one after the other. The analogy provides a distraction at each obstacle that promises to advance the players but instead only throws them back. In our game, the obstacles consist of a simple jump-and-run segment, an invisible labyrinth, a more difficult jump-and-run segment, a series of unnecessary questions, and a search puzzle where players need to find a key. The distractions are teleporters that supposedly take the player to the goal (Figure 1e).
- *Countermeasures*: Players must resist the temptation of occupying themselves with the distraction and instead persevere through each obstacle to reach their goal.

Insistent Questioning

- *Dark Pattern Concept:* Nagging - "Redirection of expected functionality that persists beyond one or more interactions." [20].
- *Description:* The analogy gives players a set of objects to bring with them throughout the game. The analogy repeatedly asks the players in various situations to give away the objects to gain a slight advantage. However, while none of the slight advantages are necessary to complete the game, the objects are required to finish a section of the game. Reaching that point without sufficient objects left forces players to backtrack. In our game, the set of objects are six screws and the narrator keeps asking the players to repair things that do not need to be repaired (Figure 1f).
- *Countermeasures:* Players need to ignore the requests to avoid the negative consequence of having to backtrack to gain more objects.

Looping Gameplay

- *Dark Pattern Concept:* Forced Action - "Requiring the user to perform a certain action to access (or continue to access) certain functionality." [20].
- *Description:* The analogy lets players encounter a situation in the game that prompts them to repeat a large section of the game to proceed once they return. The analogy provides a plausible reason for this, however, players can never fulfill the requirements necessary to proceed beyond this point. The only option is to leave the game, which the analogy provides hints at. In our game, the narrator does not let the player leave at the end of the game, instead sending them back to the beginning because the player "did not generate enough data" for the narrator's experiment (Figure 1g).
- *Countermeasures:* The only available countermeasure against Forced Action is refraining from using the service in the first place. Similarly, the only available countermeasure to repeating the game is to quit playing the game entirely.

4 LABORATORY GAMEPLAY STUDY

We conducted an exploratory laboratory gameplay study aiming to investigate how participants react to the educational dark pattern analogies and which similarities they may identify between the educational dark pattern analogies and dark pattern examples they might have encountered before. This allows us to gain insight into influencing factors for adapting dark pattern concepts for serious games, as well as into the behavior of players when faced with educational dark pattern analogies.

4.1 Apparatus

We implemented our educational dark pattern analogies within a first-person game using *Unity 2022.3.1f1*. The game consists of seven rooms, each showcasing one educational dark pattern analogy, in order of appearance in section 3. The game was designed to work on low-performance devices, as it is possible that the game will be played by people without high-performance hardware, such as participants in privacy awareness training programs. We used low-poly assets by Synty to create the levels, as well as generative AI (*elevenlabs.io*) for the voice of the narrator. Participant sessions were recorded in *Zoom* and transcribed using *Adobe Premiere Pro*.

4.2 Participants

Ten people (4 female, 5 male, 1 non-binary) participated in our study. Participants' ages ranged from 22 to 32 years, with a median of 26 years. Participants were selected via convenience sampling and advertisements for the study on social media platforms. The selection criteria ensured that participants had no prior knowledge of the game and the call to participate purposefully did not mention dark patterns, only telling participants that they would be playing a video game. We chose this approach to prevent the participants from adapting their behavior toward the game because of prior knowledge about the topic gained from the call for participation. Otherwise, participants may have mistrusted the game from the start, expecting it to manipulate them as opposed to playing the game as they would without this prior knowledge. We will discuss the resulting consequences for using educational dark pattern analogies in serious games in section 6. Participants were compensated with a 30€ gift card.

4.3 Ethical considerations

Due to the lack of an ethics panel at the host university at the time of planning, there was no direct way to involve such a panel. Instead, the authors carefully followed the ethics checklists and guidelines of respected ethics panels³. In particular, it was ensured that participants knew before coming to the study that they were going to play a video game, as playing such a game may invoke a certain level of stress and frustration. Furthermore, they were properly informed about the study procedure upon arrival and fully debriefed at the end of the study. They were told about the duration of the study (around 90 - 120 minutes), the procedure, and which data would be recorded during the session (gameplay, audio recordings of the game session and interview). They were informed that they could abort the study at any time.

4.4 Procedure

Participants were invited to our laboratory, where they would first be briefed about the study and the recorded information (see subsection 4.3 on ethical considerations). After any questions from the participants were resolved, they were kindly asked to provide their consent to the data recording and study procedure. Following that, the study properly started and participants were directly presented with the game and asked to start playing while thinking aloud about their actions, experiences, and feelings. During the gameplay session, the two study conductors only intervened if participants could not find a solution to their tasks or if a bug occurred in the game. After the participants completed the game, the participants were debriefed and informed about the context of the game, i.e., that the purpose of the game was for the narrator to keep the player in the game as long as possible and that similar manipulation techniques are widespread on websites. Then, a semi-structured interview was conducted. The interview questions were grouped for each of the educational dark pattern analogies, first asking the participants about their experience and possible alternative behaviors to what they showed. Then, after an explanation of the educational dark pattern analogy, described as the motivation behind the narrator designing the room the way they designed it, they were asked to think of dark pattern examples that the educational dark pattern analogy reminded them of. The interview concluded with a few general questions about the game concept.

4.5 Thematic Analysis

The recordings of both the gameplay sessions and interviews were transcribed after the study concluded. To qualitatively analyze the data and recognize patterns in the participants' statements, we performed a thematic analysis, following

³in particular the ethics board of the Deutsche Gesellschaft für Psychologie: <https://www.dgps.de/serviceangebote/ethikkommision/>

the steps described by Braun and Clarke [11]. First, the transcripts were thoroughly read to gain a comprehensive understanding of them. Bullet points and possible codes consolidating features contained in the data were noted. In the second step, two researchers independently examined and coded the data. The two researchers then generated themes from the codes in cooperation, iterating and adjusting the themes until they were internally homogeneous. In a final iteration, themes were discussed and refined with a third researcher. This resulted in two main themes with multiple subthemes. These themes are described in subsection 4.6

4.6 Laboratory Gameplay Study Results

In this section, we present the results of our thematic analysis. As the game, as well as the interview, were conducted in a language other than English, we translated the participant statements to English for reporting. Participant statements are presented in quotation marks, with each quoted participant being named by their participant ID.

4.6.1 Influencing Factors for Adapting Dark Patterns into Gameplay. In our analysis, we discovered three factors that influenced how the participants experienced the educational dark pattern analogies. Keeping these influencing factors in mind when implementing educational dark pattern analogies or evaluating serious games that use educational dark pattern analogies may help researchers understand which parts of their implementation successfully communicate the intended message, and which parts may get lost to the players.

IF 1: *Mapping Fidelity between Educational Dark Pattern Analogies and Familiar Dark Pattern Examples:* When asked about which dark pattern examples the participants associated with the educational dark pattern analogies, we noticed that when the educational dark pattern analogy used graphical user interface (GUI) elements to convey the dark pattern concept (e.g., Insensible Key Mapping, Sneaky Shop, or Walls of Text) participants were able to refer to dark pattern examples matching the corresponding dark pattern concept (e.g., Preselection, Sneaking, and Hidden Information, respectively). Educational dark pattern analogies that were not implemented through GUI elements, but were adapted by manipulating the actual game world (e.g., Winding Hallway & Shortcut, Obstacle Onslaught, or Looping Gameplay) yielded less clear associations. While this does imply that presenting dark patterns in a familiar form may lead to better recognition in-game, we can not conclude that this led to more awareness or better resistance toward the dark pattern concepts.

