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"Dark Cookie" - A serious game to train users to spot and interact with dark patterns in cookie banners

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Abstract

Deceptive design patterns, also called dark patterns, can be found all over the internet today. These designs are used by website operators to trick users into sharing their personal data or performing other actions that are mostly favorable to the operators. Since taking effect in 2018, the General Data Protection Regulation (GDPR), strictly mandates website operators to inform EU website visitors of how their personal data will be processed. Although they put up cookie banners to disclose such information and ask user's consent, many website operators have found ways to use deceptive designs, such as confusing design and language, to trick users into giving them their personal data, and pass them on to advertisers that use them to personalize ads and target users. In this thesis, I study different dark patterns on the internet and those in cookie banners and I delve into one of the proposed interventions against dark patterns in previous work, gamification. I hypothesize that it is possible to create a serious game to train online users to respond to dark patterns in cookie banners, so that they can retain most of their personal information without disclosing it to advertisers. In particular, I have conceptualized and developed an online game with five levels that uses game mechanics like feedback, points, levels, badges and story to make the game educative, engaging and interactive. To evaluate the game, I created a survey and gathered the answers of 54 players and assessed aspects like game clarity of goals and rules, knowledge acquisition, perceived applicability and engagement. I conclude with the analysis of the results obtained, suggesting the gamification is an appropriate and effective tool for training users on how to interact with cookie banners in a way that maximizes their privacy.

Contents

Introduction

It has become increasingly evident that manipulative practices are widespread in online services. Users are vulnerable to manipulation through dark patterns used by online services to make them purchase goods, spend more time on websites, or thoughtlessly give up their personal information [11]. Many times when a user visits a website for the first time, a cookie banner appears asking for permission to use cookies and other tracking technology. Website operators have to put up these banners, in compliance with the ePrivacy Directive and the General Data Protection Regulation (GDPR), as a means of informing people residing European Union of the collection of their personal data [58]. But even with the law, many website operators have found manipulative ways to lure users into easily sharing their personal data. They achieve this by using several technical jargon [63], obscure and ambiguous language or presenting information in a positive or negative light.

Dark patterns have been explored in a number of studies [12, 27, 45, 48, 49], and some have suggested ways of mitigating their negative effects [11, 57]. The technical measures suggested include developing tools that can automatically detect, flag and report dark patterns on the internet. The design measures revolve around using bright pattern designs to counteract dark patterns. The regulatory measures require making legal safeguards more strict towards dark patterns and the educational measures suggested include integration of gamified experiences in major online services (such as Facebook) where users can play and learn about dark patterns [57]. In this thesis, I focuses on investigating the use of gamification as an educational tool in combating the prevalent use of dark patterns in cookie banners.

In this light, I have identified three questions that I aim to answer in this project:

> **RQ1:** Can users be effectively trained to respond to dark patterns in cookie banners in a manner that maximizes the protection of their personal data (to reject all non-essential cookies)?
>
> **RQ2:** Is gamification perceived as able to train users against cookie dark patterns in real life?
>
> **RQ3:** Can a game on cookie dark patterns be engaging, clear, and appropriately challenging?

To fully understand the problem, in Chapter 1, I research on the different types of dark patterns popularly found on the internet. I collect screenshots of different types of dark patterns used on different interfaces and study how they employ designs to deceive and manipulate users. Some of these dark patterns include; forced consent where users are given only one choice, hidden text where important information is concealed from users and confirmshaming where users are guilt tripped into making decisions that mostly benefit the web operators. I also research on cookies banners and how manipulation is introduced in them to trick users into sharing their personal data with website operators. I look into the GDPR consent requirements to understand how the law defines a complaint consent request. The GDPR specifies that consent should be freely given, specific, informed and unambiguous. Despite these specifications by the law, many cookie banners on the internet still use deceptive designs to manipulate users into giving consent to access their personal data (to accept cookies). Given their prevalence and the significant role of consent they play on the internet today, it is important to mitigate these dark patterns in cookie banners.

A report by Bongard-Blanchy et al. [11], suggests that through gamification, dark pattern spotting could be taught in a real-life setting without incurring cognitive costs incurred from transferring skills from training to digital environments. This inspired the need to investigate gamification and serious games as an efficient training tool. The goal of gamification is to influence people's behavior by using game mechanics and game design techniques in non-game contexts [40]. In Chapter 2, I study different game mechanics and dynamics with the aim of discovering those that would be most effective in creating a game that trains users on how to spot and engage with dark patterns in cookie banners. These mechanics include levels, points and badges. I also study the Learning Mechanics-Game Mechanics Model which maps different learning mechanics to game mechanics based on the targeted teaching skills. The goal is to create a serious game using the right mechanics and dynamics that would make the game educative, interactive and engaging.

In Chapter 3, I research on the privacy games that currently exist. I found three games; Cookie Consent Speed.Run, Terms & Conditions Apply and Cyber Chronix. I observe the graphical user interfaces (GUI) and the game mechanics and dynamics employed in each of the games. I also give a set of three players each of the games to play and ask them for feedback on their gaming experiences. The goal of this is to know the right combination of game mechanics and dynamics used in these existing games that promotes user's learning and engagement in the game. Some mechanics identified include, question and answer, feedback, and story. The review from the test players also give pointers to other elements in the game that are interesting or that can be improved on.

In Chapter 5 of this report, I make a documentation of the creation of the Dark Cookie game. The serious game trains its players on how to identify and interact with dark patterns in cookie banners. The game is created using the Scratch programming language and it features several characters that give a back story. The game applies mechanics such as points, levels, feedback, badges, question and answer, story and stimulate/response. Through out the game, players would be shown different cookie banners and they are required to reject all cookies possible in the banners shown to them. Players would gain points for questions answered correctly and loss points for questions answered wrongly. The goal of the game is to influence players behaviour towards cookie banners in real life by training them to reject all non-essential cookies to maximize their privacy. The game is developed and shared to a diversified group of people to play and evaluate. The player evaluates the game based on their experiences using a survey provided to them.

The survey checks the gaming and learning experience of the players. Several aspects in the game are evaluated by the players to check their knowledge acquisition and learning satisfaction. Some questions also check the adequacy of the learning method and the perceived applicability of knowledge gained. Other questions check the clarity of goals and rules of the game, the players engagement, feedback, challenge adequacy and the player's skill improvement. Open questions are also provided for users to share in their own words what they enjoyed in the game and what they feel could be improved. In Chapter 6 I report the results of the survey and in Chapter 7 I analyse and discuss my findings based on the results. I check that my results provide answers to the research questions identified and I also highlight some strengths and limitations of gamification as the proposed solution and I give directions for future work based on research gaps that can be found in the Dark Cookie game.

Chapter 1

Dark Patterns

The digital era provides a range of products that constitute a big part of our everyday lives, allowing us to interact with others, share experiences, perform daily routine tasks, and buy goods and services [26]. These products consist of applications and services that have been carefully created by teams of professional designers to deliver the best user experience possible, supposedly. In today's online world, products are frequently designed to manipulate the user experience, using deceptive designs known as dark patterns, to trick users into purchasing goods and services, spending more time on the site, or allowing their personal data to be harvested [11]. Designers of dark patterns create user interfaces that deliberately confuse users, make it hard for them to express their own preferences, or manipulate them into taking certain actions [45]. Cognitive biases and human bounded rationality are believed to underlie dark patterns' effectiveness [12]. Although dark patterns can direct consumer behaviour to choices that may appear to serve as conveniences, free services, or immediate gratifications, these choices can adversely affect individual welfare, such as invasion of privacy, financial loss, and behavioural addictions, as well as collective welfare, such as harm to competition and erosion of consumer trust [49].

In 2010, a UX specialist, Brignull [13], coined the term "dark patterns" to describe the way software can slyly influence users into doing things they didn't intend or dissuade them from engaging in behaviour that is detrimental to the business. As Brignull notes, when we think of "bad design", we usually imagine a creator who is sloppy or lazy without malicious intentions, but dark patterns, on the other hand, operate on a carefully crafted level that understands human psychology and do not have the user's interest at heart.

1.1 Related Work

Several research have been published on dark patterns from different perspectives. Mathur et al. [54] gives the history of tricky user interfaces and several researchers have examined the presence of dark patterns in online services [21, 50]. In 2019, Mathur et al. [48] analyzed a large set of websites to uncover dark patterns using automated methods. Their research further characterize the underlying influence of dark patterns and the potential harm that they could cause to users' decision-making. Jamie et al. [45] show, for the first time, how powerful dark patterns can be by conducting a large scale experiment where people with different educational levels were exposed to mild and aggressive dark patterns, and observing how much influence these dark patterns had on the participants. In an experiment in 2020 [21], it was shown that most users are

unaware of dark patterns, but can recognize malicious designs if they are told about them. In 2021, Bongard-Blanchy et at. [11] found in their research that most people are aware that manipulative design can influence their online behavior, however, they are unable to counter these influences. Using normative perspectives such as individual welfare, collective welfare, regulatory objectives and individual autonomy, Mathur et al. [49] describe how to analyze dark patterns and how they impact individuals and the society. Gray et al. [27] approach dark patterns from the perspective of UX design, while Chromik et al. [15] address explainability, transparency, and control with dark UX design patterns. Colin et al. [26] elaborate on and extend notions of dark patterns by providing an account of end-user perceptions of manipulation. In their paper [12], Bosch et al. discuss privacy dark strategies and privacy dark patterns as well as a framework for collecting, documenting, and analyzing such malicious concepts. Dark patterns have also been researched in the light of compliance to legal frameworks such as the GDPR [28, 55, 58].

1.1.1 Types of Dark Pattern

Dark patterns come in many forms, some more pronounced than others. Below are some examples of dark patterns [1]:

Forced Consent - In order to gain access to a web application or service, users must agree to fixed legal terms, which are imposed by the application or service. If users do not agree to these terms, then they are denied access to the application or service. In the example below, the user is only given one option; they have no choice but to agree to the cookie policy in order to proceed to the sites.

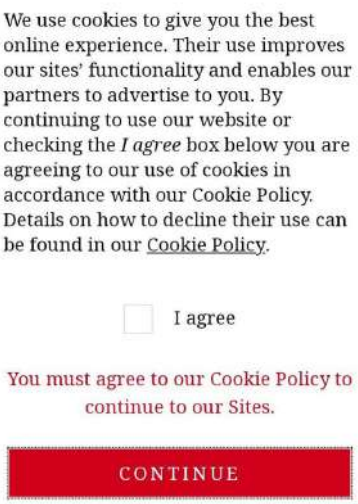


Figure 1.1: Example Forced Consent (Own Collection)

Bundled Consent - This is a common practice where an application or service will request consent to collect, use, and disclose users' personal information in one go without allowing them to choose which ones they consent to and which ones they do not. In the example below, the user has to agree to Terms and Condition bundled with the permission to receive emails and promotional offers.

[1] There are many different variants of dark patterns on online platforms today, but for the sake of this literature, I would only discuss a few popular ones.

Figure 1.2: Example Bundled Consent [2]

Trick Question - This dark pattern describes situations in which web applications or services use misleading language to encourage users to make certain decisions [11]. The question or choices appear to say one thing at first glance, for example on a form or banner with options. Yet, upon closer inspection, it is possible to be answering or agreeing to something entirely different. In the example below, a user would find it confusing in selecting the correct option to cancel their membership.

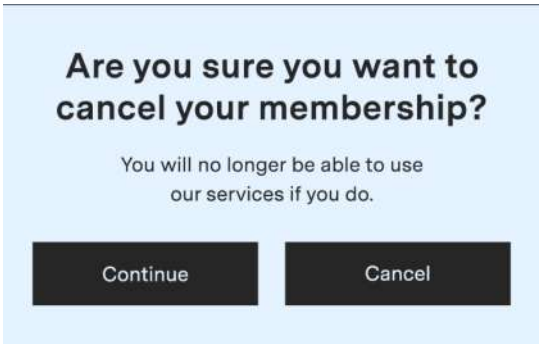


Figure 1.3: Example Trick Question [7]

False Hierarchy - This occurs when one or more options appear first or are interactively displayed before other options, particularly when items are better suited to coexist as parallels. As a result, the user selects a choice they believe to be either their only option or the best choice for them [27]. this can be used by online services to cajole users into selecting options beneficial to the service. In the example below, a user would assume that the 'NO' option is disabled and would most likely select 'YES' meanwhile both buttons are functional.

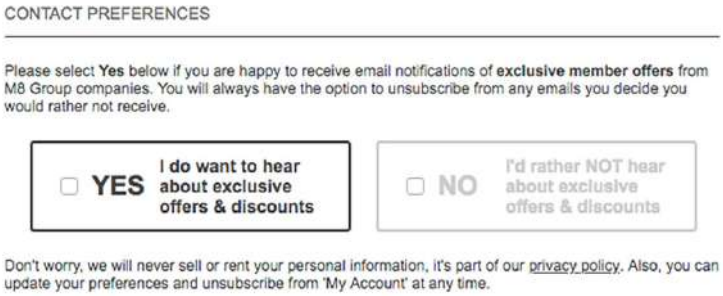


Figure 1.4: Example False Hierarchy [67]

Hidden Information - As the name implies, hidden information is information or actions that are relevant for the user, but are not made readily accessible to them. In most cases, the purpose of hidden information is to deem relevant information irrelevant to users. There are many form which hidden information may take, it can be options or content concealed in small print or discolored text, or in the usually long and boring product's "terms and conditions" [27]. In the example below, users would only see that they are consenting to receiving marketing emails when click on 'more info'.

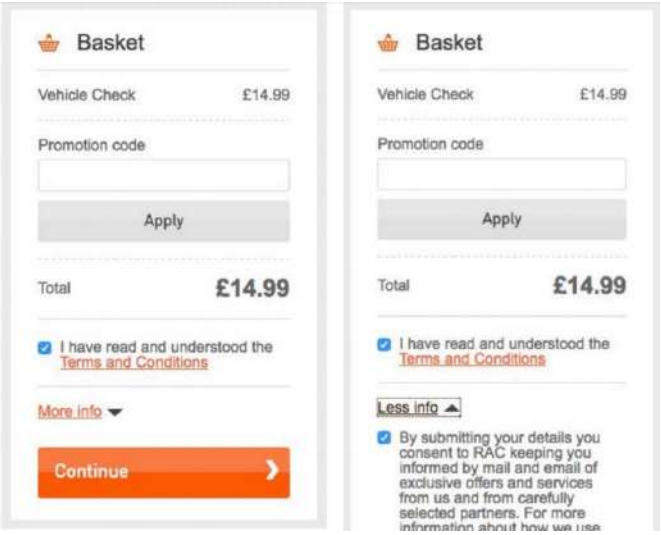


Figure 1.5: Example Hidden Information [19]

Pre-selection - An instance of pre-selection is when a default choice is made prior to user interaction, usually in the form of a default choice that the owner of the product wants the user to pick. This pre-selected option is typically against the user's interests or brings about unintended consequences. However, if the user believes the product is looking out for their best interests, they are more likely to accept the default option [27]. The example below shows cookie options that have been pre-selected for users. In most cases, only meticulous users would take their time to review preferences while majority would simple accept all pre-selected options. [27].

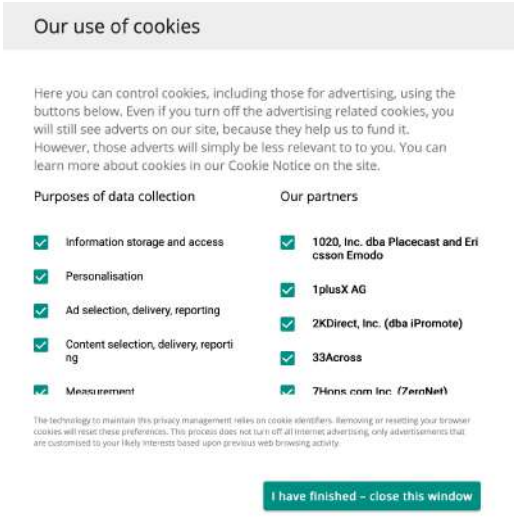


Figure 1.6: Example Pre-selection (Own Collection)

Misdirection This dark pattern forces user's attention to be diverted from one thing simply so they can focus on another [27]. Something usually happens while they pay attention to the thing in question. In one sense, this could be related to digital nudging, in which design elements encourage users to choose one option over another, like consent or reject. Misdirection could include services explaining to users that their consent to accessing their personal data is vital to making the website work properly or to giving them the best possible customer experience. While this is probably the case, users are being steered toward consenting to collecting their data for marketing purposes, that in the real sense is not necessary. In the example below, users are informed that the cookies are to personalize and enhance their experience on the website which is not the absolute truth. There is also a forced consent dark pattern in the banner as users are given no option but to accept cookies on the site.

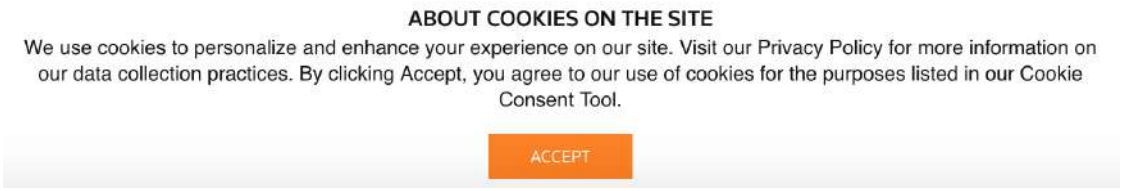


Figure 1.7: Example Misdirection (Own Collection)

Loss-gain Framing - In 1984, Kahneman et al. [64] documented that losing X€ is more unpleasant than gaining X€ is delightful. In essence, people are twice as likely to fear a loss as they are to admit a similar gain. Humans tend to protect themselves from the pain of loss, rather than assuredly enjoy the benefits of gain. Consumers do not want to miss out on the benefits of digital products after seeing their value. This could be leveraged by the designers to engage or manipulate users. In the example below, users would most likely pay for 6 sites to avoid "loosing" on a single site.

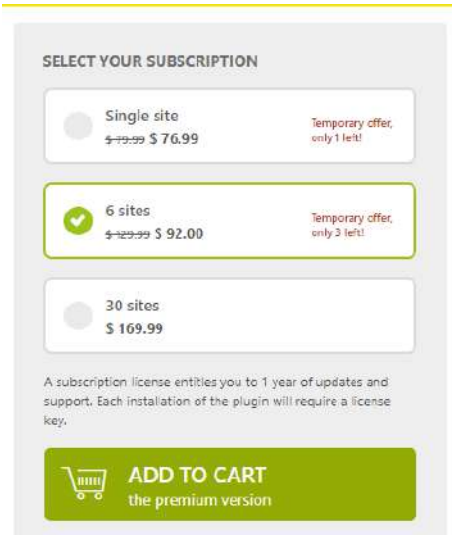


Figure 1.8: Example Loss-gain Framing [14]

Confirmshaming - In confirmshaming, a user is shamed into making a certain choice by using emotions and language [48]. A way to get the user to opt into something is to guilt them into it. There is an option to decline, but it's worded in a way that shames the user into

compliance [13]. Psychologically manipulating users with guilt is intended to lead to a decision the organization desires. This is related to several of the other dark pattern tactics, making users feel as though they are doing something wrong by not making a choice or missing out by not making a choice at all. In the example below, "I like paying more than I need to" is intended shame a user into signing up for newsletters for 10% discount.

Figure 1.9: Example Confirmshaming [7]

Limited-time Message - In this case, users are notified that a deal or sale is going to expire soon without stating a specified time limit [48]. When a deadline is ambiguous, it creates an entirely false sense of urgency, which is problematic.

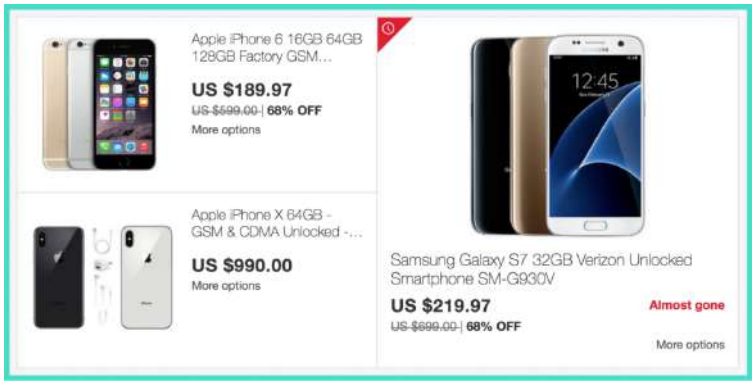


Figure 1.10: Example Limited-time Message (Own Collection)

Privacy Zuckering - The term privacy zuckering was coined from the name of Facebook CEO Mark Zuckerberg. With privacy zuckering, users are tricked into disclosing more personal information to the public than they mean to [16]. Users are encouraged to share excessive personal information and they are usually required to agree to abusive terms of service. This is some worth related to the forced consent dark pattern.

