

Polina Bobrova • 951339



# GreenFact:

gamified service design  
focused on sustainable  
development



**POLITECNICO**  
MILANO 1863

Supervisors: J. Sharp, D. Spallazzo

Politecnico di Milano • Scuola del Design  
Master of Science in Digital and Interaction Design  
Academic year 2021/2022

# Acknowledgements

*First of all, I would like to thank my Master's Thesis advisors prof. John Sharp and prof. Davide Spallazzo for their support and guidance. Our meetings and discussions made this thesis possible.*

*I am grateful to my colleagues and friends, when I was in trouble, their patience and comments were really insightful. Special thanks to Davide Bruno for all brainstorm sessions we had and my deepest gratitude to Jose Alvaro Flores Gambarelli for being there and for helping me with branding and visuals.*

*And, finally, thanks to my family for their constant support and faith in me.*

Warmest thanks!

# Contents

<b>Abstract</b>	<b>7</b>
<b>Introduction</b>	<b>11</b>
Topic	11
Background	12
Objectives	13
Target Audience	13
Problem Statement	14
Hypothesis	15
Goals	16
Design Process	16
<b>Literature Review</b>	<b>21</b>
Why mobile gaming?	21
Sustainability	24
Applied game design	28
Recent initiatives	32
Communication with policymakers	36
Sustainability and mobile apps	38
Summary	42
<b>Studies</b>	<b>45</b>
User Research	45
Market research	52
Concept	54
Prototypes	85
<b>Conclusion</b>	<b>137</b>
<b>Appendix</b>	<b>141</b>
<b>References</b>	<b>151</b>

# Abstract

## ENG

This paper reports the development of a gamified service called GreenFact focused on 3 main activities: education, financial support of the researchers working on sustainable development, and communication of the opinions of folks with policymakers. These values are aimed to improve the knowledge about ecology the public has and to provide a tool for people to claim their thoughts in an anonymous but effective way.

To develop a concept of the game we started with the general literature review about the related topics: mobile games, applied game design, sustainability, communication with policymakers and the design and development requirements for a sustainable application. Based on that we proceed with the search of applicable motivations and with the framing of the scope of the game. Then the aim was to design and to prototype the actual game. At that point we began to design the entire service that consists of different stakeholders, their relationships, and the game that activates all the values of the service.

Our concept is a mobile game that consists of a collection of quizzes grouped by topics. Each quiz is a set of cards to be sorted out between 2 groups in regards with the sustainability of the shown object. Quizzes are named by the lifecycle stages of different items. When the user enters the quiz, they are asked to express their opinion if the shown object is sustainable or not. This game mechanic was inspired by the swipe gestures used in dating applications. Once the game is finished the player can support



the related research group and if they proceed the app shows the graph with the data shared with policymakers.

As the result we developed a Hi-Fidelity prototype of the application that was iterated passing through different stages of tests. The last round of tests proved that the target audience is interested in the service and enjoys the game, that all communicated ideas and values were clear and the communication is built properly. This allows us to design new services with a gamification solution involved, to develop a new outreach strategy about the sustainability and to exchange the opinions among public and governments.

## ITA

Il presente lavoro riporta lo sviluppo di un servizio gamificato chiamato GreenFact incentrato su tre attività principali: l'educazione, il sostegno finanziario ai ricercatori che lavorano sullo sviluppo sostenibile e la comunicazione delle opinioni dei cittadini ai responsabili politici. Questi valori mirano a migliorare la conoscenza in materia di ecologia da parte del pubblico e a fornire uno strumento per far conoscere i propri pensieri in modo anonimo ma efficace.

Per sviluppare il concetto di gioco abbiamo iniziato con una revisione generale della letteratura sui temi correlati: giochi per cellulari, game design applicato, sostenibilità, comunicazione con i politici e requisiti di progettazione e sviluppo per un'applicazione sostenibile. Su questa base si è proceduto con la ricerca delle motivazioni applicabili e con l'inquadramento dell'ambito del gioco. L'obiettivo successivo è stato quello di progettare e prototipare il

gioco vero e proprio, unito alla progettazione dell'intero servizio, rivolto a diversi stakeholder.

Il nostro concetto è un gioco mobile consiste in una raccolta di quiz raggruppati per argomenti. Ogni quiz è un insieme di carte da suddividere tra due gruppi in relazione alla sostenibilità dell'oggetto mostrato. I quiz sono denominati in base alle fasi del ciclo di vita dei diversi oggetti. Quando l'utente inizia quiz, gli viene chiesto di esprimere la propria opinione se l'oggetto mostrato è sostenibile o meno. Questa meccanica di gioco è stata ispirata dai gesti di scorrimento utilizzati nelle applicazioni di dating. Una volta terminato il gioco, il giocatore può sostenere il relativo gruppo di ricerca e, se procede, l'applicazione mostra il grafico con i dati condivisi con i responsabili politici.

Abbiamo inoltre sviluppato un prototipo ad alta fedeltà dell'applicazione che è stato iterato passando attraverso diverse fasi di test. L'ultimo ciclo di test ha dimostrato che il pubblico target è interessato al servizio e si diverte con il gioco, che tutte le idee e i valori comunicati sono chiari e che la comunicazione è costruita correttamente. Questo ci permette di progettare nuovi servizi con una soluzione di gamification, di sviluppare una nuova strategia di sensibilizzazione sulla sostenibilità e di scambiare opinioni tra pubblico e governi.

*Keywords: mobile games, service design, sustainability, communication, policymakers.*

*Parole chiave: giochi mobili, design dei servizi, sostenibilità, comunicazione, politici.*

# Introduction

## Topic

Nowadays the play activity has a significant increase due to the spread of digital technologies. Play is the preliminary way of learning for children, but still has a great influence on other ages too. Most of the digital games do not require either a specific place or tool to play: the user needs only his smartphone or a computer. There is a significant number of gamified services designed to impact positively the everyday life of their players, for example, *Duolingo*. Moreover, there are several initiatives and companies that are developing research and releasing games in the field of sustainable development such as *Alba*. This research focuses on opportunities of game design to increase awareness of society about sustainable development. This project discusses opportunities to implement gamification factors into services that provide financial support to researchers, explores the ways of exchange of opinions between the public and policymakers, and emphasizes the need to increase the outreach about sustainable development.

## Background

The sustainability today is a widely discussed topic, but, at the same time, the topic is relatively new. We could confirm a lack of popularization of sustainable approaches, there are few initiatives that target the spread of the information in an adopted way for their target audiences.

This research is aimed to raise awareness about the latest updated information among the wider audience through the usage of the most spread technologies (smartphones).

In the last 20 years, we could note that many different types of games researched sustainability and related concepts (Aubert, Bauer and Lienert, 2018, pp. 64–78). Games have a possibility to grow benefits for people designing and playing them. Games could help us to research, how stakeholders perceive and interact with the associated systems (Rieber, Smith and Noah, 1998, pp. 29–37). Games require a high participation level, which increases the quality of possible outcomes.

The awareness growth is targeted to achieve global changes. We need to force the expression of sustainable perspectives, specifically on complex social and ecological systems (Kriz, 2004, pp. 495–511).

In design practice, we still can rarely find deliverables that can successfully compromise the dialogue about sustainable development and actual user needs. There are several researches that claim the issue that most of the user-centred designs lack empathy towards the ecosystems and vice versa (Fuad-Luke, 2014; pp. 42–73). One group of researchers proposes the ‘complete care’ as a means of connecting user-centered design with sustainability (Jiang, Jachnaa and Dong, 2020).

This project aims to achieve a compromised state between games, services, players, society, policymakers, and sustainability.

## Objectives

This thesis explores design opportunities of games played on smartphones among youth people living in Europe to shape their attitudes about sustainability, express their opinions about it, build a community, to provide a tool to support the researchers working on topics related to sustainability and to communicate the opinions of citizens with governments.

This paper outlines:

- Sustainable mobile game design
- Applied game design
- Service design building the communication between the public and policymakers about topics related to the sustainable development
- Gamified experience as a part of service
- Sustainable approaches in digital design

## Target Audience

To select the target audience properly several constraints had to be followed. The first consideration was who is the active smartphone user since this research aims to concentrate on that type of technology for games. Another important point was to find the age group that “needs to hear the topic of sustainability” and can adapt to changes easily. The target group of *Climate strategies*

& *targets* and specifically the *2050 long-term strategy* by the EU Commission is young people studying or recently graduated, in other words, people aged from 17 to 35 living in Europe.

The *2050 long-term strategy* by EU Commission published recently describes several focuses to prevent significant climate changes.

By all these constraints the target audience was selected as young people from 20 up to 27 years old studying / studied in the European Union with no limitations on birthplace, religion, or gender.

Moreover, as a secondary target audience for this project we selected policymakers as the group of people highly interested in opinions, interests, and knowledge of folks. Our service is aimed to build an exchange of opinions among governments and citizens. This invitation of both target groups might increase the success of the service providing additional motivation to interact with the service for both of them.

## Problem Statement

Today we can see the wish among policymakers, society, and companies to work together trying to address the negative influence of human beings on nature. At the same time, we can notice some disagreements among them.

Many entertainment projects are trying to talk with their audiences about ecological issues. One of the most famous examples could be the recent movie *Don't Look Up*, where the authors try to bring attention to the climate crisis.

At the same time, there is only a little number of games designed to represent eco-issues and grow sentiments towards nature, but we can name other examples of educational and persuasive games. For example, one of the winners of the *Apple Design Award 2021* (Apple, 2021a) in the section of Social Impact, the iOS game *Alba* that talks about Biodiversity inside of the game.

This work is aimed to point out the opportunities of digital games to influence the future by outreaching society and communicating their opinions and knowledge with researchers and policymakers.

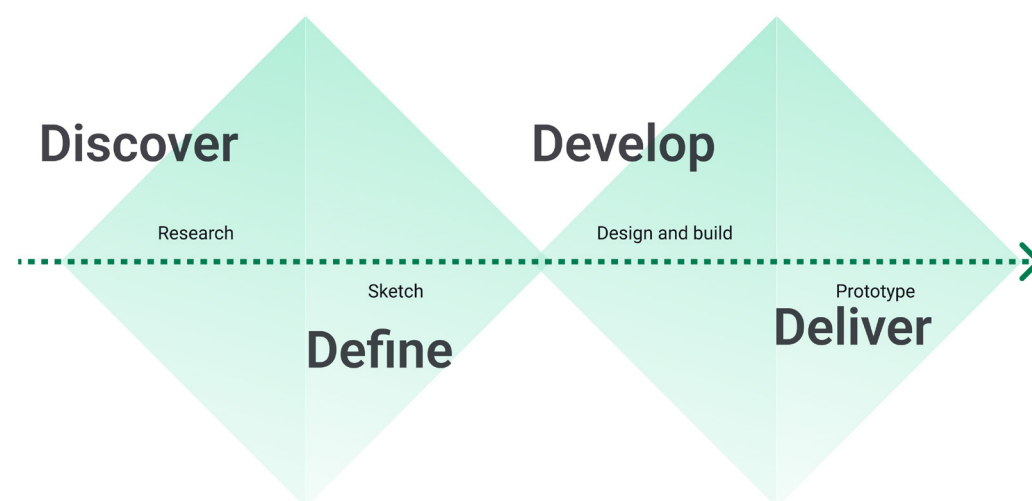
## Hypothesis

We can provide a gamified experience influencing the challenge of sustainability in a positive way by growing sentiments towards nature in the minds of players. We can develop a service that allows users to show their interests and opinions anonymously about different topics related to sustainability. We can provide an opportunity for the public to influence the future of the planet directly and indirectly by developing a digital tool, where they can express their interest in the topic.

## Goals

This paper is reporting the outcomes of project-based research in gamified service design. The goals of this project are to investigate possibilities of gamification in service design, to research real-world motivations for applied game design, and to explore different communicational strategies between policymakers and folks about sustainability-related themes. We identified the main requirements for the prototype of the game and the service at the research stage as well as the concept of behavioral changes through the play, while the prototype was done to prove the concepts in an experimental way.

## Design Process



pic. 1, Design Process

The entire design process had started from the understanding, what are the pain points of the society around. For that, I began reading the agenda of the European Commission. This helped me to understand that one of the topics that need new solutions is sustainable development.

This was followed by deeper research on different sustainable topics and solutions. It was important to understand the preliminary issues that the society is facing, what are the different projects and initiatives that are working on those challenges.

Then I started to sketch, what can help to spread the information about sustainability. At that moment, I took the decision that we can try to develop a game that talks about sustainability. Additionally, I set certain constraints. I had to limit the possible negative environmental influences and decided to design a mobile video game because it decreases the need of users to buy something different from what they have. Moreover, it was important to set the target audience. Due to several reasons, young people studied / studying in Europe were considered as the target audience.

This moved the research in a different direction. It was crucial to understand, how video games can teach people and several approaches were investigated. At the same moment, the generation of first concepts started. About 20 different game design concepts were developed.

After a single concept was chosen it was necessary to find a way to involve the target audience and to see their possible motivations.

This inspired me to change a bit the topic from applied mobile game design to a gamified service design. In that case, the main motivations applied in the game became a part of the service.

From that moment I focused my research on the collection of different guidelines for my design proposal.

Moreover, from my previous research experience, I already had data that society and policymakers do not have a proper communicational tool. In parallel, I started to develop the user experience, the wireframes, and the first interactive prototypes.

At this stage, I faced several issues trying to find the information on the sustainable design approaches since there is a lack of publications. I had mainly to rely on the grey literature, for example, Apple guidelines for developers or the recordings of Android Dev Summits.

When I finished collecting the main technical and design requirements for the prototypes, I started to develop the actual user experience and the user interfaces. Meanwhile, I was working on the service design to have all parts of the concept always at the same level of development.

Since the service is aimed to construct the communication between the young people and policymakers, I started to research, how people can express their opinions and how this is influenced by modern technologies.

# Literature Review

## Why mobile gaming?

The mobile game is a type of video game that is usually played on mobile phones, today this term is mainly used to describe any game that is played on any portable device (e.g. tablets, smartphones, etc.) (Dal, 2017, pp. 6 – 8).

The popularity of mobile games had a significant increase not in the last few years. In 1997 Nokia launched *Snake*. *Snake* was pre-installed in most mobile devices manufactured by Nokia and became one of the most played games. It was installed on more than 350 million devices worldwide (Nokia, 2009). In 2009 *Angry Birds* was released for iOS, and more than 200 million downloads occurred immediately (Chen, 2010). In 2014 155 million of Americans played video games and 25% of households in the U.S. owned a device used to play them (ESA, 2015). Games became the media paradigm of the twenty-first century, surpassing television in popularity (Flanagan & Nissenbaum, 2014, p. 3).

For this research, smartphones were selected as used and investigated technology due to several factors. The vast majority of youth people own at least one smartphone, for example, in the UK 98% of people aged 18-29 have it (O'Dea, 2021). The use of the smartphone in that case decreases a possible CO2 footprint in comparison to the case if players would need to buy a physical game or another gadget. Moreover, smartphones use less energy than laptops or desktops due to their screen sizes as well as they have a lower CO2 footprint at all stages (Manne, 2020).

Another reason is that the target audience not only owns smartphones, but it uses them for about 4 hours per day on average (21% of young people spend six hours or more on their phone daily, 2019), which means a relatively high probability that person will access the game. Most of the games are distributed via online app markets, which allows reaching a wider audience faster using already provided servers.

The main characteristic of smartphones is that they rely on the Touchscreen technology, so let us research on it more. First touchscreens were designed for a stylus. The very first one was developed in 1946 by *Philco Company* as a stylus designed screen for sports telecasting. The first version of a touchscreen that was operating independently of the light produced from the screen itself was developed by *AT&T Corporation* in 1960. The first touchscreen adapted for direct usage by fingers was designed by Eric Johnson of the Royal Radar Establishment. He described his work on capacitive touchscreens in a short article published in 1965 (Johnson, 1965, pp. 219 –220). *LG Prada* was the first mobile phone with a capacitive touchscreen released in May 2007 before the first *iPhone*.

With the first release of the *iPhone* in 2007, the market of mobile phones turned into the market of smartphones. The industry started to adopt immediately and began to produce smart devices with touchscreens.

J. Clement (2021) in her article confirms that “mobile gaming has become the driving force behind the rapid growth of the global video gaming market”. To the public statistic, we know that in 2020 smartphone games took almost 50 percent of video gaming revenue worldwide (Clement, 2022). The mobile game’s revenue is supposed to reach the level of 100 billion-dollar-mark by 2023 (Clement, 2021). From this, we can see a correlation between the number of smartphone holders and the growth of the market in the mobile video gaming sector.

The touchscreen is the main sensor of modern smartphones. It is used to build the main interaction between the user and the device, the user controls the device by it. That is why the decision to

investigate the most common gestures was taken.

The official documentation by *Apple* for developers and designers provides a piece of extensive information about it.

They list 10 common gestures that are provided within the touchscreen:

1. Tap
2. Drag
3. Flick
4. Swipe
5. Double Tap
6. Pinch
7. Three-finger pinch
8. Three-finger swipe
9. Touch and hold
10. Rotate

Moreover, developers can track custom gestures by applying mathematical formulas in their code.

All of this provides us with a clear picture, of how to design an engaging interaction in our game following all the possibilities of the Touchscreen technology.



# Sustainability

## European Union and Sustainability

European Commission adopted the 2009 Review of EU SDS in July 2009. It stressed that the EU popularized sustainable development in a broad range of its policies. The EU led in the fight against climate change and promoted a low-carbon economy. On other hand, unsustainable trends persisted in many areas.

The Commission communication “Rio+20: towards the green economy and better governance” in 2011 had a section on sustainable development, which refers to the Europe 2020 strategy as an effective approach to promote sustainability in the EU.

European Commission has established Sustainable development goals for all countries involved in European Union. They claim: “Sustainable development is a core principle of the Treaty on European Union and a priority objective for the Union’s internal and external policies.” (*Sustainable Development Goals*, no date).

Moreover, in 2015 European Commission identified 17 Sustainable Development Goals in partnership with United Nations. They committed to stopping poverty, protecting the Earth, and ensuring equality in society. The 2030 Agenda is a roadmap of actions that have to be followed. Together with Paris Agreement on Climate Change, it proposes cooperation on sustainable development in many different spheres.

In June 2021 High-Level Political Forum took a place and European Union has confirmed that they use Sustainable Development Goals developed with the UN as “a compass for Europe’s recovery and building a better future through a new growth model” (The European Commission, 2021b). The European Commission has accomplished the 2030 Sustainable Development Goals and puts the Green Deal at the main point of its efforts.

Every Sustainable Development Goal designed by the UN has a list

of targets, the list of actions to be taken as well as different events and publications. In total, there are 169 targets, 3110 events, 1307 publications, and 5488 actions.

## EU 2020

In 2010 in Brussel, the European Commission announced a strategy “Europe 2020”, which they centered on three topics: smart growth, sustainable growth, and inclusive growth. Based on this strategy there are several priorities were identified to group the main targets of the EU by 2020:

- The unemployment level of the population aged 20-64 should decrease from 31% to 25%, with the necessary involvement of female, older workers as well as the integration of migrants;
- The investments of 3% of GDP in R&D should remain the same while developing an indicator that would reflect R&D and innovation intensity;
- The CO2 footprint should be decreased by at least 20% in comparison to the level in 1990 or by 30% if the conditions are right;
- Increase the usage of renewable energy sources to 20% of total energy consumption;
- Increase the energy efficiency by 20%;
- An educational level target that solves the problem of premature leaving school by reducing the dropout rate by 5%;
- The number of people who obtained degrees should increase by 9%;

- The number of people below the poverty line should be reduced by 25% (European Commission, 2010).

The European Commission claimed that Europe should decrease the import of oil and natural gas, support the development of new technologies that potentially reduce the green gas effect, decarbonize the transport, and upgrade the Trans European Energy Network.

## EU 2030

In September 2020 the European Commission (2020) proposed to set a higher target in gas emission reduction to at least 55% in comparison to 1990 as part of the European Green Deal. That could force Europe to implement climate-neutral strategies in the economy. The main points that should be reached by the European Union by 2030 are: reduction of CO<sub>2</sub> footprint production by 40%, 32% of used energy should come from renewable sources and the level of energy efficiency should increase by 32,5% (European Commission, no date).

The European Commission organized a public consultation in March 2020 with stakeholders and citizens to listen to their opinions, on how the EU should change by 2030 from the side of climate change (European Commission, 2020). This event helped to sum up over 4000 contributions that were shared with policy-makers. In July 2021 a series of legislative proposals were adopted to set out how climate neutrality by 2050 would be achieved together with the intermediate step of reduction of 55% of greenhouse emissions by 2030 (European Commission, 2021a).