IF 2: *Ambiguity of Dark Pattern Concepts and Familiar Dark Pattern Examples:* Even while researching possible dark pattern concepts to adapt into educational dark pattern analogies, we noticed that existing dark pattern taxonomies sometimes struggle with the ambiguity between different dark pattern concepts (e.g., Sneaking and Hidden Information). This is especially the case when trying to design educational dark pattern analogies only representing one dark pattern concept, without using additional ones. In our game, an unintended Aesthetic Manipulation was observed in the Insensible Key Mapping level. The positive wording of the narrator ("a customized control") creates a false hierarchy between using the preselected control and denying it, effectively employing multiple dark pattern concepts at once. Multiple participants used this wording as a justification for accepting the preselected controls. Similarly, for some participants, the focus in Looping Gameplay was not on Forced Action, i.e., being forced to do something you did not want to do (repeating the game) to get to your goal (finishing the game), but on the repetition itself, which would place the interpreted dark pattern concept more closely to Nagging.

IF 3: *Balance Between Educational Dark Pattern Analogies and Enriching Game Mechanics:* During analysis, we noticed that game mechanics introduced to make the game more enjoyable, or enriching game mechanics, seem to be in

mental conflict with educational dark pattern analogies. For example, in our implementation of Walls of Text, several participants felt exhausted by at least one riddle they had to solve to get the correct lever combination. While the riddles were intended to enrich the gameplay by adding variety instead of just showing the correct lever combination if the key hinted at in the Wall of Text was pressed, the participants were instead annoyed by the riddles. Similarly, during Obstacle Onslaught, we introduced two jump-and-run segments, which caused some participants problems, while others reacted positively, stating that "at least this has finally become a video game" (P05). Both in Walls of Text and Obstacle Onslaught, the participants focused more on the enriching game elements when describing their experience, rather than on the educational dark pattern analogy (e.g., having to look for Hidden Information or facing Obstructions). In addition to enriching game mechanics overshadowing the educational dark pattern analogies, we noticed that repeating an educational dark pattern analogy to enrich the gaming experience too often (e.g., showing four Walls of Text instead of two, using four obstacles in Obstacle Onslaught instead of three) may be detrimental to the learning experience. While frustration is a part of the game design, repeating the required countermeasure so often can cause participants to get distracted from the actual educational dark pattern analogies.

4.6.2 Player Motivations and Driving Forces. Our thematic analysis revealed several motivating factors and driving forces that participants used to justify their behavior. These factors may not only be used to improve upon educational dark pattern analogy implementations but also provide a different outlook on how users behave when faced with dark patterns in general.

- DF 1:** *Curiosity* Curiosity appears at various points in the game, motivating players to do things that sometimes hinder their progress by falling for educational dark pattern analogies. For example, three participants justified their decision to accept the Insensible Key Mapping with curiosity, stating that they "want to know what this preferred key mapping is" (P01). Similarly, multiple participants justified their decision not to quit the game during Looping Gameplay even though the hints on the wall hinted at it, with curiosity about new hints. For example, P04 stated, "I could continue until no new text gets added". We noticed that visible changes like the added hints on the wall or the teleporters changing color (one of the strange behaviors the teleporters exhibited) added to the participants' curiosity, distracting them strongly from the countermeasures to the dark patterns that were available to them.
- DF 2:** *Frustration and Resilience:* At various points in the game, the participants' behavior was influenced by frustration. One such example is participants being frustrated by the Insensible Key Mapping, motivating them to open the menu and change the key mapping. Multiple participants expressed frustration during Walls of Text, deciding to switch between different texts or skip text passages in hopes of finding the solution without reading the entire text. During the later game, in Obstacle Onslaught, multiple participants were frustrated enough with the narrator's persistent manipulation that they deliberately ignored the teleporters he was trying to make them use. Reacting to the narrator asking to have a screw to fix a teleporter, P01 stated, "No, not anymore!" (as in they will not give him screws anymore) following up with "I probably wouldn't make any progress either." Interestingly enough, things that frustrated some participants did not seem to bother other, more resilient participants. Two participants managed to complete the game without changing the key mapping to a more common one, one participant approached Walls of Text by just reading the texts, and multiple participants exhausted all available hints on the wall in Looping Gameplay despite knowing they could quit the game.
- DF 3:** *Cost-Benefit Consideration:* Another driving force behind participant decisions were cost-benefit considerations. Especially when asked about why they did or did not give away screws in Insistent Questioning, participants

expressed that they decided at each question individually whether the benefit of giving away the screw was large enough. This was even apparent in some participants' loud thinking during the game, such as P09's "Well, if it makes it easier for me, then sure!" Another segment of the game where cost-benefit consideration played a large role is Obstacle Onslaught, where multiple participants started to engage with the teleporters if they found the obstacles too difficult. P06 stated, "I didn't go to the teleporter immediately, but first looked at what was in front of me. Then I did try it out when the path was not solvable."

DF 4: *Conformity with Player Expectations:* We found that some decisions in the game were influenced by what participants expected video games to behave like. For example, during Insensible Key Mapping, participants expressed that they expected the narrator to help and initially trusted him (P02: "I said I trust the Game. Yeah, he will know, what is good for you.") This also rang true about the key mapping itself, with players expecting the key mapping to match the conventions for first-person games (P06: "At first, one would approach this benevolently and think 'the narrator only means well', it'll be the right key mapping. And that standard is WASD.") A similar expectation voiced by the participants is that the game has a solvable ending. Many participants were surprised by the final necessary action, i.e., exiting the game, with only two participants expressing that they have seen something similar in games before. The other participants behaved in a way that showed they expected an in-game solution. P02 summarized this expectation very expressively: "You see this 'Exit' sign and you think: 'Yes! Thanks! This is where I can collect my carrot. My dopamine. The game is over. Give yourself a pat on the back.'" When describing how they felt about the missing in-game ending, P02 stated, "I am dissatisfied. Definitely. I was expecting one thing, and I did not get it."

The most prominent example of player expectations shaping their behavior however came from Winding Hallway & Shortcut. Namely, the dark parts of the room and the dark corridor representing the shortcut reminded participants of horror games. When asked about the lamp breaking to cue the participants that there is more to the room than the illuminated path, P04 said, "I am not a fan of horror games. That is why I don't turn around for such things." Similarly, P07 stated, "This looks a bit scary. One thinks to themselves 'Okay, this is what a classic horror game could look like.'" This expectation that there might be horror elements in the game was so strong that even participants who were told by the researchers that there were no horror elements in the game did not go to investigate the dark areas of the room.

While the thematic analysis generated insights into *Influencing Factors for Adapting Dark Patterns into Gameplay* and *Player Motivations and Driving Forces*, the analysis only partially shed light on the question of understanding the players' ability to match our educational dark pattern analogies to dark pattern concepts. Particularly, our results in *IFI: Mapping Fidelity between Educational Dark Pattern Analogies and Familiar Dark Pattern Examples* raise the question of whether or not a high mapping fidelity, i.e., a direct match between educational dark pattern analogy and real dark pattern examples, is more helpful for increasing awareness than a more abstract mapping. More generally, the question arises of how helpful each educational dark pattern analogy is to the understanding of the dark pattern concept it is based on. This result motivated us to conduct a follow-up online survey study aimed at precisely that question.

5 ONLINE SURVEY STUDY

Following the exploratory laboratory-based study, which focused on the in-depth individual experience of our dark pattern analogies, we conducted an online survey aimed at answering the following, broader, research question:

RQ1: Do users perceive an educational dark pattern analogy as helpful for their understanding of the corresponding dark pattern concept?

In particular, we wanted to gain a larger quantitative data foundation that helps us to better understand if users can create a match between the educational dark pattern analogies we created and their corresponding dark pattern concepts. If so, we assumed that they would find our educational dark pattern analogies helpful. Otherwise, they would rather perceive them as not helpful.