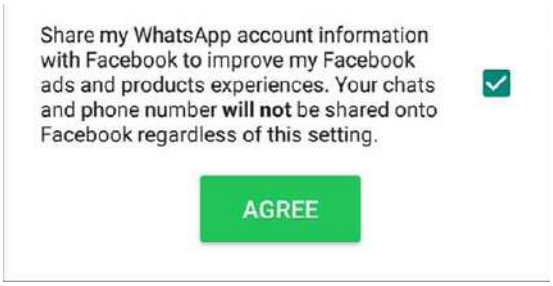


Figure 1.11: Example Privacy Zuckering (Own Collectionx)

Nagging As defined by Gray et al. [27], nagging is a minor redirection of expected behavior that may persist over several interactions. Nagging often takes the form of an interruption to a user's purposeful interaction, where their desired task is interrupted one or more times by tasks unrelated to the one they are attempting to accomplish. The user may become annoyed when pop-ups obscure the interface, audio notifications distract them, or other actions obstruct or otherwise divert the user's attention [27].

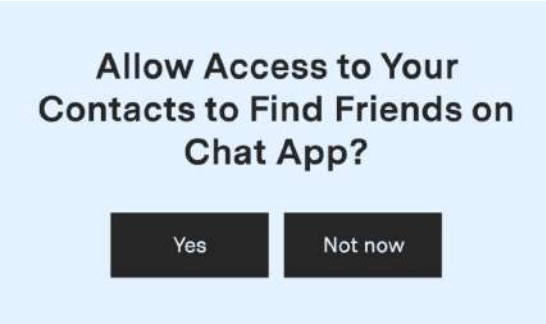


Figure 1.12: Example Nagging [7]

High-demand Message - Products that have high-demand messages suggest that the products are likely to sell out soon as they are in high demand [11]. This tactic increases the value of a product by informing users it is likely to become unavailable, thereby making it more appealing. High-demand messages are very manipulative.

Figure 1.13: Example High-demand Message (Own Collection)

1.1.2 Classification of Dark Patterns

A paper by Mathur et al. [48] offered a set of higher-level attributes or characteristics that can be used to describe dark patterns in the literature, going beyond simple definitions and taxonomies. In 2021, Mathur et al. [49] suggested an additional attribute. We discuss all six characteristics below.

Asymmetric: An asymmetric dark pattern imposes unequal loads on the user's choices. Typically, options that benefit the service are prominently displayed, whereas those that benefit the consumer are hidden behind several clicks or made difficult to view by changing their style and location. Interfaces for consent are particularly prone to this kind of dark pattern. In the confirmshaming type, for instance, emotions are used to burden choices,

since certain choices are associated with guilt while others not. Also, by introducing confusing language and double negatives, the trick questions dark pattern can impose cognitive burdens for choices withheld from consent. As another example, privacy zuckering, hides privacy-protecting settings behind obscure menus, burdening users with user interface friction [49].

Covert: Users can be influenced toward specific decisions or outcomes by covert dark patterns that conceal how users are influenced. This property may be achieved by exploiting cognitive biases, or utilizing color and style to influence users. Providing extra choices (the decoy) can be leveraged to make other choices seem more appealing, using the decoy effect cognitive bias. And it is more probable that users will fail to recognize that the decoy's presence is only to influence their decisions [49].

Deceptive: By affirmatively misstating facts, omitting important details, or misleading users, deceptive dark patterns lead to false beliefs. Shopping websites are particularly prone to deceptive dark patterns. As an example, a website may offer users a limited-time discount, but this timing actually restarts each time the user refreshes the page. Although the website may be offering a discount, some users may not realize that the deal is still open past the given time limit. In this case, users' behavior may be affected as they could postpone their purchase without being subject to time pressure if they realized that the sale is recurring [48].

Information Hiding: The presentation of necessary information is often hampered or obstructed by the presentation of dark patterns that hide information. Likewise, hidden subscription dark patterns conceal the fact that a subscription is a recurring purchase from the purchaser. Additionally, the Hidden Costs dark pattern hides relevant cost information until only a few seconds before the transaction is complete, which makes it unlikely for the user to change their mind [49].

Restrictive: The choices presented to users are limited or eliminated if restrictive dark patterns are used. For instance, users can sign up for a particular website with forced consent dark pattern, only after agreeing to the terms of use and receiving marketing emails. Similar to that, some websites allow you to sign up for subscription services online, but if you choose to cancel the service, there is no online cancellation option, therefore the user needs to call a number or a similar more burdening choice [49].

Disparate Treatment: A dark pattern belongs to this category if it disadvantages and treats one group of users differently than another [49]. According to Zagal et al. [72], these dark patterns are a common feature of games. Pay-to-skip mechanisms, such as those on gaming sites, allow users with greater resources to leapfrog less wealthy users. Other interfaces that disadvantage a certain group of users usually operate covertly, leaving the users unaware of why they have less choices than others [29].

1.1.3 Privacy Strategies vs. Dark Strategies

Dark patterns can be used to manipulate users for different reasons. Some of these reason may have an immediate trivial effect on the user (such as staying longer on a site, or watching a game ad longer while searching for tiny cancel button), while some may directly affect the privacy of the user. These privacy dark patters target the personal data of users of online services. In their paper [12], Bösch et al. developed a classification for privacy dark patterns that corresponds to

Hoepman's privacy design strategies [32]. Privacy dark strategies can be classified according to their fundamental approach. On the basis of Hoepman's eight privacy strategies (namely, Minimize, Hide, Separate, Abstract, Inform, Control, Enforce, and Demonstrate) the following privacy dark strategies were identified.

Minimize vs Maximize Hoepmans's Minimise privacy design strategy suggest that the processing of personal data should be minimized as much as possible [33]. While the dark strategy Maximize attempts to gather a massive amount of data, its goal is to do so inappropriately. In essence, there is a much greater amount of personal data collected, stored, and processed than what is necessary for the task [12].

Hide vs Publish The Hide Hoepmans's privacy design strategy ensures that the personal data is not made public or visible by making it unlinkable or unobservable [33]. While with the dark strategy Publish there is no privacy protection for personal data that is not intended to be publicly available [12].

Separate vs Centralize Hoepmans's Separate privacy design strategy suggests that processing personal data should be separated as much as possible [33]. In contrast, the dark strategy Centralize calls for a centralized approach to the processing of personal data. Using this approach, all personal data is collected, stored, and processed at one central location [12].

Abstract vs Preserve The Abstract (formally Aggregate) Hoepmans's privacy design strategy ensures that whenever possible, detailed information should be minimized, by summarizing or grouping any storage, collection, or use of personal data in accordance with the context of the specific purpose [17]. The Preserve dark strategy, on the other hand, requires that no processing affects the interconnection between different data items. Instead of storing them in a processed form, data should be preserved and analyzed in their original state [12].

Inform vs Obscure According to Hoepmans's privacy design strategy, data subjects should be informed in a timely and adequate manner about the processing of their personal data [33], for example by providing detailed information about policies and currently held data, explaining necessary details concisely and in an understandable way, and notifying users of any changes [17]. In the case of the dark strategy Obscure, the collection, storage, and processing of personal data is difficult or even impossible to learn about. Users are unable to find out what happens to the information they disclose. The method of achieving this is to create a privacy policy containing many technical terms, which are difficult to comprehend by the average user. User Interfaces can be designed to mislead users, causing them to make decisions that contradict the original intent [12].

Control vs Deny Hoepmans's Control privacy design strategy suggest that the processing of personal data should be controlled adequately by the data subjects [33]. The Deny dark strategy seeks to take control of personal information away from the user. Basically, data subjects have no control over their data. A service provider can prevent its customers from taking actions that are in opposition to that provider's interests by using this dark strategy [12].

Enforce vs Violate In line with Hoepmans's Enforce privacy design strategy, a privacy-friendly approach to processing personal data should be adopted, and this policy should be enforced appropriately [33]. This requires making every effort to create, maintain, and enforce policies and technical controls regarding the collection, retention, sharing, changes,

breaches, or other operations on personal data that meet the agreed-upon purposes, in a timely manner, as much as possible [17]. The Violate dark strategy, on the other hand, intentionally violates privacy policies that are presented to users. Privacy policies are in place, but are not kept by the service providers. Because the users are unaware of the violation, such violations do not impact the level of trust placed in that service [12].

Demonstrate vs Fake According to Hoepmans's privacy design strategy, and in general privacy by design, processing personal data should be shown to be done in a privacy-friendly manner [33]. The strategy stipulates that data controllers should be able to demonstrate that they adhere to the laws [17]. The privacy dark strategy Fake implies that organizations collecting, storing, or processing personal data pretend to have strong privacy protections, when in fact they do not.

1.2 Dark Patterns and the GDPR consent requirements

The General Data Protection Regulation (GDPR) is a broad legislative framework in the European Union (EU) that regulates the of use personal data [25]. According to the GDPR, Article 4(1), "'personal data' means any information relating to an identified or identifiable natural person ('data subject')". The GDPR law aims to consort data privacy regulation in all of the EU member countries and also provide greater protection and rights to individuals. In Article 4(11) of the GDPR, consent of the data subject is defined as "any freely given, specific, informed and unambiguous indication of the data subject's wishes by which he or she, by a statement or by a clear affirmative action, signifies agreement to the processing of personal data relating to him or her" [25]. In light of the GDPR, we would discuss the legal requirements applicable to consent and how it should be appropriately requested. For further information, you can also refer to the Recital 32 of the GDPR [3].

Freely given: Article 4(11) of the GDPR specifies that consent should be freely given. This means that users should willingly consent to the use of their data without being ordered or compelled to do so [28]. With dark patterns, however, the user is often limited in his or her ability to freely decide whether or not to consent, and instead has to deal with Forced Consent 1.1.

Specific: The Article 4(11) of the GDPR also specifies that consent should be specific. This implies that the purpose of processing must be clearly defined [55] and that users should be able to decide to share data for specific purposes in a granular way. We have cases of dark patterns where consent is not clearly defined like with case of Bundled Consent 1.2.

Informed: Another characteristic of consent according to Article 4(11) of the GDPR is that consent should be informed. That is, data processing must be transparent and completely explained to the user, including the purposes, the methods, and the means to express consent [28]. Dark patters flout this specification of the law with Hidden Information 1.5, for example, by hiding important details from users.

Unambiguous: The Article 4(11) of the GDPR further specifies that consent should be unambiguous. Therefore, consent should be collected in a way that leaves no doubt about the consenting subject's desire for their data to be processed. The user's actions should be clear and affirmative [28]. In the case of Tricky Questions 1.3, this dark pattern leave users with uncertain, with all the confusing questions. The popular Pre-selected Options 1.6 dark pattern also forestalls users activeness by selecting options by default for users.

Readable and accessible: Lastly, Article 7(2) states that "If the data subject's consent is given in the context of a written declaration which also concerns other matters, the request for consent shall be presented in a manner which is clearly distinguishable from the other matters, in an intelligible and easily accessible form, using clear and plain language. Any part of such a declaration which constitutes an infringement of this Regulation shall not be binding." [25]. The word "intelligible" can also be translated to readable. This means that in the consent request, the user should be able identify and understand the request from other issues (for example, terms of service, privacy policy and cookie policy should not be bundled in the same request). The request should be intelligible, accessible, in plain language, and it should not unnecessarily obstruct the user's view of the site or application [28].

1.3 Dark Patterns in Cookie Banners

Users of web services in EU countries are frequently presented with banners requesting their consent to the use of cookies, according to the service's cookie policies [58]. Cookies are small files that store user information while a user is browsing the Internet. By storing user preferences or remembering login on a page, cookies can benefit visitors to a website in a variety of ways, thus generally improving their experience [30]. Although, most web cookies today are used to track users online and collect their data (for example, the websites they visit and their behaviour on such websites) with the intention of creating detailed profiles about them and serve them targeted advertisements [65]. A vast amount of data associated with users is being continuously collected and tracked, which allows web advertising companies as well as data brokers to continuously profit from them [50]. These companies analyze vast amounts of data in order to identify subtle behavioral patterns users may be unaware of [30]. Researchers suggest that most site visitors accept cookies as a "necessary evil" in order to access web pages [39], regardless of advertisers' claims that the consumer does not mind being tracked by companies in order to receive "more relevant advertising" [30]. A 2017 study showed that only about 3% of users accept cookies for broader tracking [37]. Therefore, setting tracking cookies for users (not just for advertising purposes) ignores many people's privacy concerns [30].

The General Data Protection Regulation (GDPR) [25] was adopted in April 2016 and took effect in May 2018, redefining consent rules in the tracking and advertising industry [50]. This led to the introduction of cookie banners that exist as banners at the top or bottom of web pages or as pop-ups that either inform the site visitor about the cookie usage or ask for consent to set cookies [30]. Under the GDPR, website operators, no matter where they are located, must inform EU website visitors of how their personal data will be collected. The owners of websites must be transparent about the purpose of using cookies, even if they are necessary for the site to function (i.e., for authentication and security purposes) [22]. When cookies are set for analytics and advertising purposes, i.e., non-necessary cookies, most official guidelines from the Data Protection Authorities, such as the Luxembourgish Data Protection Authority, CNPD [6], agree that consent of users is required. If users don't know the specific purpose(s) of using cookies, they cannot consent to their personal information being collected [58].

Many times, the language used in cookie banners may include technical jargon [63], ambiguous and vague terms, as well as positive and negative framing [58]. By creating a lack of transparency, users are unable to fully understand why their data is collected and what risks might be involved (Recital 39 GDPR [25]), preventing them from making informed decisions and nudging

them to consent in an unlawful way.

1.3.1 Spotting Dark Patterns in Cookie Banners

Given the popularity of cookie banners and the frequency at which users interact with them, it is important to understand the different ways dark patterns can manifest in them. In the previous section, cookie banners have appeared in the given examples of the general types of dark patterns. In this section, we will look into different types of dark patterns that are specific to cookie banners. Below are some examples identified from different web sites with their descriptions.

Users have only one choice: This is one of the common ways cookie banners appear. In the example below 1.14, we have a combination of forced consent 1.1, as users are given no choice but to accept cookies, and misdirection 1.7, as the popup says that cookies are used to personalize and enhance user's experience on the website when in reality cookies are used to collect their data for marketing purposes.

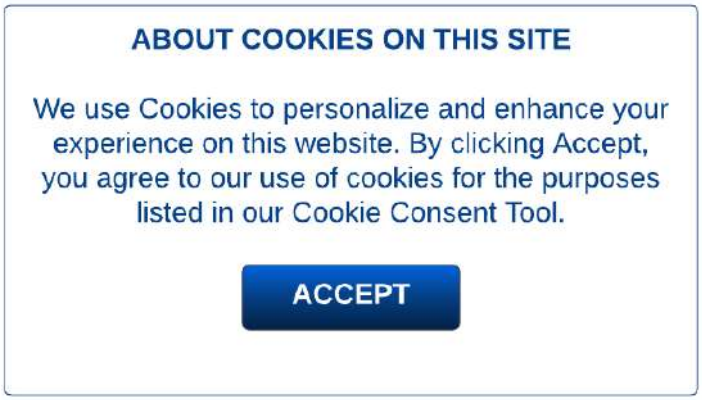


Figure 1.14: Cookie banner with one choice

It is easier for users to accept: This is another common kind of cookie banners used on the internet today. This banner employs the false hierarchy 1.4 dark pattern. With this banner 1.15, it is easier to accept all cookies than to manage complex settings. According to research [35], users are not interested in setting cookie preferences or managing cookies. Furthermore, it is unfair to expect them to know everything about the technology in order to give a truly informed opinion [35]. In a balanced cookie banner, the user should be able reject cookies as easily as he can accept.

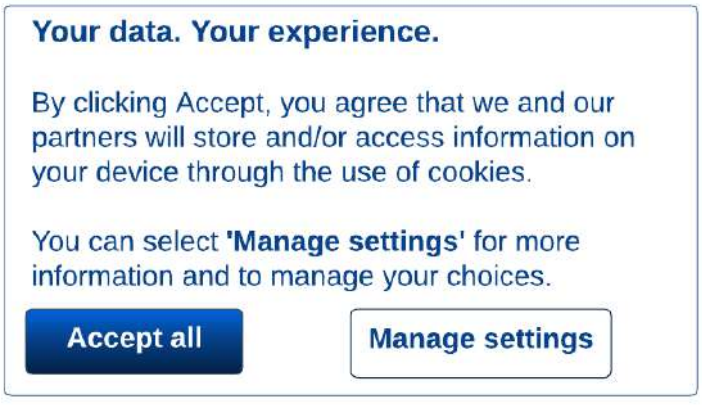


Figure 1.15: Accept or manage settings

Users can reject but with a consequence: Another kind of cookie banner used easily gives users the option to decline cookies, but this choice comes with a punishment. In the example below 1.16, if a user chooses to decline cookies, they are only allowed to visit the black and white version of the website.

Figure 1.16: Reject with a consequence

There is a more visible choice: This is another common type of cookie banner. Here, users are given the choice to decline or accept cookies easily, but the accept option is made more visible than the reject option 1.17. This is another form of pre-selection 1.6 as the website operators have placed emphasis on the choice that favors them even before the user gets to make their own choice.

Figure 1.17: More visible Accept button

Use of manipulative language: In this types of cookie banners, web operators use devious language to trick users into doing what benefits the company. As seen below 1.18, no matter the cookie selections a user makes, once they click the following button (which should normally save their preference), they would be accepting all cookies. Only users who pay much attention would be able to notice that the button accepts all cookies, or even notice the tiny "No thanks" option below.

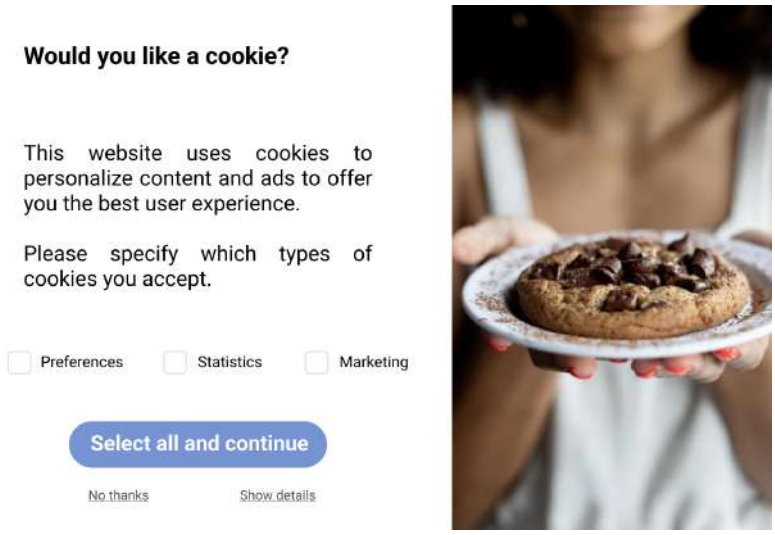


Figure 1.18: Cookie banners using manipulative language

Allowing legitimate interest cookies: This type of cookie banners usually have normal consent toggles alongside legitimate interest toggles. According to Article 6(1F) of the GDPR [5], processors may process personal data based on legitimate interests pursued by themselves or by third parties, for example, freedom to operate a business [50]. However, the European Data Protection Board(EDPB) stated that legitimate interests are not regarded as a sufficient lawful foundation for tracking, profiling, advertising, or other processing of personal data [1]. But as seen in the image below 1.19, some web operators might use legitimate interest as a means to harvest users data. The normal consent toggles might be turned off by default but a user has to be meticulous enough to also turn off legitimate interest toggles off as it also gives consent to use their data.

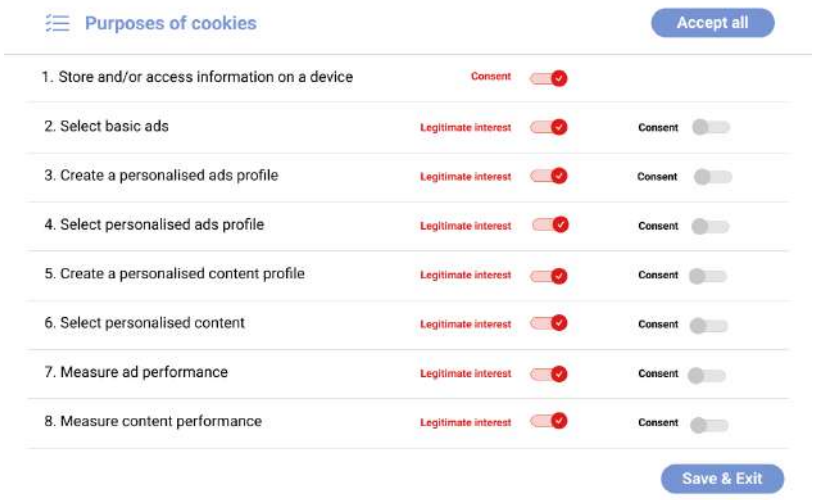


Figure 1.19: ?

It is worth noting that many studies have demonstrated that cookie consent banners are full of dark patterns [55] [39] [62]. They come in different forms on different interfaces. Given their prevalence and the significant role they play on the internet today, it is important to mitigate dark patterns in cookie banners.