## EU 2050

The European Commission claims the target of the EU to be climate-neutral by 2050 in an economy with net-zero greenhouse gas emissions. For that mission, several initiatives were established (Paris Agreement, a European Green Deal, etc.). In March 2020 the Commission proposed to include the 2050 climate-neutrality target into the European Climate Law.

From December 2019 to September 2021 the European Commission organized several events on European Green Deal, and policy initiatives. This initiative aims to tackle issues created by different parts of human beings such as food, construction works, and living, transport, energy systems, etc. They implement different actions on 8 main topics (European Commission, 2019). One notable part of it that has to be mentioned in the New European Bauhaus. This initiative started firstly with activities that proposed a series of conversations on the places people inhabit. They organize experimental laboratories to bridge new technologies, current needs, and society are inclusive, sustainable, and beautiful. Moreover, they called for the young participant in the competition to collect new proposals for a better future enhancing the collaboration (New European Bauhaus Prize, 2021). The call showed ideas of youth people about different issues that might be implemented into the 2050 strategies.

## Applied game design

Games are often used to show the hidden reality to the players, people are interested in things that can be assumed as the truth without being so. From this perspective, games are one of the modern tools that are used for education and persuasion. Games grow experience and the main task of the designer is to construct this experience.

Several aspects of human beings are linked to the reasons why people can play games: empathy, imagination, and attention.

To begin to design a game that might influence the attitudes of players we should begin with the definition of the game. Greg Costikyan (2002, p. 21) defines games as “interactive structures that require players to struggle toward goals. This approach can be applied to sustainability challenges. Then sustainable environment is considered as a *goal*, while all actions towards it are *struggles*.”

Games often use the mechanics of developing solutions and help people to increase their skills of it, “a game is a problem-solving activity, approached with a playful attitude” (Schell, 2008). This approach confirms the similarity between any play activity and education.

At the same time, most of the educational games face the issue that it is complex to force players to reflect on the topic, but if they succeed this experience has a significant influence on users.

To change the attitudes of players on certain topics, we should first understand, how we can shape the opinions in general. For this purpose, we often use different types of rhetoric.

Rhetoric has a long history of 2500 years and it comes from the Greek word *great*, which refers to the *orator*. This term was firstly mentioned by Plato’s Gorgias meaning *the art of persuasion* (Plato, 1977, p. 453). In Ancient Athens and in ancient soci-

ety in general, public life was very different than it is for us today. Public speaking was a part of everyday life mostly used in the law court or the public forum, where the public was highly involved.

Technical rhetoric is what it was called a process of making yourself well understood and it could be described as a technique and things to do. A person could even get a personal trainer to help with this. They were called *Sophists* and they taught a rhetorical technique of public speaking (Kennedy, 1999, p. 33).

For any mobile game based on visual materials, to use the visual metaphors properly we need to understand the Visual Rhetoric too. Visual Rhetoric is how visual nonverbal media can build arguments. We can consider this mode particularly important in light of the trends in global mass media such as TV and advertising. We can think about photographs or drawings that can influence the opinions of other people (Helmets and Hill, 2004, p. 2). From a rhetorician’s perspective moving images like cinema might also be construed as visual rhetoric. Visual rhetoric is easy to share today due to the level of development of technologies. At the same time, visual rhetoric needs less deep analysis, which makes it easy to understand and to use as a form of manipulation as well (Hill, 2004, pp. 25 – 40).

This leads us to the concept of Digital Rhetoric. One of the definitions of Digital Rhetoric is rhetoric that has the following characteristics: “speed, reach, anonymity, and interactivity” (Gurak, 2001, p. 29).

Digital Rhetoric is the way is the traditional rhetoric works in digital spaces. What user sees online is the attempt to take call them and look at the ways that those have been redistributed on the computer (Bogost, 2007a, p. 34). We could reimagine the ways that we write, and the way that we create visual materials. If we look from the visual rhetoric perspective, even if we consider computers as image-producing machines, the way that they produce images by photographic means or by design means, painting or other kinds of artistic practices the computers do it in code and they make you encode it differently.

Digital rhetoric focuses “on the presentation of traditional materials – especially text and images – without accounting for the computational underpinnings of that presentation” (Bogost, 2007a, p. 37).

When we try to have a look at technologies that are used to deliver Digital Materials (Rhetoric), we will see that it is all about code and it is very little about the image that we see on the screen. Visual rhetoric alone is not sufficient to explain the way that the things like software and video games make arguments. By Bogost (2007a, p. 38), we can say that this new type of rhetoric has to “address the role of procedurality”.

Ian Bogost proposed the idea of Procedural Rhetoric. He defines Visual Rhetoric as the art of being effective and persuasive with images. Then Procedural Rhetoric would be that of using processes persuasively and we might imagine lots of ways of interpreting this idea of “using processes persuasively” and not all of them need to be computational (Bogost, 2007a, p. 38).

Usually, when we make arguments whether they are verbal or written, or they are made of images or in videos we are essentially mounting arguments about processes or we are describing processes themselves.

Procedural narrations build models that make arguments about how things work and those things are right. We think of modeling it is not just airplanes or bridges or traffic patterns or other kinds of material phenomena, but also conceptual processes (eg., social practices, public policy, everyday experiences, etc.). We could represent with computational processes thereby making arguments about them. What we are doing when we are practicing procedural rhetoric, when we are acting as a procedural rhetorician, we are constructing or reading and understanding models particularly. Ian Bogost (2007b) says at the Microsoft Research meet-up that “persuasive games are nothing more than his name for video games that mount effective procedural rhetorics... we could look at different kinds of processes themselves, but there is something about video games that I think makes them particularly promising as a place to engage this concept”.

While the persuasive game design is aimed to “convey messages, draw arguments, convince players to adopt a specific point of view, change their beliefs about the world or influence their behaviours” (Bogost, 2007b). Serious Games take a charge of something else. One of the broadest definitions could be: “Serious Games”: any piece of software that merges a non-entertaining purpose (serious) with a video game structure (game)” (Djaouti, Alvarez and Jessel, 2011, p.1). This comparison of definitions gives us a possibility to understand them better. Serious Games are those games that include educational materials when Persuasive Games are designed to deliver a specific point of view. Both of approaches can apply to the topic of the thesis and will reflect in the materials provided within the game.

To build a system that involves an applied game design approach it is crucial to understand the possible motivations of the players. The idea of Intrinsic motivation was introduced as an idea of getting people to do something for the sake of doing it without the need for any external rewards.

The first two authors to be mentioned are Edward L. Deci and Richard M. Ryan (1985). They have done the research on the elements that facilitate intrinsic motivation and they narrowed it down to three main points that are easy to implement in games:

1. Autonomy (when players feel they are in charge of what they are doing)
2. Competence (when players’ actions are leading to mastery of them)
3. Relatedness (when players feel that they belong to a community)

Later on, Thomas Malone (1981) in his research added three more elements that can help us to construct the interaction in the case of Applied Game Design.

According to Malone, the 3 other motivations are:

1. Challenge (designed for an optimal level of difficulty resulting in a flow experience)

2. Curiosity (makes current knowledge seem incomplete)
3. Fantasy (engaging make-believe activities)

All 6 motivations mentioned above could work for Applied Games, but for the purpose of this thesis work, from which we will select only a few at the concept stage of this project.

## Recent initiatives

In order to understand, what are the design opportunities for a game that can grow sentiments towards nature the research about the existing initiatives in game design that are working on sustainable topics.

### Sustainable Learning

*Sustainable Learning* is an initiative created by and for teachers. It is funded by the Department of Energy and Climate Change of the UK Government, which allows them to continue the legacy of that very special year when they engaged 30.000 local school-children (Sustainable Learning, no date). They made a website to help teachers to inspire pupils all about sustainability. They share different learning materials as well as information about events. For the learning process, they try to be keen on more gamified processes and include different participatory activities there. For

example, Sustainable Shaun is a series of different teaching materials, which aims to encourage children to cooperate and to design. Design activity is taken by them as a game. Moreover, these teaching materials include an imaginary character – Shaun, who tries to show the path to children and even “sends” them letters to describe some topics and inspire new designs.

## Persuasive Game Design at TU Delft

*The faculty of Industrial Design Engineering of the Technical University Delft* conducts research on gamification to motivate behavioral changes in society (TU Delft, no date). They developed several types of research and produced several projects.

One of their projects that could be mentioned in the Family game for electricity use, focused on how families with children could decrease energy use by playing together. In the game, every family member receives a Flo Cube containing electricity (a liquid substance). The family could use these cubes for entertainment devices at home e.g. TV and the PC. The goal is to have as much liquid remaining as possible at the end of the week. Using insights from this research, a product had to be designed that fits within the current activities at Philips and that brings together parents and their children in their attempts to reduce their energy consumption. The focus of this product was on something fun that parents and children could do together (Lavrysen, Bakker and Stappers, 2010).

Another project they released was *In the Loop Games* (In The Loop Games, no date). The goal of this game was to help to raise

awareness about critical raw materials. Materials with high economic importance and significant supply risk, have been receiving increased attention in recent years. This is a board game, where players take on the role of a manufacturing company and try to be the first to seven 'Progress Points' by collecting resources and building products, but the game world stresses the uncertainty of the real world, where you cannot be sure how much progress your company could make.

## Games for Sustainability

*Games for Sustainability* is a website created by the Center for Behavior, Institutions, and the Environment at Arizona State University, where they share the outcomes of their activities.

For example, *Irrigation Games* were designed for a series of lab experiments performed with a computer-based version of the irrigation game as well as the paper and pencil versions from the field. They shared 5 papers with protocols and outcomes for different experiments. One that could be crucial is the effect of information in a behavioral irrigation experiment, where they discuss the level and quality of information available to the users on the actions of others and the state of the environment may have a critical effect on the performance of groups. They found that inequality of investment in irrigation infrastructure and water appropriation across players is more pronounced in experiments where resource users have limited information about the actions of others. They also found that inequality is linked to the ability of groups to cope with disturbances. Hence a reduced level of information indirectly reduces the adaptive capacity of groups (Center for Behavior, Institutions and the Environment, no date).

## Games4Sustainability

*Games4Sustainability* platform is a guide to making your sustainability message more compelling and accessible by employing games and social simulations. On their website (Games4Sustainability, 2018) we could find many examples of different games categorized by 17 topics of sustainable development. One of the games that is published is *Tradeoff!*. It is a series of mapping games developed by the *Natural Capital Project* that simply introduces concepts related to nature's benefits to people. The process of preparing spatial data, running software tools, and appropriately interpreting results can be challenging; *Tradeoff!* represents a more effective means to convey our approach to a broader audience, especially those who are not computer savvy or experienced scientific modelers.

Another shared game is *World Rescue*. This is a mobile game, where through fast-paced gameplay set in Kenya, Norway, Brazil, India, and China, players meet and help five young heroes and help them solve global problems—such as displacement, disease, deforestation, drought, and pollution—at the community level.

## Games4Change

Founded in 2004, *Games for Change* (Games for Change, 2021) is a non-profit initiative that aims to inspire game creators to impact reality through games. They organize the annual *Games for Change Festival*; they inspire young people to discover civic issues through Student Challenge and showcase leading impact-focused games through live Arcades. The *Games for Change* is a crucial festival in game design circles, it spreads the latest information and raises awareness on different issues. During those festivals, they organize different types of events from lectures to workshops that can communicate the concepts and approaches with different levels and types of specializations in the game industry. Moreover, since they partner with people in the game industry and production, they collaborate with worldwide companies, they try to force that there are those design opportunities, and they are not controversial to any kind of business model. Moreover, they aim to stress the opposite.

## Communication with policymakers

One of the main ideas of the service is to build proper communication between the public and policymakers. This issue has been addressed in many different types of research.

For example, P. Lewis in his work 'Policy thinking, fast and slow: a social intuitionist perspective on public policy processes' (2013, p. 7) provides a list of cognitive shortcuts, which are currently a key feature of research including:

- the 'availability heuristic', the relation between the size or probability of a problem to how easy it is to remember;
- the 'representativeness heuristic', when people overestimate the likelihood of events;
- 'prospect theory', when losses tend to hurt more than the positive impact of gains;
- 'framing effects' based on subjective judgments;
- 'confirmation bias', where disproportionate reliance is placed on material that confirms what we already believe;
- 'optimism bias', unrealistic expectations that our goals will be successful if we achieve them;
- 'status quo bias';
- a 'need for coherence'.

The research was done by Paul Cairney and Richard Kwiatowski 'How to communicate effectively with policymakers: combine insights from psychology and policy studies' (2017) frames 3 main points for the effective communication:

1. Present the conclusions instead of evidence to speak for itself, minimize the cognitive overload
2. Select a proper moment to identify the right time to exploit 'windows of opportunity'
3. Collaborate with real world policymaking

# Sustainability and mobile apps

## Sustainable IT development

There are some guidelines provided by developers and researchers. Baptiste Montagliani (2020), iOS developer, in his blog provides a shortlist of main sustainable concepts for IT:

1. Select a Green Hosting Provider
2. Design an efficient Cache Policy
3. Optimize your Medias & Images
4. Reduce the amount of data being transferred between your Server and your App
5. Remove unused features from your App
6. Follow Energy Efficiency best practices for your App
7. Optimize your use of Location Services
8. Adapt your use of Timers & Notifications

Moreover, some developers also suggest performing high energy consuming tasks on the server-side, since those machines are designed for that when the main task of the smartphone is to show the results instead of dealing with complicated tasks.

Luis Cruz and Rui Abreu (2019, p. 15) in their research also stress the need for an efficient Cache policy. They suggest to “avoid performing unnecessary operations by using cache mechanisms”.

For example, a mobile app shows the data to users that is requested from a remote

server, but this data should be requested only once or if some changes have appeared.

As a solution, it could be offered to “implement caching mechanisms to temporarily store data from a Server” (Gottschalk,

Jelschen and Winter, 2014, pp. 437–444). Moreover, Cruz and Abreu (2019, p. 16) suggest to “verify whether there is an update before downloading”.

The need to optimize the Media and Images, use of Location Services, and use of Timers and Notifications are mentioned in official guidelines for developers by Apple (2016).

Considering this we can also try to limit the usage of in-app advertisements since those mechanisms require lots of back processes and plenty of HTTP requests.

Another point to be mentioned in the selection of the development technologies and paths. It is crucial to select the most optimized language for the device as well as to compromise the development and testing processes.

C++ and C# are the most used languages for game development using additional software (Unreal Engine and Unity). We can also use a pure coding approach and develop the games with the languages supported by the devices (eg, Kotlin or Java for Android and Swift or Objective C for iOS) or commonly used language Dart. Or we can create a progressive web application, using JavaScript. If we have a look at the research of Rui Pereira, Marco Couto, and others (2017), we can conclude that C is one of the most “green” languages, while Dart and JavaScript are significantly less efficient in comparison to Java and Swift based on energy consumption and memory usage.



## Sustainable User Experience and User Interface Design

The visual design appears on the screen and screens are the most energy consuming parts of modern smartphones. The rendering is linked to both User Experience and User Interface and we can reduce energy consumption by adopting them. This has an additional point to be considered that “Apps that require heavy usage of the screen (e.g., reading apps) can have a substantial negative impact on battery life” (Cruz and Abreu, 2019, p. 10), which means a shorter lifetime of the battery and of the device. In order to provide a list of requirements for the design of the user interface, the literature review was performed on this topic too.

Today we can notice a lack of guidelines and articles about sustainable User Experience and User Interface Design. This chapter would mostly refer to the guidelines provided by Apple for developers and the research of Luis Cruz and Rui Abreu.

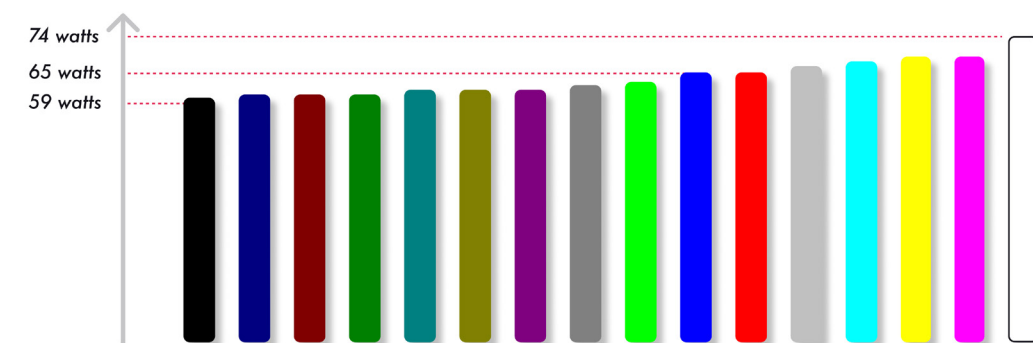
Apple (2016) suggests to:

- “Cast down the number of screens your app uses
- Decrease the use of opacity. If the use of opacity is needed, you should avoid applying it over the animated content.
- Avoid calculations of render when your app or its content is not visible, for example, when the content is hidden by other elements or offscreen.
- Use lower frame rates for animations whenever possible. For example, a high frame rate may make sense during gameplay, but a lower frame rate may be sufficient for a menu screen. Use a high frame rate only when the user experience calls for it.
- Avoid using multiple frame rates at once on a single screen.
- Use recommended frameworks when developing games. These frameworks are optimized to provide great performance and optimal energy efficiency.”

Luis Cruz and Rui Abreu (2019) in their work provide some tips for developers and designers, on how to reduce the energy use with the design. The first recommendation they provide is ‘User Knows Best’. They suggest to “allow users to enable / disable certain features”, which helps to decrease energy use for the features that are not relevant for a specific user (Cruz and Abreu, 2019, p. 16).

Cruz and Abreu (2019, p. 17) also recommend ‘Inform Users’ and they refer to “letting the user know if the app is doing any battery intensive operation.” This idea leads us to a combination of two solutions. We can inform the user if some features are not being used, but at the same moment, they consume extensively the energy. Moreover, we can let the user request certain information to be presented only when it is necessary. For example, if we have a list that is can be updated, we do not necessarily have to update it by the program, the user can “request” the updated list.

Since the screen is the major source of power consumption in modern smartphones, we should consider sustainable color usage. For that Cruz and Abreu (2019, p. 10) suggest “providing a UI with dark background colors”. In particular for the devices “with AMOLED screens, which are more energy-efficient when displaying dark colors” (Cruz and Abreu, 2019, p. 10).



pic. 2, Energy Consumption of pixels displaying certain colors

*Android Dev Summit 2018* “the cost of color pixel” was described, in other words, which colors use the energy the most and the least. For example, white color uses 74 watts, while black consumes only about 59 watts. This gives us a direct correlation between the brightness of the color and its energy consumption. In order to decrease energy use, we can provide a design with a higher density of dark colors instead of white.

## Summary

The topic of sustainability is widely discussed today. It is one of the main issues that governments tend to deal with. One of the activities of policymakers is to promote and to outreach the information about sustainability among their citizens, which helps them to build a better system of rules and show the reasoning behind their actions. Nevertheless, this activity might be supported by additional services. Most of the modern outreach tools are highly academic, which leads to misunderstandings between the society and policymakers, sometimes the first ones get “bored”. Moreover, there is a public opinion on the topic, but citizens do not have an opportunity to participate in decisions making process and could not influence the situation directly.

One of the possibilities is to design a gamified service that invites citizens to express their opinions and collaborate for a better future. Games are well-known tools for building communities. Gamification might sustain the balance between educational purposes and having some fun.

In order to talk about sustainability, we should also design and provide a sustainable service. For that, we need to target the most critical and active audience, who are young people. Smart-

phones are owned by the vast majority of them. The video mobile games market continues to grow, which provides additional design opportunities.

In modern research practice, there are lots of information about different sustainable approaches, but at the same time, some topics are not well covered. For example, during the research, it was challenging to reach the guidelines for sustainable user interface design when there are some materials for developers and plenty of information about the topics of less modern technologies.