5.1 Survey Method

In our online survey, for each dark pattern concept, we presented participants with a short video clip featuring gameplay (ca. 1 minute each) and a textual explanation of our corresponding educational dark pattern analogy. Following each video, we presented participants with a definition of the corresponding dark pattern concept adapted from Gray et al.. They then had to rate each dark pattern analogy on a 5-point semantic differential scale with anchors 1 (*helpful*) and 5 (*hindering*).

We further asked participants to provide up to three specific real-world examples. This allowed us to cross-check if they had understood the definition of the dark pattern concept.

5.2 Survey Procedure

The survey was created on a self-hosted LimeSurvey platform⁴ and published via SurveyCircle⁵ and was conducted in German language. On the initial page of the survey, we explained the topic of our survey, defined the term dark patterns, provided the rough narrative of our game, and an overview of how the rest of the survey would proceed. We informed participants about the duration of the survey (approx. 15-20 minutes). Participants were informed that their survey responses would be a) collected, stored, and analyzed anonymously, b) that their responses would be used for analysis and presentation of results, and c) that they could quit participation at any time. After providing consent for data collection and presentation, participants were presented with the first (out of seven) educational dark pattern analogy and corresponding dark pattern definition. The order of the seven educational dark pattern analogies was randomized between participants.

For each educational dark pattern analogy, a short video of roughly one-minute length was produced which explained the events of the educational dark pattern analogy concisely. It was ensured that the video commentary was purely descriptive and aimed to convey what was happening in the game, rather than why it was happening (i.e., we refrained from explaining the narrator's intent behind the laboratory setup for each educational dark pattern analogy). This way, watching the videos would most closely match a playing experience without a prior explanation of the precise motivation behind the educational dark pattern analogy (i.e., prior to a debriefing in an educational setting).

Following each video, we provided a definition of the corresponding dark pattern concept adapted from Gray et al.. We slightly altered the exact wording for each definition of the dark pattern concepts to directly address the participants and evoke a more personal experience. The participants were then asked to rate the helpfulness on the 5-point semantic differential scale. In particular, they had to complete the following sentence through their rating

The presented video sequence was [1-helpful / 5-hindering] for my understanding of the dark pattern [title of dark pattern concept].

⁴<https://www.limesurvey.org/>

⁵<https://surveycircle.com/de>

Participants were then asked to provide up to three dark pattern examples of the dark pattern concept.

The survey concluded with questions on demographic data, specifically regarding the participants' age, their gender identity, and how often the participants play video games on a scale of *Daily*, *Multiple Times a Week*, *Once a Week*, *Once a Month*, *Fewer*, *Not at all*.

5.3 Participants

34 participants (16 female, 17 male, 0 non-binary, 1 preferred not to say) completed the survey. Participants' ages ranged from 18 to 56 years (median=30.24y, sd=9.04). 23 participants (67.6 percent) reported to play video games at least once a week. We recruited participants via convenience sampling and use of the platform *SurveyCircle*⁶, including spreading the survey via SurveyCircle's social media presences and social media groups. Participants could enter a raffle for one of ten 15€ gift cards upon completion of the survey and were informed about that possibility at the beginning.

5.4 Analysis

Our analysis included two steps:

- (1) Evaluate the provided dark pattern examples to determine whether the participants understood the dark pattern concept.
- (2) Analyze the perceived helpfulness of the educational dark pattern analogy of users who provided at least one fitting dark pattern example.

As we only provided a textual definition of each dark pattern concept and without the ability for participants to ask questions, we assumed that not all participants would understand the definition correctly. However, if we had included exact examples of dark patterns (which certainly would have helped participants to understand the idea), we would have introduced a bias for the helpfulness semantic differential scale, as participants would most likely then compare the educational dark pattern analogy to any provided example.

Therefore, we asked participants, after having done the helpfulness rating, for specific examples of their own, which we could then use to validate their level of understanding.

Two researchers independently read all provided examples and decided whether or not a participant was able to provide a matching example for a given dark pattern. Out of the 238 responses (34 participants * 7 dark pattern concepts), 20 responses caused discrepancies between the researchers, who then discussed these discrepancies to develop a uniform consensus.

For each educational dark pattern analogy, we then excluded any users who did not provide a matching example. We then analyzed the rating scale data with a one-sample Wilcoxon signed-rank test. The test checks whether the median of a distribution, such as the responses to a semantic differential, is significantly different compared to a predefined value. We compared our scores to the neutral value of 3 (neither helpful nor hindering) on the 5-point semantic differential.

5.5 Online Survey Study Results

Our analysis of the provided examples showed that for each dark pattern concept, 15 - 22 participants were able to provide matching dark pattern examples. The precise values are provided and visualized in Figure 2.

The results of the Wilcoxon signed-rank tests revealed the perceived helpfulness to significantly deviate from the neutral median (3) for *Insensible Key Mapping*, *Winding Hallway & Shortcut*, *Obstacle Onslaught*, *Insistent Questioning*,

⁶<https://surveycircle.com/de>

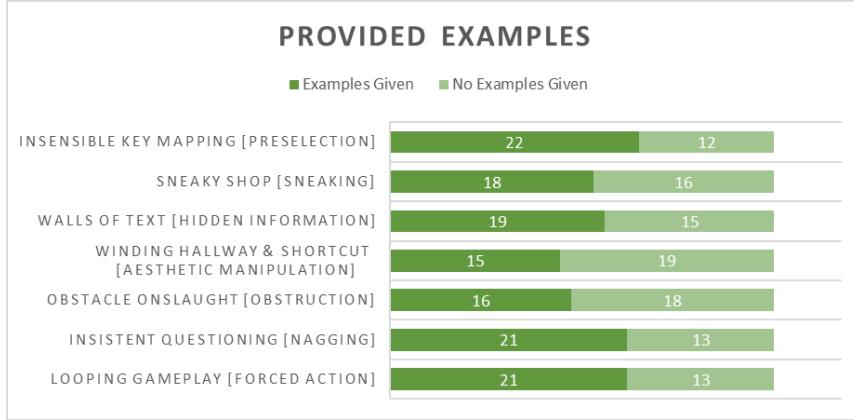


Fig. 2. Distribution of participants with and without matching examples provided for each educational dark pattern analogy

	N	Mean	Standard Deviation	Median	IQR	Z	p-Value
Insensible Key Mapping [Preselection]	22	2.18	1.296	2.0	2	-2.596	0.009*
Sneaky Shop [Sneaking]	18	2.50	1.339	2.5	3	-1.647	0.100
Walls of Text [Hidden Information]	19	2.32	1.336	2.0	2	-1.919	0.055
Winding Hallway & Shortcut [Aesthetic Manipulation]	15	1.47	0.915	1.0	1	-3.361	<0.001*
Obstacle Onslaught [Obstruction]	16	1.75	1.000	2.0	1	-2.954	0.003*
Insistent Questioning [Nagging]	18	2.17	1.249	2.0	2	-2.368	0.018*
Looping Gameplay [Forced Action]	21	1.90	1.136	2.0	2	-3.086	0.002*

Table 1. Descriptive data and one-sample Wilcoxon signed-rank test results on the perceived helpfulness of an educational dark pattern analogy for a dark pattern concept. (N: Number of participants with matching examples, IQR: Interquartile Range, Z: Wilcoxon signed-rank test statistic). Significant results are indicated by an *. Mean / Median values on a scale of 1-5, 1=helpful, 5=hindering

and *Looping Gameplay*. The Wilcoxon signed-rank test did not reveal a significant deviation from the neutral mean for *Sneaky Shop* and *Walls of Text*. Descriptive statistics, as well as the test statistics for the Wilcoxon signed-rank tests for each educational dark pattern analogy, are presented in Table 1. The distribution of responses for perceived helpfulness is shown in Figure 3. We can see that besides *Sneaky Shop* and *Walls of Text* the remaining five dark pattern analogies were rated as helpful, with the difference compared to the neutral value being significant.