1.4 Possible Interventions

Several possible measures, identified by Rossi et al. [57], can be put in place to combat dark patterns in general. Theses measures include:

Technical measures: To warn users, to expedite watchdogs' supervision tasks, and to provide consumer advocates with proofs of unlawful influence, tools can be developed that identify, flag, and classify potential dark patterns automatically [48, 55, 57].

Design measures: To counter dark pattern designs, bright pattern designs can be put in place. Using digital nudges to counter dark nudging strategies, designing consent options that carry the same visual weight, and using friction-based design to reduce binge watching on streaming services are some examples [57].

Regulatory measures: Now that dark patterns are becoming more and more widespread, legal safeguards should also become more strict, since many dark patterns are unlawful according to the EU consumer law [57] and data protection law.

Educational measures: The research and design communities can explore manipulation protection strategies with target users. Researchers should investigate folk models [68] that trigger users' skepticism towards certain interfaces. Also, embedding gaming experiences in major online services might improve motivation to counter dark patterns in real-life settings without incurring in the cognitive costs associated with transfer of skills from one context to another [57].

1.5 Conclusions

In this chapter, we looked at what dark patterns are and some of the different types of dark patters found on the internet. We also compared the dark strategies to privacy strategies and discussed dark patterns specific to cookie banners. We further looked into the requirements of consent according to the GDPR, how dark patterns infringe them and the possible interventions in combating dark patterns. In the following chapter, we will delve into one of the educational measure proposed as an intervention to dark pattern: gamification. We will explore the different mechanics and dynamics that can make this an effective solution.

Chapter 2

Gamification for Learning

Under the educational measures of intervention discussed in Chapter One 1, embedding gaming experiences is a noted solution. Towards creating such solution, it is important to explore gamification for learning as well as the game mechanics and dynamics that will foster the desired learning outcome.

Like any other product, creating a game requires distinctly defining the structure and objectives of the game. In a game, the end users are the players and it is important to define how these players can effectively interact with the game to achieve the set goals; this could include entertaining, educating or training the player on a given subject. In this chapter we discuss various concepts in game development, with a focus on Serious Games. We also list different forms of game mechanics that can be used as building blocks and can be combined, strategically, to develop a positive engagement loop in a game.

2.1 Gamification

Gamification is the application of game mechanics and game design techniques to non-game contexts meant to influence people's behaviour [40]. It is typically used in non-game applications and processes, to increase participation and engagement by integrating game mechanics and game dynamics [38]. Gamification works by making technology more captivating, by encouraging users to engage in desired behaviours, by capitalizing on the humans' psychological tendencies to participate in gaming and by showing a path to mastery [47]. The main two concepts of conceiving a game are game mechanics 2.1.1 and game dynamics 2.1.2.

The most perceptible aspect of gamification is the game mechanics and this tends to be the main focus of most gamification projects. In their book [40], Janaki and Mario likened game mechanics to paints in the palette of an artist. Great art cannot be created simply from adding many colors to the picture, without firstly having an artistic vision, talent, and training. Likewise, to successfully apply game mechanics, we need to have a well-designed gamification strategy that is based on a sound understanding of the player, the goal, and human motivation [40].

On the other hand, understanding game dynamics requires that the game must be played through a combination of multiple player actions, enacting interconnected game mechanics during gameplay. The game dynamics emerge from the game mechanics when a player's actions trigger multiple game mechanics. The game dynamic is therefore designed to emerge from the game's arte-

fact during gameplay. The characteristics of game dynamics can be seen through the concept of the digital game system as a dynamic system [66]. Game Mechanics motivate behaviors while Game Dynamics satisfy desires [38].

Through gamification, we can motivate and engage people to participate in activities or communities by offering them an engaging, dynamic, and sustained gamification experience that can be used for a wide range of purposes [47].

2.1.1 Types of Game Mechanics

Game mechanics provide a structure of how the game reacts to the various actions, behaviors, and control mechanisms performed by players. These mechanics are the frames upon which the rules and procedures that help players navigate the gaming process are predominately built upon. The different mechanics in a game come together to hatch a compelling, engaging user experience [38]. These mechanics are the tools the player must use in order to interact with it [23]. Two games employing the same set of mechanics would oftentimes play out differently based on how the creators blended and accentuated them. There are many kinds of game mechanics that can be used in structuring a game see Figure 2.1, some of the common mechanics are briefly discussed below:

Points: are good motivators for players as people, in general, love to earn and collect them [38]. Gamification utilizes points to measure the granularity of achievements. In the overall gamification strategy, this is how the system keeps track of the players' behaviour related to the targeted behaviours. Users can be awarded points across multiple dimensions, and the same site or application can reward users for different behaviours using different categories of points [40]. Examples include LinkedIn [1] which counts user's connection and SHEIN [2] which awards users points for daily check-in.

Points can be used to indicate status and users can exchange them for access to new content, virtual good or gifts. Examples are computer games where players can see the points gained and in some games, use points gained to unlock new levels or buy virtual goods. Players receive immediate feedback from points, which caters to the feedback motivational driver [40]. Research conducted at IBM Research and the University of Chicago shows that earning points has a dramatic effect on user behavior, even if there is no monetary value associated with them [31]. Users love to be rewarded as it gives them the feeling that they have gained something [38].

Levels: are milestones or thresholds of points that a player must achieve in order to gain access to certain contents and functionalities of the game. Frequent flyer status, grade levels, job codes in the industry, and coloured belts in martial arts are classic examples of levels. User levels are often defined as points thresholds so that users can automatically rise through the ranks depending on their participation and achievement in a community and should be accorded a certain amount of respect and status [38].

Challenges, Trophies, Badges, Achievements: can all be categorized as challenges where players are given a task to accomplish and a reward is given to them when they successfully complete the task. A player can also be awarded a badge after accumulating a certain number of points. This reinforces the targeted behavior of players [40]. Challenges give

[1] LinkedIn website - `https://linkedin.com/`
[2] SHEIN website - `https://shein.com/`

people a sense of purpose and make them feel that they're working towards something [38]. Challenges are, in general, configured according to the actions players track, and rewardable milestones are rewarded with trophies, badges, and achievements. Providing a forum for users to show off their achievements, such as their badges or a trophy case, is key to making levels and challenges successful. In the real world, similar designs are also seen in Scout badges, credit cards with colors denoting high spending limits, and colored frequent flyer cards that signify membership [38].

Virtual Goods: an effective game economy needs an avenue to spend points, give an incentive to earn more, and grant users the ability to customize something to represent personal identity. The concept of virtual goods refers to non-physical items purchased for use in online communities or games. These goods, by definition, are intangible and have no inherent value. Examples of virtual goods include items like digital gifts, digital clothing for avatars, coins, swords, potions and virtual rooms [38]. There is great potential for creativity, competition, and self-expression with virtual goods since they get users very invested and thus, locked in. By selling users virtual goods for real cash, creators can also profit from virtual goods [38].

Leader-boards: by displaying the players in descending order on a list, leaderboards bring in the social aspect of points and badges [40]. Users can see how they rank and their scores, as well as that of others, on leaderboards. They bring aspiration, fame, and a spotlight on player's name [38]. Leader boards encourage healthy competition when displayed in a community but a possible disadvantage of a leaderboard is that it could demotivate new players. Like in an instance where a new player A logs into a game with only 8 points and sees another player B with 2,000 points on top of the leaderboard. While some player A might be up for a challenge, it might also be the case that A gives up entirely as 2,000 seem unattainable at the point. Gamification uses leaderboards to track and display desired behaviour, motivating it by using competition [38].

Gifts and Charity: donating and gifting are effective acquisition and retention tools, particularly for users who are motivated by altruism. Having an opportunity to show benevolence through a game would motivate these users to keep engaging.

2.1.2 Types of Game Dynamics

Game dynamics describe how the game emerges as a result of the interaction between the game mechanics and the player [43]. There are several kinds of game dynamics, some of them are briefly outlined below:

Reward: being rewarded for taking some sort of action is a motivating factor for humans. The purpose of a reward is to induce the repetition of an action or behavior. A primary reward mechanism for gamification is earning points or equivalents. The desire to obtain virtual goods and to level up satisfies this urge, as well as completing achievements [38].

Status: refers to the rank or level of a player. Generally, human beings seek esteem and respect from others, as well as status, fame, and prominence. The status of players in a gaming environment should be easily accessible, and (as is often the case) displayed publicly. It is important for people to gain recognition and get a sense of contribution in order to feel accepted and valued. These dynamics are driven by all elements of the game mechanics, and levelling up is the main motivator [38].

Table 2.1: The relationship between Game Mechanics and Game Dynamics

GAME MECHANICS	GAME DYNAMICS
Points	Reward
Levels	Status
Challenges	Achievement
Virtual Goods	Self-expression
Leader-boards	Competition
Gifts and Charity	Altruism

Achievement: achieving something in a game is represented physically or virtually through achievements, and they are similar to levels in that they require the completion of a milestone before a reward is awarded. People who wish to achieve goals, to accomplish a difficult task through sustained and repeated efforts, and to succeed tend to be motivated by achievement. Individuals in this category like challenges and set reasonably difficult but attainable goals, and they want to be recognized for their achievements as a reward for overcoming challenges [38].

Self-expression: there is a desire and need for people to express their independence and originality, to mark themselves as different from those around them. It is rooted in the human desire to show off our sense of style, our identity, and our personality, as well as our affiliations and connections with groups and celebrities. The use of virtual goods is a common way for players to express themselves, whether they buy it with what they earned through rewards, receive it as gifts, or purchase it with real money. It is possible to create rich, expressive avatars using individual characteristics [38].

Competition: can be a motivating factor for individuals. Performance levels can be increased when a competitive environment is created and the winner is rewarded. The reason is that comparing people's performance with others gives them a certain degree of satisfaction, especially when they achieved better results. All game mechanics appeal to this desire, even self-expression, but leaderboards are the most effective method for displaying competition results and celebrating winners. There are many games that provide a straightforward top ten list, and using that public display to acknowledge the achievement of new levels, rewards earned, or challenges met can be an excellent motivator [38].

Altruism: in a community where people actively pursue relationships, gift-giving is a powerful motivator. In a world of free and commodity gifts, motivated givers will seek out a more meaningful way to express their feelings, whether it is through money or through the time spent earning or creating the gift. Gifting is one of the most powerful acquisition and retention mechanics in gamification. Players are pulled into the game with a gift from someone, and then they are incentivized to send gifts to all their friends, creating a wonderful acquisition loop. Whenever they receive a gift, they are prompted to redeem it within the application, so it also serves as an effective retention tool [38].

Game mechanics and dynamics are interconnected. In other words, a mechanics rule set that defines a points structure can be translated into dynamics by using a reward structure, as well as rules of levels can be mapped onto statuses. A game mechanic can be mapped to several game dynamics, but the table 2.1 shows the game mechanic mapped to the primary desire (dynamics) that it fulfills, extracted from [38].

2.2 Serious games

There are various perspectives in the literature on how the experiences of serious games are interpreted, both theoretically and practically. Alvarez et al. [52] believes that a serious game is a game that combines aspects of tutoring, teaching, training, communications, and information with a recreational element and/or technology derived from video games for users to interact with and learn from. According to some researchers, all games are intended for serious purposes such as gambling, fortune telling, or politics [41]. In this scenario, serious games could refer to any application developed with gaming software, which means a majority of simulators are serious games [59]. Dempsey et al. [20] defined serious games as being composed of essential features such as competition and goals, rules, challenging activities, options, and fantasy elements. The essay "Serious Games: A Broader Definition" [3] defines Serious Games as a gaming solution involving the application of gaming technology, process, and design to solve problems faced by businesses or organizations. Through serious games, game development knowledge and techniques can be transferred to markets traditionally outside of the game industry, such as training, education, marketing, sales, etc [4].

Zyda [73] describes serious games as mental contests, played with a computer under certain rules, that provide training or education through entertainment. An entertaining game and a serious game are differentiated by their overarching principles. As their design involves more than just storytelling, art, and software development, serious games are more complex artefacts [42]. The design of serious games must include rigorous pedagogical strategies that distinguish learning theory, teaching and learning approaches, and assessment and feedback [18]. By adding these features, a game becomes an educational tool [71].

2.2.1 Classification of Serious Games

A serious game can be classified based on certain characteristics that are important in their design and these characteristics can make a significant difference in success of the game. Fedwa et al. [41] propose the following five criteria in classifying serious games:

Activity: The first characteristic identified is the type of activities the player performs in order to complete the game. These are the responses or inputs of the player in the game. Physical exertion is one type of activity, such as in games for well-being [61] or those that help to prevent childhood obesity. Activities can also be mental, such as in educational [60], training, and interpersonal games. It may also be physiological, such as games used for rehabilitation or games used for the detection of certain health conditions [41].

Interaction Style Interaction style describes how the player interacts with the game: using traditional methods such as keyboards, mouse, and joysticks or with more intelligent methods such as eye gaze, motion tracking, and tangible interfaces. If the interaction method is not selected well during design of a serious game, it may adversely affect the game's success. The use of traditional interfaces may not be appropriate for certain games, such as games that need biological data as input, such as the heartbeat rate, which is collected from the user by means of biosensors and sent directly to the game [41].

The right interface is vital in many other areas, such as rehabilitation, for instance. A game designed for stroke patients seeking help with rehabilitation would be useless unless

[3] Serious Games: A Broader Definition - `https://lostgarden.home.blog/2005/05/14/serious-games-a-broader-definition/`

an appropriate interface between the user and the game was selected carefully according to the specific needs of the intended users [34].

Application Area Application areas encompass the different application domains that can be employed in serious games. Several of these areas exist including education, military, corporate, health care, training and advertisement.

Environment Several criteria can be used to determine the environment of a digital game. A serious game can have either a two-dimensional or three-dimensional environment, or a combination of the two. A serious game can also be in virtual reality or mixed reality environment. In virtual reality, a computer-generated immersive environment is created and represents either the real world or an imaginative world. Mixed reality is a blend of both augmented reality and augmented virtuality. In this environment, objects from the real and digital worlds interact in real-time. Another criterion that defines environment is location awareness, that is, if in the game, the player's location can be determined. The mobility criterion determines if the game is mobile or not. The online criterion ascertains if the player can play the game over the internet. Lastly, the social presence criterion is dependent on if the game is played by one or multiple players [41].

Modality In this context, modality describes the channel of communication between the computer and human being(s) playing the game. Players are exposed to a variety of sensory modalities in games and these include seeing, hearing, and touching. The game's purpose can be improved by using modalities to the game's advantage. Additionally, the inclusion of the right modalities improves the user's experience and consequently increases the game's success [41].

Jeffery et al. [70] carried out an investigation on certain properties that contribute to the success of a well-being serious game. They found that one of the most significant properties is the music integrated in the game. The music helped in motivating players to exercise when playing the game. This a good example of how auditory (hearing) modality help improve a game's success.

2.2.2 Learning Mechanics-Game Mechanics Model

There is a fair amount of understanding and descriptive work on game mechanics within the context of entertainment games, but not nearly enough on serious games. The academic definition of the term game mechanics refers to the relationship between players and the rules of the game, as well as conventional properties like goals, actions, strategies, and game states. Nevertheless, many uncertainties remain regarding the definition of serious games and whether or not they are of the same degree of abstraction as conventional entertainment games.

Mechanics of serious games need to reflect the complex interrelationships between pedagogy, learning, and entertainment and connect the educational and gaming agendas. Accordingly, serious game mechanics in this context refer to the elements of a game that directly tie pedagogical practices to game mechanics. Game mechanics described from the user's perspective offer an interesting alternative to the game-centric approach to design patterns. Many studies have been done on how humans learn, but no single theory has lived up to defining how we learn, because the characteristics of each individual differ according to their objectives and circumstances. It is imperative that one consider this observation when mapping gaming to learning mechanisms, so that one can understand what game mechanics can enhance learning. To properly understand

GAME MECHANICS	THINKING SKILLS	LEARNING MECHANICS	
○ Design/Editing ○ Infinite Game play ○ Ownership ○ Protégé Effect ○ Status ○ Strategy/Planning ○ Tiles/Grids	CREATING	○ Accountability ○ Ownership ○ Planning ○ Responsibility	
○ Action Points ○ Assessment ○ Collaboration ○ Communal Discovery ○ Resource Management ○ Game Turns ○ Pareto Optimal ○ Rewards/Penalties ○ Urgent Optimism	EVALUATING	○ Assessment ○ Collaboration ○ Hypothesis ○ Incentive ○ Motivation ○ Reflect/Discuss	
○ Feedback ○ Meta-game ○ Realism	ANALYSING	○ Analyse ○ Experimentation ○ Feedback ○ Identify ○ Observation ○ Shadowing	LOTS to HOTS
○ Capture/Elimination ○ Competition ○ Cooperation ○ Movement ○ Progression ○ Selecting/Collecting ○ Simulate/Response ○ Time Pressure	APPLYING	○ Action/Task ○ Competition ○ Cooperation ○ Demonstration ○ Imitation ○ Simulation	
○ Appointment ○ Cascading Information ○ Questions And Answers ○ Role-play ○ Tutorial	UNDERSTANDING	○ Objectify ○ Participation ○ Question And Answers ○ Tutorial	
○ Cut scenes/Story ○ Tokens ○ Virality ○ Behavioural Momentum ○ Pavlovian Interactions ○ Goods/Information	RETENTION	○ Discover ○ Explore ○ Generalisation ○ Guidance ○ Instruction ○ Repetition	

Figure 2.1: The Learning Mechanics-Game Mechanics Model [10]

the purpose and design of serious games, a pedagogy-game mechanic mapping is essential [9].

There are several pedagogical theories and approaches that have been studied and analyzed to describe the human process of learning, such as behaviourism, humanism, cognitivism, constructivism, personalism, etc. The Learning Mechanics-Game Mechanics Model (LM-GM) [10] model was developed to enable different users to describe games based on different pedagogical approaches. This model of learning mechanics includes a number of different aspects such as tasks, activities, goals, and relationships derived from a number of different pedagogical approaches. Based on the specific nature of the serious games being analyzed, LM-GM users can map these aspects of learning mechanics to different game mechanics [10].

A pedagogical perspective argues that the method by which someone learns is more significant than the domain specificity of the medium used to perform the learning. In [10], Sylvester et al. combine the Bloom's theory [51] in accordance with the digital taxonomy of Anderson et al. [46] to define a simplified framework that can be used in linking popular game mechanics to learning mechanism, see Figure 2.1. The table, for example, emphasizes task-focused learning rather than cognitive learning. Essentially, a game is an assessment of the player's knowledge as players progress through the levels.

2.3 Conclusions

In this chapter, we looked into gamification for learning. As important aspects of gamification, we delved into understanding several game mechanics and dynamics and how they can be mapped to each other. We also looked into serious games and how they can be applied as educational tools. Lastly we analysed the Learning Mechanics-Game Mechanics Model and saw how game mechanics can be mapped to learning mechanics.

As we seek intervention for dark patterns in our world today, it is important to find an effective

way of educating people on how to recognize and respond to dark patterns in order to protect their personal data when they navigate on websites and cookie banners appear. Using the right combinations of game mechanics, game dynamics and learning mechanics, gamification of the learning experience can be explored as an entertaining and effective way to educate users about deceptive dark patterns and how to maximise their privacy.

Chapter 3

State of the Art

In light of gamifying the learning experience of users on how to identify or react to dark patters, very few solutions currently exist. In this chapter, I will analyse three games that are already available: the game mechanics employed, the structure and design of the Graphical User Interface (GUI) and the general impression of a few players to the games. In order to get feedback from players, I asked three people (test players), who were not conversant with the dark patterns research, to play all three games and give their impressions of each of the games. All three players were between the ages of 20 and 30, resident in the EU, and had completed a bachelor's degree.

3.1 Game 1 - Cookie Consent Speed.Run

This game, created by Fred Wordie, can be played on `https://cookieconsentspeed.run/`. The goal of the game is to make users say no to all cookies. The game imitates common cookie consent pop-ups and banners.

3.1.1 Graphical User Interface

The game is played by clicking several buttons and toggles 3.1. Each button represents an action a player can take, either to accept or to reject or to adjust cookie settings. The rules of the game are displayed to the player before he/she can click the start button that begins the game. There are two main display boxes; on the right is the game play interface and left is a timer. The timer starts running once the player starts the game and stops when the player successfully completes the game.

3.1.2 Game Mechanics

1. Levels: There are three levels in the game. The first level presents several buttons with several options to accept cookies and policy and just one button to modify preferences. To proceed from here, the player must click the button to modify preferences. In the next level, several toggles with option of Yes or No appear next to a drop-list of cookie management options. A player must set all the toggles right to move to the next level. The third and final level again several buttons with the option that counter the settings from the previous level and just one button to successfully save the player's setting. If the player identifies and clicks the correct button, the game is finalized.

2. Feedback: During the game play, the player receives no direct feedback from the game. But at the top of the display box, several hints are given and the amount of toggle yet to be set right is indicated. This gives the player a pointer to how many toggles need to be corrected in order to finish the game.
3. Time Pressure: As stated earlier, there is a timer counting how long it takes the player to complete the game. As the name of the game implies, the player should try to finish the levels in the shortest time possible.
4. Reward: In this game, the only indicative reward is that players who finish the game in 45sec time, get a ten percent discount on buying the book called "Big Data Girl", written by the game creator.