# Studies

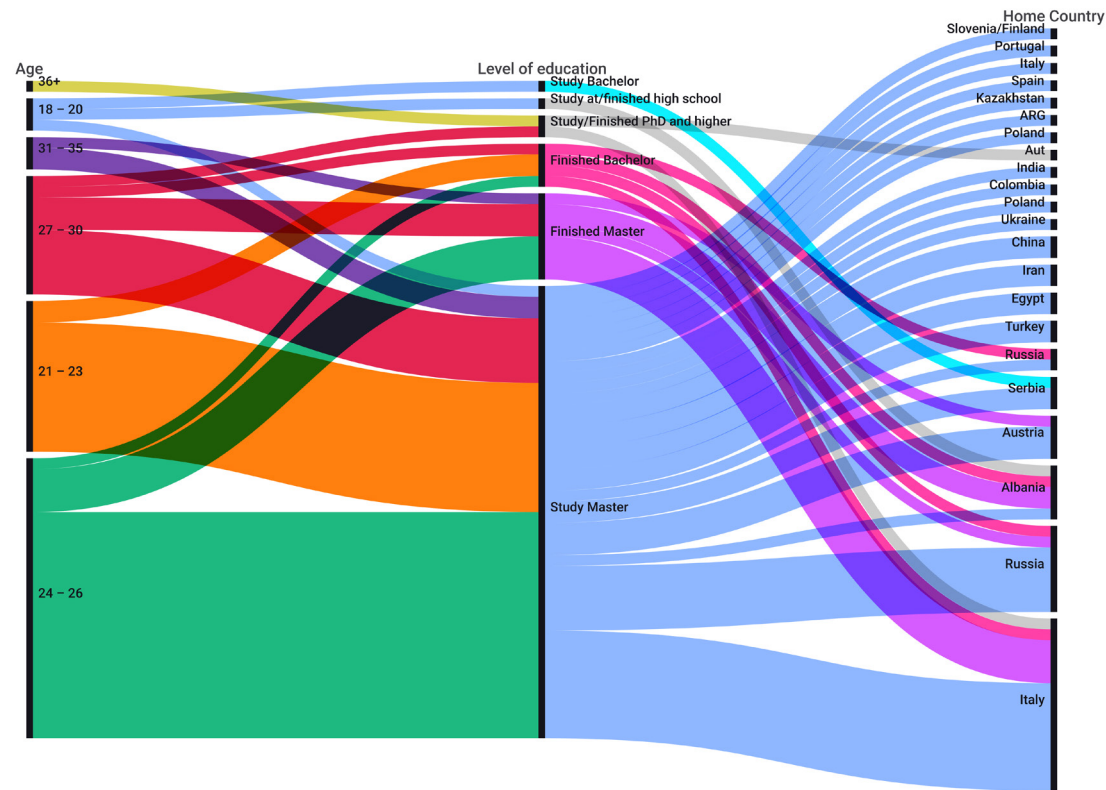
In this chapter, the research moves towards a project-oriented approach. This includes the description of the drafts, user research, market research, service design, game design, user interface design, and different tests conducted to come up with the final proposal for a smartphone game towards sustainability, development of the low-fi, mid-fi, and final prototypes.

## User Research

### Survey

To understand the possible Personas the User Research was performed at an early stage. This preliminary research also reflected on the literature to be reviewed.

For the preliminary User Research, possible players were considered. At this step, the survey was created and spread among 58 young people living in Europe aged from 18 to 36 with the main focus on the age groups from 21 to 23 (~ Bachelor Students, Generation Z) and 2 Millennial groups of 24 – 26 (~ Master Students) and 27 – 30 (~ Master Students, recent graduates, and young professionals). To perform the survey the online form using AirTable was prepared.

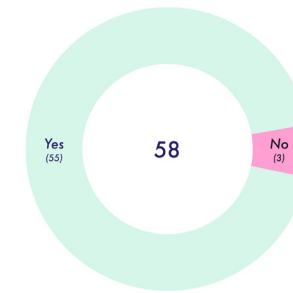


pic. 3, Antropology of participants

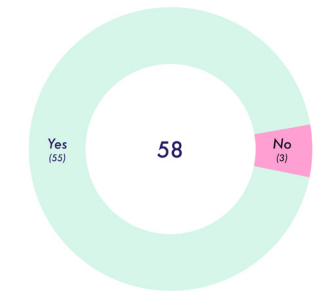
The survey was divided into 3 main parts: anthropology data with specified questions on the country of studies; introductory questions about sustainability, mobile games, and their possible effect on the behavioral changes towards nature; questions to hear the complaints that are related to the research topic and constraints for the design brief (the survey sample is in the Appendix).

From the survey, it became clear that some sustainability topics are more known by young people than others. The less known topics are Stormwater management, Sustainable IT, and World-wide and European targets on carbon footprint in the future.

Most of the respondents agreed that games can shape attitudes and they could be used for the positive purposes too.



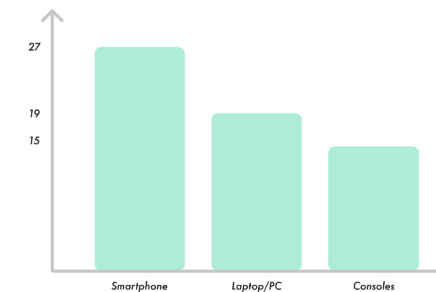
pic. 4, 'Can games influence attitudes?'



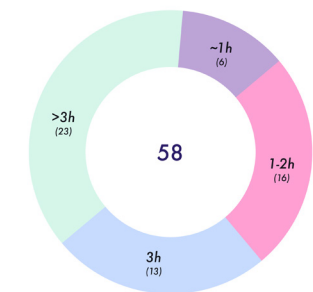
pic. 5, 'Can games influence attitudes positively?'

About 64% claimed that they play video games and the vast majority of them are using smartphones as a play tool, while different consoles are considered as less used tools for play.

If we have a look at the time respondents use their smartphones per day, we can see that almost a half use them for more than 3 hours, while another half use them for 1 – 3 hours per day. Moreover, no one has mentioned less than an hour.



pic. 6, Playtool



pic. 7, Screen Time

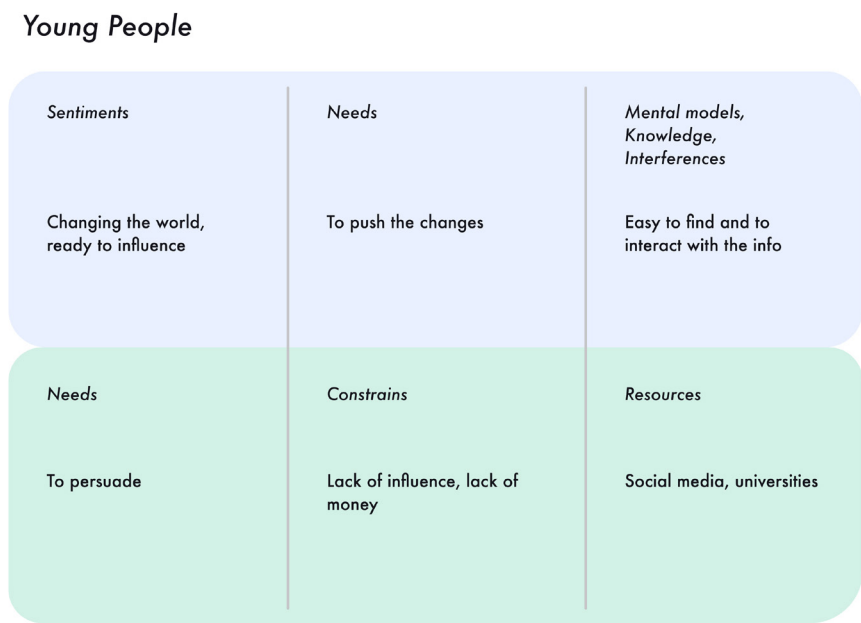
To shape the target audience ("players") the replies to the open questions were taken and the data on the most popular words used were analyzed.

Sample reply:

*"The health crisis is proving that people are indeed capable of working collectively towards a common goal. If the*

same type of attention and care is posed towards the environment, we could probably set up the basis for more sustainable business models.”

Persona Canvas



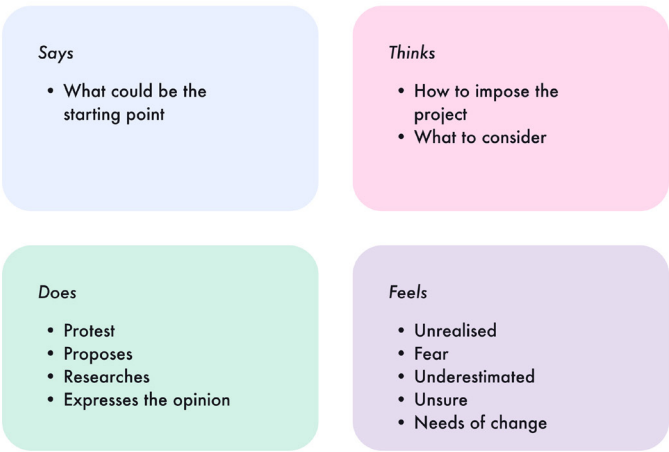
pic. 8, Persona Canvas

Based on the preliminary field research we could compose the Persona, which helps us to describe our target audience better.

For this project, the Persona is considered to be a young person that has a strong wish to influence the future of the planet and/or society positively. Persona wants to change the world and feels inspired. The main need of our Persona is to force the changes. Persona is easy to interact with, communicative and friend-

ly. Persona sometimes struggles with connections with people in power or funds for their actions, but is active and tries to act in all reachable ways using social media or connections at the place of studies. The selected Persona has certain abilities to propose and promote different solutions. This Persona faces different mental crises due to the lack of tools to act but hopes to be heard. The Persona is active and curious.

Empathy Map



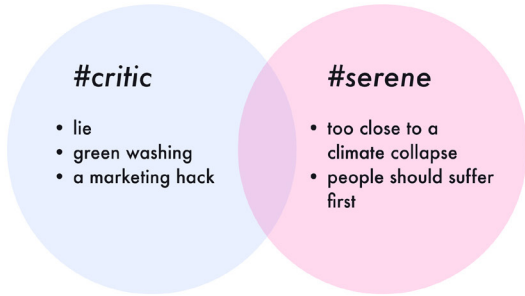
pic. 9, Empathy Map

To understand the beliefs and attitudes of our target audience we decided to create the Empathy Map that is divided into 4 blocks: what the user says, what thinks, what does and what feels. Our user is mainly considered with different questions, for example, “where to start if I want to help”. At the same moment, the user thinks about how to persuade other people and change their attitudes on certain topics, how to bring their eyes to it, and what



should be considered to do it in the best way. Our user is active and protests do the research, propose, and expresses their opinion. All these actions are normal at the age of youth. Nevertheless, our user is not shy, feels unsure, scared, or underestimated, but still feels the need for change, which forces them to act.

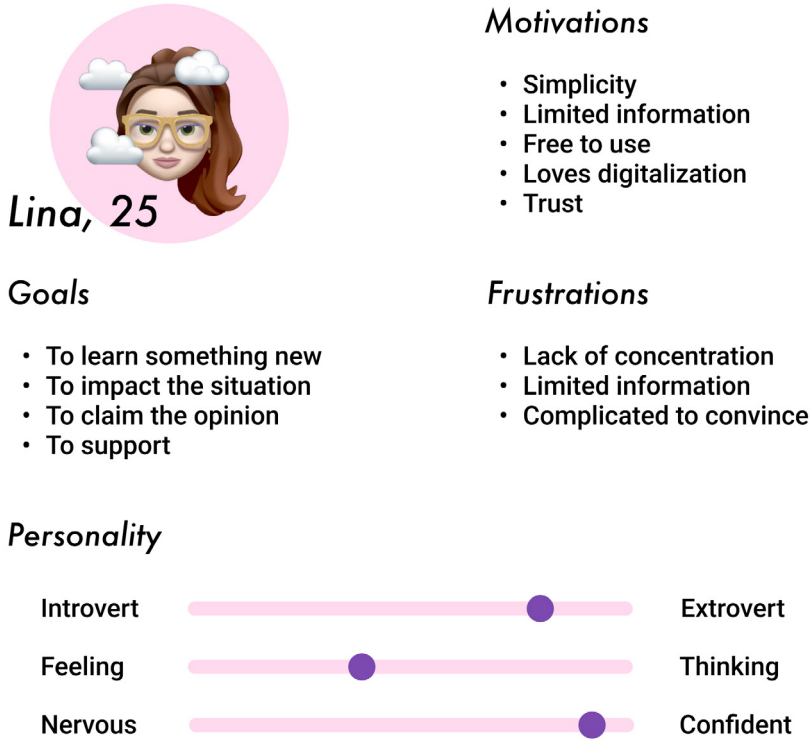
User Clusters



pic. 10, User Clusters

Based on the results of the survey we came up with two main groups of user clusters. The User Clusters are considered to be critical and serene about the existing solutions and want to communicate their opinion with the government, researchers, and different social institutions. The serene group wishes to bring more attention to sustainability. We noticed that some of the users are concerned if the existing approaches are helping, if what they hear is the truth, and if this all is not just a marketing hack. At the same moment, the other group of people feels strong empathy for the topics of sustainability. They believe that we do not do enough for our planet and future and that we are too close to climate collapse.

User Persona



pic. 11, User Persona

Probably the main User of the application is going to be young women around 22-27 years old, who studied in Europe. She wants to change the world. One of her main beliefs is that she knows everything, what makes her a little challenging person to persuade. This age group struggles with keeping focused for a long time, what the service has to pay attention to. Moreover, it is crucial to build trust with that Persona and convince her. This Persona is aimed to learn something new, but also to impact on the situation, for example, supporting different researchers. She is Extraverted and often listens to her feelings. For her it is important to collaborate and to be heard.

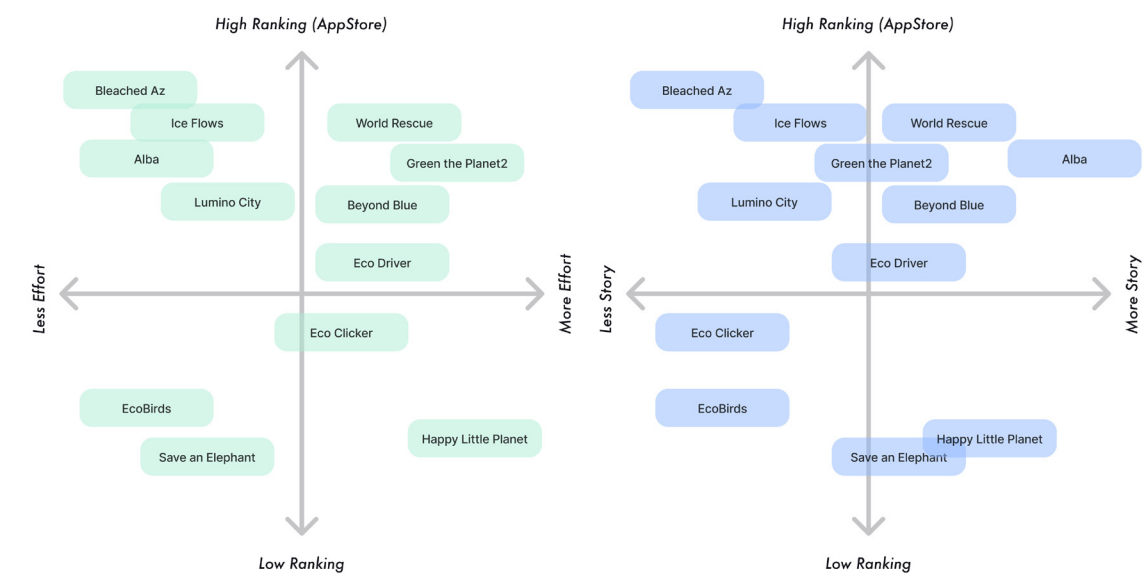
## Conclusion

The proposed service relies on the players of the game inside of it. Those players can be considered as the target audience of the service. They can interact with it directly or indirectly. They can easily get interested in this service. They would not face any issues related to the lack of funds since they are never required to pay. They can promote the service among their friends or on social media. They can support different sustainable projects by outreach. The service can be seen as a place to express an opinion by joining certain communities and as a tool to influence the situation directly and indirectly. This game might help to reduce the level of critics related to sustainable development by educating its players in a fun way. The service can create a safe environment for the users, where they can discuss, get new knowledge and share their opinions and interests anonymously. Our users can see the real impact because our service supports the projects involved in sustainable development.

## Market research

To create the basic list of requirements for the game design 12 mobile games related to topics in ecology were selected. These games were analyzed with Benchmarking graphs. The most important correlations were between the ranking (people enjoy and interest) and players' effort (how complicated the mechanics are) and between the ranking and the presence of narrative in the gameplay.

The most ranked games present less or middle effort from the player and more arcade or have a moderate level of the narrative.



pic. 12, Benchmarking

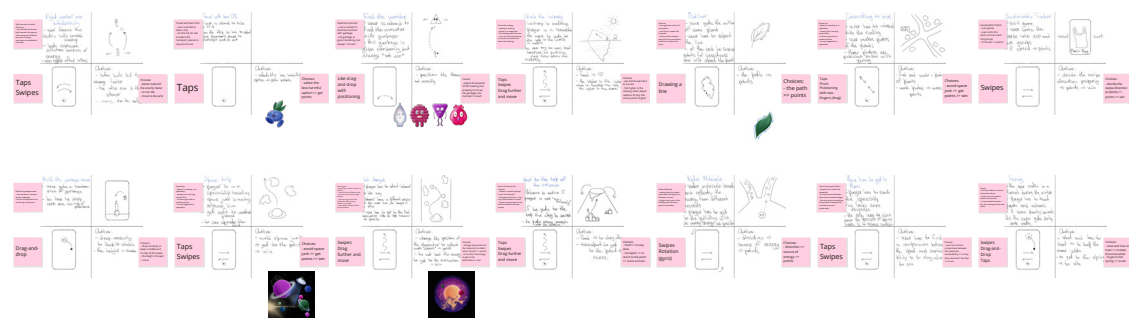
The first scheme shows the direct correlation between the success of the game and the middle level of effort from the player. This means that playing on smartphones people do neither enjoy the complex gameplays nor too simple. From the second scheme, we can conclude that the moderate implication of the narrative might increase the joy. Probably, the level of the narrative and of the complexity of the gameplay is also related. Modern smartphones are more advanced than some years ago, but still, they cannot replace game consoles. We can predict that this is the reason for the moderate level of gameplay's complexity and of the narrative implication to bring the most success to the game.

# Concept

## First Ideas

At the very beginning, the project did not have a game concept. We had the main constraint that we would like to explore the possibilities of game design to educate players about sustainability. Moreover, at this stage, the thesis was considered to research only the game design, while later on, it became an entire service.

Game design has a similar design approach as any other kind of design, when given a problem the designer searches for the proper solution. For that, we often decided to develop plenty of different proposals that might solve the design issue. I have decided to come up with up to 14 different concepts. To describe every concept, I proposed a small matrix divided into 4 cells. The first cell was used for the storytelling explanations, the next one was for the visual explanation of the idea, the third one was used for the gestures and gameplay mechanics applied in the game and the last cell contained the information about the decisions the player has to do to win.

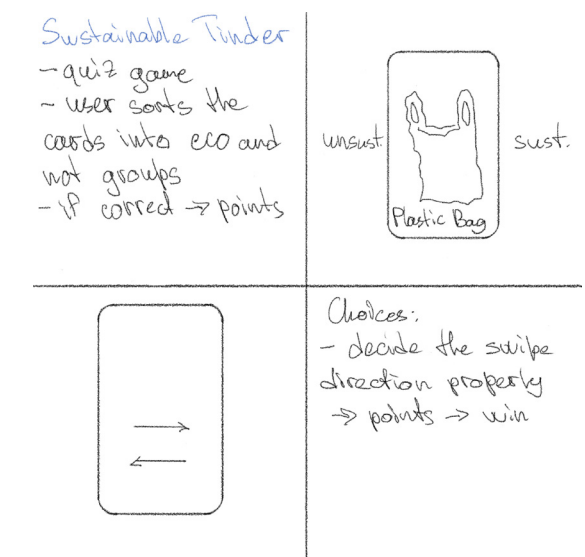


pic. 13, First Concepts

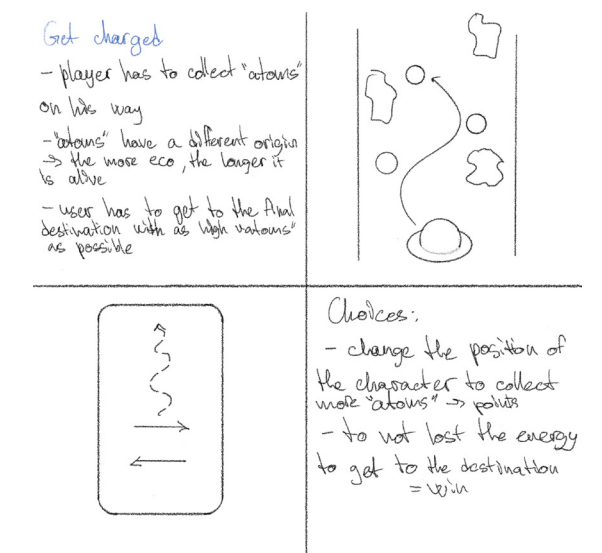
Out of these 14 concepts firstly we had decided to take two that seemed to be the most promising. This approach helped us to design two different approaches and to select the one we believed in more. This process was an important part of the research when we found out that a more creative technique is needed to bring more players and, as the result, to impact sustainable development and education with higher probability.