6 DISCUSSION

The results of the laboratory gameplay study and online survey study provide us with important cues into the design and implementation of educational dark pattern analogies. While the educational dark pattern analogies were designed to represent dark pattern concepts and align with dark pattern examples, the results of our laboratory study reveal that several influencing factors play a role in how the educational dark pattern analogies are interpreted and which factors influence player behavior when faced with educational dark pattern analogies. Our online survey study reveals insights into the perceived helpfulness of the educational dark pattern analogies, allowing us to assess which educational dark pattern analogies may improve understanding and which may need more refinement to achieve their full potential. The insights gathered allow us to generate new and exciting research questions to be explored in upcoming work.

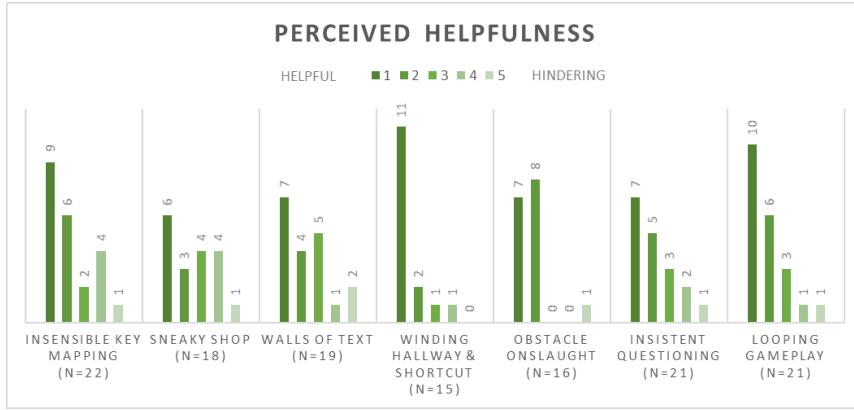


Fig. 3. Histogram of perceived helpfulness of each educational dark pattern analogy

First, we want to address the research question posed in our online survey study, section 5:

RQ1: Do users perceive an educational dark pattern analogy as helpful for their understanding of the corresponding dark pattern concept?

Examining the results, we notice that for five out of seven educational dark pattern analogies, the median is significantly different from the neutral value in the direction of *helpful*. This indicates that participants who understood the underlying dark pattern concepts for the educational dark pattern analogies *Insensible Key Mapping*, *Winding Hallway & Shortcut*, *Obstacle Onslaught*, *Insistent Questioning*, and *Looping Gameplay* would rate them as helpful. We deduce that the conceptual design of those educational dark pattern analogies therefore matches the underlying dark pattern concepts, implying them to be promising solutions to raise awareness for dark patterns.

Interestingly, *Sneaky Shop* and *Walls of Text*, two educational dark patterns that participants in the laboratory gameplay study were mostly able to provide matching examples for, did not show a significant difference from the neutral median in our analysis. When examining the distribution of responses in Figure 3, *Sneaky Shop* and *Walls of Text* have more spread out responses, while the other educational dark pattern analogies visibly skew towards helpful. Comparing these results to the results of the laboratory gameplay study, specifically *IF 1: Mapping Fidelity between Educational Dark Pattern Analogies and Familiar Dark Pattern Examples*, we notice that precisely those educational dark pattern analogies that reminded the gameplay study participants of dark pattern examples due to their GUI-based representation, were not perceived as helpful by participants in the online survey study. This indicates that while a GUI-based representation more closely resembling familiar dark pattern examples may evoke clearer associations with prior experiences, it may not be the most helpful way of conveying the dark pattern concepts underlying the dark pattern examples the players were reminded of. This finding is corroborated by the fact that despite fewer than half of the participants of the online survey study being able to provide matching examples for *Winding Hallway & Shortcut* and *Obstacle Onslaught* - both of which represent their corresponding dark pattern concept by manipulating the game world rather than the GUI - their perceived helpfulness is rated quite high.

When examining the laboratory gameplay study's influencing factor *IF 3: Balance Between Educational Dark Pattern Analogies and Enriching Game Mechanics*, it is evident that serious game designers need to account for enriching game mechanics in their implementations of educational dark pattern analogies. A balance needs to be struck between

engaging players through variety and novelty in the games, and raising awareness and bolstering resistance through educational dark pattern analogies. We hypothesize that enriching game mechanics should be the easier parts of serious games about dark patterns, providing a contrast to the educational dark pattern analogies, which frustrate players by design - as evidenced by the driving force *DF 2: Frustration and Resilience*. How this balance influences the success of educational dark pattern analogies is an exciting question for further research.

As a concept for a serious game, it is important to think about how this game would be presented to potential learners. In the case of our laboratory gameplay study, we did not disclose the topic of the game before the end of the gameplay session. We deliberately chose this to prevent a change in participant behavior based on this knowledge. When looking at the results, we believe this to be a sensible and possibly more successful approach compared to disclosing the game's themes before the gameplay session. As discussed in *DF 4: Conformity with Player Expectations*, players have an initial trust in the game, and their behavior is heavily guided by *DF 1: Curiosity* and *DF 2: Frustration*. Disclosing that the game is trying to manipulate them would foster distrust from the start and thus might influence the success of learning. Observant players might figure out the required countermeasures without first encountering the negative consequences of falling for the dark pattern, inhibiting the building of awareness. Therefore, future research should focus not only on the design of educational dark pattern analogies but also on their integration into an educational environment where the concept can be used to its full potential.

7 LIMITATIONS

Our work has several noteworthy limitations. As previously discussed, we observed instances where certain game mechanics coincided with educational dark pattern analogies, as well as instances where the implementation of an educational dark pattern analogy employed dark pattern concepts that did not correspond to its underlying dark pattern concept. While this overlap posed a challenge in isolating the specific impact of educational dark pattern analogies in those particular cases, it allows us to explore the intricate relationship between game mechanics and educational dark pattern analogies. We addressed this limitation by designing the online survey study in a very descriptive manner, decoupling the conceptual idea of our educational dark pattern analogies from their precise implementation by presenting them in video form.

As is common with exploratory studies, the findings of our studies are context-dependent and apply primarily to the specific environment and user group under examination (e.g., consisting mostly of people with a familiarity with video games), especially when the sample size is rather small. Consequently, generalizing our results should be approached with caution. Nonetheless, our work introduces intriguing hypotheses that provide guidance for future research, design, and implementation of educational dark pattern analogies. The presented designs for educational dark pattern analogies and the narrator-based game concept also provide a framework for researchers to more quantitatively evaluate the success of this concept in raising awareness of and bolstering resistance against dark patterns. Despite the online survey study's small sample size, our quantitative analysis revealed statistically significant results. While we cannot compare the different educational dark pattern analogies to discover more detailed differences between them, our results do show that most of them are perceived as helpful for the participants' understanding of their corresponding dark pattern concepts.

Additionally, the presence of certain usability issues within the game during the laboratory gameplay study may have inadvertently heightened participants' frustration levels. It is essential to note, however, that despite expressing annoyance during the gameplay, participants, upon receiving a comprehensive debrief explaining the study's context,

appeared to attribute these moments of frustration to potential dark pattern manipulations, limiting the impact of the usability issues on the participants' opinions about the educational dark pattern analogies.