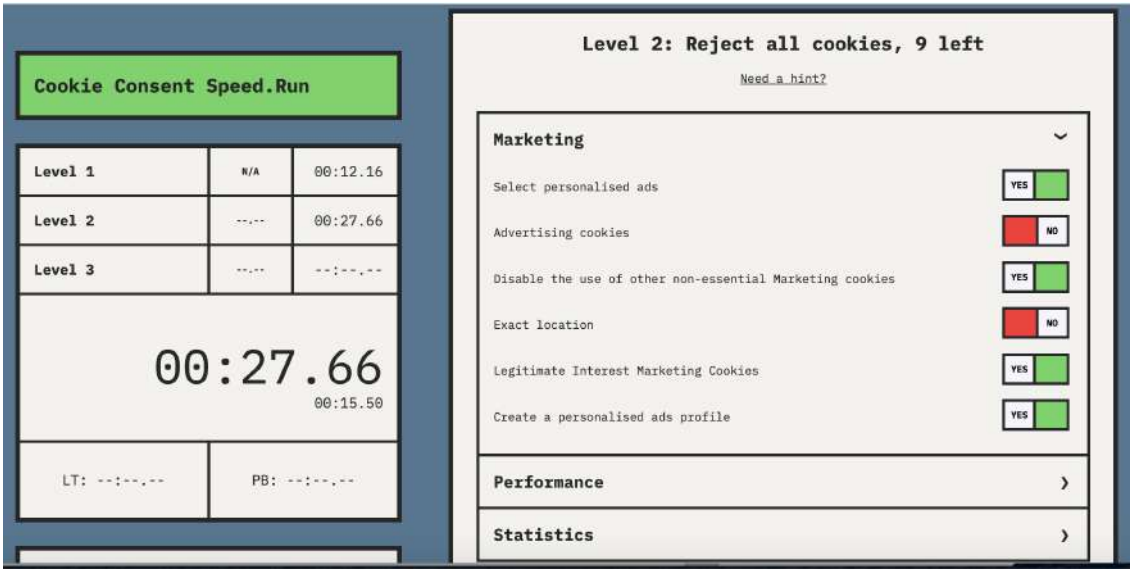


Figure 3.1: Screenshot of Cookie Consent Speed.Run

3.1.3 Player's Review

To get the review of this game from the player's perspective, I shared the link to the game to the three test players to play and share their experience. In summary, the players thought the goal of the game was good but two out of three could not figure out how it worked in the first instance. All three of the players confirmed that the toggles were very confusing as they didn't know when Yes or No was implied. One of the players also stated that the timer made her anxious and since she was given no real instruction or feedback, she got stuck in the game as the timer continued to run. This made her frustrated and quit the game entirely. They recommended that the game instructions should be made clearer, the toggles should be unequivocal and the game should be made a bit more interactive in terms of feedback.

3.2 Game 2 - Terms & Conditions Apply

This game, created by WKLondon et al., can be played on `https://termsandconditions.game/`. The goal of the game is for players to successfully not accept any terms and conditions, to say no to all notifications and to always opt out of cookies. This game models different variants of privacy dark patterns 1.1.1 where users are tricked into giving their personal data away.

There are 29 questions in the game and each question has a timer. The game ends when the player has answered all question or the timer on each question has run out.

3.2.1 Graphical User Interface

The game implements a very interactive interface. Players are given 29 different pop-up banners to react to and different actions can be performed on different pop-ups. The pop-up banners consist of buttons, toggles, drop-down lists and check boxes that the players can interact with. At the beginning of the game, the instructions and description of the game is clearly displayed to the player. The challenges grow harder the more the player advances in the game.

3.2.2 Game Mechanics

1. Time Pressure: The game employs the time pressure mechanism by allocating a limited time bar above each pop-up banner, where players would have to respond to the banner before time bar is exhausted. If the time lapses, the banner disappears and the task is considered undone.
2. Stimulate/Response: The entire idea of the game is to get player's response to each banner. The pop-up banners are shown to the players and the task is to respond appropriately to the displayed banner. A player can either pass, fail or abandon the task till the timer runs out.
3. Urgent Optimism: The time pressure and the urgent optimism work in conjunction here. Because there is a time frame for each questions, player try to immediately tackle the task in the pop-up banners in the fastest time possible. Players would want to complete a task quickly and move on to do same in the next task.
4. Feedback: The feedback in this game works in two phases. During the game play, if a player respond to the pop-up banner correctly, the background turns green indicating that the player passed the task. While in a case where the player fails the task or does not complete the task, the background turns red. These two indicators are also accompanied by respective sounds. The second phase of the feedback is after the game play. A full analysis of the player's performance is given, including comparison with other players performance (see Feedback interface in Figure 3.2). It further gives player's the option of revisiting wrongly answered questions.

Figure 3.2: Example of Feedback for Terms & Conditions Apply

3.2.3 Player's Review

To get the review of this game from the player's perspective, I also shared the link to the game to the three test players to play and share their experience. All three players stated that the game was interactive and educative. The time pressure also increased their engagement as they had to give the full attention in order to meet the time span. One player said he found the game confusing on his first play but had a better experience on his second play as he initially did not expect the game to be in form of plain pop-up banners. All three players noted the game had a variety of privacy dark patterns examples. They also lauded the fact that the game creators added some fun elements and sarcasm to the game. As for recommendation, one player suggested that the game was interesting but could become even more interactive with active feedback.

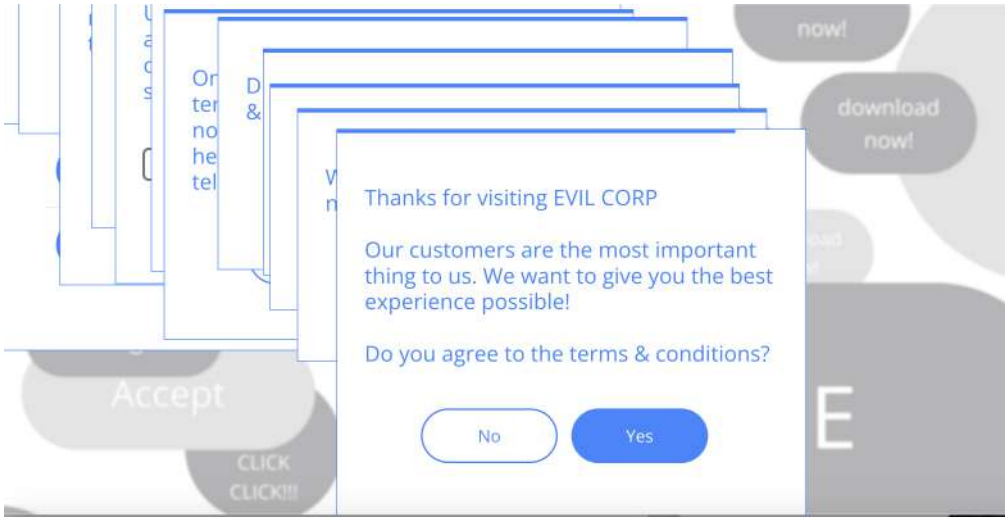


Figure 3.3: Screenshot of the interface of Terms & Conditions Apply

3.3 Game 3 - Cyber Chronix

This game, made by the European Union, can be downloaded on Android OS via `https://play.google.com/store/apps/details?id=ec.europa.publications.cyberchronix`. The game is a comic game, composing of a lot of dialogues and the goal of the game is to create awareness on privacy risks and data protection rights. The game allows players to create a story path through decision making surrounding Data Privacy.

3.3.1 Graphical User Interface

One notable thing about this game it that it is available in eight languages, including English, French and Italian. The game is composed of several characters that create a story, based on players actions, through out the course of the game. The game uses a lot of text boxes to display dialogues to players (see example of interface in Figure 3.4). The outcome of the game depends on the decisions the player chooses to take. There are also questions available for users to answer and get a reward during the game. Players interact with the game by choosing what actions the characters perform next. The game ends when the player reaches a final good or bad outcome.

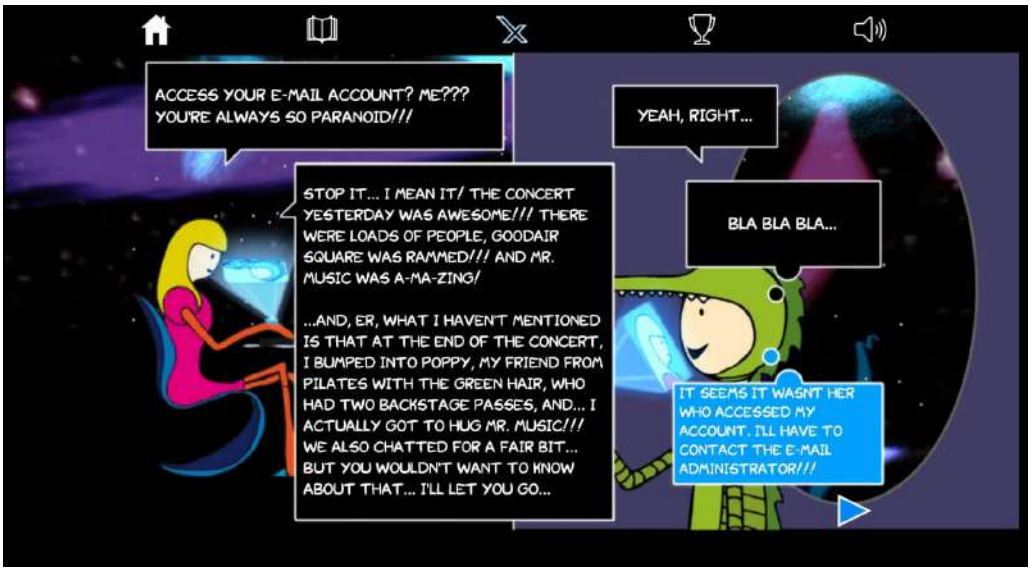
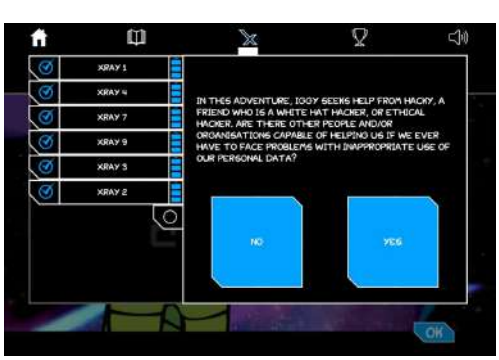


Figure 3.4: Cyber Chronix

3.3.2 Game Mechanics

1. Action Points: At every scene during the game, the player is required to take an action that would result in the next scene. The player usually has two courses of action to pick from and the next scene is dependent of which the player chooses.
2. Cut-scene/Story: As stated before, this game is comic-based. There are cut-scenes that usually explain the game in general or the situation the player is currently in. The cut-scene are elemental to the story telling parts of the game.
3. Question and Answers: Every now and then during the game, some questions are made available for the player to answer. The questions are ten in total and player gets a reward after answering a question correctly, although it is not clear how users can apply this reward in the game (see Question and Answer interface in Figure 3.5).
4. Feedback: If a player answers a question correctly, he is given a congratulatory message supporting his answer. If the player answers wrongly, a message also displays explaining the correct answer to the player. Also, after every game round, the game give the player a feedback. If the player's actions lead to a bad final outcome, the game explains why the player failed that round (see Feedback interface in Figure 3.5).



(a) Question and Answer

(b) Feedback

Figure 3.5: Examples of Game Dynamics used in Cyber Chronix

3.3.3 Player's Review

As before, I gave the three test players the game to download and play, and give me their opinions about the game. All three players confirmed that they took away lessons from the game. They especially commended the Question and Answers 3.5 that they found very enlightening. Two players complained about the voluminous text they had to read. The three players claimed to have enjoyed the relationship between the choices they made and the outcome they brought.

3.4 Conclusions

The three games we have briefly analysed have a determined educational goal that reflects in the game mechanics and dynamics applied in their implementation. Like most technologies, these games have their perks that can be emulated and also have their drawbacks that can be further improved on.

There are research gaps that emerge from the analysis of these games and the existing literature on dark patterns in general. Gamification as a solution to dark patterns has been proposed but not studied or reported. Although some of these games above have been developed as tools for combating dark patterns, evaluating and reporting the effectiveness of these games is still required. The key question still is; can a game effectively train people to recognise and interact with dark patterns. It is important to address these gaps towards overcoming dark patterns on the internet today.

By analysing these games, I have been able to identify some of the game mechanics and dynamics that would be efficient to the goal of the game I intend to develop and evaluate. Some these include key engaging mechanics such as Levels, Badges, Feedback, Cut-scene/Story and Question and Answers. Also, several of the graphical contents of these games will also inspire attributes of the intended game.

Chapter 4

Research Questions and Methodology

The deception used by online service providers to gain users' personal information has become more sophisticated over the past few years [12]. Many studies have investigated these dark patterns [12,27,45,48,49] and some have proposed ways to mitigate this deleterious trend [11,57]. As seen in Chapter 1, there are numerous variants of dark patterns and addressing all would require a very broad scope. In this thesis, I intend to understand how to counteract dark patterns found in cookie banners as it is one of the most common dark pattern users encounter on the internet today.

As suggested in [11, 57], there are several possible interventions applicable to dark patterns. Technical measures involve developing tools that can help in flagging and reporting dark patterns on the internet. Design measures require putting bright pattern designs in place. Regulatory measures such as making legal safeguards more strict is also suggested. Educational measures include embedding gaming experiences in major online services where users can play and learn about dark patterns. Amongst all four measures listed, the educational measure presents a means to directly influence the behaviour of online users and therefore might be a useful way to sensitise and train people in spotting and interacting with privacy dark patterns. I therefore ask:

> **RQ1:** Can users be effectively trained to respond to dark patterns in cookie banners in a manner that maximizes the protection of their personal data (i.e., to reject all non-essential cookies)?

From Chapter 2, we understand that gamification makes technology more captivating, by encouraging users to engage in desired behaviours. Gamification capitalizes on the humans' psychological tendencies to participate in gaming and by showing a path to mastery [47]. In their paper [8], Al-Azawi et al. argue that games can serve as a tool for evaluating and/or conducting research where individuals from diverse demographics can participate. Additionally, games can stimulate learning because they provide participants with novelty, curiosity, and challenges [8]. According to their research, Jayalath et al. [36] found that integrating game components into online learning environments enhances students' motivation and makes it easier for them to attain the determined goals. With these shown advantages, gamification shows much potential as an effective tool in training people to identify and interact with dark patters in cookie banners. This leads to the second research question:

> **RQ2:** Is gamification perceived as able to train users against cookie dark patterns in real life?

In Chapter 2 we looked into several game mechanics, dynamics and learning mechanics and the relationships between some of them. In Chapter 3, we analyzed games that already exist on the subject of data privacy. We examined the game mechanics and dynamics used and also got some player's reviews, which clarified how the mechanics of the games can influence engagement and learning in this specific field. To test all the knowledge gathered, we would attempt creating a gaming solution to dark patterns in cookie banners. This leads to the third research question:

> **RQ3:** Can a game on cookie dark patterns be engaging, clear, and appropriately challenging?

Creating a serious game that is engaging, clear, and appropriately challenging would keep players interested in the game and encourage them to further in the learning process. A boring and unclear game would tire players out and the learning objective might not be achieved. It is therefore important to use the right combination of game mechanics and dynamics that can be used in the game to keep the players continually interested.

4.1 Methodology

4.1.1 Research Goal

For my Master Thesis, I aim to create a game that would train players to identify privacy dark patterns in cookie banners and respond to them in a manner that preserves the most privacy, i.e, to only accept essential cookie.

4.1.2 Motivation

I am studying the design and implementation of privacy dark patterns and the different forms they take in cookie banners and other different interfaces 1 because I want to find out the possible design patterns that can be used to manipulate users, in order to understand which strategies the users should be trained against.

I am also studying game mechanics that are used to design interactive and engaging serious games 2 because I want to find out the most successful or appropriate techniques employed in developing a game that can be educative and still entertaining with the aim of creating a game that can effectively train users on how to spot and interact with dark patterns, in an engaging manner.

Lastly, I am analysing three privacy-related serious games already exist on this subject matter with the help of test players 3 because I want to identify the game mechanics and dynamics used in these game and understand their effects on players in order to find the research gaps of these games that I can further improve on.

4.1.3 Implementation Method

I created The Dark Cookie game on Scratch, because of its ease of use, where I implemented all of such game mechanics and dynamics collected from my research. Refer to Chapter 5 for the details about the implementation part.

4.1.4 Evaluation Method

I shared the game with several players in different locations and with different educational levels and level of expertise with dark patterns. Then I created a short survey for such players, based on established questionnaire to evaluate games. The survey investigated elements such as: feedback, clarity of rule, learning experience and game engagement. Refer to Chapter 6 for the details about the evaluation.

4.1.5 Data Analysis Method

The data analysis of this research was descriptive, both quantitative and qualitative. The survey questions mostly used the Likert Scale [44] and so that data can be analysed quantitatively, as the survey tool also provided calculated percentages of responses. There were other questions in the survey required participants to type in their remarks. These parts of the survey were analysed qualitatively, as I gathered all responses in an Excel spreadsheet and used color coding to find patterns in participants' responses. In Chapter 6, I give details on the results of the survey and in Chapter 7, I discuss the results and offer answers to the research questions.

Chapter 5

Implementation of the Dark Cookie

This chapter documents the processes carried out in designing and developing the prototype of the Dark Cookie game. The goal of the game is to train players to spot various types of dark patterns and interact with cookie banners in a way that maximizes the protection of their personal data, which means, rejecting all unnecessary cookies. The game should be educating, engaging and interactive. The player's main goal during the game will be to reject all cookies in the series of cookie banners that will be displayed to them. The below sections give details on the various steps taken during the development of the Dark Cookie game prototype.

5.1 Analysing State of the Art

Before planning implementation, I analysed existing games that tackle data privacy 3. The goal of this process was to observe the game mechanics and dynamic that were implemented and the effects they played out, see report in Chapter 3. Another goal was the find research gaps 3.4 in these games and improve on them. Analysing these games created inspiration for the contents in the cookie banners and graphical context of the Dark cookie game. Additionally, the feedback gathered from the three test players throw more light on what some players may expect from a privacy serious games. These include, provision of clear goals and instructions of the game, feedback on players performance, interaction between the game and the player, continued engagement through out the course of the game and useful educational content. These elements should be reproduces in the Dark Cookie game.

5.2 Gathering Cookie Banners and Dark Patterns Typology

In creating a game based on cookie banners, it was an important step to make sure that the game reflected as many cookie banner types as possible. This is so that players of the game will be exposed to many cookie banner variants found on the internet today. I began visiting different websites and collecting screenshots of different variants of cookie banners. I also collaborated with researchers from the Decepticon project [1] who had several examples of cookie banners gathered from social media. There were many similarities in cookie banners found as most web operators employ the same consent model. It now became idea that to make the game more versatile, I could create some cookie banners that reflected other types of dark patterns and also some

[1] Decepticon - `https://irisc-lab.uni.lu/deceptive-patterns-online-decepticon-2021-24/`

that embedded several fun elements. The reason is to create:

- Versatility in the cookie banners that appeared in the different levels of the game. This is to keep players from getting bored from encountering the same types of cookie banners through out the game.
- A reflection of other types of dark patterns in the game, such as nagging, confirmshaming and hidden exit, that could further sensitize players of dark patterns beyond cookie banners.
- Elements of fun, such as word play, moving buttons and riddles, that can make the game more interactive and enjoyable.

5.3 Learning Mechanics

In chapter two 2, I researched on Learning Mechanics-Game Mechanics Model as related to serious games. From the table provided 5.1, I identified the learning mechanics that resonated with educational goal of the Dark Cookie game I intended on developing. The learning mechanics are classified according the thinking skills they influence and I made a selection of those that will be implemented into the game based on the learning goals of the game. They include:

1. Reflect/Discuss- This is classified under the thinking skill of Evaluating. With the Dark Cookie game, I want players to be trained to be more meticulous when responding to cookie banners. When presented with cookie banners in real life, users should evaluate their options carefully before taking an informed decision.
2. Identify- This is classified under the teaching skill of Analysing. One of the main goals of this project is to teach users how to spot dark patterns in cookie banners. The identify learning mechanic can be used as a tool on helping players know how to analyse different cookie banners and successfully identify dark patterns in them and respond to them appropriately.
3. Action/Task- This is classified under the teaching skill of Applying. When a player has gained insight on the topic of the game, it is important to give room to the player to apply and test their knowledge. With the Action learning mechanics, players will be given tasks in the game where they can apply what they have learned.
4. Question- This is classified under the teaching skill of Understanding. When trying to reinforce understanding, Questions and Answers could be a good way to test and affirm the knowledge of a player. In the game, it might help the player further understand the concepts in the game if questions are asked and answers are provided.
5. Instruction- This is classified under the teaching skill of Retention. During the game play and after, it is important that players retain the important lessons that the game is trying to teach. One of the learning mechanics that promote retention is instructions. The game should present clear instructions that will help the player navigate the game and also help the player retain the basic knowledge taught through the game.