The first one is a small quiz game, where the player is given a card with an item or action and has to decide if it is sustainable or not. If the player replies correctly, we assign the points. The game uses the swipes and taps as gestures. This concept is the current concept we work on.

The second concept at first was just a typical game, where the player has to avoid and to collect the items that are moving toward him. The player had to collect atoms of energy that were divided by energy sources used to produce them avoiding the asteroids and space junk. The more and the greener atoms user collects the higher the score becomes. The player has to decide the proper position of the character, where he can collect the atoms and to avoid the junk. The main gesture applied is a drag. Later on, we expanded this concept and added mini-games inside, while we excluded the concept of at-



pic. 14, First Selected Concept



pic. 15, Second Selected Concept



om collection. Now the player had only to avoid asteroids and can get repaired on the planets on the way, where they are supposed to help locals with sustainable issues.

Both ideas were promising. For the second concept, it was obvious that it can work, but also it seemed to be classical and would not be considered creative by possible players. When the first concept had a huge number of challenges, but if it can be successful then we would be able to provide a unique experience.

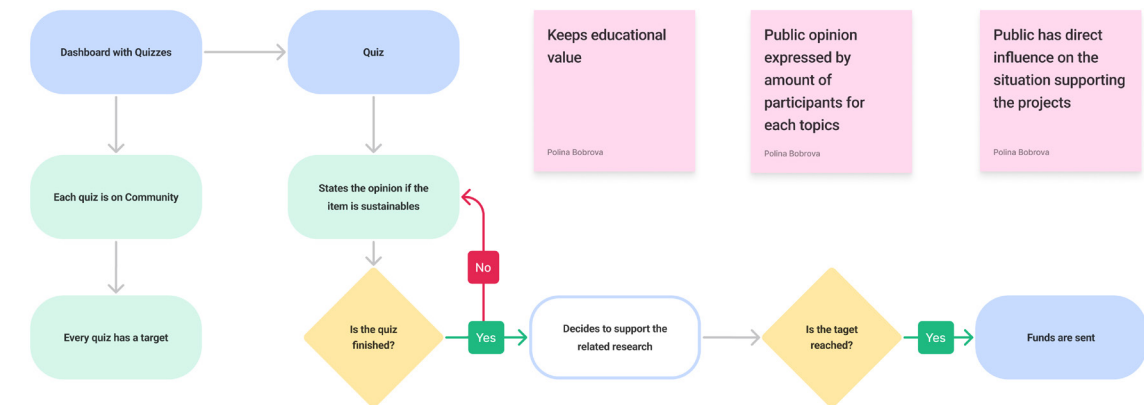
After a few prototyping rounds and tests inside of the research team, the decision to continue the development of the first concept was taken.

## Design Brief

In this chapter, I will briefly describe the service and its details.

I propose to create an integrative system that would provide educational and entertaining activities to the users that can be used as a communicational platform to express their knowledge about the sustainability.

Their opinions on certain topics to the policymakers and will become a collaborative tool to influence the quality of living in the future by supporting the funding systems for the researchers working on sustainability projects.



pic. 16, Design Concept

## What?

The design proposal is to provide a communicational service that has a gamified experience in it. This service is supposed to build communication between policymakers and the public. The communication can be indirect, where policymakers see the actual results instead of personalized opinions. It consists of a game with quizzes divided by sustainability topics. Every topic has a target to reach. The content of the quizzes has to provide verified data that can educate the players using literacy. When the target is reached a related artwork is sold and money goes as funds to the researchers that work on sustainable projects. The reports from researchers as well as from the services on the money flow represent the public opinion and interests on certain topics. Moreover, when the service will expand, it could start to get more opinions on social media that can be communicated to policymakers too.

## Who?

The service involves mainly the folks (mainly young people), researchers, and the policymakers, but it should be developed by the third parties in collaboration with investors and universities to ensure a safe place to speak for the players and fair distribution of finances among researchers. The projects to be fi-

nancially supported have to be selected by the service that takes the responsibility to verify if the applicant is aligned with all the requirements.

How?

By creating a mobile game, where users can freely select the topics, they want to contribute to or get more educated about. Including the collaboration with investors and reports of outcomes, the service can build trust with its users and with policymakers. The service can be promoted on social media, by the press, during conferences, or by folks and policymakers.

Where?

The entire service can operate online. The game can be distributed via online markets, while the data can be communicated on social media and in the physical/digital reports by the platform and the researchers. In some cases, the data can be also presented during public discussions, debates, and conferences. For the test environment, it can operate in a selected region (for example, in a city or in a region) with the further expansion to the entire Europe or even worldwide.

Why?

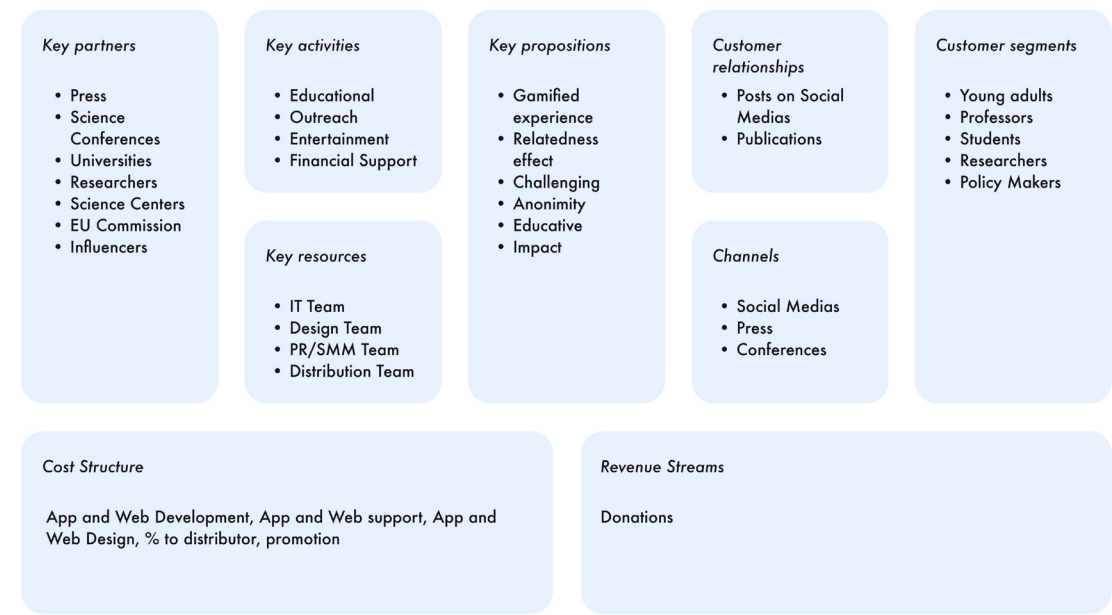
Today some topics of sustainability are more known by folks than others, which influences the funds of researchers to be distributed unequally (the more known is the topic the easier it is to describe and receive the financial aid). Behavioral change can be provided. Moreover, some sustainability topics are seen differently by policymakers and the public. The public can have a platform to state their opinion and be sure that it will not influence their private lives. On another side, the modern educational system can be improved in the communication of those topics, which can be supported by this service too. This service can become a

platform that allows people to contribute to a better future with zero financial effort from their side. The gamification of the service can bring a wider audience to the service, which will impact the outcomes.

Service Design

Since we decided to expand the scope of the project and introduce it as a service, it is necessary to explain the service in more details.

Business Model Canvas



pic. 17, Business Model Canvas

This service is aimed at outreach, but it still can produce economical value too. With the involvement of the key partners (that are mainly the Stakeholders) the service can provide educational and entertaining activities. For the service, it is important to be promoted via different channels but considering the main playing audience, the focus should be on different Social Media.

The service needs a multidisciplinary team to develop and to support the product that gathers programmers, designers, and professionals in relationships with the audience. The Revenue Streams for the project itself can grow from donations in the amount of 10% of the donations received to sustain the service, while the other 90% will be reserved for the researchers.

SWOT analysis



pic. 18, SWOT

To position the service properly on the market and to design it considering all the needs the SWOT analysis was performed.

The strengths are simplicity of the representation for players and clear outcomes, the game does not have complicated rules or mechanics, and the collaborative participation provides an opportunity to influence the laws and opinions. As a weakness to consider we can name that this game might be not able to keep long-term relationships with players (one-time games) as well as the first

impression might destruct the entire image of the product.

The service provides an equal opportunity to exchange the opinions anonymously and to help to support the research. To succeed, we should keep in mind that the service might be seen as controversial and the money flows can be unclear for the players, what can lead possible players not to start or to continue to touch with the service.

Service Blueprint

Stages	Become aware		Playing			Fidelization		
Substages	Promotions	Official communication	Act of Play	Receiving the results	Contribution	Artwork sales	Merch distribution	Social relationships
Channels	Social Medias, Press, Service website, websites of partners	Reports	The application	The application	The application	The application, public events, artwork markets and galleries	The application, social occasions, partner shops	Social occasions, Social Medias, partners and conferences
Players Actions	Future player gets a promotional information about the service and the game		Selects the topic to learn about and to contribute to, plays a quiz game	Checks his/her results	Decides to contribute with his/her rewards or not		Buys and wears merch	Shares the experience with others
Policymaker actions		Reads the reports from researchers and from the platform				Gets information on money flows	Sees the public opinion occasionally	Hears the public opinion occasionally
Artists actions	Generates the artworks for the service				Provides an artwork for sales	Provides the rights for an artwork to be sold		Contributes in promotional activities
Front of Stage Interactions	Value proposition, promotional materials	Providing the communicational channels (eg. events, mailing, etc)	Exchange of educational materials, knowledge, opinions and interests	The app provides the results to the player	The app provides a collaborative contribution system based on players success	Platform provides the sales channel and communicates the money streams with the players	Provides physical goods to the players	Shares the experience of their players and other stakeholders
Back of Stage Interactions	Development of the platform and communicational strategy	Compilation of processes and outcomes	Design of materials to be provided in the game	The visual representation of rewarding system		Cooperation with marketplaces and art dealers	Manufacturing and distribution systems	
Support Processes	Professors, researchers and PR team		The application collects and analyses the data without association to certain players		Communication with artists and marketplaces	Promotion activities		Promotion activities, search for new partners

pic. 19, Service Blueprint v.1

To describe better, how the service operates and interacts with users and stakeholders, we decided to provide a matrix that represents the Service Blueprint.

The designed Service Blueprint describes the entire process of the service delivery including different layers of interactions,

three types of involved “users” as well as communication channels. In this service flow actions are divided into 3 main groups: “Become aware”, “Playing” and “Fidelization”. Each one is divided into smaller actions. Players are the ones that are involved in most of the processes of the service, while policymakers and artists almost do not participate in the “Play” activity. The policymakers mainly touch on the outcomes of the service, when the artists are supporting the system. This diagram does not include other stakeholders, since their level of participation in the service is relatively low in comparison to policymakers and artists, who joins more than a single step of the interaction.

During the “Become aware” stage the service operates simultaneously, where the “Promotions” is aimed to reach the possible player by inviting artists, and promoting the service on online platforms, while the “Official communication” targets policymakers delivering them the data the service has so far and promoting the need of this service to them during Conferences or by emails.

The action of “Play” is mainly focused on players and their interaction with the gamified application provided by the service. It consists of 3 steps: “Act of Play”, “Receiving the results” and “Contribution”. “Act of Play” is the moment, when the user of the application communicates their opinions, knowledge, and interest chooses the topic they want to know more about, and by solving the quiz. The data on the selected topic is counted by the platform. The actual replies during the quiz are also taken into account as “most common mistakes or disagreements”. During this step, the user is given an educational card about a certain tool/service / item / etc with the picture and description of its characteristics from a sustainability point of view. The player has to confirm or to decline if they think the item on the card is sustainable or not.

After finishing the “Act of Play” the user receives their results and the correlated reward, what is the second step “Receiving the results”. At this moment system provides the overall result to the user and finalizes the direct interaction with the user unless they get again to the beginning of the “Playing” action of the flow.

Important to consider that it has to be clear for the user that his personal data is not being saved or shared, and that all provided materials have to be clear, short, easy to understand, and as less controversial and confusing as possible. We note that in any case most of the topics can be argued, and we will apply the most common and scientifically proven considerations in the educational materials.

When the player moves to the stage of “Contribution” the service starts to involve artists in the process too. At that moment the artwork is shown partially to the player and asks if they want to contribute their rewards received at the previous step to the current weekly / monthly target, where the target is “to open” the entire image by contribution from rewards of the players. If the user decides to ‘invest’ the reward the equal part of the image becomes visible for them and other users.

Then another group of sub-actions is the “Fidelization”, where the service builds stronger relationships with possible new players and other stakeholders. “Fidelization” has the first step, while two other actions can exist in parallel after it. The first step is to sell the actual artwork. When the common weekly / monthly target is reached by players, the artwork opens entirely and appears on sales (on marketplaces or by art dealers). At the same moment, the service activates the funding agreement. When the artwork will be sold, the money streams have to reach the researchers working on sustainable projects. The platform has to explain the money streams in a clear way to all the stakeholders and players. At that stage, the legal question about the artwork has to be finalized too. As the back interaction, we can also see the direct way to inform policymakers on certain financial aids moving to researchers as well as results of different researches that were supported by the service before.

After the artwork is sold and money reaches the researchers this artwork can be also distributed as a part of the service. The artwork can be printed on different physical goods that can be sold to the players and delivered physically. This process can also trigger the policymakers to act as long as they can see people wear-



ing similar symbols. Moreover, this gives an additional feeling of Relatedness to the players.

At the same time, when the merchandise is being distributed, the community can start to share their experience with others occasionally, some players might share it online and promote it actively. This also involves the growth of popularization of the participated artist/s, who can behave in a similar way to players. The service has to activate the promotional activities, here again, to reach a new audience and grab more attention from the policymakers.

The entire system has to exist in a strong collaboration between 3 main groups of “users” along with the provider of the service. The main action of the service is to spread the ideas, while the platform that it uses is the game. The communication around the service is highly important even though the service itself communicates the statistics, the reports, and the outcomes to the

Stages	Become aware		Playing			Fidelization		
Substages	Promotions	Official communication	Act of Play	Receiving the results	Contribution	Data share	Financial Aid	Social relationships
Channels	Social Medias, Press, Service website, websites of partners	Reports	The application	The application	The application	The application, email, reports	The fundrasing system	Social occasions, Social Medias, partners and conferences
Players Actions	Future player gets a promotional information about the service and the game		Selects the topic to learn about and to contribute to, plays a quiz game	Checks his/her results	Decides to contribute with his/her rewards or not			Shares the experience with others
Policymaker actions		Reads the reports from researchers and from the platform				Gets information on money flows		Hears the public opinion occasionally
Researchers	Generates the artworks for the service						Recieves funds	Contributes in promotional activities
Front of Stage Interactions	Value proposition, promotional materials	Providing the communicational channels (eg. events, mailing, etc)	Exchange of educational materials, knowledge, opinions and interests	The app provides the results to the player	The app provides a collaborative contribution system based on players success	Platform provides data	Provides financial goods to the researchers	Shares the experience of their players and other stakeholders
Back of Stage Interactions	Development of the platform and communicational strategy	Compilation of processes and outcomes	Design of materials to be provided in the game	The visual representation of rewarding system			Fundrasing system	
Support Processes	Professors, researchers and PR team		The application collects and analyses the data without association to certain players			Lobby activities	Taxation	Promotion activities, search for new partners

pic. 20, Service Blueprint v.2

policymakers and the public.

The service not only outlines the need for more trustable and engaging communication about the sustainable topics, and the need for entertainment in this process, when this occurs, but also tries to build a new complex and indirect communicational channel between the public and local or global policymakers.

Later on, we decided to change the way we raise the funds since the mechanics were not clear for the players. For this, we eliminated the part of artwork sales and decide to involve more investors and the public to provide the finance for the service and researches.

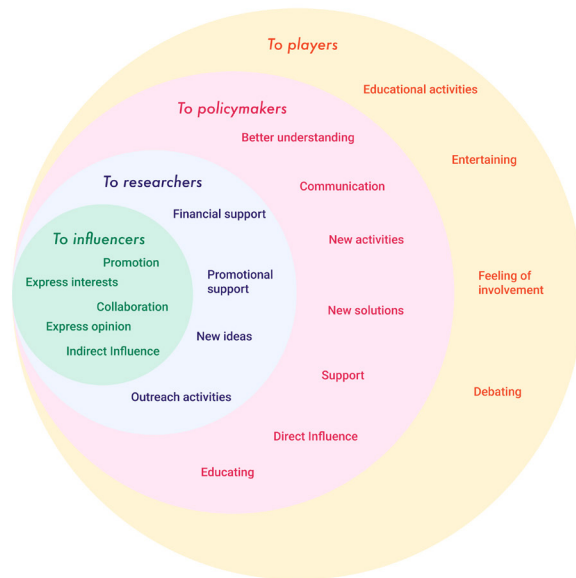
Offering Map

The designed service profit is not only about the commercial part of it, but it focuses a lot on values and other types of goods that can be provided to the society. To prove this concept the offering map was developed.

The Offering Map represents all the main values that the service can provide to its users and the main stakeholders. It is structured as 4 circles one inside another one, what represents different stakeholders and the groups of users.

The smallest circle is dedicated to the influencers, the next circle represents the researchers as one of the most beneficial, economically speaking, group, the bigger one is dedicated to values related to the policymakers and the biggest one is to the players. Every circle is located inside of others since the values provided to other groups include the values provided for smaller ones. The influencers get the least number of values, while the players receive the most possible from the service.

The correlation between the values and actions of users was also visible from the Service Blueprint and relies on the level of the integration of the user group into the service, even though the researchers were not mentioned there. The main reason for that



pic. 21, Offering Map

is that they do not contribute directly to the service, but only receive something from that, while 3 other groups can be named as users due to the opposite structure of their relationships with the service. At the same time, for the service itself, it is important to mention the researchers since its fundraising system contributes exclusively to them.

The offers for influencers are highly linked to their everyday activities and the service could help them to promote their works, to build new relationships, and to express their opinions and interest simply by participating in the service.

The researchers, as mentioned above, are mostly involved in the financial aid programs, but can also benefit from collaborations or just spread of their projects and get funds from other places too. Nevertheless, they are highly important for the general target of the service – to build a better future.

Moving to the policymakers we can see, how the influence on the society grows from the participation in the service. Moreover, we can state that for their career the understanding between them and the public is crucial, what the service can improve and give some tips, on what to work next.

For the players, the service provides all the values of other groups, such as collaboration, communication, and influence, but also gives them something new to learn and to discuss in an entertaining way.

## Stakeholders and Eco-System Maps



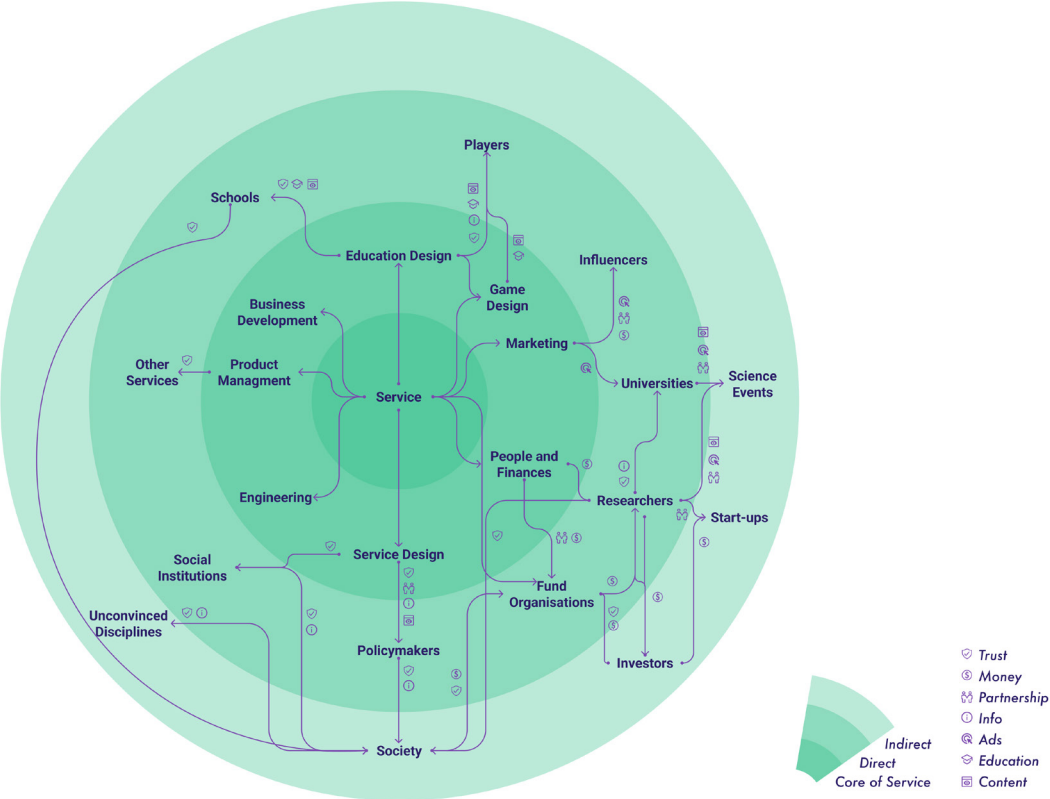
pic. 22, Stakeholders Map

The Stakeholders Map shows the number of stakeholders that are involved in the service. The inner circle is the service itself, then we see the core of the service, next we can find the direct stakeholders, and lastly, we can notice the indirect stakeholders. The service brings together different institutions that can all collaborate to build a more sustainable future.