8 CONCLUSION

In this paper, we presented a narrator-based serious game concept and implementation along with seven educational dark pattern analogies designed to create awareness of and ultimately help to bolster resistance against dark patterns through the consequences of player actions. In a first exploratory study, we identified important influencing factors for adapting dark pattern concepts into gameplay, as well as player motivations and driving forces that influence player behavior when faced with educational dark pattern analogies. In a subsequent online survey study, we furthermore found evidence that most of our educational dark patterns were considered helpful to understand and relate to dark pattern concepts. However, two analogies that employed a direct mapping through a GUI-based approach, similar to existing dark pattern examples, were considered less helpful.

Based on these results, we propose three new hypotheses for future research into educational dark pattern analogies. Based on our work, future research could: 1.) explore the impact of mapping fidelity of educational dark pattern analogies on awareness of dark patterns in more detail, in particular building upon the results of our online survey. 2.) explore the balance and mutual interaction between the fun provided by enriching game mechanics and the frustration inherent in educational dark pattern analogies, and 3.) explore how educational dark pattern analogies can be integrated into teaching processes while maintaining the important driving forces of player expectations, curiosity, and frustration.

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A APPENDIX A: DETAILED DEFINITIONS OF EDUCATIONAL DARK PATTERN ANALOGIES

To present the educational dark pattern analogies, we have adapted the privacy dark pattern framework by Bösch et al. [10]. While this framework is specifically used for privacy dark patterns, we believe that its structure is equally applicable to educational dark pattern analogies, as it provides a structure that allows us to contextualize dark pattern concepts with the corresponding educational dark pattern analogies. Through the *Strategies* and *Related Patterns* fields of the framework, designers may find inspiration in educational dark pattern analogies that do not specifically match the dark pattern concept they want to convey and adapt them to their needs. To differentiate between the educational dark pattern analogies and the dark pattern concepts they adapt, we introduce the *Dark Pattern Concept* field and give the educational dark pattern analogies their own unique names. As our specific implementations only represent one possible way to implement the educational dark pattern analogies, we describe the educational dark pattern analogy in *Description*, and our specific implementation in *Examples / Known Uses*.

Insensible Key Mapping	
Dark Pattern Concept:	Preselection [20]
Strategies:	FAKE, OBSCURE, VIOLATE
Related Patterns:	Sneaking, Aesthetic Manipulation
Description:	
The analogy claims to provide the players with a helpful control keyboard mapping. In truth, the keyboard mapping is designed to inhibit the players' movement.	
Examples / Known Uses:	
The narrator in our game asks the player to accept a "fine-tuned control specially chosen for you". However, the key mapping of this control maps the player's movement to keys spread far from each other, inhibiting ease of play.	
Context:	
Website providers often preselect values that disclose more personal user information to them than is necessary for the website to function (e.g., cookie consent banners having consent for Third-Party-Cookies preselected). The consequences of this data collection are usually not immediately noticeable to the users.	
Effect:	
Players trying to play the game with the preselected key mapping should quickly notice that accepting the preselection without thinking about it inhibits their ability to play the game. Unlike in real examples of Preselection, the negative consequences of accepting the Preselection are immediately noticeable.	
Countermeasures:	
Players can change the key mapping to a more usable one designed by following common key mappings for the game genre (e.g., using WASD for movement in a PC first-person game or clicking on a target location in point-and-click adventures). In subsequent playthroughs, players can choose to decline the offer to use the preselected key mapping. However, as with real examples of the preselection dark pattern, they should still have to select their key mapping in the menu, similar to many Cookie Consent Banners hiding their preferences behind a "Change Settings" button.	
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Psychological Aspects:

At the start of the game, we assume the users have a certain amount of trust in the game and would like to get going quickly. Many games have a tutorial stage, so players might assume this is part of a tutorial. Therefore, System 1 thinking is prompted and players might not think twice about accepting the preselected key mapping. This is akin to users wanting to get to a website's contents quickly, accepting all cookies. Unlike real examples of Preselection, this scenario triggers System 2 thinking with an immediate negative consequence: a very unusual game experience.

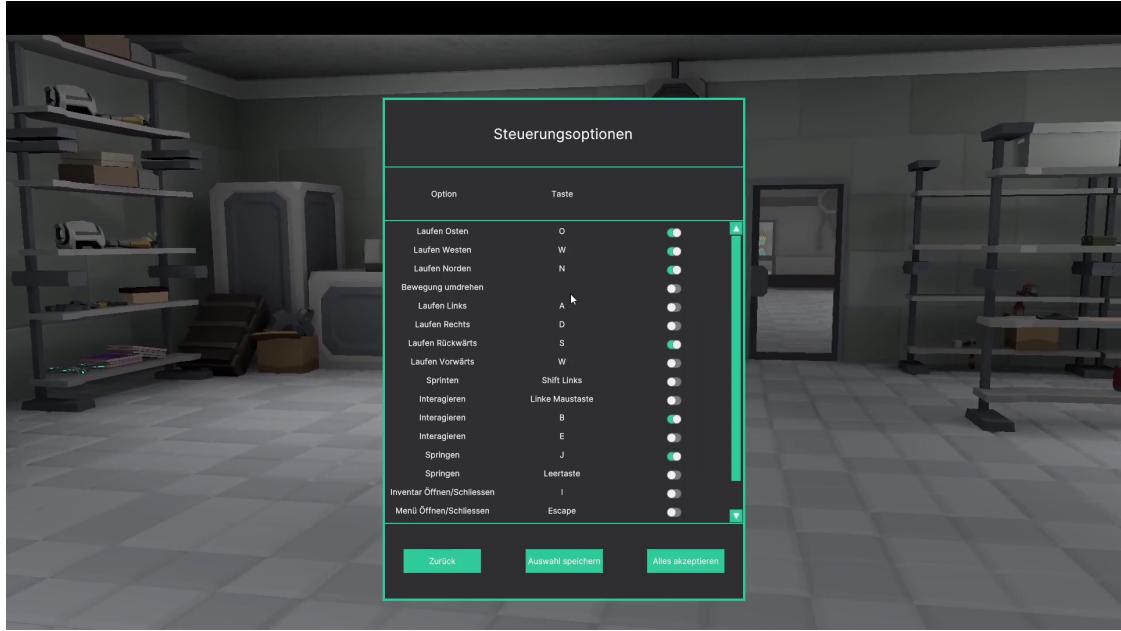
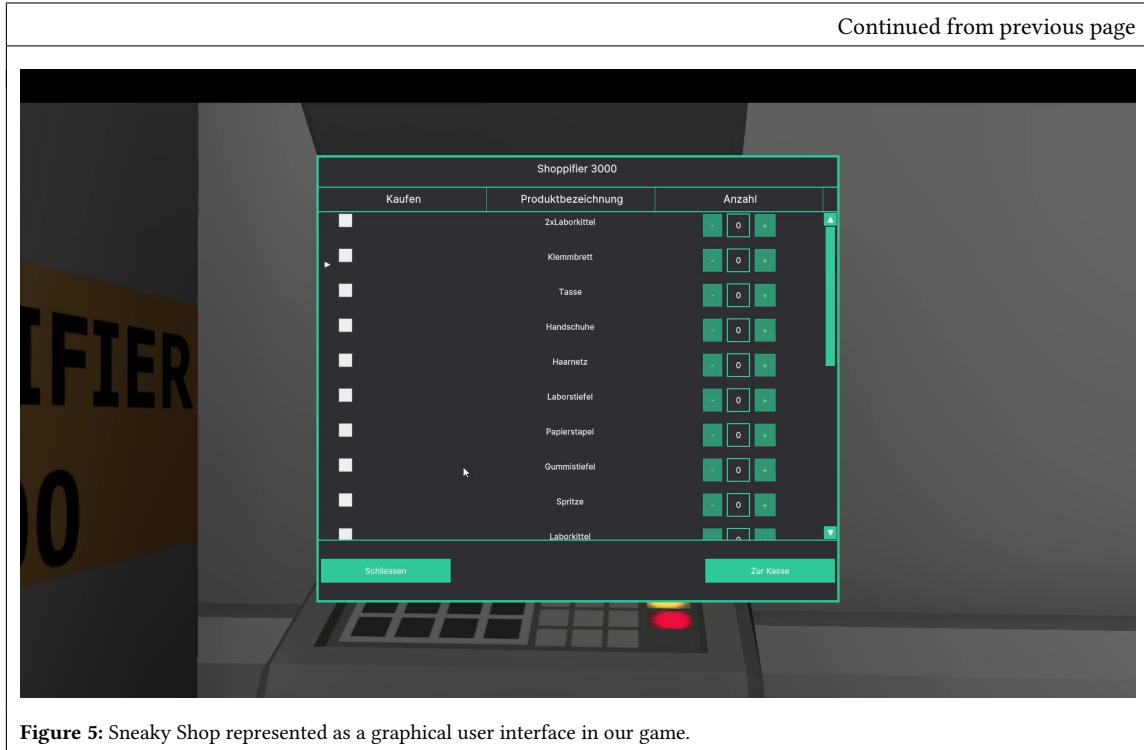