GAME MECHANICS	THINKING SKILLS	LEARNING MECHANICS	
○Design/Editing ○Infinite Game play ○Ownership ○Protégé Effect ○Status ○Strategy/Planning ○Tiles/Grids	CREATING	○Accountability ○Ownership ○Planning ○Responsibility	LOTS to HOTS
○Action Points ○Assessment ○Collaboration ○Communal Discovery ○Resource Management ○Game Turns ○Pareto Optimal ○Rewards/Penalties ○Urgent Optimism	EVALUATING	○Assessment ○Collaboration ○Hypothesis ○Incentive ○Motivation ○Reflect/Discuss	
○Feedback ○Meta-game ○Realism	ANALYSING	○Analyse ○Experimentation ○Feedback ○Identify ○Observation ○Shadowing	
○Capture/Elimination ○Competition ○Cooperation ○Movement ○Progression ○Selecting/Collecting ○Simulate/Response ○Time Pressure	APPLYING	○Action/Task ○Competition ○Cooperation ○Demonstration ○Imitation ○Simulation	
○Appointment ○Cascading Information ○Questions And Answers ○Role-play ○Tutorial	UNDERSTANDING	○Objectify ○Participation ○Question And Answers ○Tutorial	
○Cut scenes/Story ○Tokens ○Virality ○Behavioural Momentum ○Pavlovian Interactions ○Goods/Information	RETENTION	○Discover ○Explore ○Generalisation ○Guidance ○Instruction ○Repetition	

Figure 5.1: The table shows the relationship between the learning mechanics (in red boxes) and the game mechanics (in green boxes) chosen for the Dark Cookie game

5.4 Game Mechanics and Dynamics

After outlining the learning mechanics I wanted to deploy in the Dark Cookie game, I tried to connect the educational and gaming agendas. Thus, I mapped the learning mechanics to the appropriate game mechanics that will achieve the intended goals of the game, see Figure 5.1. I also added other game mechanics (and dynamics) that will further improve engagement in the game. The selected game mechanics and how they will apply in the game are described below:

1. Reward/penalties- Towards the reflect learning mechanics, the game should employ the reward/penalty game mechanics. To ensure that players make sure to pay close attention to the task provided, there is a reward given for a correct answer and a penalty given for incorrect answers. Points are awarded for correct answers and points are deducted for incorrect answers. Given that there are consequences for actions, players are motivated to reflect well before providing answers.

2. Feedback- With respect to the identify learning mechanics, the game will employ the feedback game mechanics. Feedback will help the player understand the correctness of their responses and why their response was valid or not. This knowledge will aid the player in easily identifying dark patterns in the cookie banners. In the Dark Cookie game, feedback would be given on every question a players answers. The feedback reinforces good responses and dissuades bad responses through informative, humorous or sarcastic comments. Players are able to learn from the comments the deceptiveness of dark patterns not to respond to them in order to maximize privacy.

3. Stimulate/Response- With respect to the action/task learning mechanics, the game will employ the stimulate/response game mechanics. The concept of the game is to train players to respond to different types of cookie banners. In the game, several pop-up cookie banners are shown to the players and their task is to respond to the displayed banner in a manner that preserves privacy and evades the dark pattern. A player can either pass or

fail the task and gain or loose points respectively.

4. Question and Answers: Towards the question and answers learning mechanics, the game will employ the question and answers game mechanics. The goal of this is to foster the player's understanding of the concept the game is trying to teach. Asides the regular questions provided to the player one the different levels of the game requiring them to reject all cookies possible, the Dark Cookie game will also have a bonus question at the end of each level. These bonus questions will consist of the most common types of cookie banners and users will be taught about the factors that make these banners manipulative.
5. Cut-scene/Story: With respect to the instruction learning mechanics, the game will employ the cut-scene/story game mechanics. Giving a background story of the characters in the game, the goal they require the players to help them attain and the rules to follow for achieving the goal, will make it easier for the player to understand and remember the instructions of the game. This instructions from the game can be retained by the player and its application can be transferred into their real-life interaction with cookie banners. Meaning that players may now begin to apply the instruction of the game, "reject all cookies possible", in their interactions with cookie banners in the real world. In the Dark Cookie game, the story will be told by Mama Bear at the beginning of the game. The story will also encompass all the rules and instructions of the game.
6. Points: To motivate the player and also measure their achievements, point earned during the game will be displayed to the player. The player starts the game having zero points. For every banner a payers respond to, they either are awarded or loose points.
7. Levels: To set milestones for the player's achievements the Dark Cookie game will be divided into different levels. As the game progresses, the player's level advances. The game is programmed in a way that player are presented with more challenging or engaging (in terms of fun) questions as they progress through the five levels of the game to keep players absorbed through out the game.
8. Badge: For every level players complete, they are awarded a new badge. These badges depict status in the game and they include Cookie Sergeant, Cookie Lieutenant, Cookie Captain, Cookie Major and Cookie General. The goal of the badges is to create a sense of achievement for the players as they advance in the game.

5.5 Game Development

The technical part of developing the game prototype required creating a schema, graphic designing and coding amongst other things. The processes are detailed below.

5.5.1 Content Gallery

For the development phase, the first thing I did was collect the all the content I wanted to utilize in the game. I selected some banners that I wanted represented in the game from the cookie banners I had initially collected, see all banners used in the Appendix **??**. Some of the contents were inspired by the Cookie Consent Speed 3.1 and the Terms & Conditions Apply 3.2 games. I also came up with ideas on how to fuse other dark patterns into cookie banners to make the game more versatile.

5.5.2 Story

As it was in the intended game mechanics, it was important to create a story that the game will be built around. I the back story of the Dark Cookie game, there are five characters; Mama Bear, her three bear cubs and the Evil Raccoon. Mama bear wants to feed her baby cubs and in order to get food, she takes a job with the Privacy Force. She protects the data of internet users and in exchange, the Privacy Force gives her family cookies to eat. But the Evil Raccoon wants to steal these data and the constantly try to exchange Mama bear's cookies with dark poisonous cookies. The goal of the player is to make sure too not accept any "dark" cookie and only keep good cookies in Mama bear's jar. When a player answers a question correctly, a good cookie is put into the bear's cookie jar and the player earns a point. For every banner the player responds to incorrectly, the Evil Raccoon replaces a good cookie with a poisonous dark cookie and the player looses a point. The game ends when there are no good cookies left or the players completes all five levels successfully 5.5.6.

There are dialogue boxes that contain story line, instructions and feedback comments from Mama Bear. The player's job is to successfully provide the bears with good cookies by interacting with the banners correctly. There are also bonus questions after each level, where players can earn extra good cookies (and points) for the bears. While this happens, the player is learning how to correctly answer to cookie banners trying to refuse as many as they can. The comments from Mama bear give the players a feedback on their actions and add engagement to the game, as the feedback comments add humor and sarcasm. For example, Mama bear could give comments like, "There was tiny cancel icon X there, please wear your glasses." or "Stop overthinking, the red button was the right one!", see all Mama bear's comments in the Appendix **??**. The game and it's contents will be developed around this story line.

5.5.3 Game Design Layout

To visualize how the elements of the game mechanics will be laid out on the gaming interface, I made a paper sketch. The sketch featured the characters, banners, the point indicator, the player's badge and the level indicator, see Figure 5.2.

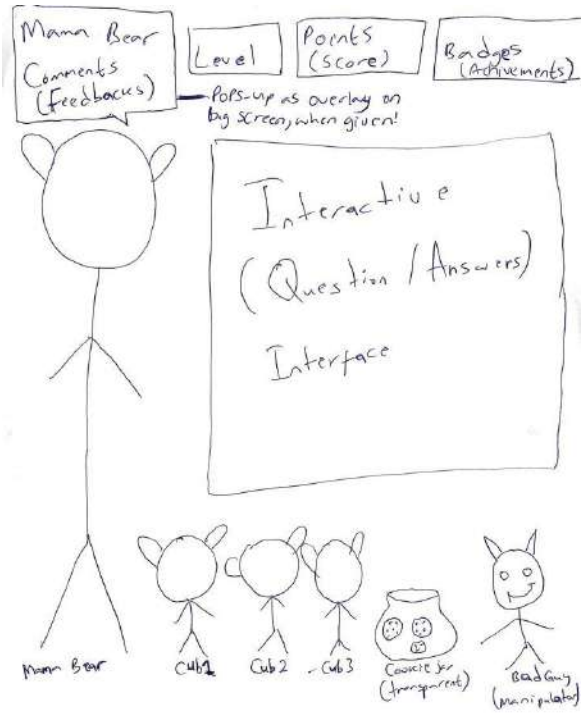


Figure 5.2: First Paper Draft of Game Layout

5.5.4 Game Schema

The game schema was created to serve as a map on how the levels of the game will play out and learning objective of each question and level. The schema contained how the various type of cookie banner should appear and the dark pattern, or combinations of dark patterns, that they should reflect, see in Figure 5.3. Through the schema, I also decided at what point the fun elements should begin to set in and how frequent they should appear in the game. Although there are no relationships between all banners in all every specific level, there is a flow of how the game advanced in challenge and engagement.

The fun elements of the game was put into stages of the game where a player might become bored. So the more the game advances, the more fun it should become. There were bonus questions added at the end of each level. These questions present cookie banners with dark patterns with the end goal of teaching players to recognize manipulation in those types of cookie banners. The schema also contained the badges players would receive after successfully completing each level. Creating the schema was an important part of the game development, as it made it easy to plan and visualize the structure of the entire game.

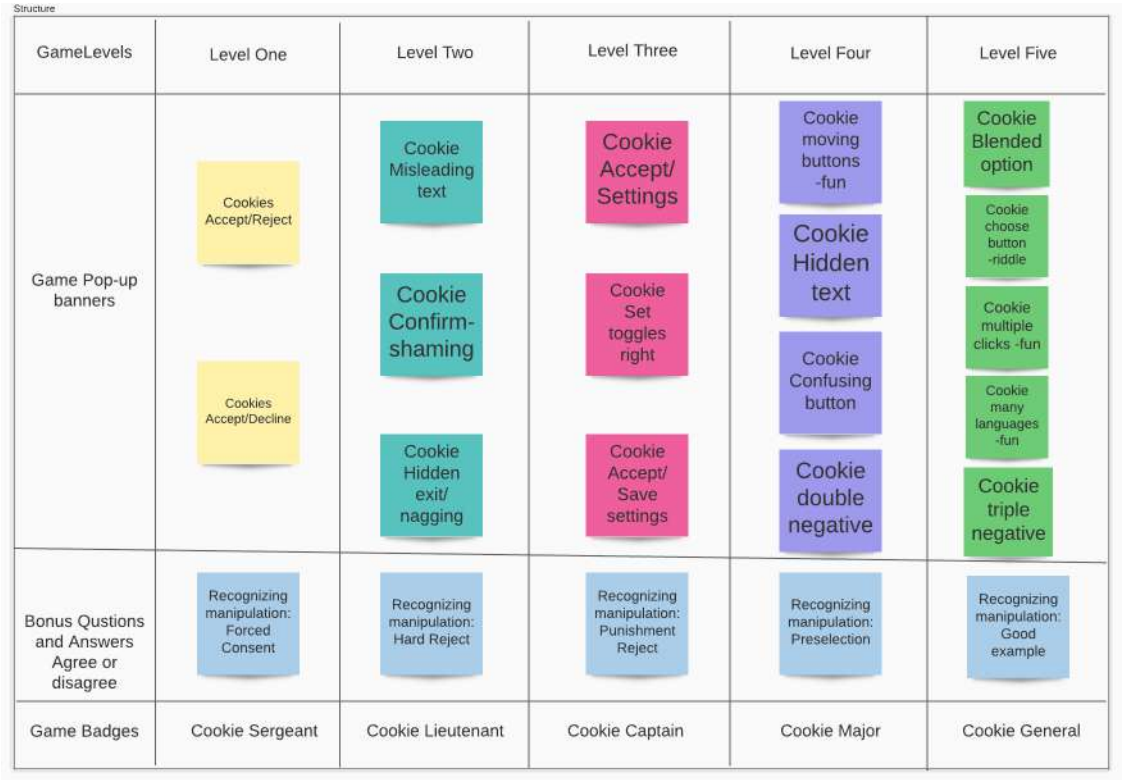


Figure 5.3: Game Schema

5.5.5 Game Engine

The game engine is a framework that consists of the code that renders 2D and 3D graphics, plays sounds, enables animation, and supports physics simulations. With game engines, game developers can focus on the details that make their games stand out instead of worrying about the basic mechanics [69]. For the game prototype development, two game engines were considered.

- Unity Game Engine [2]: Developed by Unity Technologies, "Unity" is an open-source cross-platform game engine used to develop computer, console, and mobile video games. Although Unity is a sophisticated engine to develop an interactive game, learning how to use it requires spending a lot of time watching tutorials. This became a challenge due to the limited time allocated to the project. So I carried on the search for an engine that did not require so much learning time.
- Scratch [3]: Although Scratch is not a game engine, the service developed by the MIT Media Lab can be used to create digital stories, games, and animations. Code is written using drag-and-drop blocks in Scratch 5.5.7. Due to ease of use, I chose Scratch as the tool to develop the Dark Cookie game prototype with. Using Scratch made it easier to integrate and animate aspects of the game such as graphics, characters, backgrounds and audio in the game in a timely manner. Scratch also made it easier to develop a fully functional and interactive game with a limited time span of two months. The platform is user friendly and has a lot of functionalities that aided the realization of the Dark Cookie game. See some examples of coding blocks used in developing the game in Figures 5.85.95.105.11.

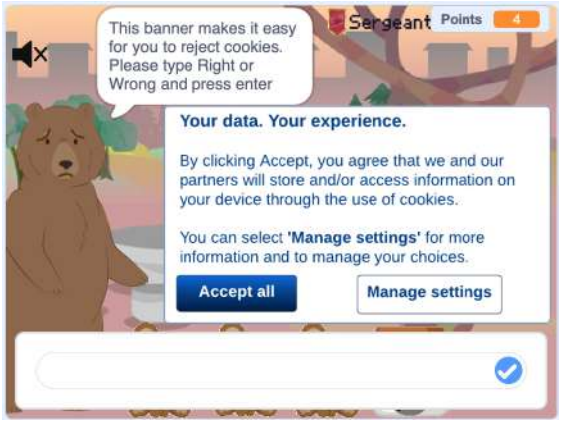
[2]Unity Game engine - `https://unity.com/`
[3]Scratch - `https://scratch.mit.edu/`

5.5.6 Graphics

A big part of the game development was making the graphical contents. I had to create banners, characters and other graphical elements that would work well together with the theme of the game. I also got images of some characters from 123RF stock photo website [4].

Banners

I designed the game banners on Scratch but the cookie banners used for the bonus question were designed on Lucid [5]. Some of the banners replicated real-world cookie banners 5.4a while others had either fun elements or combined cookie banners with other dark patterns outside of existing cookie banners 5.4b. The buttons and toggles used on the banners are images that were animated and made interactive for players. Most questions in the games required the player to simply click the button baring their preferred option, as seen in 5.4b, but the bonus question required to type their response in a text box, as seen in 5.4a.



(a) Example of real-world cookie banner designed on Lucid, used as a bonus question

(b) Example of cookie banner merged with confirmshaming designed on Scratch, used as a regular question

Figure 5.4: Designing Cookie Banners

Characters

Scratch has a lot of in-built characters, or sprites, that users can utilize in their projects. For example, Mama bear is a Scratch sprite. To create different facial expression for Mama bear and maker her more animated, I duplicated sprite and altered the facial expressions via painting. I also sourced for other images of characters in the game, like the raccoon, the bear cubs, the cookie jar, the large cookies and players badges. I edited each character to fit into the game and created varying duplicates of them to aid animation. When a player answers a question right, the bear and her cubs have a happy face and the cookie in the jar turns brown 5.5a. But if a player answers a question incorrectly, the bear and her cubs have an angry or sad facial expression and the cookie in the jar turns grey, see Figure 5.5b.The background of the game also changes on every level of the game and there are also screens that announce the new level a player advances into.

[4] 123RF - `https://it.123rf.com/`
[5] Lucid - `https://lucid.app/lucidchart/`

(a) Correct Answer Reaction

(b) Wrong Answer Reaction

(c) Image of big Dark Cookie used during story telling

(d) New Level Announcement

Figure 5.5: Characters in the Dark Cookie Game

Storytelling and Feedback

In the Dark Cookie game, Mama bear does the interaction with players. She tells a story to give an introduction of the game at the beginning where she also explains the rules of the game. Mama bear communicates with players and also gives them feedback using a speech bubble on the top right of her sprite 5.6a. To also aid the story telling, pictures of characters are displayed as mama bear does her narration 5.6b.

(a) Mama Bear giving feedback after player's response

(b) Mama Bear telling the introductory story

Figure 5.6: Story telling and Feedback

Game Exit

There are two ways the game can end: either when the player successfully finishes all levels 5.7a (i.e., win) or when the player has less than zero points 5.7b (i.e., game over). In each case, different messages are displayed to the player.

(a) Display when play successfully finishes game

(b) Display when player fails the game

Figure 5.7: Game Exit Displays

5.5.7 Programming on Scratch

Scratch is high-level visual programming language that uses blocks for coding. To animate a sprite, one has to simply stack blocks of code that specify the desired behaviour of the sprite. There are different types of blocks available on Scratch, including motion, sound, event, control and sensing blocks. There are also operators and variable blocks that allow assignment and comparisons.

To start the fist action in any project, we use "when flag clicked" block found under the event blocks. Actions and interactions between sprites in the game are synchronised with the use of the broadcast block. A sprite broadcasts a message through the "broadcast" block and other sprites can take actions specified in their blocks upon receiving the message in the "when I receive" block.

The looks blocks allow users to manage the appearances of sprites. On Scratch, sprites can have different costumes and to animate a sprite, we use the "switch to costume" block to alternate between costumes of the the sprite. The text in the speech bubbles, such as the ones used by Mama Bear, are managed from "say" looks block. Sound effects can be controlled with the sound blocks.

The control blocks include blocks like the "if and else" block, the repeat block, the wait and the forever block. These block allow programming with time, loops, conditions and formal logic on Scratch.

The motion blocks are used to coordinate the movements in scratch, such as move, turn, position and direction. On scratch, the stage is a Cartesian (X,Y) plane, where (0,0) is the centre. The X and Y coordinates are used to specify positions of sprites on the stage.

Some examples of the Scratch blocks are given in the images below:

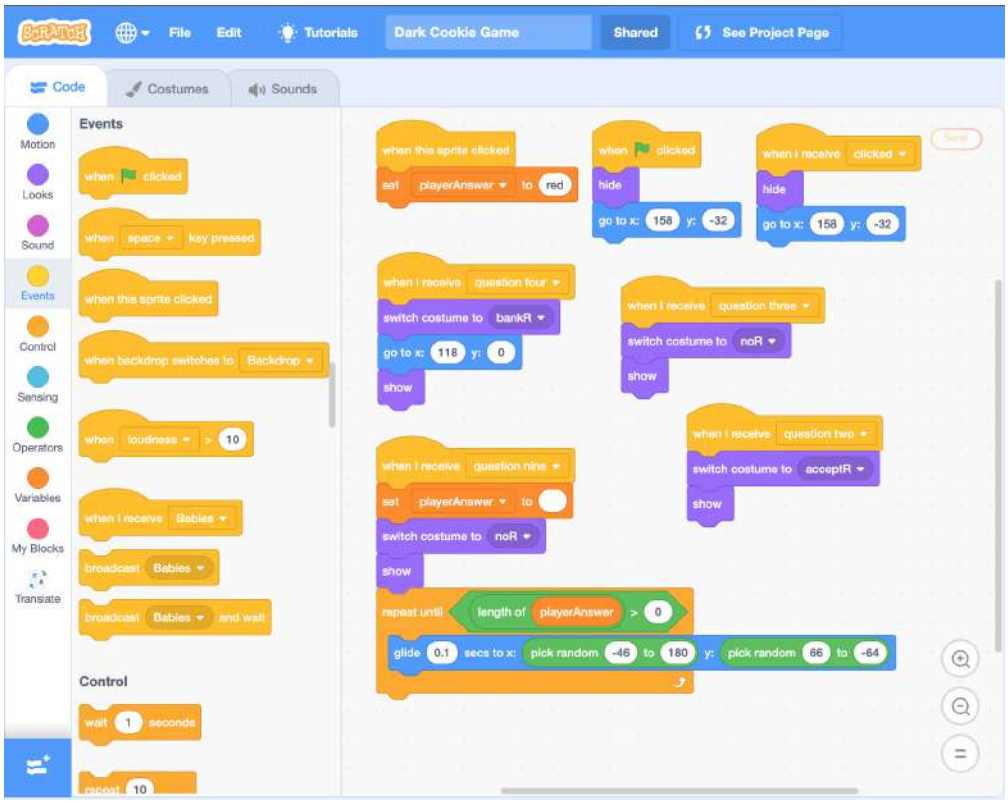


Figure 5.8: This image shows Scratch's events blocks on the left and coding blocks including one that specifies the behaviours of the moving buttons in question nine on the right.