The core of the project is related to its development and promotion. Direct stakeholders are those, who benefit from the collab-

oration with the service directly and in a short-term perspective, while the indirect group of stakeholders can benefit from the outcomes of the entire system.

For example, when the team develops the service and is ready to provide it, it starts to build relationships. The Service Design Team can start the communication with policymakers and researchers. Those two groups of stakeholders can impact the society and science, what is impossible without them.



pic. 23, Eco-System Map

To describe the values exchanged between different stakeholders and the service the Eco-System Map was developed. The map is divided into 3 sectors, where the inner circle is the service itself, the middle one represents the direct partners, and the outer circle contains the indirect partners. The map shows different cat-

egories of shared values: trust, money, partnership, information, advertisements, educational activities, and the creation of the actual content and product.

The service is mainly aimed to share the trust, money, and the content. The most linked group is the society, but this stakeholder is not a part of the service, it benefits from it indirectly only through others.

At the first layer, we can see a strong collaboration between the service and its close partners. These relationships preliminary are developed by trust and in some cases with money streams too. Already at the first layer, the stakeholders of the service start to collaborate with each other. For example, policymakers are linked with social institutions, and fund organizations are related to researchers and players can be considered as support partners to researchers.

Adding the next group of partners, the system complicates more. We can see that even though the service does not operate with them directly, but it is necessary to provide possible values through the intermediate step. To name a couple of examples, the service does not collaborate with the science events directly, but it supports the researchers that can get additional funds and promotions and deliver their works during those events. Or start-ups are also not a part of a close circle of the service, but they can gain from the knowledge provided by the researchers and even more from the investors that can get familiar with the topic in before the research.

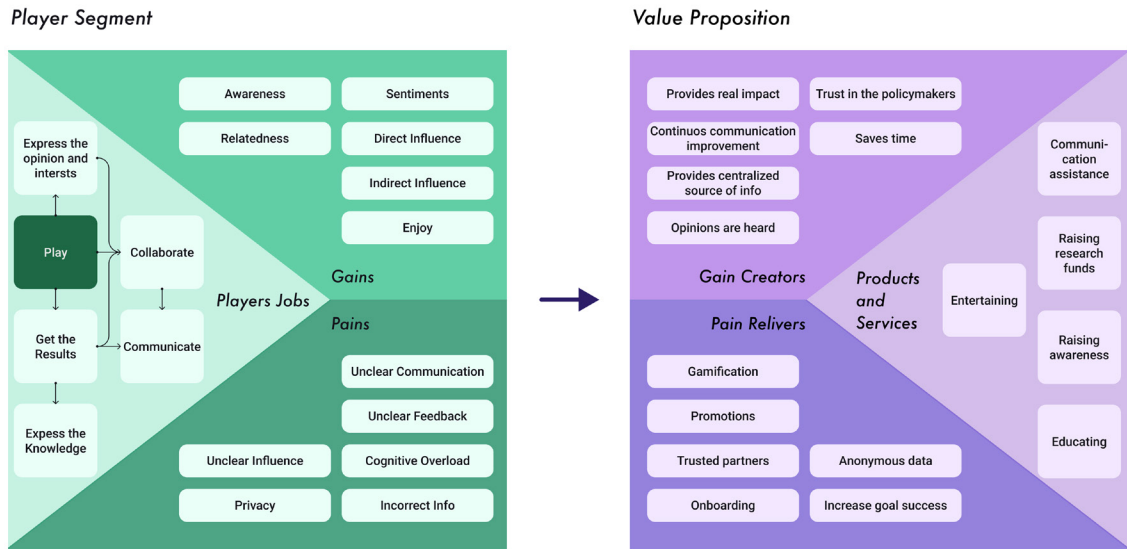
From the map, we can notice the high level of collaboration between investors, researchers, and other manufacturing- and science-related partners. The service supports the complex relationships between investors, researchers, events, and universities. They are all interested in this service to exist even though those relationships are already built, and the service operates additionally to stronger it. Players are given a significant role in the service. Policymakers operate as an intermediate step between the society and the service and benefit directly from the service.



Another important branch of the map to describe is the relationships between the service and influencers. These groups are taking the responsibility for a promotional activity, which is one of the main targets of the service. They both can generate the content that can be sold for the fundraising system, but also they can share their experience with the audience and involve new players and some other stakeholders. Moreover, since the service targets not only usual citizens but also policymakers it is crucial to involve others in social media and press communicational activities. This can be provided by art dealers and by galleries. They can present the artworks, they can sell them, and bring the interest from other parts of society.

This entire system helps the service to speak out about the problem, it supports the relationships and the communication between different stakeholders, it provides benefits to its partners, and lastly, but not least, it impacts the society and the current situation.

### Value Proposition Canvas



pic. 24, Value Proposition Canvas

To stress the importance of the gamification of the service the Value Proposition Canvas was designed. This canvas is constructed out of 2 main parts: the value proposition and the player segment. The player segment describes the gains, the pains, and the jobs of the players, when value proposition part explains the products and the services, the gain creators, and the pain relievers. In the player segment, it was important to mention the links between players' jobs since the only act of play activates all other elements of the system and can be considered as a part of it.

Let us explain the players' segment in a bit more detailed way. When the player opens the game and plays it, they start to express their opinions, which contributes to the average statistics. Receiving the results the user expresses the knowledge, which is also considered in the statistics. All of this allows the player to collaborate with other players and in the end to communicate their thoughts with the government.

The players might get confused, lost, or even feared by the service. Sometimes the users cannot be sure if their actions impact what they want to impact and if they even impact. This has to be noted in the design of the service.

From the platform, the player can receive new knowledge, can impact the systems, the society, and the situation, can trigger behavioral changes, and simply enjoy the act of play.

If we move to the value proposition part of the canvas, we can notice that the service offers plenty of services and products. The service has to take care of the communication, the promotion, the education, and the entertainment. To relieve the possible pains of the player the service has to provide clear explanations, to ensure the user about the money streams and data streams, but it can also get in partnership with the trusted personas or businesses.

To provide the most gains to the player the service provides different values. For example, it helps to impact, it helps the user to not get stressed from the communication with the government from any side, and it provides a gamified experience.

The collaboration between the service and its players is crucial.



The service is aimed to simplify the actions for the user, so it provides a game, which constructs the communication and helps to provide a real impact without any economical investments from the user.

## Service and Data

One of the values of the service is the communication of people's interests, opinions, and level of education about the sustainability with policymakers. For this, we propose different solutions. There are 3 main ways of communication that are direct from the service to policymakers, indirect via reports of fund recipients, and occasional communication of people with policymakers (eg. sharing their app experience on social media).

In the first case the service has to take care of the data collection, and the data representation and align it with the local laws. Since the target audience is considered as young people living in Europe we propose to stick with the European rules on data protection and privacy policies.

Moreover, the policymakers that will receive the information are selected to be the European Commission, since the service operates in Europe and this selection does not require the player to share his location. The application can be downloaded only from the online stores that are associated with the countries in the European Union. The European Commission can imply the rules not only for small regions but in a more global sense.

After the installation of the application user is given the privacy policies with the explanations, of how the service collects and performs the data, and asked to consent to them. The service does not collect nor share the personal data of the users. All the data that is saved is statistical. After every participation is finalized the service performs the calculations and saves the final overall results.

To build the trust between the service and players in questions that are related to privacy policy we decided to show inside of the application the same data and graphs that will be communicated with policymakers. To do so the interface provides two blocks of the information, which are available after the contribution of the user to the target. The first one is related to the number of participants, and the average and medial "investments" of participants. The second block represents the graphs for each item that was shown in the quiz. These graphs are presented as bar charts that indicate the percentage of participants sharing their opinions with policymakers.

On this screen, we also provide a personal statistics of the user, but it is being kept on the device of the user as a cache and never send to the servers.

This data is accessible by users not only in case if they contribute to the target, but also in the history section of the application, where all the past targets are accessible.

The data being shared in the reports of fund recipients does not include any data about users. In these reports, they have to mention only the amount of donation, which indicates the level of interest of folks in the project. And if players share their experience occasionally the privacy policy is applied by the platform they use and the service is not responsible. The service might request to share the experience of the user on social media, but then the player would be contacted directly and shared asked for the permission to do so.

## Communication Design

The designed service aims to communicate opinions and information between people and policymakers. This outlines the importance of the communicational design that has to be developed for all interested stakeholders of the service. Communication has to be performed clearly for every group of people.

### Target audience

This design proposal consists of several target audiences. As the main and most influential one is the group of players. For players we consider young people aged mainly from 22 to 26 years old, studied / studying in Europe, coming from different countries, regardless of their subject of studies, working status, gender, orientation, family status, or income. The most active group can be considered as that one, who is interested in the topics of sustainability. These people can involve their friends and can help with the popularization of the service in general. Young people are mainly involved in the act of the play, they are firstly a target audience of the game, and then optionally (depending on the level of their interest) they are also a target audience of the service.

Then we should mention policymakers as a second crucial target audience. It could be both local government and higher institutional levels. They can be considered as the target audience of the service. They are not involved in the gamification part and the main communication with the service goes indirectly. Policymakers have a great interest in the service since it could help them to build trustable dialogue with the public, it provides an opportunity to listen and to act based on public wishes. Policymakers are a part of the post-play stage and thankfully to the service can communicate with the public and research groups.

## Tone of Voice

### To players

In order to invite people to play the game and participate in the service, it is important to develop a clear promotional strategy that enriches the trust and the interest in the service. For that, all communicational materials have to ensure that this is a safe place to speak out and that players will not get judged. Moreover, since one of the aims of the service is to outreach sustainable topics all materials have to be delivered in a clear entertaining way and should be verified in prior.

During the play, it is crucial to stress that the service itself is built and acts considering all possible environmental negative influences from it. The service should approach the less energy consuming technics for its design, development, and promotion of it to increase the level of trust.

To support the service trusted people can be invited for collaborations. For example, influencers and artists.

The service should prove the actions it does. For that, the service should communicate money streams and selected funds and projects with the players. Players have to be sure that their actions influence the situation in a positive sense. Players always should be aware.

Keywords to be used for the communication with possible players: safe, anonymous, sustainable, verified, checked, famous, fun, joy, influence, relatedness, community, better, future, play, participate.

### To policymakers

The service could exist in case if the communicational loop operates. It needs not only the players or general society, but it is also interested in policymakers, communication with them, and in their actions.

The communication with policymakers is more tricky. The service does not tend to build a direct communication, while it creates more or less occasional way of informational spread. Nevertheless, policymakers should receive the statistics from the service, see the global reports from researchers and get the general public interest.

The communication provided has to be focusing on concrete results, and ideally suitable for multiple purposes.

The communication should avoid Factual Overload, be consistent and structured, and should be repetitive. If something happens repetitively, it is more effective. In particular, regular targets can help with it.

Policymakers can get general public opinions occasionally, for example, from social media.

Keywords to be used for the communication with policymakers: opinion, folks, sustainability, future, impact, research, science, better, public, results.

## Naming, Logo and Slogan

The naming for such a service is highly important. The service tries to communicate opinions and has to be recognized even if there is no visual support. We want to outreach the questions of sustainable development and to shape the attitudes of people. For all this, we need a proper Name.

In order to come up with a good naming for the game and the service, we performed two main actions. At first, we tried to collect all the tags, keywords, and associations in words that are related to the sustainability or mechanics, or story of the game. Then we also decided to ask about naming all people that have tested the game.

We collected the following words: Quiz, Sustainability, Future, Swipe, Play, Opinion, Cooperation, Collaboration, Support, Hope, Policy, Changes, Green, Ecology, Influence, Impact, Digital, Com-

munity, Soon and Sun.

The ideas we came up based on the associations of the players and the development team:

- Buzzco
- GreenFact
- Swipe for Future
- Re-earn
- Greensight
- Bee Green

Based on all these options we decided to name the application and the service GreenFact since this option has an additional meaning related to the service that reflects the fact-checking. After the quiz is finished the user is given some facts about the items that were in the quiz and their sustainability.

To build the visual concept of our service it was necessary to design the logo too. Our service is called GreenFact. So we wanted the logo to reflect the fact that we work on sustainability and provide some facts. In our game users always have to select from two options (sustainable or not), which means that the logo might be designed out of two entities. With the logo, we wanted to express that we are growing new values and even small projects need support. And another point was to make a logo that can be used as a part of the game too.



pic. 25, Logo

To align with all these points we designed a logo that appears as a small green plant that has two small leaves now expressing the future growth that we invest for. The shape of the plant also reminds me of the check bow symbol. This symbol can be used as a scoring system since in our game people earn and spend plants to support different projects.

For this service it is also important to have a slogan that can be used in different promotional materials and on the splash screens in the application. The slogan for this brand has to be short, catchy, but also introducing the values of the service and supporting the trust. For that it is important to use the following keywords: save, together, planet. The final proposal for the slogan is: “Together we save the planet”.

## Branding

Branding is important for any kind of product. It played a crucial role in most of the known services, but in particular for those that are developed for the communication purposes. Since the service desires to deliver a public opinion, its branding could become a visual symbol of the opinion or even of the protest.

The aesthetics of the application and eventually of the service depend on the sustainable requirements we are using for the visual design of the interface. We decided to apply the minimalist style, using mainly the strokes to show all the visual elements. Only the scoring system is using the filling.

The interface is made of 3 main colors: dark grey as the main color, bright grey (almost white) as the secondary color, and bright green as the accent one. These 3 colors are going to be used throughout the entire service, where we only add the bright red to be able to communicate negative opinions too.

The line art style is also used for the illustrations provided in the interface. We believe that the same approach can be used for all the promotional materials of the service.

Probably, for the printed materials we will have to invert the used

color approach, using the white for the backgrounds and the dark grey for the texts and illustrations keeping the green and the red in the same shades.

The visual density of all the materials has to be reduced as possible to decrease the amount of energy and other sources used.

## Service Design

In this Chapter we are going to describe the application and the game in more details.

### User Journey Map

The User Journey Map describes the interaction process between the service and two main target audiences. It is divided into 4 main levels of description (a player, policymakers, a provider, and innovations) and presents the activities during 5 different stages of the interactions (become aware, onboarding, become a part, playing, and post-play).

On this map, we can notice that policymakers are involved only at 2 stages of interaction when the players are almost always considered as the subject of the interaction.

Becoming aware is the moment when the player and

policymakers get familiar with the service. The service distributes information about it through different channels. Players mainly see the information on social media, while policymakers can get it also through the official reports. In the case of policymakers, materials are mainly designed in a summary with the main outcomes of the activities performed by the service. Materials prepared for the players are focused more on values that the game



pic. 26, User Journey Map

and the entire service can provide, such as education, outreach, and simply a joy. Both target audiences can get curious and interested in the service. Nevertheless, the communicational activity should be clear and possible to be reached via different sources.

The onboarding process is aimed to share more details about the service with the players, to explain to them all features, and increase the level of trust in the service.

One of the main features of the service is to collect statistical data about the interests and level of education of the users. To do so the game is created out of different targets to be reached related to certain topics, which creates communities as well as allows the service to have a general tag system in the statistics. When the player selects a certain topic for play, they become a part of the community. The service provides an opportunity to contribute to the common target. Here it is important to provide a clear list of topics that can engage users in a play activity. The service can always expand the game by adding new topics and targets.

The playing stage is constructed out of 4 substages. In the first step, the user plays the quiz game. The player is focused and enjoys the process. But it might be that the mechanics or feedbacks of the game are not clear to the player or the player simply might get frustrated from it. All the data collected by the service during the play has to be anonymous and deleted as soon as statical calculations are performed.

After the player has finished the quiz they receive the results. Users might get happy or sad from it, which depends on their success. The game has to show the results precisely and in a clear way and should involve the user for another play.

When the player gets points, the service provides an opportunity for the user to contribute in order to put the related piece of art on sale and activate the funding process for the research. If the player has an opportunity to collaborate, they feel like being related to something. It is crucial to let the player know, how the service operates and what is their influence is in the real world. The player can decide when to contribute (invest his points) and also the topic / target.

When the target is reached the user sees the final contribution and gets more details on their personal impact on the topic. The service has to provide it and limit all possible doubts of the player about the service.

The post-play process consists of two main activities, the communicational activity of the service and occasional promotional activities of the player. The service is aimed to organize the sales of the related artwork that has reached the target. Then the service has to support the funding system, so the funds from artwork sales can reach the actual researchers and activate its real impact of it. This provides additional value to the service and enhances the trust between the service and the players and between the service and policymakers. The service has to provide statistics to policymakers and support the communication between researchers and policymakers.

In the end, we also consider that occasional promotions from the players can support the service. If players feel inspired, they can share their experience with others through different channels, which can invite more people to try to play and expand the influence of the service. If the service reaches a certain level of fame, it can get promoted by other social institutions. This might increase the probability that policymakers will catch up with the service provider. It can grow a wish of policymakers to get involved in the service and maybe even to support it.

## Game Design

### Concept

The concept came up from the draft title “Sustainable Tinder”. It is a game made off of several quizzes divided by topics. In each quiz game, the player is given a set of cards that they have to sort by being sustainable or opposite. The cards consist of different items or actions we can see in real life that can be discussed or well known for being sustainable or not. The player has to swipe to the right if they believe it is a sustainable item or action and to the left, if they consider the opposite.

### Motivations applied

In order to develop an engaging game that can support the entire service, it was necessary to understand the possible motivations of the players and the way they could be delivered inside of the game. Applied games might struggle with bringing the audience even for the first try of the game, but also to keep them playing it since they provide a bit fewer entertainment activities.

One of the main features of the entire service is that usually, people can influence the rules, the laws applied, the opinions of policymakers, and others, which can impact directly by supporting the foundation system. The service provides those opportunities by the act of play. When a player selects the artwork to invest the earned points, they actually select a community to cooperate with for a better future. This makes the Relatedness to become one of the motivations provided in the game.

The same concept of selection of the artwork to contribute supports the idea of autonomy. The players feel being in charge of their actions and the reality.

When the user plays the game three other motivations appear challenge, competence, and curiosity. The quiz games often trigger the idea of unfinished actions, what is forced by challenge and curiosity. The literacy of the game can educate and train the players more, which means they also can grow their competencies.



## Rules of the Game

The game is presented as a set of quizzes, where each one is a topic consisting of cards. Every card the user sees as an image, title, and also a piece of hidden hint information. The topics are divided into the lifecycle of the items. The player has to decide if the item shown on the card can be considered being sustainable or not at the related stage of its life. If the reply of the player is correct, considering the correct opinion is the one stated by law or the general opinion of policymakers, then the user gets the points. The points, later on, can be spent on the target of this or a different topic, what activates the sales process of the related artwork to support the funding system of the service. To educate the user we provide a small report card after each play.

## Goals

The player is aimed to participate in as many quizzes as possible, which allows them to earn the most points that can be contributed to the service. Another aim of the game is to educate the user, providing the hidden information about the item on the card.

## User Skills

Each time when a user plays the game, they can get new knowledge about different items or actions from the real world. The player can master the knowledge of sustainability and bring other people to this topic.

## User Interface

The main game section is proposed to have a simple user interface, where the player has to swipe to the right or the left. After the swipe, the interface imitates the card sorting process through the animation. To provide clear affordances to the user and to “teach” them to use swipes, the buttons to indicate their opinion have to be placed too.

## Art Style

Based on the constraint that the game has to be developed with the least environmental impact the art style of the game follows the sustainable design guidelines. The art style is proposed to be minimalistic, using up to 4 colors, where the background has to be dark and the density of other colors has to be decreased to the least possible level.

## Prototypes

### Requirements

Since the product is aimed to deal with the sustainability it was decided that the product has to be sustainable itself. Based on the literature review we can compile simple guidelines for the technologies used as well as for the user experience and user interface design. These will significantly impact on the prototype.