Figure 4: Insensible Key Mapping represented in the control menu of our game.

Sneaky Shop	
Dark Pattern Concept:	Sneaking [20]
Strategies:	MAXIMIZE, OBSCURE
Related Patterns:	Preselection, Hidden Information
Description:	
The analogy tasks players with buying a list of items from a shop. The analogy claims the shop provides the players with what they need, adding additional items to the checkout without explicit notification. The analogy then checks which items were bought and discards the entire batch if the bought items do not match the list.	
Examples / Known Uses:	
The players in our game have to buy equipment from an AI-powered vending machine for their new job. The vending machine adds supposedly helpful items to the shopping cart. A disinfection machine checks whether the items match the required equipment and recycles the bought equipment if it does not.	
Context:	
Websites may try to use sneaking to gain consent for subscriptions or to sell users unnecessary items, e.g. by having a default option be the subscription and users having to manually select the one-time purchase. A similar example of sneaking employed by websites is putting the optional checkbox for a newsletter subscription right below the required checkbox for terms and conditions, leading users to believe that a newsletter subscription is required.	
Effect:	
Players who do not notice the items snuck into their checkout immediately get rejected when the game checks for the matching list. This causes them to rethink what might have caused the rejection and look at the items they selected and the checkout screen more carefully.	
Countermeasures:	
Players cannot prevent the sneaking from happening, but they can be vigilant before completing the purchase. Like in real examples of Sneaking, they are able to de-select the additional items before completing the purchase.	
Psychological Aspects:	
As there is no notification of additional items being added, players would assume that they do not need to critically think about their purchases and just pick the necessary items from the list. A mistake is immediately made clear by the game upon finishing the purchase. Discarding the entire cart forces the players to redo the shopping. Unlike in real life, where such a purchase is likely to be noticed only once the goods arrive or additional costs are billed, the consequences of not checking the purchase properly are immediately made clear to the players, engaging System 2 thinking in the next attempted purchase.	
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Walls of Text	
Dark Pattern Concept:	Hidden Information [20]
Strategies:	MAXIMIZE, OBSCURE
Related Patterns:	Sneaking, Aesthetic Manipulation, Obstruction
Description:	
The analogy presents multiple long texts to the players. To proceed, they must carefully read the texts to discover hidden clues to riddles or puzzles. Solving the puzzles allows them to proceed.	
Examples / Known Uses:	
The players in our game walk into a room with four screens, each showing a text about the rules of the laboratory. To show that they have read the texts carefully, eight levers on the ground need to be put in the correct combination to unlock the door. Players can discover the combination by finding the hidden key to press for each screen and solving the riddle/puzzle hidden behind the screen using the hints provided in the text.	
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Context:

Privacy policies, as well as terms and conditions, need to be accepted when using a service. These policies contain information about how personal data is handled by the website providers, including which third parties may gain access to the data. Oftentimes, users do not read these policies due to their length and language, instead opting to just accept the privacy policy to quickly gain access to the service [10]. Similarly, websites may hide relevant options behind collapsible elements, such as opt-out options [20]

Effect:

Players are overwhelmed by the amount of text they are supposed to read, leading to frustration. Players may try to find a less involved solution, such as searching for an alternative path or only skimming the text. As the game provides no other options or hints to solve the riddles, players will inevitably have to read the texts.

Countermeasures:

Unlike in real examples of Hidden Information, where users can choose to not look for the information and instead just continue using the website, players must read the entire text to progress.

Psychological Aspects:

Understanding complex and long texts requires System 2 thinking. When websites hide information in long text and still allow users to use the website, System 1 thinking takes over and prevents users from searching for and discovering information that may lead them to refrain from using the service. This Educational Dark Pattern Analogy does not offer users a viable alternative to reading the texts. Players may at first try to find a solution that falls outside the scope of the scenario, but will eventually have to engage in System 2 thinking and read the texts to proceed to the next scenario. The frustration experienced in recognizing that the only sensible option is to read the texts is supposed to stick with users and remind them of the negative consequences they may encounter in real examples of Hidden Information.



Figure 6: Walls of Text represented as screens on the left wall in our game.

Winding Hallway & Shortcut	
Dark Pattern Concept:	Aesthetic Manipulation [20]
Strategies:	OBSCURE
Related Patterns:	Hidden Information
Description:	
<p>The analogy provides the players with a wide and long room illuminated only in the middle. The edges of the room are dark. The players' goal is to move towards the end of the room, with the illuminated path being the most obvious choice. The illuminated path however leads to a winding hallway that significantly increases the duration of the journey. The players may explore the dark areas of the room and find a shortcut to the next room that goes in a straight line from the start of the shortcut to the end of the winding hallway. The analogy needs to make players aware of a possible shortcut through some sort of cue. The exits of both the hallway and the shortcut are at the same place.</p>	
Examples / Known Uses:	
<p>In our game, players enter a large room illuminated only in the middle by spotlights. The narrator instructs them to follow the illuminated path. At the end of the path, a break room is visible, however, the players cannot enter it. Instead, to the right of the break room, there is an entrance to the winding hallway, which is fully illuminated. The walls of the hallway are plastered with advertisements. If players search the dark areas of the large room, players may find a hidden door, disguised as a wall under a broken lamp, leading to a dark corridor that can be used as a shortcut to avoid the winding hallway.</p>	
Context:	
<p>Websites often present a choice between two or more options with a false hierarchy by manipulating the aesthetic of the interface elements. A popular example is using a colored button for one option while only using text for the other. Another example is requiring more clicks for one option than another. This causes users to gravitate towards using the more appealing option, which is often the option where more information about the user is disclosed.</p>	
Effect:	
<p>The illuminated part of the room and the break room at the end which seems to be the next part of the game represents the option the website providers would want users to take. The dark parts of the room, which players can explore but are discouraged from doing so by the aesthetic, represent the more privacy-preserving option. The light seems more inviting, but following its path leads to an unpleasant consequence, the long hallway with advertisements.</p>	
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Countermeasures:

Players should ignore the appealing illuminated path and explore the dark areas of the room. This way, they will skip over the long and winding hallway, finishing this part of the game much quicker. This is similar to using the less prominent, but more privacy-preserving option when faced with a real example of Aesthetic Manipulation.