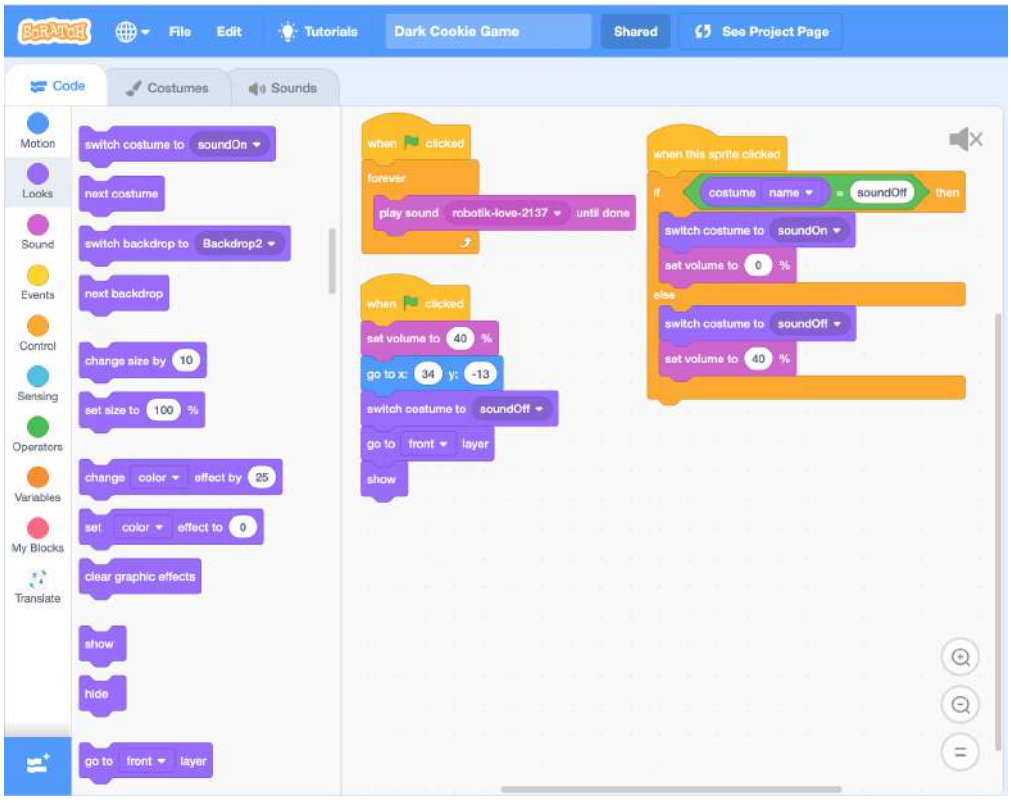


Figure 5.9: This image shows some of Scratch's looks blocks on the left and coding blocks that show the how sound is programmed in the game on the right.

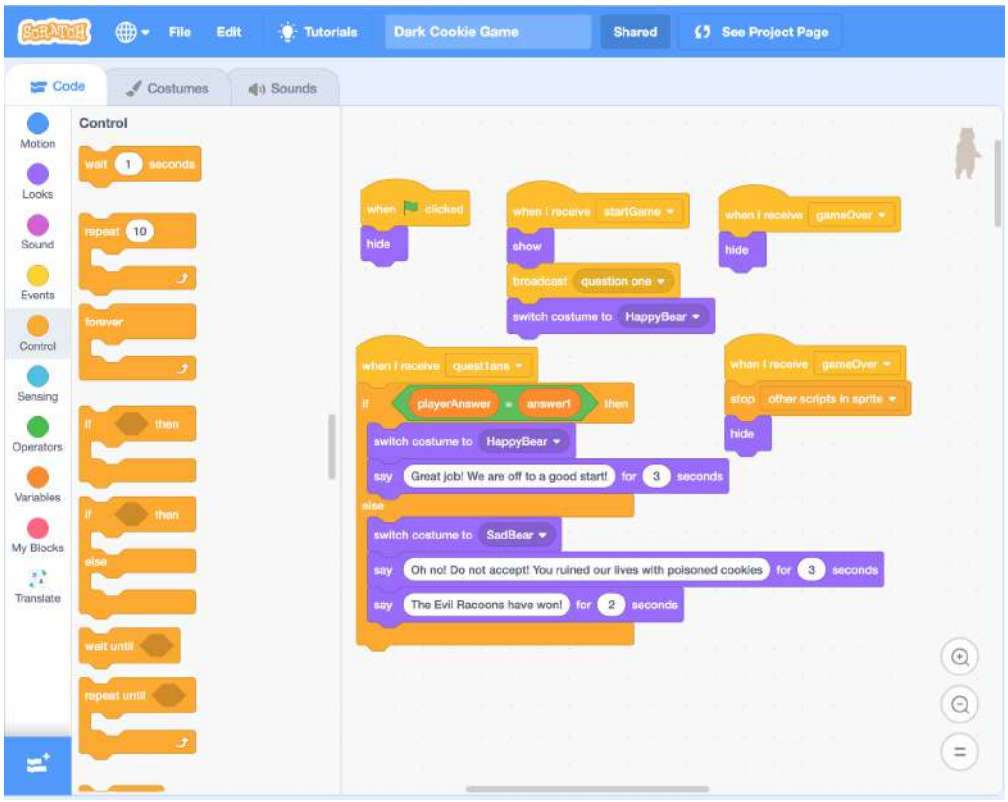


Figure 5.10: This image shows some of Scratch's control blocks on the left and coding blocks including one that specifies Mama Bear's comment and costume based on the response of the player on the right.

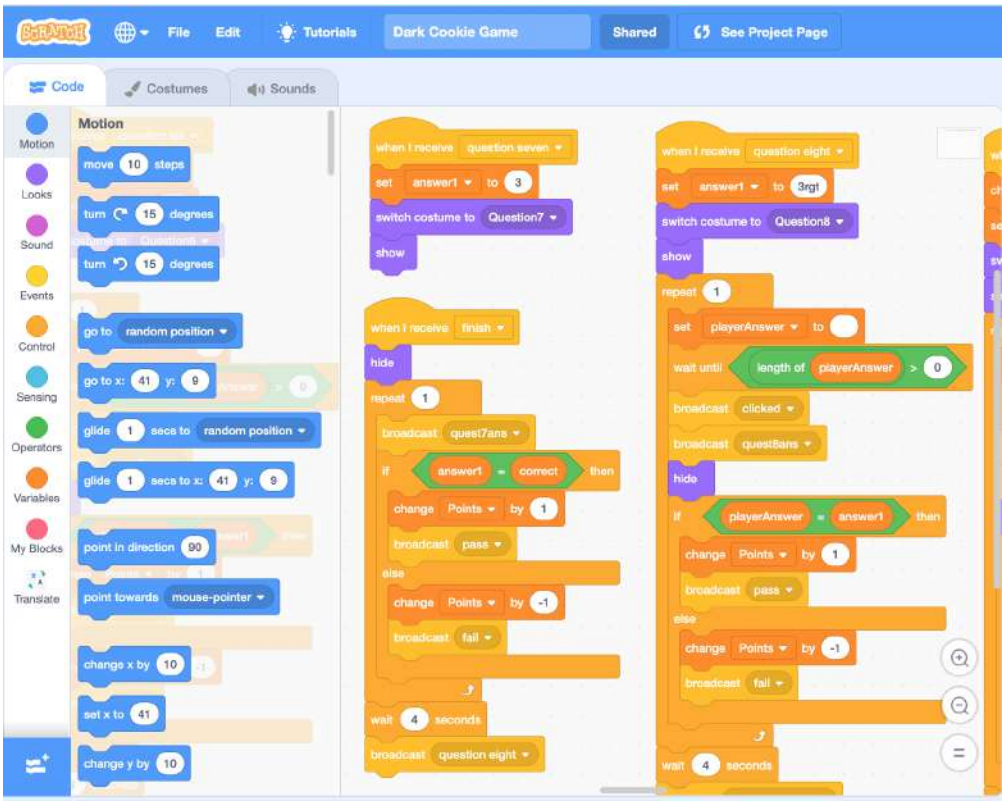


Figure 5.11: This image shows some of Scratch's motion blocks on the left and some coding blocks that specify the flow of actions carried out on each question of the game on the right.

5.6 Testing and Implementing

During the development of the prototype, I used an iterative approach where I continually tested and reviewed the methods that I used. I received continued feedback from my adviser and supervisor and implemented changes where it was required. Also, during the game development, I asked friends and family members to play the game at intervals and took note of their feedback. For example, the original schema at the beginning of the implementation had all the banners with fun elements only placed at the last level (level 5). But during the game development a player helping me with testing noted that she got bored of playing at level three. That was when I got the idea to move a fun element to the first question in level four, the moving buttons. This way, when a players starts to get bored, encountering such questions with fun elements would spark their engagement again and encourage them to complete the game.

Several changes were also made to other game aspects such as characters, banner designs, grammatical expressions in text, story contents, and other aspects of the game. The game prototype took shape from all the iterative improvements made until the final product was published. The Dark Cookie game is available on GitHub Pages at `https://prillaakiny.github.io/Dark-Cookie-Game/` and on Scratch at `https://scratch.mit.edu/projects/704537556/`.

Chapter 6

Evaluation

For the evaluation, I asked for feedback from the people who played the Dark Cookie game using a survey I created on Survey Legend [1]. In getting participants for the survey, I used the snowball procedure where I asked family and friends to participate and then share it to other people they knew. My advisor also asked some of her colleagues working in the field of dark patterns to give an expert feedback.

The survey featured questions gotten from reports on EGameFlow [24] and MEEGA+ [56]. Both reports present validated gaming questionnaires, rating scales, and instruments that can be used in evaluating a game. I made a selection of questions that are related to the objectives of this project and tailored some of the questions to be more specific to the Dark cookie game, see in 7.5. The survey also contained questions I formulated to evaluate specific aspects of the game. For example, a question that ask players if the game would influence their future interactions with cookie banners.

I was able to get responses from participates residing in several geographical locations around the world, consisting of five continents. These include both countries in the EU, like Portugal, Greece, Spain, France, Germany and Luxembourg, and countries outside the EU like Canada, the United States of America, Australia, Barbados, Turkey, Nigeria, Ireland, Great Britain and Nigeria, see in Figure 6.1.

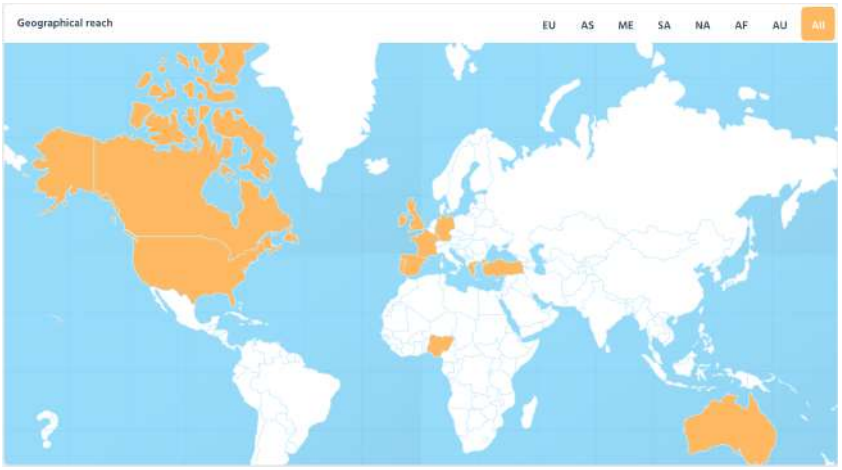


Figure 6.1: The Geographical Reach of the Survey

[1] Survey Legend - `https://www.surveylegend.com/`

There were two categories of participants involved in the survey: some were experts in the subject of dark patterns coming from human-computer interaction, law and computer science; the majority were players who where not conversant with the topic. Although the survey records a total number of 59 participants, only 54 of them completed the entire survey, but all responses to questions are considered in this report.

The survey contained 23 questions in total and these questions where divided into four different sections: demographics and xperience with cookie banners, game experience, learning experience and remarks. Using a GitHub Page, I embedded the game and the survey on the same web-page and shared the link [2] [3] to different people to play and evaluate the game.

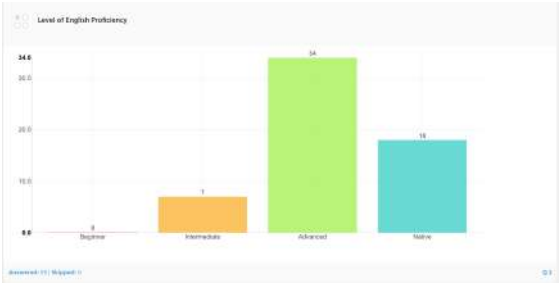
6.1 Demographics and Experience with Cookie Banners

The goal of the questions in the section is to gather a few important background information about the participants of the survey. The results from the questions are given below.

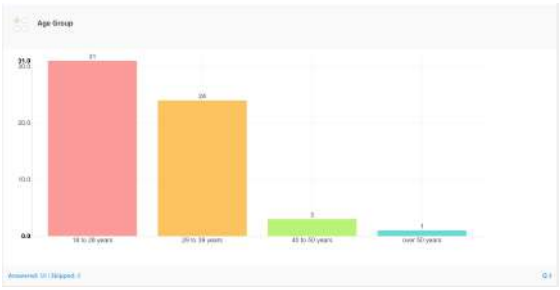
1. Country of Origin: The participants in the survey, regardless of their present location, hail from different part of the world. 59 participants who answered this question came from 27 unique countries, see in Figure 6.2a.
2. Level of English Proficiency: The game was developed for an English-speaking audience. Knowing the English proficiency of players is therefore useful. About 60 percent of the players had an advanced English level, 30 percent were native speakers and only about 10 percent had an intermediate English level, see in Figure 6.2b.
3. Age Group: The age group was asked to further understand (and categorize) the participants in the survey. Majority of the players fell under the 18 to 28 years and 29 to 39 years age groups, see in Figure 6.2c.
4. Highest level of education completed or in progress : This question was aimed at understanding the educational background of players. Out of 59 participants, 7 have or are doing their doctorate degree. Majority of the players either have or are doing a master's degree or a bachelor's. The other few participant have lower levels of education, see in Figure 6.2d.
5. Are you familiar with Cookie Banners?: To check exposure to the subject matter, I asked players if they were familiar with cookie banners. 56 players responded with a yes and only 3 players chose no, see in Figure 6.2e.
6. How do you usually interact with cookie banners?: I also wanted to understand how the players normally interacted with cookie banners before playing the Dark Cookie Game. 20 out of 59 respondents claim that they usually accept all cookies, 13 claim that they make sure to reject all cookies and 19 claim that they make sure to choose only the cookies they prefer. 4 respondents claim to just click whatever button is highlighted and 3 of them indicated that none of the options applied to them, see in Figure 6.2f.
7. Do you know the purpose of cookie banners on websites?: I also wanted to know if players the purpose of the cookie banners they normally interacted with. While about 10 percent of respondents did not know the purpose of cookie banners on websites, close to 70 percent claim they know the purpose and about 20 percent were not sure, see in Figure 6.2g.

[2] Link to Game GitHub Pages- `https://prillaakiny.github.io/Dark-Cookie-Game/`
[3] Link to Game Scratch - `https://scratch.mit.edu/projects/704537556/`

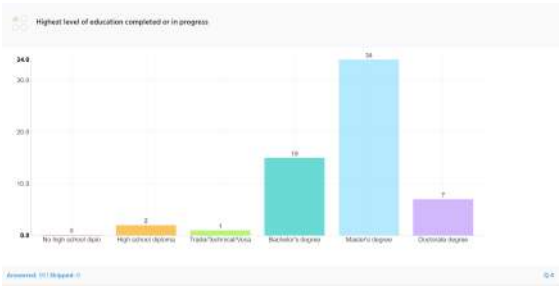
(a) Country of Origin



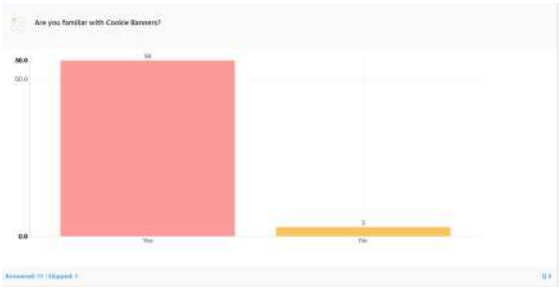
(b) English Proficiency



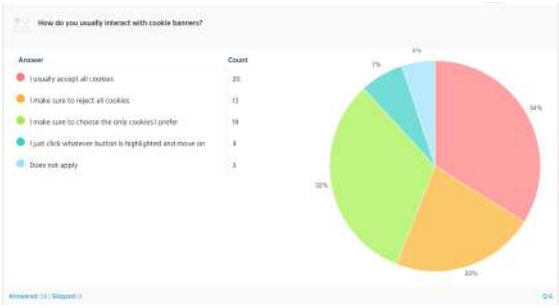
(c) Age Group



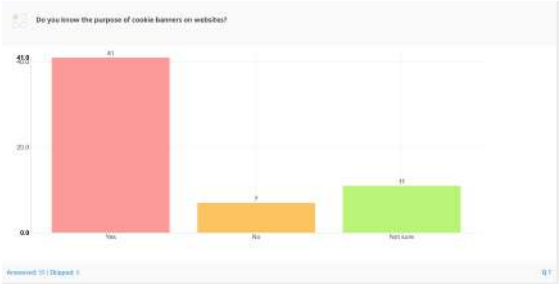
(d) Level of Education



(e) Familiarity with Cookie Banner



(f) Interaction with Cookie Banners



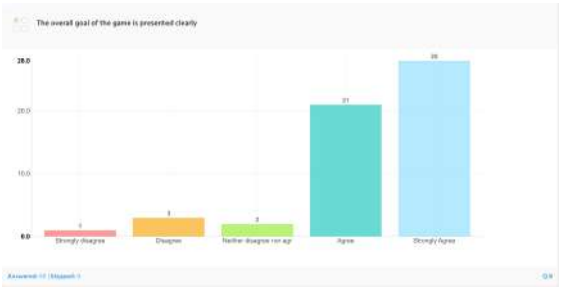
(g) Purpose of Cookie Banners

Figure 6.2: Demographics Section of Survey

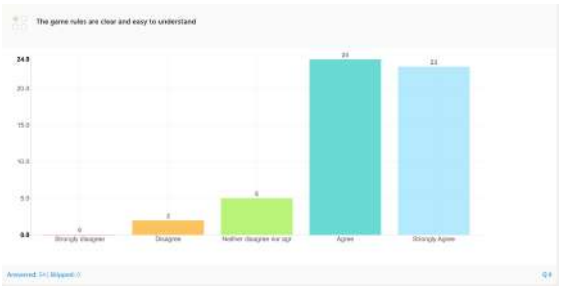
6.2 Gaming Experience

The goal of the questions in the game experience section was to understand the players interaction with the game. This is to check how the players understood, enjoyed and interacted with the game. The results from the questions are given below.

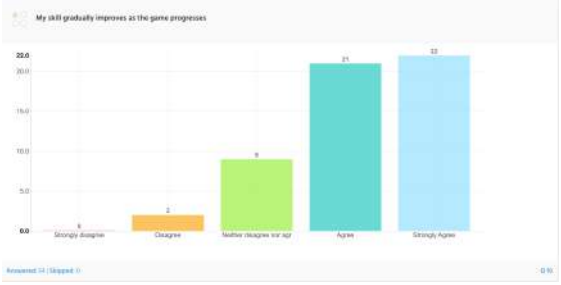
1. The overall goal of the game is presented clearly [24]: This question checks the clarity of the game's goals. About 90 percent of players either agree or strongly agree that the goals of the game were presented clearly, see in Figure 6.3a.
2. The game rules are clear and easy to understand [56]: This question checks the clarity of the rules of the game. While 47 out of 54 participants agreed or strongly agreed to this, 7 participants disagreed or showed indifference, see in Figure 6.3b.
3. My skill gradually improves as the game progresses [24]: This question checks the learning progress of the player in response to the game. Agree and strongly agree were selected by the close amount of 21 and 22 participants respectively, each. While 9 participants neither agreed nor disagreed and 2 participants disagreed, see in Figure 6.3c.
4. I receive feedback on my progress in the game [24]: This question checks if the player received feedback as they progress through the game. About 95 percent of the participants responded that they either strongly agree or agree to this, see in Figure 6.3d.
5. I received feedback on my success (or failure) of each question immediately [24]: This question checks that the player received active feedback on their responses in the game. 33 out of 54 players strongly agree, 18 agreed and 3 players neither agreed nor disagreed, see in Figure 6.3e.
6. I enjoyed the game without feeling bored or anxious [24]: This question checks the players engagement with the challenges presented thought out the game. A combined amount of 46 players strongly agreed or agreed while 7 players were indifferent and 1 player strongly disagreed, see in Figure 6.3f.
7. The challenge is adequate, neither too difficult not too easy [24]: This question checks how the players perceive the challenges presented in the game. Out of 54 respondents, 15 strongly agreed, 29 agreed, 7 neither agreed nor disagreed and 3 disagreed, see in Figure 6.3g.