## Technical requirements

In order to avoid direct environmental influence several points have to be considered for the development of the prototype:

- **Decrease the number of HTTP requests.** Each HTTP request consumes the energy of the device, of the internet providers, and of the server.
- **Use the most or, at least, compromising energy-efficient programming language.** Some programming languages require more energy to be compiled than others, for example, Swift is more sustainable than JavaScript. Moreover, some languages are designed specifically for certain devices, which limits the bugs and incapability issues as well as requires fewer energy sources for the specific device.
- **Reduce the amount of data being transferred.** The amount of energy being consumed by the HTTP requests depends on the amount of data to be transferred. For this, we can try to use images of the lower quality and in formats that provide a “smaller” size of the image.
- **Apply efficient cache policy.** If data to be presented on the screen of the user can be stored for a certain period of time in the memory of the device, it can help us to reduce the number of HTTP requests to the server.
- **Limit the usage of timers and notifications.** These two features require running the application in the background mode and in the sleeping mode of the device.

Moreover, there are several points that can have indirect negative environmental impacts. To decrease such a probability, it is suggested to select a green hosting provider.

Due to the high energy consumption and a significant number of HTTP requests it is also recommended to avoid in-app advertisements.

For the testing purposes, we decided to develop all the visuals on *Figma* exporting it to *ProtoPie*. In *ProtoPie* we add the interac-

tive elements and the animations. Moreover, it allows us to test the prototype with the users using their own smartphones, which provides more precise data.

## Design requirements

For this design proposal, it is crucial to consider and limit the possible impact of the prototype from the user experience and user interface design points of view. Based on the literature review we can compile a shortlist of the requirements for the designer:

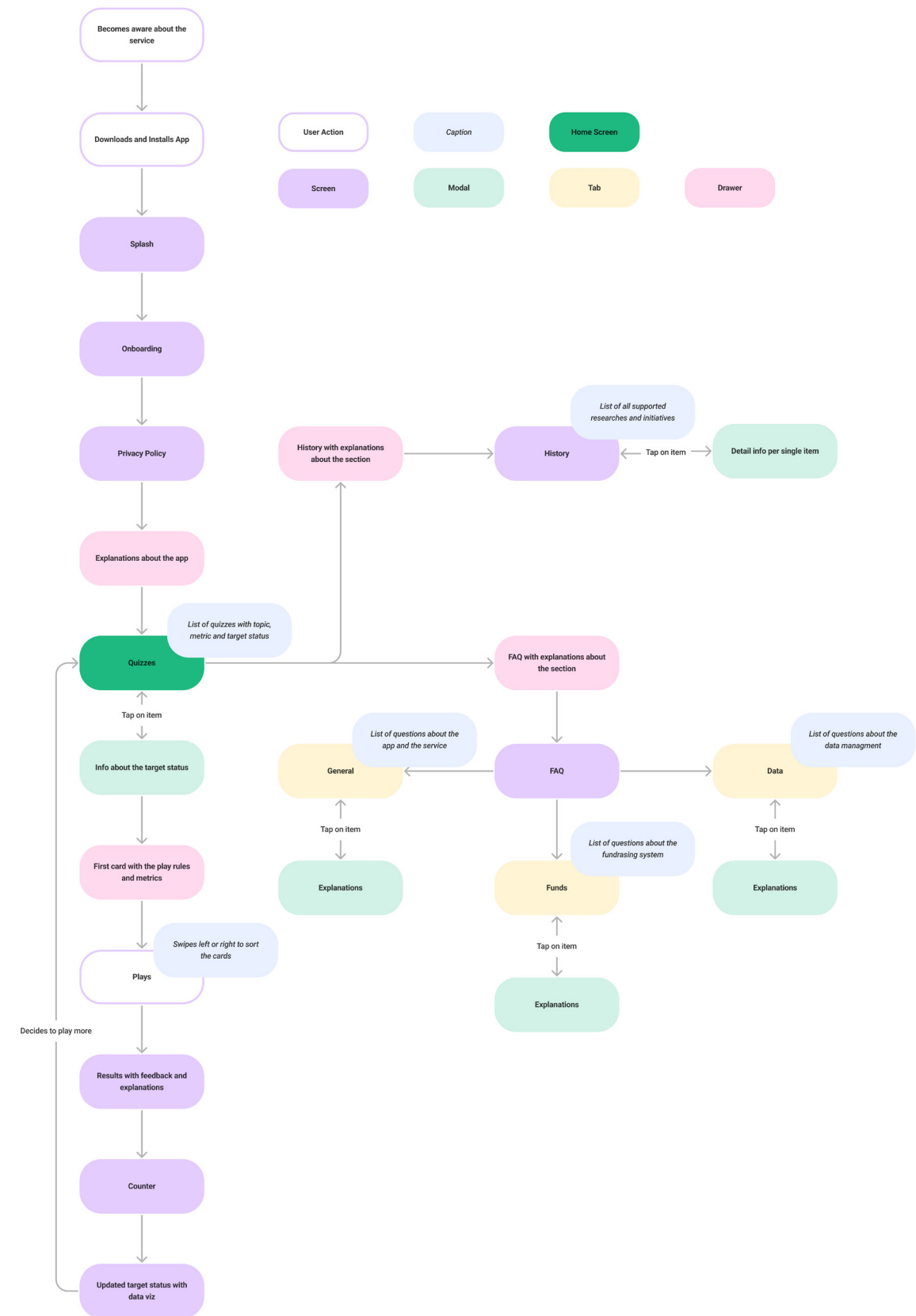
- **Provide a dark UI.** Dark colors consume less energy than bright ones. The visual design of the interface can be done with a dark background. Moreover, we can limit the density of the bright pixels using the minimalistic style, for example, we can try to use the line art design style for the entire interface applying additional color fillings only at those places, where it is impossible to avoid providing a better user experience.
- **Use system fonts.** This can help us to reduce the number of HTTP requests from the app to the server of the service or the API of the external font providers. Usage of the fonts that are not pre-installed can also lead to less energy efficiency since the file might be not well adapted for the device.
- **Avoid usage of the animations and provide an optimal number of frames per time,** where the animation is required. Every new frame needs to run the rendering process again, which increases the energy consumption of the device.
- **Optimal user flow.** This point tackles several issues. First of all, we limit the usage of the app in time. Secondly, if the data presented on the next screen has to be updated, we decrease the number of HTTP requests. Another reason is that changing the interface appearance needs animations, which are consuming lots of energy.
- **Use optimized images.** This is necessary to decrease the amount of data being transferred via HTTP requests from the server to the device.



- **Inform the user.** We can notify the user if the app uses too much energy and also about the purposes of the design approach.
- **The user knows better.** We should allow the user to prevent the application to perform unnecessary for the user actions. For example, if the user does not need a piece of certain information at the moment, there is no need to request it from the server.
- **Decrease the usage of opacities.** For most of the devices, an additional amount of energy is needed to render the layers that are using the opacities. Instead of opacities, we can use other colors that are imitating the color that would be visible to the user if we would have used the opacity.
- **Avoid the usage of notifications.** Even though notifications can bring the user back to the app and provide a personalized experience, they require high energy consumption running the application in the background mode.

## Informational Architecture

The informational architecture of the app is made of 3 main groups that are going to be presented as a navigation bar: quizzes (list of topics and targets), the account, and the gallery (the history of sold artworks). In the beginning, it was proposed to have the 4th tab with the market, where players could order the merchandise with the sold artworks. The idea was to support the needs of the service through these money flows, but then we decided to cut off this functionality from the app. The reason is that the probability that the money received from the sales of merchandise could cover the needs of the service is super low. The service itself will still provide this opportunity, but via private orders through the direct contacts from the users and not only inside of the application.



pic. 27, Informational Architecture of App

At the first time usage, the user sees a small onboarding that describes the values and the actions of the service. It tells the user that the game is not just a game, but it is much more. This approach might increase the possible outcomes of the game and support the motivations of the players.

The main flow is the list of topics since this part provides the gaming functionality. It is necessary to provide additional searching, sorting, and filtering functionality, so the user can get a more personalized experience. When the user selects the topic, they can see the related artwork that will be sold as soon as the target is reached. Below it we located a small notice that 90% of the funds will go as a donation to the researchers working on sustainable development projects including the references to the recipients. Then the player is can proceed with the actual quiz. Before the start, the player receives a small notice to remind which stage of the item or the action of the card it is necessary to guess being sustainable or not together with the description of the game mechanics. After the player reads and closes the notice the cards appear and the actual game starts. Every card is styled in the same way and consists of the picture, the title, and the hint button, the user can also see the number of points available. The animation of the cards is designed in order to support the gesture that is used – the swipes. But at the same moment, we also provide the buttons if this mechanics is not clear for the player.

When the user has sorted all the cards of the quiz, the new screen is presented. This screen contains the information about the points earned and a small report on all replies the user did during the play with the correctness and a small description with the reason and asks if the player wants to spend the points for the target related to this quiz. If the user decides to do so, they are forwarded to the screen with a counter that adjusts the number of points to spend. After the selection of the amount, we provide a small animation to visualize how the target was changed. Afterward, the player is sent back to the selection of the topics.

The account of the user provides two main functionalities. First of all, it shows and allows to change the personal data and other

settings. But the main section in this tab group is to provide a history of the contribution to the player. In addition to it, there are two other active buttons that provide the additional information about the data privacy policy and about the service. It is necessary to grow the trust between the service and its' players.

The history has to be located on a separate screen. The history is shown as the list with targets, where the player spent the points. Each row represents one target. To describe the contribution we are going to present the topic and a small preview of the related artwork together with the number of points the user invested.

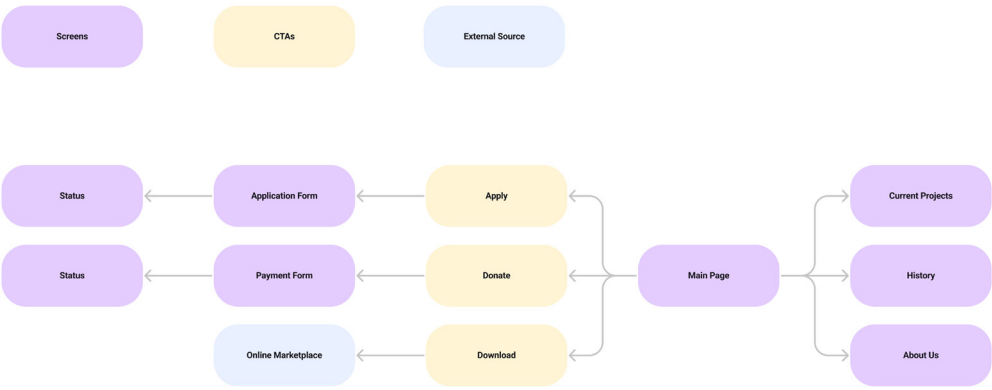
If the user wants to know more, they can click on the row and see the pop-up with more detailed information (the artwork, the author, and the projects with links that received the funds).

The third tab group of the navigation bar brings the user to the history of all targets. This screen is similar to the personal contribution history but shows the entire impact of the service. Here it is again necessary to provide the sorting and filtering functionalities. Each row of the history contains the title of the topic, the preview of the related artwork, the date, and if the target was reached. Moreover, here we indicated additionally whether the user contributed to this target or not. Each row is clickable and by clicking it the related pop-up appears. This pop-up shows the related artwork in a bigger format, the author, and all the recipients that received the money from the sales of this artwork with the links.

This informational architecture allows us to provide the shortest user flow possible, to explain the values of the service. It helps us to communicate the possible impact on the sustainable development. It ensures the users, how the service operates and that all the information provided to policymakers does not contain any personal references.

Later on, we decided to modify our informational architecture. We understood that the account is not a necessary part, while the special section with all important points about the service and about the game is needed. Before the account was supposed to be

used for two main purposes, to store the location of the player to use the data of this user for the statistics of the related location, and for the scoring system. We decided to share the information exclusively with the European Union Commission and limit possible downloads of this application accordingly. In that case, we are not required to locate the player. The score of the player can be stored locally on their device as a cache. We might consider the case that the player deletes the app or changes the device, but losing points is not an issue since we use it only to support the project instead of using it for the profit of the user. This solution increases the trust between the service and the user. The player does not provide us with any personal details.

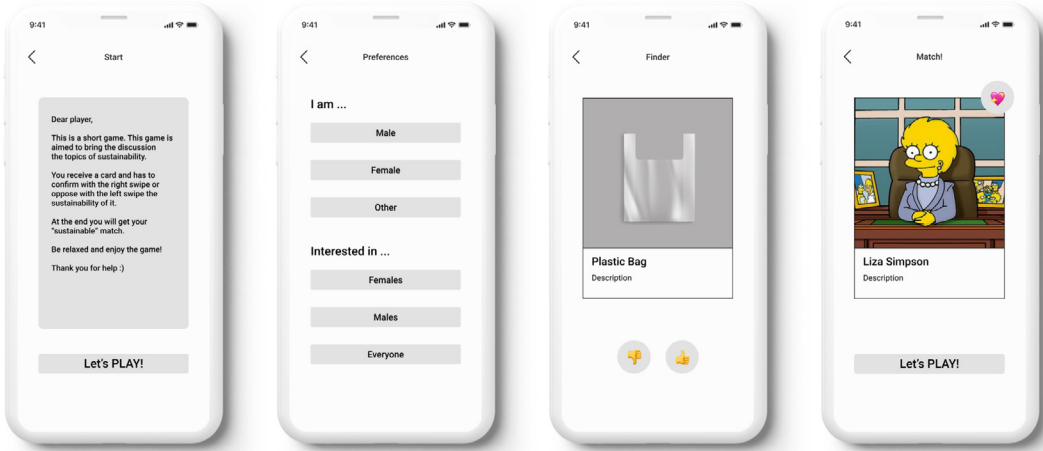


pic. 28, Informational Architecture of Website

Working on the project we have realized that in addition to the application we need a promotional website, which has to be designed for all the target groups and stakeholders. For that the main page is made of 3 CTA buttons to provide an access to donation form for possible investors, to an application form to future recipients and to the online market to download the app for all interested visitors. This website also has addition pages that are accessible from the header to get more detailed information about the service and the game. These tabs are similar to the navigational bar sections of the app.

## Wireframes

At the very beginning, the concept of the game and of the thesis was different. It was just a quiz game that was supposed to imitate dating applications. Users still were asked to sort out the cards if they consider something being sustainable or not. The application was aimed to educate its users. Before I started the design of the digital wireframes I made small sketches by hand indicating the positions of the main elements on the 4 main screens of the game application. Then I continued to develop all the designs in digital form with *Figma*.



pic. 29, Wireframes

For this, the informational architecture had a single flow only, where people had at first to select their preferences and then to proceed with the game, where at the end they were receiving their matches with famous people that share a similar opinion about the sustainable development as the player and then the user can start with the flow again.

Later on, the part of the match with the famous person was deleted and the design was simplified to an endless game, where

the player was matching with the cards that are being sorted. The user could be “matched” in case if two conditions were met: the card presents a sustainable item or action and the player stayed that it is sustainable.

Even though the project has changed significantly, the main idea of the card sorting was kept.

The wireframes of the cards were useful to design the actual user interface. The designed wireframes had 3 main visual zones: the header of the application at the top, the card zone, and the active gaming zone below it.

The header of the application consists of the backward button, the title to locate the user inside of the app next to it; below there was the timer on the left that was used to limit the time frame when the user can reply, and the score of the player on the right.

The card zone before the reply of the user was designed in two entities: the image of the item or action and the written information below it, where the card title and a small description of the item or the action were located.

At this stage, it was clear that we should provide a feedback to the user about the reply, so we proposed an additional wireframe. After the reply of the user and in case of a “match” the additional element was provided at the top right corner to indicate the feedback from the application.

The active game zone was designed in two states too. Before the user replied this zone was used for swipe gestures and for two buttons. Swipes and buttons had the same functionality, they were used by users to indicate their opinion. The left swipe and the left button were proposed as negative replies while the right button and the right swipe were provided for the positive replies. After the reply of the user, this zone had a single button to provide a possibility to continue with the game.

The wireframes were later developed into interactive low-fidelity prototypes.

## Low-Fi Prototype

The first low-fidelity prototype was necessary to understand if the game mechanics can work for our target audience and if players might want to play it in general. Moreover, it was important to catch all preliminary issues in the usability of the design proposal.

For this purpose, the wireframes were detailed. First of all, we took 10 real-world items and actions to show on the cards. One of the main criteria was to select those items or actions that are rarely a subject to a debate if it is considered green or not. For the visual appearance of the cards stock images were used to illustrate the action or the item and we also added titles, so the tests could be performed. At that moment we decided to import all the designs to *ProtoPie* in order to develop the interactive and animated prototypes.

## Try It Yourself Tests

### First round

Before showing the idea to the outer audience we decided to perform the tests on our own using the Try It Yourself methodology. At that moment, the project still had a selection of preferences and other associations with the dating applications.

When we tried to play it and we found out that the correlation between the “dating part” of the application and the gameplay with sustainable or not items is not clear. So we decided to take it away. Another point we were trying to understand, what are the additional motivations that can be applied in the game. We noticed that the game was lacking from challenging. Another point we found out was that the feedbacks inside of the game have to be designed to engage users, but at the same moment not to inter-

rupt too much. We also noticed that even at that stage we could provide basic animations for our narrative.

Considering the list of preliminary drawbacks, we prepared a list of changes for the next iteration:

- Get rid of the preference selection
- Get rid of the matching functionality with famous people
- Provide feedback to the replies of the player
- Design the animation of card sorting to support the idea

## Second Round

For the second round of tests among the project team, we developed the new prototype. Instead of matching with the famous people, we decide to match the player with the item or action on the card if the item is sustainable and the user confirmed it. This idea allowed us to provide the feedback to the player too. We also added the slide-out animation that is activated by swiping in the same direction as it.

We tried to play the game and playtests of this prototype lead us to several questions:

- How can we keep the users playing the game?
- How can the game grow in the future?
- How to add the motivations?

All those points were considered for the future development. This moment twisted the entire project development and allowed me to come up with the idea of a gamified service. I proposed to apply the motivations with real-world application.

I have decided to add a second value to education, which is the communication of opinions with policymakers.

The users play the game digitally, but the impact on the opinions of real-world policymakers.

## A/B Playtests

In parallel to this, I had another concept in my mind with a completely different game mechanics and narratives. Due to this fact we decided to perform first playtests to see, which story and mechanics are more applicable to develop for the selected target audience. For this, we proceed with A/B testing, where each group was given a single prototype to test to compare the results.

With these tests, we were going to discover the possibilities and basic impressions of the games. It was aimed to help us to find the proper communication with the target audience and identify the exact topic to be implemented inside of the game, to avoid subjective views, and to avoid stale experiences in the future. The test objectives were two main ideas of the games were selected out of the first pull of the concepts to point out the challenges of sustainable development.

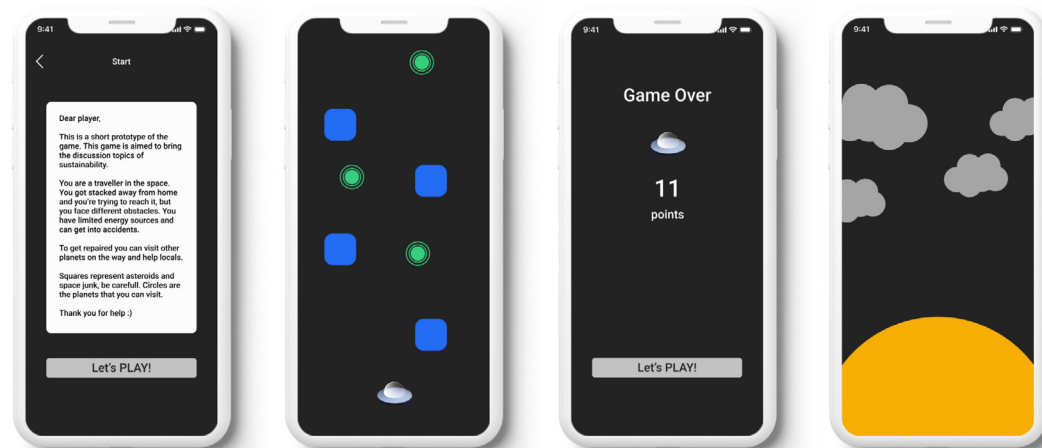
The games we selected to try out were completely different. The first concept to test was “Sustainable Tinder”. This is the concept that was inspired by the gesture mechanic of the dating application and was later on selected for this thesis work. The concept is using literacy as the main educational mechanic, there are no metaphors, and the information is communicated directly. The gameplay is built using taps and swipes. This is a quiz game, where the user sorts the cards into eco-friendly and not groups. If the player replies correctly the points are being awarded. The decision that the user has to take is the same during the entire play experience. The player has to select the swipe direction properly to indicate the opinion. In this game, users were given a set of 10 cards with images and titles and had to sort them. And at the end, the players were given a small report card with the earned points.