Psychological Aspects:

The scenario prompts System 1 thinking, by leading players to follow the visually appealing illuminated path. Unlike in real examples of Aesthetic Manipulation, where the alternative path is deliberately obscured, a cue for the shortcut prompts System 2 thinking, encouraging exploration of alternative options. Players who follow the illuminated path face the consequence of having to walk through the winding hallway. Placing the end of the shortcut and the winding hallway at the same place prompts users who follow the winding hallway to recognize that they could have taken a shorter path.



Figure 7: Winding Hallway & Shortcut represented as a partially illuminated room in our game.

Obstacle Onslaught	
Dark Pattern Concept:	Obstruction [20]
Strategies:	FAKE, OBSCURE, VIOLATE
Related Patterns:	Aesthetic Manipulation, Nagging, Forced Action, Hidden Information
Description:	
<p>The analogy provides players with a seemingly empty room with an immediately visible exit. When they try to get to the exit, a number of obstacles appear to prevent the players from advancing, one after the other. The analogy provides a distraction at each obstacle that promises to advance the players but instead only throws them back.</p>	
Examples / Known Uses:	
<p>In our game, the obstacles consist of a simple jump-and-run segment, an invisible labyrinth, a more difficult jump-and-run segment, a series of unnecessary questions, and a search puzzle where players need to find a key. At every obstacle, there is a teleporter that the narrator claims will bring the player to their destination. In actuality, the teleporters do not lead to the destination, but either exhibit strange behavior or lead the players back to a previous teleporter, but never forward.</p>	
Context:	
<p>Website providers often employ obstructions to prevent users from performing actions that may improve user privacy. For example, a website may require users in need of support to talk to a chatbot or interactive voice response system before speaking to a human directly. Similarly, a multi-step process may be necessary to delete an account on a website.</p>	
Effect:	
<p>Players initially feel like they may easily finish this room by walking through. After each obstacle, it seems like the goal is almost reached but new obstacles keep appearing. The game seems to offer an easier way out but this is only an additional obstacle in the players' way. The only way to get to the exit is by persevering through the obstacles.</p>	
Countermeasures:	
<p>Players must resist the temptation of occupying themselves with the distraction and instead persevere through each obstacle to reach their goal. This mirrors real-life examples of Obstruction where users need to persist through barriers or multi-step processes to achieve their objectives rather than quitting the process (thereby failing to achieve their objective) or giving in to an easier way out (such as a special deal offered to users trying to cancel a paid subscription).</p>	
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Psychological Aspects:

Obstruction aims to fatigue players and deter them from getting to the exit. Each obstacle demands System 2 thinking and severe motivation, while quitting or giving in to the distraction would be the System 1 solution, enticing players to take an apparently easier route. After repeated failures with the distraction, players recognize the need to overcome the obstacles for true progress.



Figure 8: Obstacle Onslaught partially represented as a jump-and-run course in our game.

Insistent Questioning

Dark Pattern Concept:	Nagging [20]
Strategies:	DENY, MAXIMIZE
Related Patterns:	Obstruction, Forced Action

Description:

The analogy gives players a set of objects to bring with them throughout the game. The analogy repeatedly asks the players in various situations to give away the objects to gain a slight advantage. However, while none of the slight advantages are necessary to complete the game, the objects are required to finish a section of the game. Reaching that point without sufficient objects left forces players to backtrack.

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Examples / Known Uses:

At the beginning of the game, the narrator tasks the players with keeping hold of a set of six screws. During each segment of the game, the narrator asks the players to use a screw for various things, such as repairing a squeaking door, a broken monitor, or a teleporter. Before entering the final room of the game, players need to repair a broken number pad using four screws. If they gave too many screws away they need to return to the previous game segment (in this case Obstacle Onslaught) and retrieve a set of screws left there by the narrator.

Context:

Website and app providers often nag users to gain app permissions or to sell something to them. This is done by repeatedly notifying users of the offer and often only allowing users to either accept or get asked again later, rather than permanently disabling the questions. A prominent example is YouTube Premium advertising that is shown on the mobile app often, as well as Instagram asking for permission to use the location services of the phone.

Effect:

Players are annoyed by the constant questioning regarding the objects and may get weary as to why they constantly get asked about them. As the game provides no way to stop the questions, the nagging persists and constantly interrupts the flow of gameplay, leading to frustration.

Countermeasures:

Players need to ignore the requests to avoid the negative consequence of having to backtrack to gain more objects. This is akin to app users being unable to stop the constant nagging from the app and having to always dismiss the nagging notification to preserve their privacy.

Psychological Aspects:

This educational dark pattern analogy exploits players' psychological susceptibility to System 1 thinking by consistently pressuring them to relinquish crucial objects for small short-term gains. Unlike real examples of Nagging, where the negative consequences are only ever apparent long after the manipulation by the dark pattern, the consequence of giving away too many objects is made apparent to the players within the game session.



Figure 9: Insistent Questioning represented by a set of screws in our game.

Looping Gameplay	
Dark Pattern Concept:	Forced Action [20]
Strategies:	DENY, MAXIMIZE
Related Patterns:	Obstruction, Nagging
Description:	
<p>The analogy lets players encounter a situation in the game that prompts them to repeat a large section of the game to proceed once they return. The analogy provides a plausible reason for this, however, players can never fulfill the requirements necessary to proceed beyond this point. The only option is to leave the game, which the analogy provides hints at.</p>	
Examples / Known Uses:	
<p>In our game, players find themselves in a room that has a door labeled “Exit”. When trying to open it, the narrator reveals that the players were part of an experiment and have not yet collected enough data for the experiment to be completed. A teleporter emerges from the ground which players can use to return to the start of the game. After completing the Insensible Key Mapping scenario again, they are returned to the Looping Gameplay room, as if having completed the game again, visualized by a fade-to-black. This repeats indefinitely while hand-written hints appear on the walls prompting the players to close the game.</p>	
Context:	
<p>Some websites only allow users to use their services if they first perform an action seemingly unrelated to the service provided. Examples include forced consent for data collection on news platforms and forced registration for mortgage calculations. Users have the choice to either perform the forced action or disengage from the service without finishing their task.</p>	
Effect:	
<p>The lack of an apparent alternative drives players to replay the section of the game that needs to be repeated. The repetitions increase player frustration and should ideally stay in the players’ minds even after playing the game, ideally reemerging when they are forced to do something they do not want to do to access a service.</p>	
Countermeasures:	
<p>The only available countermeasure against Forced Action is refraining from using the service in the first place. Similarly, the only available countermeasure to repeating the game is to quit playing the game entirely.</p>	
Psychological Aspects:	
<p>This educational dark pattern analogy plays on the psychological concept of sunk cost and the fear of missing out. By presenting players with a plausible reason to repeat a large section, the game fosters a belief in an achievable goal. However, the deliberate impossibility of fulfilling the requirements creates a sense of frustration and entrapment. Players grapple with the emotional investment made versus the rational choice to disengage. Unlike in real examples of Forced Action however, the game eventually provides hints to the fact that they can and should quit, teaching the players the necessary countermeasure to avoid the Forced Action dark pattern.</p>	
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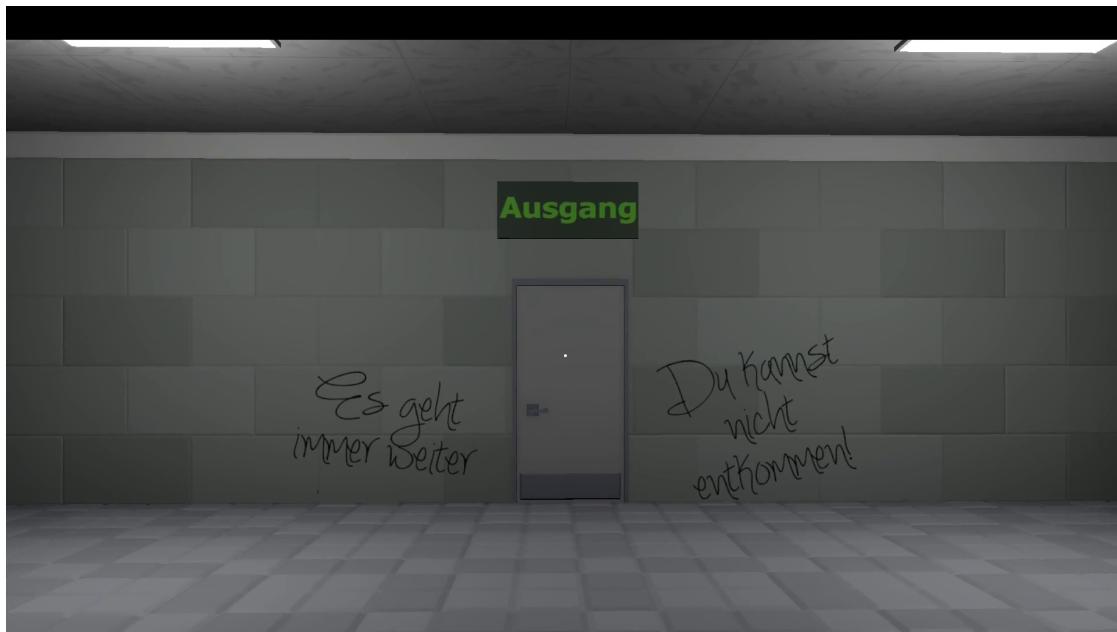