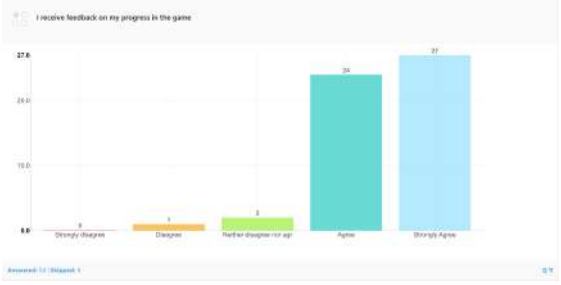
(a) Clearly Presented Goals



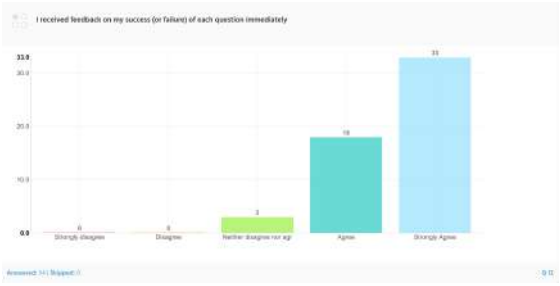
(b) Clear Rules



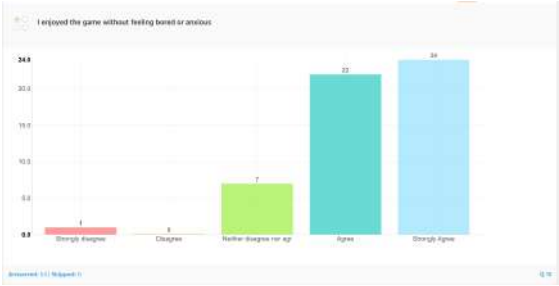
(c) Skill Improvement



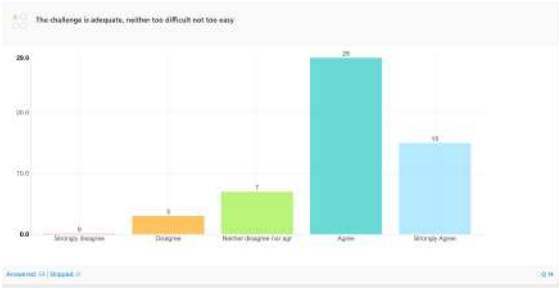
(d) Feedback on Progress



(e) Feedback on Success or Failure



(f) Game Enjoyment



(g) Adequate Challenge

Figure 6.3: Gaming Experience

6.3 Learning Experience

The goal of the questions in the learning experience section was to attest whether the players understood and are satisfied with the lessons taught by the game. This also checks if the players can apply their understanding to real-life situations. The results from the questions are given below.

1. I catch the basic ideas of the knowledge taught [24]: This question checks that the player acquired knowledge from playing the game. 51 players in total either strongly agreed or agreed with this and the remaining 3 players neither agreed nor disagreed, see in Figure 6.4a.

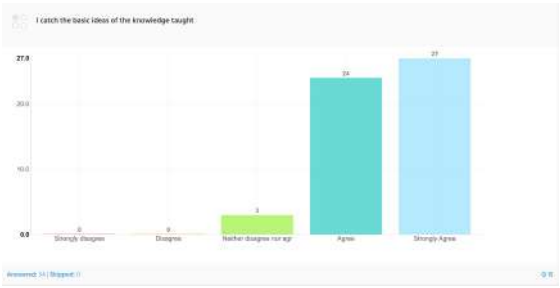
2. I feel satisfied with the things that I learned from the game [56]: This question checks that the player's satisfaction with the knowledge acquired from playing the game. About 90 percent of players strongly agreed or agreed to satisfied while about 10 percent were indifferent, see in Figure 6.4b.

3. This game is an adequate method for learning how to interact with cookie banners to maximize my privacy [56]: This question checks that the gamification is an appropriate method of teaching players to maximise privacy while interacting with cookie banners. Out of 54 players, just over half of them strongly agree, while 21 players agreed and 3 players neither agreed nor disagreed, 1 disagreed and 1 strongly disagreed, see in Figure 6.4c.

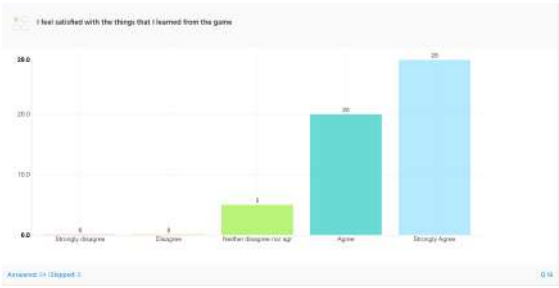
4. It is clear to me how the contents of the game are related to their real-life application [56]: This question checks that the player's can apply the knowledge acquired from playing the game in real world settings. While a majority of 48 players either strongly agreed or agreed to satisfied, 5 players were indifferent and 1 player disagreed, see in Figure 6.4d.

5. This game will influence how I respond to Cookie Banners in the future: This question checks that the knowledge acquired from playing the game would influence the behaviour

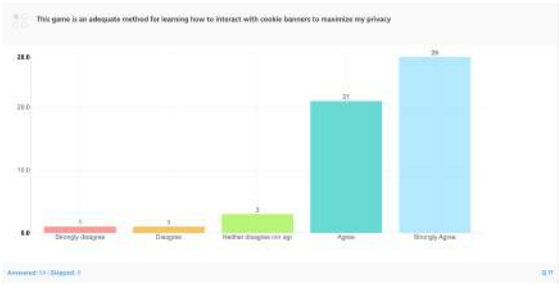
of the player when interacting with cookie banners in the future. 31 out of 54 players strongly agree, 12 agreed, about one-quarter players neither agreed nor disagreed, 3 disagreed and 1 strongly disagreed, see in Figure 6.4e.



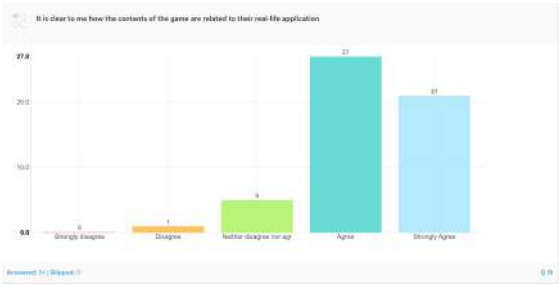
(a) Knowledge Taught



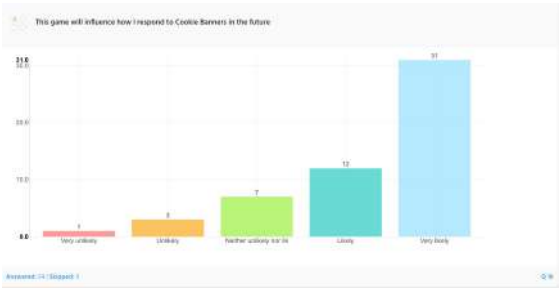
(b) Learning Satisfaction



(c) Adequate Learning Method



(d) Real-life Application



(e) Game Influence

Figure 6.4: Learning Experience

6.4 Remarks

The goal of the questions in the remarks section was to give players the chance to express, in their own words, their opinions on what they enjoyed about the game and what they feel could be further improved on. This section also checks if players would recommend the game to other people and leaves room for further comments. The results from the questions are given below.

1. Which aspect of the game did you enjoy the most?: This was an open ended question that required players to state what they found most enjoyable about the game. The most common aspect identified by 13 players to be the most enjoyable are the tricky questions in the game. 10 players also enjoyed how easy the game was for them and the challenges presented in the game. Several player liked that the game was educational and some found it to be very relatable to their real-life experiences. While 9 participants said they enjoyed how educative the game and Mama Bears comments were, 2 others pointed out that they also enjoyed how funny the game was and how Mama bear gives feedback in a funny and sarcastic way. Some players indicated that the game to them was fun, playful, interactive

and and engaging. 7 players expressed that they liked the story line of the game, and others enjoyed aspects like music, bonus questions, double negatives and word play. 5 players also stated that the enjoyed all aspects of the game.

2. Do you have any suggestions about how the game can be improved? [56]: This question was also open ended, requiring players to state what the feel can be improved on in the game. The most common aspect players found difficulty with the bonus questions, expressed by 11 players. 9 players also expressed that the UI design could be better and 7 players expressed that the explanation or instructions of the game could be made clearer. A few players said that the speed of the story telling was slow and one of them suggested adding audio to the story. A few players commented that the feedback comments from Mama Bear should linger a bit longer. 1 player suggested that the game should be adaptable to the age of the player. There were 5 players who found the cookie banners in the game to be exaggerated and unrealistic. A few players would have preferred a different music and 1 player suggested the used of "bad cookies and good berries" instead of "bad cookie and good cookie".

3. Would you recommend the game to your friends or family? [56]: When asked if they would recommend the game to family and friends, combined of 51 out 54 players responded that they would very likely or likely recommend the game. 1 player showed indifference while 2 players responded that they are unlikely to recommend the game to their family or friends, see in Figure 6.5.

4. Any further comments? [56]:The final question was an open ended, giving the players a chance to give further comments. The most common response from a total of 13 players was that the found the game to be very educative. 12 players also commented "good/great job" or "great game". Some other players said they found the game fun and enjoyable and one player suggested making a French version of the game. A player commented that the survey was too long and another suggested having a "play" and "stop" button. 1 player also suggested a better layout for the GitHub Page.

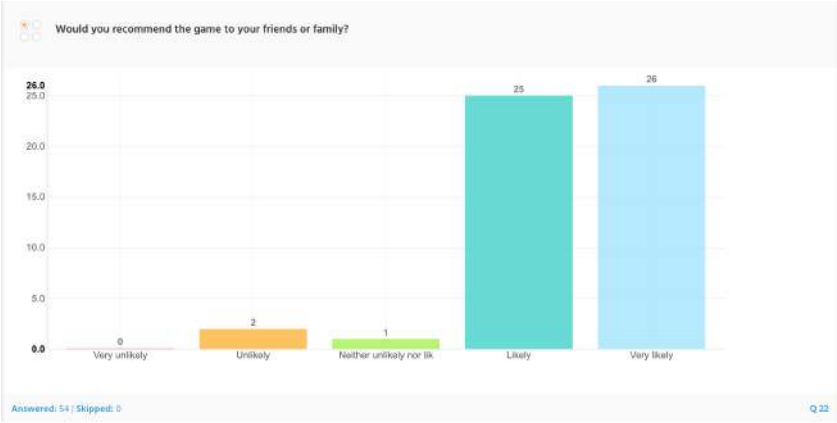


Figure 6.5: Recommend Game

Results from the survey can be viewed here: `https://www.surveylegend.com/s/4bp2`

Chapter 7

Discussion

In chapter 4 I identified three research questions that I wanted to address and in that light I created the Dark Cookie game and a survey where players of the game can evaluate it based on their experience. In this chapter, I discuss the results, the players' recommendations, the strengths and weaknesses of the project and future work.

7.1 Finding Answers

RQ1: Training Users

Firstly, I asked if users can be trained to interact with cookie banners in a manner that preserves their privacy i.e rejecting all non-essential cookies. To answer this, we focus on the questions in the survey that check for players knowledge acquisition and learning satisfaction. Looking into the survey results, one can observe that the majority of players report that they understood the basics of the knowledge been taught 6.4a, they felt satisfied with that knowledge 6.4b and that the knowledge gained would have an effect on their future interactions with cookie banners 6.4e. Given that the goal of the game was for players to reject all unnecessary cookies possible, the results suggest that users can be trained into answering in a predefined manner to cookie banner requests and thereby maximize their privacy in this domain. While these results are good indicators, it may be useful to further check it in practice. We might consider repeating the game with the same players after a period of time, and check if the player's learning retention lasts over time.

RQ2: Gamification for Training

Secondly, I asked if gamification could be used as a tool to perform such training. To answer this question, I observed responses of users to questions regarding the adequacy of the learning method and the perceived applicability of the lesson taught. In the survey, about 90 percent of game players agreed that the game was an adequate method of teaching the subject matter 6.4c and that they understood how the game lesson are related to their real-life application 6.4d. Also, over 90 percent of players agreed to recommending the game to family and friends6.5. Also, in the open questions, several players noted that the game was educative and relatable to their real-life experiences 1. These results suggest that gamification can be an effective and recommendable tool in teaching people how to interact with cookie banners. These results may also

suggests that this method of teaching does not disrupt the translation between the knowledge taught and its real-life application, as in this case where the game presents the subject in a playful manner but players still walk away with useful applicable knowledge.

Although these results suggest that gamification is a promising tool for training users to spot and respond to dark patterns in cookie banners, these is no assurance that it is effective in other subjects beyond this scope. We also need to investigate if gamification can be used with all kinds of users, for example, users of all age groups or users of all kinds of educational background.

RQ3: Engagement in the Game

And lastly, I asked if the game utilized can be engaging, clear, and appropriately challenging. To answer this, we focus on the questions in the survey that check the clarity of goals and rules, the players engagement, feedback, challenge adequacy and the player's skill improvement. These questions are what encompassed the gaming experience section of the survey. From a broad view, between 95 and 80 percent of players agree: that goals and rules of the game were clear 6.3a6.3b, that their skill gradually improved as the game progressed 6.3b, that they received regular feedback 6.3d6.3e, that the challenge was adequate 6.3g, and that they didn't experience boredom whilst playing the game 6.3f. These results indicate that the game achieved a high level of engagement, clarity and challenge appropriateness. However, these results points out that more work can be done towards engagement and making players perceive that their skills advance as their levels increase in the game. This may be achieved by adding more content in the game that covers several types of dark patterns where the challenge increases by the level. In the open questions, a players suggested that the game should be adaptable to the age of the player 2. This a good suggestion that can be implemented in terms of difficulty level. A player can choose between easy, intermediate and hard and the challenges in the questions would be set according to the player's choice.

7.2 Players' Opinions

When we look into the open questions, players were able to give more details on their experiences with the game. The players expressed that they enjoyed several aspects including educative feedback, engagement, challenges, real-life applicability and story telling and other fun elements 1. While these comments align with the goals of the game, there were also several loopholes found in the game. Players where also given a field to indicate parts of the game that could be further improved on. Some of their responses included the bonus questions, the user interface design, the speed and explanation of the game (clarity) 2. Some players, likewise, expressed that they found some banners in the game to be exaggerated and unrealistic. These loophole are discussed in detail below:

Bonus Questions: The bonus questions consisted of five common cookie banners seen on the internet. The goal of these questions was to check, directly, if players could recognise the different kinds of dark patterns used in cookie banners and to teach them on why the designs are considered manipulative. The bonus questions were presented as statements and players had to type in their opinions, unlike other questions were the players simple clicked a button. Many players had issues understanding the instruction on what to do at that point and others also found typing to be inconveniencing. To better player's experience, the framing of the bonus questions would be changed and made more clear, clearer instruc-

tions and explanation would be provided for players and the question would be responded to via buttons and not a text box.

User Interface: I personally designed and selected all the graphical elements in the game and my lack of expertise in this field was not hidden from the players. Also the interface used to design the game was not as sophisticated as other game engines and could not produce a high standard user interface. To solve this issue, a superior game engine should be used in designing the game and the skills of a graphic designer should be employed in designing the game features.

Speed of Commentary: The speed of Mama Bear's story telling was a bit delayed. I did this so that players who were not so fluent in English would be able to catch up with Mama Bear's story. A few players also suggested that Mama Bear's feedback comments went too fast. From this contrasting feedback, the best solution would be to make it possible for players to navigate the commentary at their on pace. This can be achieved by adding a "next" button that players can click on after they are done reading each part of the dialogue.

Clarity: The game explanation was not clear to some players, this may probably point back to the bonus questions. To resolve this, the bonus question should be improved on as stated before, and a section with instructions of the game should be put in a place where players can access through out the game. Maybe a button that pops up instruction when player clicks on it.

Players vs Expert: From the two categories of players, there was a disparity in opinions on the types of cookie banners used in the game. The experts claimed that the cookie banners were exaggerated and did not reflect real life banners. Some further stated that such banners have no real educational value. But on the other hand, the majority of the players were non-experts and they claimed to have enjoyed that part of the game that involved these exaggerated banners. Under the question of what they enjoyed most in the game, the most reoccurring answer from players were the tricky questions.

It is important to note that the game was created targeting regular users on the internet who are not experts in the subject of dark patterns. In this light, the satisfaction and feedback of this audience has to be prioritize. As seen and explained in the testing and implementation phase 5.6, a regular user/player might become bored of the game without these fun elements. While an expert is particularly interested in the subject matter, a non-expert would quickly loose interest on the topic if it is not engaging enough for them. The exaggerated elements in the game make it more fun and engaging for regular players, so they don't take it as a wearisome questioner about cookie banners, instead of a game.

Nevertheless, many experts gave other very insightful, constructive feedback that would help improve the game and research in general.

It is worth noting that majority of players who participated in this survey are resident in the EU who have experienced cookie banners and interacted with them. Although several other players from outside EU also reported that they also encounter and interact with cookie banner on website they visits. Given the similarity in players' experiences, we may draw conclusions about all players in the world based on the results gotten in this survey.

But to further confirm this assumption, the evaluation can repeated on a lager sample of play-

ers spread out across the globe. The game evaluation was also dominated by adults between the ages of 18 and 39. The game can be played and evaluated by more adults of higher a age group (40 years and over), to understand how the game can be tailored to suit the needs of such audience.

7.3 Strengths of the Proposed Solution

In the first chapter 1, we saw several types of dark patters users are exposed to on the internet today. Recent studies have shown that many of these users are aware of these manipulations but yet many do not actively counter these deceptions. [11]. Bringing people's attention to this privacy issue might make them act more intentionally against manipulation. As seen in chapter 2, gamification is used to increase participation and engagement, typically in non-game applications and processes. This is achieved by integrating game mechanics and game dynamics that make technology more captivating, by encouraging users to engage in desired behaviours. The main advantage of using gamification to combat dark patterns in cookie banners and in general, is that we can take this real-life problem by presenting a solution to people in a very captivating manner. With a good combination of game mechanics and game dynamics, sophisticated games can be developed and shared with millions of internet users. The game can be shared through social media or promoted by influential online communities or personalities. Such game would provide players with practical education on privacy and security issues while keeping them entertained.

Another advantage of using serous games to counter dark patterns is that users can evaluate the teaching method and continued improvements can be made by researchers or game developers, based on the feedback received. For instance, the game can introduce new mechanics and designs that would improve user experience, provide better user interface or adapt to the age of players by giving different contents with different difficulties based on age group.

7.4 Limitations of the Proposed Solution

Gamification as a solution does have its own limitations. Going through the examples of dark patterns in chapter 1, one can see that not every dark pattern (even in cookie banners) give users option to opt-out. Dark patterns such as forced consent 1.1, bundled consent 1.2 and privacy zuckering 1.11 often leave users no choice but to succumb to them. Even though games like Dark Cookie successfully train players to identify such dark patterns, users would still have one option when faced with banners like these. So the problem should probably be solved on a systemic level, as training people to resist dark patterns is probably not enough. Tools can be developed to automatically identify, flag, and classify potential dark patterns on the internet, legal safeguards against dark patterns can be enforced more strictly, and the educational system can ensure to familiarize students with internet security measure from a young age so that they are kept informed about deception on the internet.

Another limitation this solution might face is distribution. While entertainment games focus on providing fun rich experiences for players, serious games are mostly focus on the important learning elements and solving a problem [53]. Getting people to play a serious game out of the academic context wound require a lot of creativity. One solution to this is embedding gaming experiences in major online services [11] or creating a reward system for people who play such games (such as discounts on certain products on sites if player achieves certain score).

7.5 Future Work

The Dark Cookie game was developed under limited time and resources, although it is functioning a prototype, there are several improvements that can be made to it. First, I propose a development of the game on a more sophisticated game engine that uses better graphics. I also propose adding other game mechanics to the game design, such as, time pressure and leader-boards, to further increase engagement.

Expanding the game to consist of many kinds of dark patterns, and not limited to cookie banners, would give the game increased content to cover. With more content, the game can have more levels and each of those levels can address one kind of dark pattern. This would create more diversification in the game. The game can also be played and evaluated on a larger scale to both educate people more and also further understand what works better.

Challenges and Learning Experience

Creating and evaluating the Dark Cookie game was an enjoyable, educating and challenging experience for me. Designing the games and graphics were totally alien to me but within the time frame of two month, I was able to start and successfully complete the game prototype. For the evaluation, my initial target number of participants was 10 people, but I was eventually able to gather complete responses from 54 players. My advisor was also very helpful in finding experts to review the game and some participants shared the game around. Although it was not a perfect product, the Dark Cookie game was a fully functional prototype that achieved its goals.