The second concept that we tested was the “Spaceship”. This concept was the opposite of the previous one. This game is made up of small different games and has full clear storytelling. It was developed with the inspiration from Doctor Who, and a similar story was proposed. The traveler in the space is far away from his home planet and has to reach it. On the way, he faces obstacles like asteroids and space junk that can damage his spaceship. For him to



repair his spaceship, he can stop at different planets and help locals to solve the issues they have. The prototype was designed to force the user to go to the planets. When he helps locals, the traveler gets points that he can spend to repair the spaceship. Every planet has its own problem with ecology. Every planet is introduced as a small game with unique gameplay. For testing purposes, we developed two games: one planet did not have the rain for many years and got dry, the traveler has to generate the clouds (by tapping on the screen), so the rain starts; and the other planet got into a war with the plastic bags and the traveler has to help them to win by collecting the plastic bags (by dragging the character and catching the moving bags). The players were asked to try both.

The scenarios of the test for both groups were similar. At first,



pic. 30, "Spaceship" Concept Wireframes

we introduced them to the topic and the prototype (see the Introductory Script of the 1st prototype<sup>1</sup> in the appendix). Then we took a small survey to understand their background (see Survey Sample 2 in the appendix) and their general opinions about the topic. Small surveys were designed slightly differently for both groups, after collecting the basic anthropology data we decided to ask questions that are more related to the concepts of the test-

ed prototypes. After that, they were given the interactive prototype with a single option of the game. Then we discuss, what they think generally about sustainability and their sentiments about the future of Earth. In addition, the group with the Spaceship concept was asked if they like sci-fi and some other media about the future and if they know about the sustainable issue of space junk. Afterward, the playtests were conducted, which were followed by a small open interview. During the playtests the players were not receiving any information from us but were asked to share their experiences, opinions, and thoughts. Small interviews were needed to check the general experience of the players, to indicate attitudes on the topics of sustainability, and to understand, what are the associations and reflections they come up with during the play. Moreover, it was necessary to check on the understanding of metaphors by players, and what means for us if we can deliver the materials to the users with the selected narrative approaches.



pic. 31, A/B playtest

The tests were conducted among 10 participants, and all were a part of the target audience regardless of their gender or specializations. During the interviews, we confirmed that the target group was selected correctly to develop a mobile video game since they do this on their smartphones limiting the possible environmental impact of the game. In general, players were interested in educational games that are related to sustainable topics. The players believed in both cases in the materials that were delivered. The main outcome was that both of the games can be

engaging. The Spaceship concept might be addressed to younger people than a selected group. The Spaceship is made with familiar game mechanics for the users, while the Sustainable Tinder is not. This makes the Sustainable Tinder more challenging to design, but more promising too. We can be sure that the Spaceship concept will work, but the probability of the “wow” effect is low, while the other concept can reach a higher level of joy since it is something new. Based on this testing we decided to continue to develop the Sustainable Tinder concept.

## Design System

When we started to develop the user interface, we began to introduce the design system. The design system is an important detail in this project’s proposal since we are trying to develop the entire service that as a result would deliver a sustainable solution. We based the entire solution on the design guidelines collected in previous chapters. In order to decrease the possible density of bright pixels to limit the energy used to render the screens of the application, we proposed several ideas.

First of all, we decided to have the background color as a dark grey (#23242D), and for all the user interface elements and illustrations we proposed applying the line art style in a bright color to have enough contrast. The absence of fillings allows us to design the screens mainly in dark colors. To reduce the environmental impact, instead of pure white we use a bit greyish white color as a secondary one (#E9E9E9).

Moreover, we selected a single constant accent color as a bright too with the green shading (#68DF39). We could select any other hue for the color, but green is the most associated color with



pic. 32, Color Palette

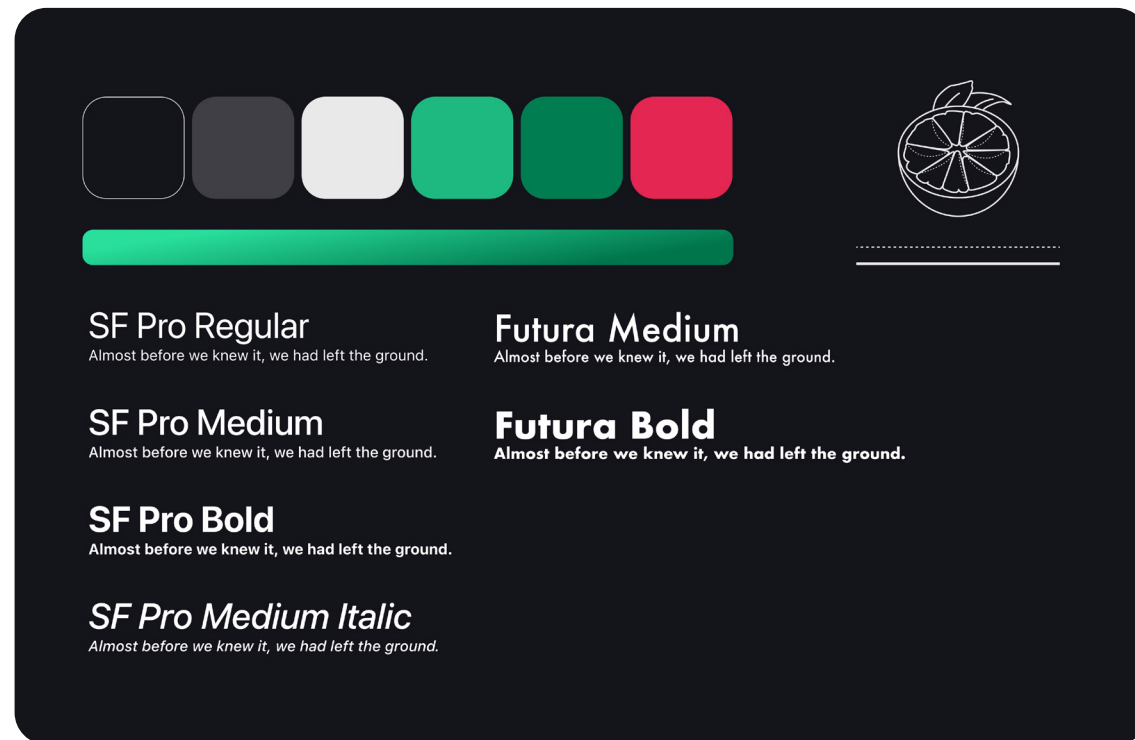
sustainability. At the same time for the grouping purpose of the cards, we can use dark colors, for example, dark violet or dark green.

For the inactive elements instead of opacities, we use other colors with 100% opacity that are imitating the color that would be visible to the user if we would have used the opacity of 40% as per the design guidelines of online app markets.

And we decided to avoid completely the usage of opaque elements in other places. For example, we do not use shadow effects to differentiate different elements or visual groups on the screens. To do so we decided to use different widths of the stroke. For the buttons, we use a wider stroke than for the grouping elements. That allows us to keep visible the icon-designed buttons and to not increase significantly the density of bright pixels for call-to-action buttons. For the illustrations to give them a certain dimension we decided to use the wider solid stroke for close parts of the objects and the thinner dashed stroke for the elements behind. Also, we decided to use 2 point perspective to support additionally the feeling of the dimension of the object presented on the card, which is important for the usability of the game.

Another point to be considered at the beginning was the usage of the preinstalled on the device fonts, so for the last version of the prototype, we selected for the iOS SF Pro and Roboto to be used for the Android devices and Futura in both cases for accents.

Later on, we decided to change the color pallet to decrease even more the harmful environmental impact choosing the preliminary color in a darker shade of grey being almost black (#14141B),



pic. 33, Design System

and the same for the accent colors that are also used to express positive and negative feedback of green(#1EB980) and of red(#E32652).

To provide more visual interest we decided to use one more darker shade of green (#007D51) and we use it for the logo and for the green gradients.

For the final prototype, the secondary color was selected to # and the unactive elements to #.

To differentiate different elements of the interface we used two main stroke widths of 1px and 2px and for the illustrations, we also provide a dashed option with the line of 2px and a gap of 2px too.

This design system allows us to build a visually pleasant and usable interface with a limited environmental impact.

## Mid-Fi Prototype 1

When the concept to be developed through this thesis was selected, we decided to proceed with a more detailed prototype of it. This first middle fidelity prototype still was not supposed to be developed precisely. The main aim of this prototype was to test the design system we proposed, the metaphors we use in the interfaces, the gestures applied, and its gameplay of it. Moreover, this prototype was needed to confirm that the service and the game can operate together as the system, that the game can activate all other parts of the service, and can engage players in the topics of sustainability.

The design of the interface was developed using Figma and then transferred to ProtoPie to add interactions and animations to it. Moreover, ProtoPie allowed us to get more honest usability data during the tests since players were able to use their smartphones.

This prototype was made of a single branch of informational architecture. The flow we constructed was made of a small introductory card explaining the values and actions of the service, followed by the dashboard screen of the app with the topics / quizzes available to play. The player could select one of the quizzes and play it. For testing purposes, we have prepared two quizzes on the topics of Food and Packaging. The Food quiz had 7 items to sort, and the Packaging quiz contained 6 elements.

Before taking the actual quiz, the player sees the card with the target, to which it is possible to contribute, and a small description of the fundraising system of the service. When the user finishes the play, we display a report card with the earned points and then we propose to continue the flow by investing the points into the related art.

All user interface elements were developed in coherence with the proposed design system. In order to get a proper result from the tests, the interactive prototype had a scoring system, and the actual data for the cards were prepared.



The interface of the dashboard screen had a navigational bar at the bottom with 3 main entities (the account, the quizzes, and the gallery); the header had a search bar, filter and sort icons, and the number of points the user has. To support the entire flow the start number of points for the user was 10. The main section of the screen contained clickable elements for the quizzes. Each element was grouped out of the title of the quiz, the deadline notice for the target, the information on the progress of the collaborative target as a pie chart with the percentage written, and a small arrow to support the possibility to click of the element.

The screen of the target before the quiz consisted of the header to indicate for the user the location inside of the application with the button to go back to the dashboard and the points of the player; the artwork for sales with the title and author; a small description below it with the information on the possible usage of the points; and the call-to-action button to proceed to the quiz.

Every screen of the quizzes was divided into 3 sections: the header, the card, and the active game-play zone. The header contained the information about the location of the user, the go-back button together with the number of points the player has at the moment. The card was designed with the title of the item in the upper part, followed by the hint button and the image made with lines. In order to support the grouping of quizzes, we colored the upper part of the cards, where the title and the hint button were located. If the player clicks on the hint button a small notice saying that this is a paid (with a single point) action was displayed. If the user decides to spend one



pic. 34, Play Screen



pic. 35, Dashboard, Target and Hint Screens

point for the hint, the card expands vertically to the bottom and a small text about the item appears below the image. The hint was made of two points. The first point was describing, how much CO<sub>2</sub> was polluted by the item during its production phase and a fact that supports the opinion whether the item is sustainable or not. For example, for the Plastic Bag in the quiz about the Packaging, it was written “CO<sub>2</sub> 1.58 kg ≈ 8 km of the car ride” as the first point, and “often thrown away after a single use” for the second one.

The active game zone was set to track the swipes but also had the buttons which were used as the equivalent to the swipes. The animation of movement from one card to another one was defined as a Slide Out to support the idea of sorting cards, but also to explain the possible swipe gesture. The image on each card had to follow the same guidelines as for the entire interface. We decided to develop unique images of the objects drawn in a line art style too using the secondary color of the interface. Each image was supposed to have the outlines of the item with dashed lines and thinner lines for the outlines behind the visible parts of it.

The screen with the results of the game had the same header as the previous ones, in the main area we provided the information with the earned point, and below we provided an opportunity to contribute to the collaborative target or to avoid it by the call-to-action and the ghost buttons. If the player decides to contribute the points to the artwork, we change the middle part of the interface to the counter that is used to indicate the number of points to be invested and with the confirm button below it. After the selection of the number of points to be invested into the col-

laborative target, the user sees the animation with the pie graph showing the contribution. Then the player can get back to the dashboard with the quizzes.

## Play- and Usability tests

For the development purposes, we decided to test this prototype. The tests were going to discover the possibilities and basic impressions about the game and the service. The test was also considered if the UX design had been done correctly. The tests were necessary to understand if the communicated values are clear for the target audience if the game is engaging and to discover the main issues of the user interface design to catch and resolve them on time.



pic. 36, Testing

These tests helped us to find a proper communication strategy with players and identify the topics discussed inside of the game. If the tests would not be performed, we would risk developing a subjective view and providing a stale experience. The main concept of this prototype was to explain, how the service explores the possibilities of the gamified experience to educate the players as well as to give them a tool to express their interests and influence sustainable development.

The tests were conducted in

person among 5 different people. Every person was a part of the target audience of the game. For the tests, we used the laptop with a webcam to record the session and an iPhone with the prototype installed. Before the test, we introduced the concept of the service to each participant explaining the procedure that we would follow (see the Introductory Script of the 2nd prototype in the appendix).

Users were asked to follow the main flow of the prototype, where they have to select the topic of the quiz at first. Then to play the quiz or quizzes, they were asked to take at least one and if they wanted to continue to proceed with both prepared quizzes. The players had to understand the rules of the game on their own from the interface and feedback in the application. They were also asked to try to use hints during the play and to try to understand the point system. To test the service itself, the players were also required to try to spend the earned points contributing to the related artwork. In order to avoid biased results during the play experience, users were not given any hints from the conductor of the test on the tasks to be performed and the rules of the game. One of the ideas was to see if the tasks required for the service can become familiar to the user, at least, after a couple of times they meet this feature.

After the test was finished the participant was interviewed about the gained experience (see the Survey Sample 3 in the appendix). The interview was divided into 4 parts, where we started with the question about the person that tested the prototype and their opinion and then depending on their actions and experiences additional questions were asked. The second part of the question was related to the game and game experience to understand if we managed to deliver a usable interface and engaging gameplay. It was followed by a group of questions about the service. We needed to understand if the communication about the values, of the educational materials, and the actions of the service were easy to understand.

Let us describe each testing session and then we will move to the conclusions and the list of necessary changes in the prototype.





*Young female student, specializing in Digital Design, Turkish, 26 years old*

The participant firstly decided to try the quiz about the Packaging. Taking both quizzes the participant did not use the hints, during the interview she explained that she did not want to spend the earned points. The player was confused if the replies were correct or not. In any case, she decided to play more and joined the second quiz too. In the section on “Spending Stars”, she was not sure if she will lose them or keep them if she does not spend them on the collaborative target. Afterward, she also asked about the meaning of the dates in the dashboard for every quiz. The participant was curious as, to why there were few colors used in the user interface design.



*Young male student, specializing in Digital Design, Kazakh, 27 years old*

He firstly proceeded with the Food quiz. He noticed that the text of the introduction was similar to the description of the target, which confused him. He easily understood the gameplay gestures and even pointed “It’s like the Tinder app!”. The participant got confused by the stars, this was not obvious to him as the pointing system. He also was not able to track if he replied correctly or not. The player did not find the texts of the hints helping, they made him more unsure about how to reply.



*Young female student, specializing in Landscape Architecture, Russian, 23 years old*

This participant tried firstly the quiz about the packaging since she assumed it could be easier for her. A few times she was not able to use the hints because the size of the button was too small. She was not sure, from which point of view to consider items being sustainable or not. She wanted to participate in the contribution both times, she found this process easy even though she was not sure, what exactly she was doing.

After the second quiz, she could not manage it due to the technical issues with the prototype. Moreover, she managed to get a negative number of points. The player additionally managed that she liked the visual style of the application, even though she did not know the reasoning behind it and wanted to know.



*Young female worker, specializing in Architecture, Russian, 26 years old*

She decided to start with the Food quiz. She was not sure if the artwork of the target was a physical one or an NFT. During the play, she did not want to use the hints because she wanted to play on a bit more challenging level. Almost every card she received, she was doubting from which point of view the item is sustainable or not. Nevertheless, she enjoyed the play and after taking the second quiz she wanted to play more. Moreover, she noticed that the introductory texts are too long and complicated. After the play experience, she was not able to remember, what the usage of points is.



*Young female student and worker, specializing in Digital Design, Iranian, 26 years old*

The participant chose the quiz about Packaging. When she got to the actual game, she was confused with the interface. She did not know the meaning of the buttons and she did not notice the possibility to use swipe gestures. Moreover, she did not notice the hint button. After the first play, she decided not to contribute and to see the target of another quiz. The player needed more onboarding information.

To sum up the results we can say that the players needed more explanatory information on the values and the service. Some participants required the onboarding to understand the gameplay. Texts in the app were not able to communicate the values and the service in detail to the users. Some user interface elements were not clear or even noticeable to the players. Most of the participants could not understand the pointing system. Most of the participants were not sure. After the explanations, the participants mentioned that they would love to be heard by policymakers and will agree to share the statistical data with their opinions. Some participants were confused by the technical issues of the prototype. The users enjoyed the play and wanted to continue. The visual style of the interface was liked by them.

In order to improve the prototype, we should introduce the following changes:

1. Provide the onboarding for the gameplay
2. Explain the idea behind the visual style
3. Shorten the texts about the values and actions
4. Provide more trustful information
5. Design the feedback to improve the educational activity
6. Provide more animations to engage players more
7. Find the proper metaphor for the pointing system
8. Redesign the active gameplay buttons
9. Clarify the grouping of the topics / quizzes
10. Clarify the point of view that players should follow during the play
11. Tell which data will be shared

## Mid-Fi Prototype 2

Based on the testing results of middle fidelity prototype version 1, we have decided to implement several changes and test them again. Moreover, we also identified several issues that might be sorted out separately from the prototype using different techniques. At this stage, we still kept mainly the functionality of the game to be tested at first, since the entire service activates by an act of the play.

In this prototype, we decided to change the entire grouping concept of the quizzes. From now on we divided the quizzes not by the types of items that are in the quiz, but by the life stage of the item presented we a certain reference to a metric. This should reduce the ambiguities of the decisions to be made by the player by providing a clearer question. Moreover, this approach al-

lows us to provide more playing materials in the game since the items can be repeated throughout different quizzes. In addition, it supports the need for educational materials to provide information about sustainability during the life cycle of the item. For example, if we compare just the carbon footprint of the plastic bag and the paper bag, we will decide that the paper bag is more harmful to the nature, but at the same moment, if we talk about recycling possibilities, we can conclude that it is easier to demolish the paper bag and it will not have a possibility to hurt the ecosystem in a long run.



pic. 37, Feedback Screen



pic. 38, Onboarding, Notice and Target Status Screens

Another pain point we found in the previous prototype was the lack of clear explanations for the user on the actions to be done as well as complex and long introductory texts. We decided to start the prototype with 6 cards made of an illustration together with the one-sentence text. These cards are aimed to communicate the values and the actions of the service. When the user proceeds further, we provide additional onboarding notices to explain the application and the gameplay. Moreover, in order to build more trust between the service and the players, we decided to provide the information about the recipients of the funds inside of the application before the start of the game.

In order to simplify the service and the interface of the application, we decided to get rid of the deadlines for the targets and updated the quiz materials after the target is reached. This also

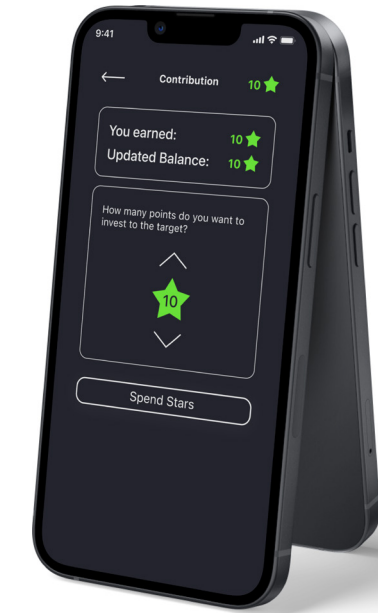
helps us to provide the information on the metrics used in the quiz.

When the game starts, we remind the player of the gestures we use and the stage of the life-cycle and the metrics to be considered during the play.

One of the main issues of the previous version of the prototype was the lack of feedbacks to the user that might help to educate the player more. We decided to support it with the animation after the player has made the choice by applying a

color to the scoring system in case of the wrong reply and scaling up the symbol of the score in the opposite case. At the end of the game together with the summary with points, we show to the player all the items colored in corresponding colors to indicate the correctness of it followed by a small explanatory text.

If the player decides to contribute to the collaborative target with the earned points we allow them to select the number of points to spend and after we present all the data on how many points are still missing, how many people participated, and which project will receive the funds at the end. Here we also show, how the data on opinions of the folks has changed in the past 24 hours. This screen is designed to represent the data that will be communicated to policymakers. It helps the service to show its transparency and be clear with the privacy policies.