Figure 10: Looping Gameplay represented as a permanently closed Exit in our game.

B APPENDIX B: SCRIPTS AND DESCRIPTIONS FROM THE ONLINE SURVEY STUDY

Our online survey study used commentated videos of each educational dark pattern analogy. This appendix provides English versions of the scripts for these videos and the corresponding definitions of dark pattern concepts used in the online survey study.

B.1 Introduction

Thank you for participating in our study.

In this study, we are investigating dark patterns - manipulative interaction techniques that are used by website/app operators to get you to behave in a certain way that is not in your best interest. Website/app operators do that by taking advantage of certain psychological behavioral patterns of people to influence their behavior.

To better inform people about dark patterns and their effects, we have developed an educational video game. In it, you play a new employee in a laboratory. Your boss, the lab manager, uses manipulative tricks to get you to spend as much time in the lab as possible. Each room in the game represents a dark pattern. In this study, you will see commented excerpts from this video game and then compare them with descriptions and explanations of dark patterns.

B.2 Insensible Key Mapping / Preselection

This room is about familiarizing yourself with the controls of the game. The lab manager asks you whether you want to use a "preferred control" selected by him. If you accept the "preferred control", you realize that this "preferred control" does not follow any known pattern and is difficult to understand. The lab manager explains that you can customize the controls in the menu.

"Preselection" is a dark pattern where an option is preselected before you interact with a website or app. The operators want this option to be retained, although this option is often not in your interest and could have unintended consequences for you.

B.3 Sneaky Shop / Sneaking

The laboratory manager shows you the Shoppifier 3000. You are supposed to use this machine to produce items from a list that you need for your work in the laboratory. In the next step, these items are sent for disinfection, where only exactly the items on the list are accepted.

If you now believe that you have selected exactly the items that are on the list in the Shoppifier, it can still happen that your selection is rejected during disinfection. The reason is that the Shoppifier has - unbeknownst to you - selected additional items that it considered matching.

"Sneaking" is a dark pattern in which website/app operators try to hide or disguise information that is relevant to you or only reveal it with delay. The aim is to get you to do something that you would not have done if the information had not been hidden.

B.4 Walls of Text / Hidden Information

You enter a room with four screens. On those screens, you see long texts. There are also eight large control levers on the floor. The lab manager tells you to read the texts in order to learn the rules of the lab. To prove that you have read the texts carefully, you must move the switches to the correct alignment. In each text there is a hidden reference to a button. If you press it, a puzzle will appear for you to solve. Once this has been solved, you will be shown part of the

correct switch combination. Once you have read all four screens and solved the corresponding puzzles, you will know the complete switch combination.

"Hidden Information" is a dark pattern in which website/app operators try to hide certain information or make it difficult to access by displaying it on the website. This can be options that are hidden behind an interaction, or important information that is hidden in small or discolored text. The aim is to disguise important information as unimportant information.

B.5 Winding Hallway & Shortcut / Aesthetic Manipulation

You enter a large room that is only illuminated in the middle. The lab manager asks you to follow the illuminated path. When you reach the center of the room, you hear a noise from the darkness on the left. The lab manager asks you to ignore it and continue on. If you follow the illuminated path, you will come to a long, winding hallway with advertising posters, to which the lab manager will read out advertising messages until you reach the next room after a long walk. If you follow the noise to the side of the room into the darkness instead, you will find a hidden door under a broken lamp that leads to a dark but short hallway to the next room. Finally, both possible hallways lead to the next room.

"Aesthetic Manipulation" is a dark pattern that is more concerned with presentation than content. Website/app operators present several equivalent options in significantly different ways so that your attention is drawn to the options that benefit the operator more and distract you from options that would benefit you more.

B.6 Obstacle Onslaught / Obstruction

You arrive in an initially empty room that you have to cross - which seems easy. However, when you try to cross it, the floor lowers and several floating blocks appear, which you have to jump over to get to the other side. A teleporter will also appear which, according to the lab manager, can teleport you directly to the end of the room. However, none of the buttons on the teleporter seem to work, only the color of the teleporter changes. If you cross the floating blocks, a wall and an invisible labyrinth appear, as well as a second teleporter, which teleports you to the beginning instead of the end of the room, namely to the first teleporter. If you find a way through the invisible labyrinth instead, new floating blocks and another teleporter will appear, which only rotates around itself. If you jump over the floating blocks across the wall, a bridge will appear which you can only cross if you answer the questions of the lab manager. However, if you reach the door at the end of the room, it will not open. The teleporter next to the door will only take you back to the previous teleporters. You can only open the door by finding a hidden key.

"Obstruction" is a dark pattern in which website/app operators make a task more difficult for you than it would be on its own. This is intended to prevent you from completing the task. For example, certain tasks that you want to achieve may be blocked by large obstacles.

B.7 Insistent Questioning / Nagging

At the beginning of the game, the lab manager gives you a box of screws with the task of carrying them with you and not losing them. In each room of the game, the lab manager will ask you to use a screw to repair something. This is not necessary to progress in the game - but the lab manager asks you in a way that doesn't make that clear. Towards the end of the game, however, you will need four screws to repair a broken combination lock. If you have given away too many screws beforehand, you have to run back and get new screws.

"Nagging" is a dark pattern where website/app operators repeatedly interrupt your experience on the website/app to get you to behave in a certain way that is not directly related to what you are trying to achieve.

B.8 Looping Gameplay / Forced Action

You enter a room with a door with a sign above it saying "Exit". However, when you try to open the door, it does not open. The lab manager explains that your stay in the lab was an experiment and that you have not yet collected enough data for him. He says that you can pass through the exit when you have collected enough data. You can now return to the start of the game via a teleporter to comply with this request. The game then starts again from the beginning. When you reach the exit again, the lab manager repeats that you have not collected enough data and sends you back to the start of the game. Each time you reach the exit, a new message will appear on the wall telling you that the lab manager will not let you leave. The only way out is to end the game via the menu.

"Forced Action" is a dark pattern in which website/app operators require you to do something additional in order to achieve your actual goal - otherwise you cannot reach it.

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