Conclusion

Dark patterns are prevalent on the internet and users are made to interact with all kinds of deceptive designs. These deceptive designs lure users into sharing their personal data or performing certain actions that benefit the online service providers and not really the users. Cookie banners are one of the most common interface encountered by users when they try to access web services. They are used by website operators as a means of informing EU residents of the collection of their personal data, in compliance with the ePrivacy Directive and the GDPR [58]. But unfortunately, many of the cookie banners used by website operators employ manipulative designs to trick users into easily sharing their personal data.

The goal of this master these was to design a game that would train users to identify and interact with cookie banners in a manner that preserves their privacy i.e rejecting all cookies. The game was also aimed to be clear engaging and appropriately challenging.

By researching the dark patters and different types found on the internet in Chapter 1, I was able to understand how the deceptive designs on different interfaces are used in tricking users into performing certain actions. I continued by researching on how manipulation is introduced in cookies banners to trick users into sharing their personal data with website operators. And by studying the GDPR's requirements on consent, I understood that consent should be freely given, specific, informed and unambiguous to be complaint. The prevalence and significance of cookie banners on the internet today motivated the need to combat these dark patterns found in them.

Several measures have been suggested to mitigate dark patterns including technical, design, regulatory and educational measures. As an educational measure in solving the problem of deceptive design, I investigated the use of gamification as an educational tool in combating the prevalent use of dark patterns in cookie banners.

With the goal creating an educative, interactive and engaging game, in Chapter 2, I studied and identified different game mechanics and dynamics that would be most effective in creating such game. These mechanics included levels, points and badges. I also studied the Learning Mechanics-Game Mechanics Model that helped me identify different learning mechanics based on the intended teaching skills and mapped them to corresponding game mechanics.

Following that, in Chapter 3, I researched the state of the art of privacy games and I found three games; Cookie Consent Speed.Run, Terms & Conditions Apply and Cyber Chronix. In order to know the right sets of game mechanics and dynamics combined in these existing games that promoted user's learning and engagement, I studied the the game mechanics and dynamics used in each of the games. Some mechanics identified include, question and answer, feedback, and story. I also gave three test players each of the games to play and asked them for feedback on their gaming experiences in order to what these subset of players found interesting or thought could be improved on. Their review gave pointers to elements in a game that players may find engaging, like clear instructions, interactive feedback and fun or playful elements.

In Chapter 5 I document the implementation phases of the Dark Cookie game. The game, as intended, trains players on how to spot and interact with dark patterns in cookie banners in a manner that maximizes their privacy by rejecting all non-essential cookies. The game was developed using the Scratch programming language and it featured several characters like Mama bear, her bear cubs and the Evil Raccoon. These characters provided a back story for the game and the instruction of the game "reject all cookie" was embedded in this story. Game mechanics like points, levels, feedback, badges, question and answer, story, reward/penalties and stim-

ulate/response were used in the game to keep the users educated and engaged through out the game. The game has five levels and players are to reject the cookies presented to them in the cookie banners shown in different questions through out the game. Players gained points for questions they answered correctly and lost points for questions they answered incorrectly. The game was aimed at reinforcing the behaviour of rejecting all non-essential cookies in players,so that they can transfer such behaviour to their interaction with cookie banners in real life.

To check that the game fulfilled this goal, I let player evaluates the game based on their experiences using a survey I provided to them. As reported in Chapter 6, the survey contained several questions that required players to evaluate their gaming and learning experience during the game. Several aspects in the game were also evaluated by the players to check their knowledge acquisition and learning satisfaction. Some questions also checked the adequacy of the learning method and the perceived applicability of knowledge players gained. Other questions checked the clarity of goals and rules of the game, player's engagement, feedback, challenge adequacy and the player's skill improvement. Open questions were also provided where users expressed in their own words what they enjoyed in the game and felt required further improvement.

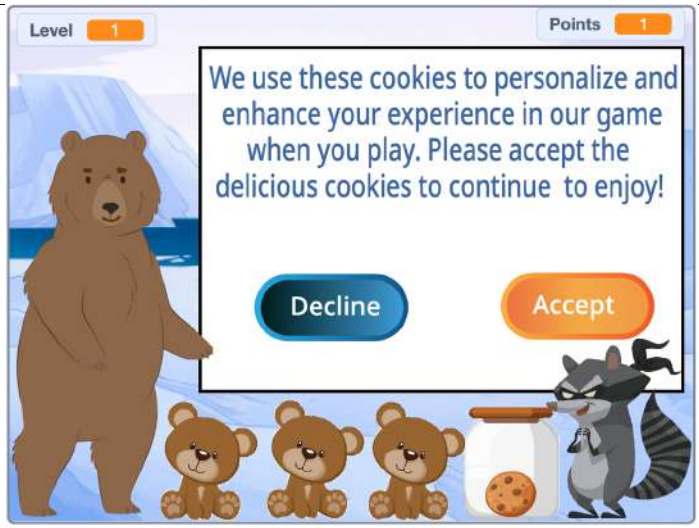
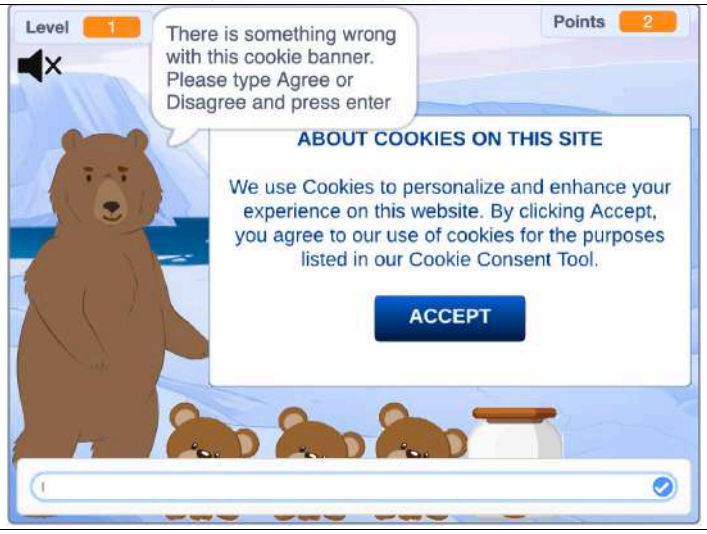
In Chapter 7, I analyse and discuss my findings based on the results retrieved from the survey. The results featured responses from over 54 players from different age groups, educational background and geolocations. I checked that the results provided answers to the research questions I earlier asked by analysing aspects of the survey that answered each research question. Although the results generally suggest that the project was successful in educating players on how to identify and interact with dark patterns in cookie banners, the results also expose aspects of the game that require further improvement. While many players enjoy the tricky questions, educative (and funny) feedback, story, challenge, applicability and engagement of the game, many players also noted that aspects like bonus questions, UI design, explanation and speed of the game could be made better.

There was also a contradicting view of the cookie banners used in the game from players who are expert in dark patters and players who are non-experts. The experts complained that some of the banners used in the game are exaggerated, unrealistic and of no educational value. On the other hand, most players were non-experts and they mostly expressed that they enjoyed these exaggerated banner as it brought the fun elements to the game. These non-experts were the main target audience for the Dark Cookie game, so their opinions were prioritized in this case.

In the same chapter, I also point out some strengths and limitations of gamification as the proposed solution and I give directions for future work based on research gaps found in the Dark Cookie game. Through the results, I identified that despite its limitations, gamification shows promise as an effective tool in combating dark patterns in cookie banners.

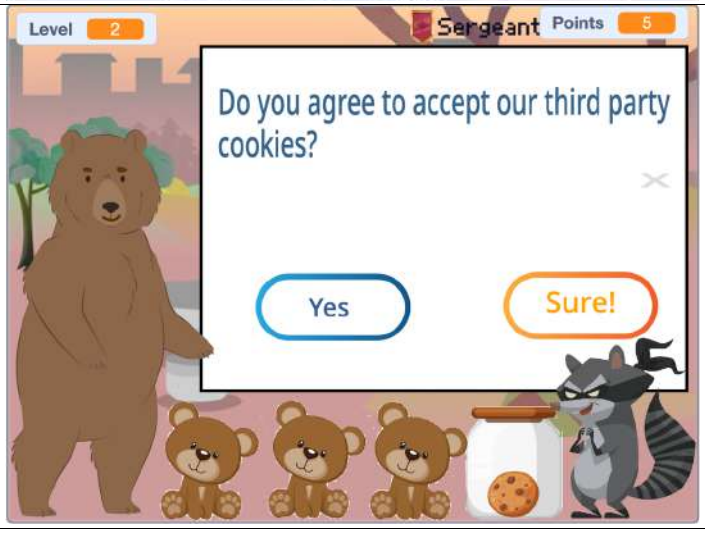
APPENDIX - DARK COOKIE GAME DESCRIPTION

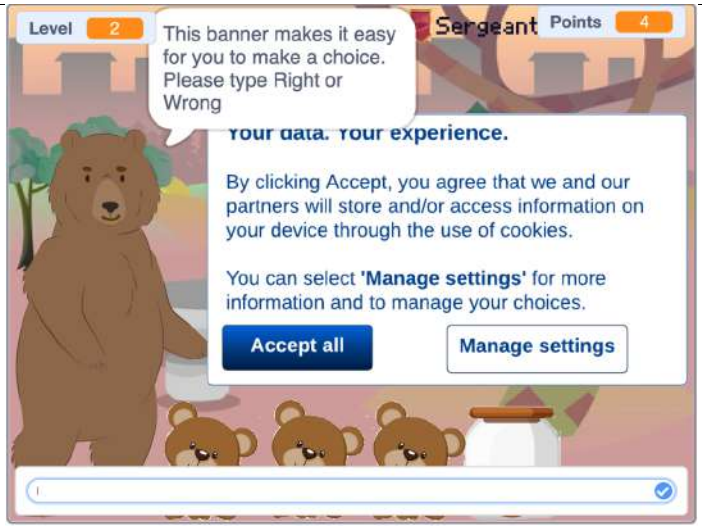
Level One:

Question	Screen	Idea	Bear Comments
1.		Welcome player to game and test basic knowledge.	Answer: No Correct comment: Great job! We are off to a good start! Wrong comment: Oh no! Do not accept! You ruined our lives with poisoned cookies
2.		To double check basic knowledge.	Answer: Decline Correct comment: Well done on declining, one cookie for my babies! Wrong comment: Oh gosh, I had faith in you! Just decline!
Bonus		To check if player can recognize manipulation. The banner is manipulative as it only leaves one option to the user: user must ACCEPT	Answer: Agree Correct comment: The banner only gives you one choice, FORCING you to accept cookies whether you like it or not. Wrong comment: The banner only gives you one choice, FORCING you to accept cookies whether you like it or not.

Badge Earned After Level: Cookie Sergeant

Level Two:

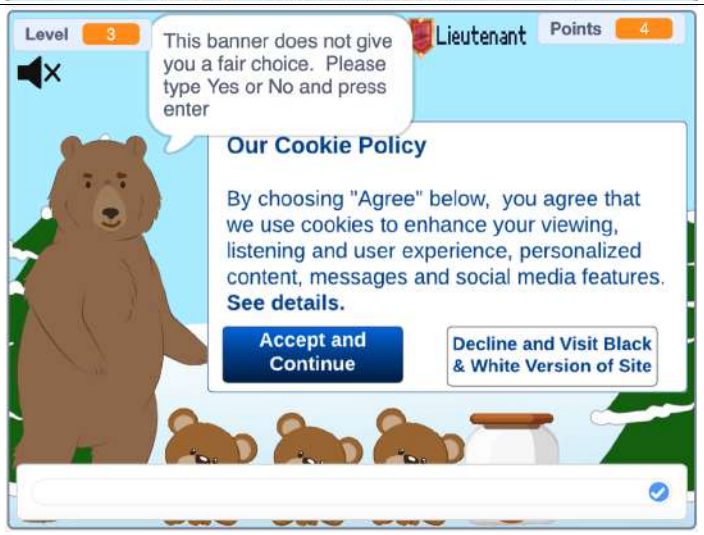
Question	Screen	Idea	Comments
3.		Player needs to pay attention to tricky sentences.	Answer: Yes Correct comment: Good catch on the tricky sentence! Wrong comment: Read carefully please, that was a tricky sentence.
4.		Player should withstand confirmshaming. Cookie banner + Confirmshaming.	Answer: No. I want your company to go bankrupt Correct comment: Phew! I was honestly scared the guilt tripping would get to you Wrong comment: They got you! Their company model is not your problem.
5.		Player needs to pay attention to detail, the exit option is subtle. Cookie banner + Nagging	Answer: The subtle “X” icon Correct comment: You got great eyes my friend, well done! Wrong comment: There was tiny cancel icon X there, please wear your glasses.

Bonus		To check if player can recognize manipulation. Although the user now has two options, it is harder to manage setting as they must go through multiple stages. Reject should be as easy as accept.	Answer: Wrong Correct comment: With this banner, it is easier for you to Accept than to go manage complex settings Wrong comment: With this banner, it is easier for you to Accept than to go manage complex settings

Badge Earned After Level: Cookie Lieutenant

Level Three:

Question	Screen	Idea	Comments
6.		Player needs to know the right option to select when presented with such situation.	Answer: Settings Correct comment: Great job! Often times, it is only in the settings that you can reject cookies Wrong comment: no no no! you should always check if the SETTINGS suit you.
7.		Player should be able to set toggles correctly.	Answer: Preference, statistics and marketing cookies should be turned off When Necessary toogle is clicked comment: Necessary cookies are essential to operating online services. Correct comment: Welldone! Well done! Keep the necessary cookies, reject others and avoid the reset button. Wrong comment: Next time, keep the necessary cookies, reject others and stay away from the reset button.

8.		Player needs to know the right option to select where they intend to save their preferences.	Answer: Accept Only Selected Correct comment: Yes yes. Accept only the options you selected. Wrong comment: Confusing buttons can make you accept all cookies, regardless of your selection. Be careful!
Bonus		To check if player can recognize manipulation. In this case, it is easy to Accept or Reject but Rejecting comes with a punishment.	Answer: Yes Correct comment: In this case, the banner gives you options, but if you reject, there is a consequence of degraded site. Wrong comment: In this case, the banner gives you options, but if you reject, there is a consequence of degraded site.

Badge Earned After Level: Cookie Captain

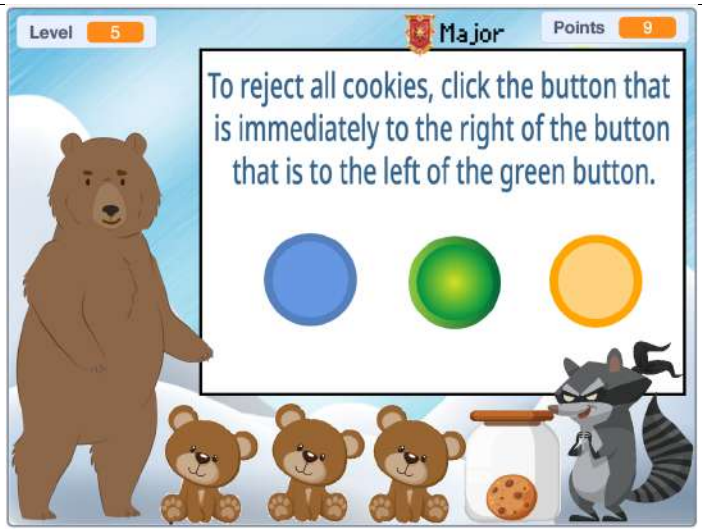
Level Four:

Question	Screen	Idea	Comments
9.		A simple Accept/Reject banner, but both buttons bounce around till one is clicked. This is to create some excitement in the game.	Answer: No Correct comment: Nice catch! You move at the speed of light. Wrong comment: You are as fast as a snail.....disappointing!

10.		Player needs to pay attention to detail, the real instruction is in subtle text. Cookie Banner + Hidden Information	Answer: Yes Correct comment: Phewww! You noticed the hidden text, well done. Wrong comment: If only you got your glasses, you would have noticed the hidden text.
11.		Pretty easy, player needs to click the right button color and not text.	Answer: I Am Blue Correct comment: Thank you for not over thinking it. Wrong comment: Stop overthinking, it said RED BUTTON!
12.		Player needs to pay attention to text framing.	Answer: Yes Correct comment: You caught the double negative word play. Good job! Wrong comment: Pay attention to the double negative word play, don't fall for it!
Bonus		To check if player can recognize manipulation. In this case it is easy to Accept or Reject but there is still a preference given to ACCEPT as it is Pre-selected.	Answer: Disagree Correct comment: This banner is ALMOST great, but the Accept option is more visible than the Reject option Wrong comment: This banner is ALMOST great, but the Accept option is more visible than the Reject option

Badge Earned After Level: Cookie Major

Level Five:

Question	Screen	Idea	Comments
13.		Player needs to be creative here in finding solution, mostly for engagement	Answer: The text “No” Correct comment: You have a great mind, well done! Wrong comment: Just click the "No" in the text!
14.		Tricky Question for Players to have fun with.	Answer: The Green button Correct comment: Easy, wasn't it! Wrong comment: Read carefully and reflect, it's not hard!
15.		Counting clicks for Players to have fun with.	Answer: Click the Blue button 21 times Correct comment: Nice one, Thank you! Wrong comment: Please who taught you how to count? You need help!

16.		Guessing correct option in different languages for Players to have fun with.	Answer: Rara Correct comment: Was that a lucky guess? Well done! Wrong comment: The correct option was "Rara", go learn a language!
17.		Player needs to pay attention to text framing: this is a bit more complex than previous ones.	Answer: Yes Correct comment: I know it is complicated, well done! Wrong comment: The answer is "Yes". I know it is complicated, but please try!
Bonus		To check if player can recognize manipulation. Finally, a good example of how a cookie banner should look. Equal Accept and Decline Button	Answer: Correct Correct comment: This banner is just great, you can decline as easily as you can accept! Wrong comment: This banner is just great, you can decline as easily as you can accept!

Badge Earned After Level: Cookie General

Game is WON successfully!!!!

APPENDIX – EVALUATION SURVEY

Dark Cookie Game Evaluation

Welcome to this research study organized by Priscilla Akinyemi and supervised by Prof. Gabriele Lenzini and Dr Arianna Rossi for a master thesis project at the University of Luxembourg. For any questions, contact: opeyemi.akinyemi.001@student.uni.lu and arianna.rossi@uni.lu.

1. The goal of this study:

Through this short survey, we want to evaluate the game you just played. Evaluation is a crucial part of the master thesis, so please take the time to answer thoroughly. It will take 5-10 minutes to complete.

2. All information will remain strictly confidential and anonymous:

The information you will give in the survey will not be used to identify you. Only the researchers working on the study will access and analyze the answers, which will be used in a master thesis project (details above).

3. Your rights:

Your participation in the project is voluntary; you can withdraw at any point without giving reasons.

To start, you confirm that you have read, understood and accepted the information presented above and that you are at least 18 years of age.

Start

*

Country of Origin

*

Level of English Proficiency

- Beginner
- Intermediate
- Advanced
- Native

*

Age Group

- 18 to 28 years
- 29 to 39 years
- 40 to 50 years
- over 50 years

*

Highest level of education completed or in progress

- ◯ No high school diploma
- ◯ High school diploma or equivalent
- ◯ Trade/Technical/Vocational training
- ◯ Bachelor's degree
- ◯ Master's degree
- ◯ Doctorate degree

*

Are you familiar with Cookie Banners?

- ◯ Yes
- ◯ No

*

How do you usually interact with cookie banners?

- ◯ I usually accept all cookies
- ◯ I make sure to reject all cookies
- ◯ I make sure to choose the only cookies I prefer
- ◯ I just click whatever button is highlighted and move on
- ◯ Does not apply

*

Do you know the purpose of cookie banners on websites?

- ◯ Yes
- ◯ No
- ◯ Not sure

*

The overall goal of the game is presented clearly

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

The game rules are clear and easy to understand

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

My skill gradually improves as the game progresses

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

I receive feedback on my progress in the game

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

I received feedback on my success (or failure) of each question immediately

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

I enjoyed the game without feeling bored or anxious

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

The challenge is adequate, neither too difficult not too easy

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neither disagree nor agree
- ◯ Agree
- ◯ Strongly Agree

*

I catch the basic ideas of the knowledge taught

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

I feel satisfied with the things that I learned from the game

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

This game is an adequate method for learning how to interact with cookie banners to maximize my privacy

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

It is clear to me how the contents of the game are related to their real-life application

- Strongly disagree
- Disagree
- Neither disagree nor agree
- Agree
- Strongly Agree

*

This game will influence how I respond to Cookie Banners in the future

- Very unlikely
- Unlikely
- Neither unlikely nor likely
- Likely
- Very likely

Which aspect of the game did you enjoy the most?

Do you have any suggestions about how the game can be improved?

Would you recommend the game to your friends or family?

- ○ Very unlikely
- ○ Unlikely
- ○ Neither unlikely nor likely
- ○ Likely
- ○ Very likely

Any further comment?

Submit

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