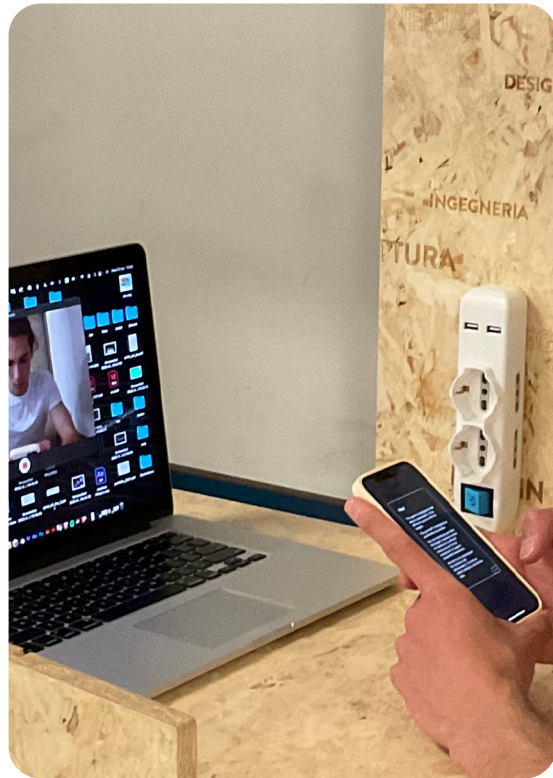


pic. 39, Counter Screen



## Playtests

For the development purposes, we decided to test this prototype too. The tests were going to discover the more hidden issues in the user interface and if we managed to solve the previous ones. In the previous prototype, we did not have the onboarding system, the feedbacks were unclear for the players, and the metrics used in quizzes were not clear.



pic. 40, Testing

These tests helped us to find proper UX writings and mental models of certain elements. If the tests would not be performed, we would risk developing a subjective view and providing a stale experience. The main concept of this prototype was to deliver the main values and contents to the players.

The tests were conducted in person among 5 different people. As for the previous prototype, every person was a part of the target audience of the game. For the tests, we used the laptop with a webcam to record the session and an iPhone with the prototype installed. Before the test, we introduced the concept of the service to each

participant explaining the procedure that we would follow.

Users were asked to follow the main flow of the prototype, where they have to select the topic of the quiz at first. Then to play the quiz or two quizzes. The players had to understand the rules of the game on their own from the interface, onboarding, and feedback provided in the application. In order to avoid biased results during the play experience, users were not given any hints from

the conductor of the test. The main purpose of these testing sessions was to check the understanding of the service's values by users.

After the test was finished the participants were interviewed about what they gained experience. Every interview was improvised on the personal experience of the players, where only two questions were kept the same:

1. Can you, please, describe the service?
2. What is the target? How does it work

Let us describe each testing session and then we will move to the conclusions and the list of necessary changes in the prototype.



*Young female student, specializing in Digital Design, Italian, 24 years old*

At first, the participant was not sure, how to state her opinion, even though she was reading all the explanations. During the play, she mentioned that she had never thought that “some items are sustainable from one side and not from not”. When she received her final score with the explanations, she has already forgotten, how she replied, but still she was curious why something is better or worse from the sustainable point of view. She struggled with the back arrow from the quiz to the Dashboard. She was curious about the visual design of the application. The participant could explain the values of the service. Moreover, she liked that she received the graphs that will be communicated to the policymakers. But she was confused about the approach for the target and she did not understand, why there are some artworks. During the playtests it was also clear that the font size of notices and of the feedbacks were for her too small. Moreover, for her, it was a little complicated to differentiate the main content and pop-ups.





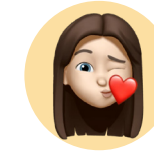
*Young male student, specializing in Digital Design, Honduran, 26 years old*

This participant spent less time reading the explanations, he basically skipped them and immediately proceeded with the game. He started to play and was actively commenting that he enjoys the gameplay and that he has never thought about sustainability and does not know that much about it. He did not pay attention to other parts of the service, but he wanted to continue to play. For him, this was mostly about the game. In any case, he was still able to describe the values of the service at the end, but the target and fundraising system were unclear for him too.



*Young female student, specializing in Digital Design, Serbian, 27 years old*

The participant was curious about the project and was reading all the texts in the prototype. She understood the rules on her own, but after a few cards, she forgot them and took some time to remember. For this participant, the game was engaging and she liked the concept. She took a new knowledge and got surprised about some items. During the play, this participant forgot the metrics related to the quiz. Moreover, she got lost in the funding system. For example, she asked, “where does the money come from?” and “to whom is the artwork sold?”. For her, it was complicated to trust the service in money-related actions, even though in general her experience was positive. This participant also mentioned that some of the explanations provided in the application were too complicated to understand.



*Young female student, specializing in Digital Design, Italian, 24 years old*

This participant at the very first glance mentioned that she liked the visual appearance of the interface. She did not focus on the texts and instructions but still managed to understand the rules of the game. She was not confused with the mechanics. This participant during the post-play interview also said that for her this way of education is more effective because she wants to get the reasoning behind the results and it works for her. Nevertheless, she could not explain, how the funding system operates and how funds are distributed.



*Young male student, specializing in Management Engineering, Russian, 24 years old*

This participant has enjoyed the game, but the affordances of some user interface elements were not clear to him. At the same time, he also understood the rules of the game as well as he got how the fundraising system and collaboration with artists functions. For this user, one of the issues was the layout of the texts since it was complicated to read. This user requested more explanations about the visual appearance of the interface.

To sum up we managed to communicate the values of the service, to provide clear feedback.

In order to improve the prototype, we should introduce the following changes:

1. Redesign the scoring system
2. Redesign the active gameplay buttons
3. Increase the font size
4. Redesign the approach for the targets
5. Develop a new approach for the funding system

6. Provide more information about the service building more trust
7. Redesign pop-ups
8. Rewrite the explanations
9. Provide a possibility to recall the metrics and the rules during the play experience

## Visual Surveys

The current prototype has two main issues in the user interface that lead to biased replies and a worse user experience with the game and the service eventually.

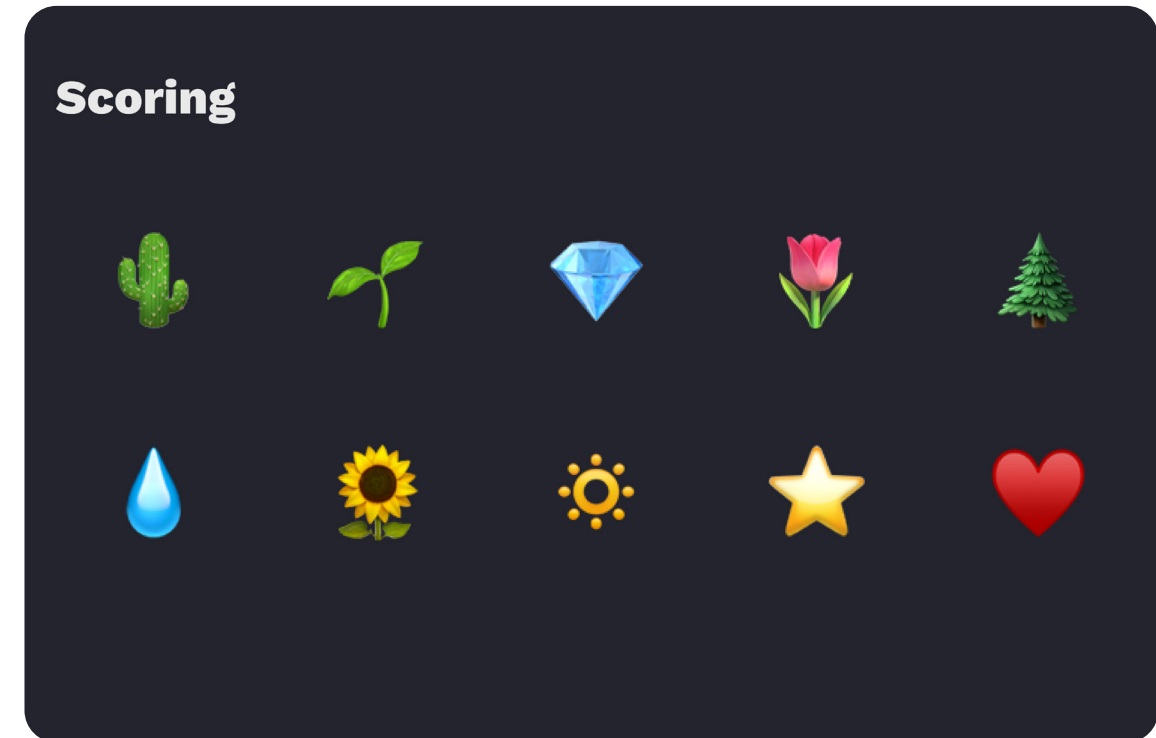
The first issue is the mental model of the scoring system that is presented now as stars. So the players earn and spend stars. Most of the people that tested the prototype mentioned that Star seems to be unrelated to the sustainability and this part looks separated from the concept of the game.

Another issue we noticed is the visual appearance and the mental model of the two active gameplay buttons. The current prototype has these buttons designed as the “x” to state that the item is not sustainable and the “heart” to claim that the item is sustainable. Some players during the playtests were confused and did not know, where to tap. Moreover, the same issue appeared even when we added the onboarding notice with the explanations.

For those two user interface elements, we decided to perform visual surveys that allowed us to find better solutions faster.

### Scoring System

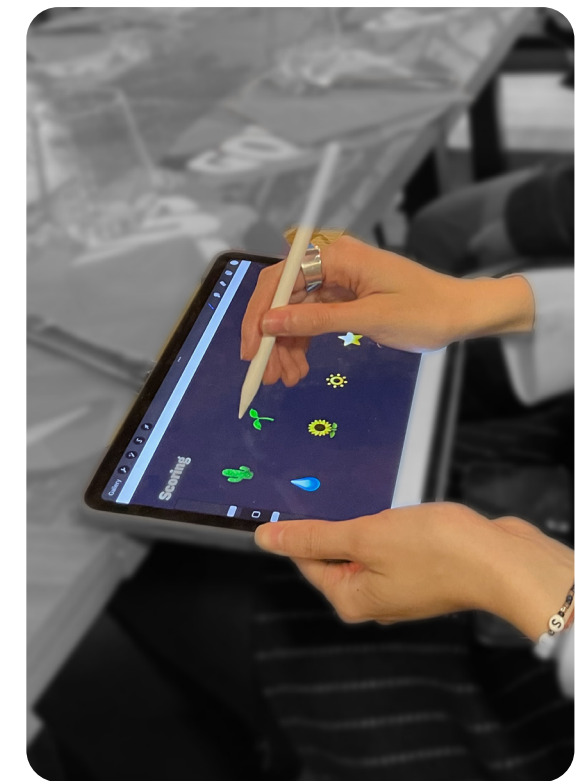
The current prototype has a scoring system that is represented by the stars, but during the tests, we have found out that the mental model between stars and the scoring system inside of the game that deals with sustainability might be unclear to the players. Some people that tested the game claimed that they were



pic. 41, Scoring System Survey Sample

not aware of the meaning of the stars. To solve this issue we have decided to prepare a small visual survey.

The visual survey consists of 10 different visual symbols and each interviewed person has to select all the symbols they find appropriate for the purpose of the game. This survey was aimed to help us to identify a proper mental model between the possible earnings of the player and the topic of the game. All visual symbols were provided using emojis since they are familiar to the target audience and designed in the



pic. 42, Visual Survey in Process

same style. This helped us to limit biased results and have a better understanding of opinion.

We hired 7 participants for this survey. All of them were coming from different parts of the world. Each of them has studied or is studying in Europe and spent in Italy, at least, 1,5 years. All of them are finishing / finished the master's degrees. The participants were given a brief explanation of the service and the game rules. Then we gave them the prototype to play one quiz and after this, we gave them the visual survey. The participants were asked to select as many items as they wish or to propose theirs if they want to.

In the end, we collected all the data and made the ranking of selected emojis by the times it was selected:

- 1. Plant – 5
- 2. Sun – 3
- 3. Dimond – 2
- 4. Sunflower – 2
- 5. Star – 2
- 6. Water Drop – 2
- 7. Heart – 1
- 8. Tulip – 1
- 9. Christmas Tree – 1
- 10. Cactus – 0

On average every participant selected 3 options, every one has selected at least two. Participants that selected only 2 have rarely chosen the Plant emoji, for them the water drop was the most popular option.

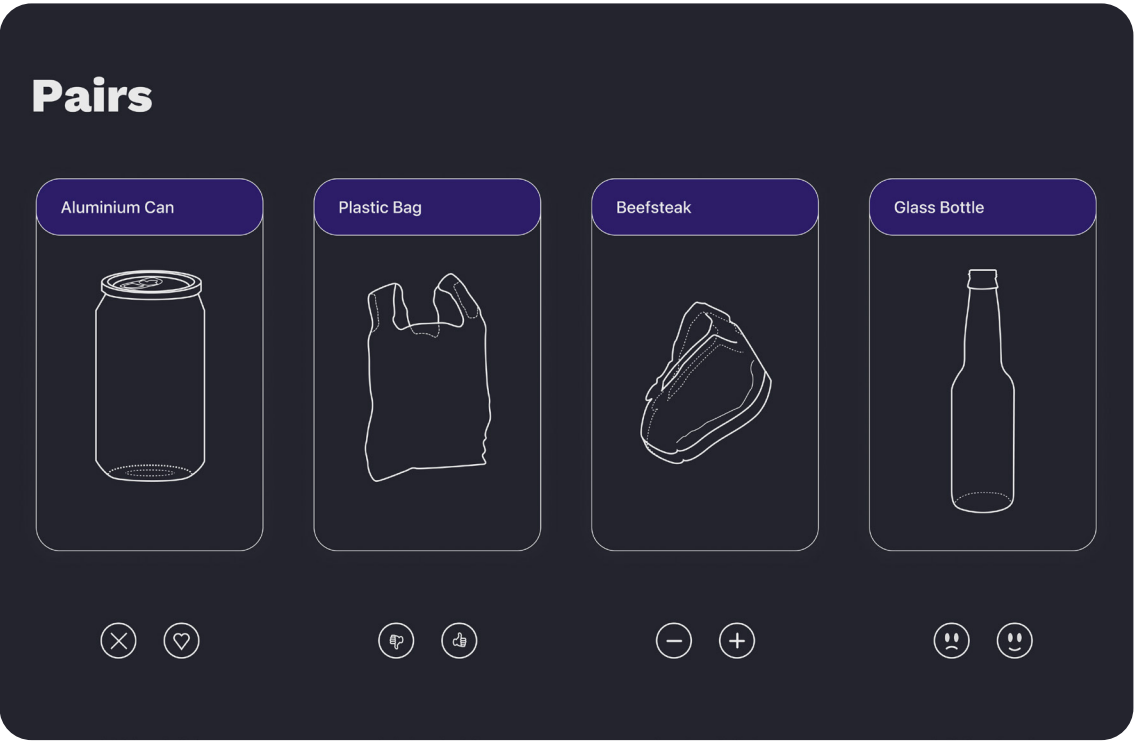
Based on this survey it is clear that the plant has a higher score, we decided to replace the star with it in the next iteration of the prototype.

Gameplay Buttons

The current prototype has the gameplay buttons in the user interface designed as “heart” for sustainable items and as “x” for unsustainable ones. This approach during the usability tests showed bad performance and we decided to try to redevelop these elements. To build a more logical mental model between the user interface and the action of the buttons we created 3 new options for the gameplay buttons: “thumbs up” and “thumbs down”, “plus” and “minus”, and “smiling” and “sad” emojis.

For this survey, we asked the same participants as before to participate.

The participants were given 4 cards, below each one we placed one of the existing approaches. The participants were asked to state if the item on the card is sustainable or not. We set the timer for every card of every participant, and we also asked them to say out loud, what is their opinion.



pic. 43, Gameplay Buttons Survey Sample



In order to have fair results, the cards were mixed for every participant.

In all four cases, the opinion of the participant was the same as the meaning of the tapped button. The “thumbs up” and “thumbs down” still showed the best performance because for participants it took less than a second to decide, which one to tap. When for 3 other systems it took from 1 to 3 seconds.

To sum up, all 4 systems have a clear mental model at the end, users always were able to complete the task correctly, but the clearest mental model is “thumbs up” and “thumbs down”. Based on the results of this experiment we decided to change the gameplay active buttons from “heart” and “x” to “thumbs up” and “thumbs down”.

## Hi-Fi Prototype 1

In this prototype, we decided to implement several changes related not only to the interface but also to the service design. The main issues that the previous prototype had were related to the fundraising system and the trust issues. Moreover, with the technologies and approaches we use, we realized that the account is not necessary for this application. Moreover, this prototype is considered a Hi-Fidelity Prototype, so all the sections are functioning, we increased the number of quizzes from 2 to 5. All necessary materials are provided.

First of all, we decided to apply changes to the fundraising part of the service. The service is no longer collaborating with artists and does not sell the artworks. Instead, we proposed to have a donation system, where every person interested in this service

can donate as much as they wish. Those funds are distributed among the projects upon their needs as well as about 10% of this money can be used for the maintenance of the service and the application.



pic. 44, Promotional Website

Another question that was not solved before was how the projects are selected for the financial aid provided by the service. For this, we decided to create an additional touchpoint. All interested teams and projects can apply anytime with the description of the project, contact details, and described list with financial needs and purposes. The service will take care to check if the project can be supported with the main requirement of the topic of the research to be related to sustainability. The service will also verify if the requested funds are necessary and are in line with the available funds for the service has.

Both touchpoints described above are not a part of the application and will be developed as a separate website, but inside of the application, we provide the related links to the donation and the application. This website can have a simple structure, where on

the main page we have a slogan with a short explanation of what the service has done accordingly to its values with the links to the past supported projects, an FAQ section about the service, current participants and the forms for donation and with the application for the projects. The structure of the website is similar to the application but has a different purpose. Based on this the sections with current and past projects and FAQ can be designed similar to the application. The most important function of this website is the promotion of the service among people that can donate and can participate in the service. The links to these forms have to be noticeable. These links lead the visitor to the related form. Once the form is submitted we provide a notice with success or opposite feedback and provide a link to the home page. This allows us to shorten the informational architecture and provide a better experience, which increases the chances to get support for the service.

To build meaningful and trustful relationships between the service and the players we brought several ideas. We decided to add a special section that can answer all the questions the players might have about the game, the application, and the service. The main function of our application is the game, but at the same time, it provides all relevant information about the service and stakeholders. The new section is called FAQ and we decided to provide an access to it from the navigational bar of our application since we consider this section crucial for the application and the service. In order to simplify the navigation among the questions, stress the importance of values provided by the service, and to be aligned with the concept, we divided this section into 3 tab groups: general, data, and funds.

The first group is designed to provide all basic information about the values of the service, the design of the application, and about the game and its rules. The second group is dedicated to the questions that are related to the data the service obtains, stores, and shares with the policymakers, and how these actions are performed reflecting all legal requirements based on GDPR. The third section provides information about the fundraising system, distribution of funds, and the recipients.

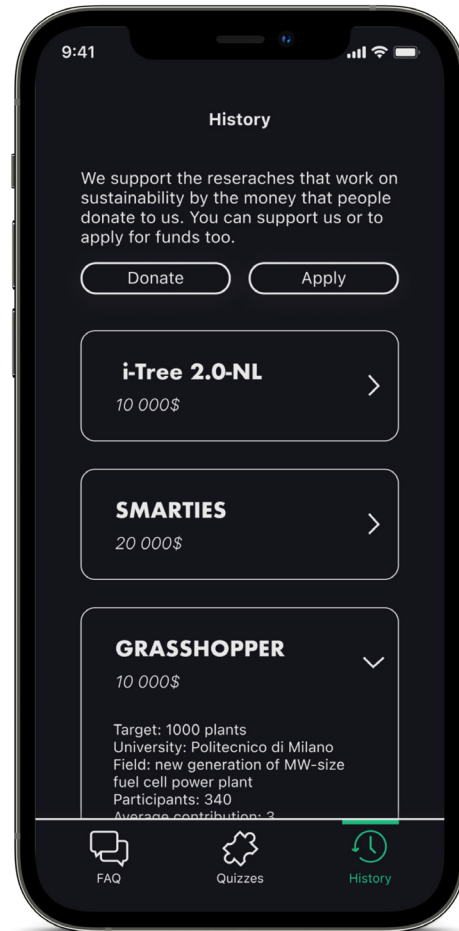


pic. 45, FAQ Section Screens

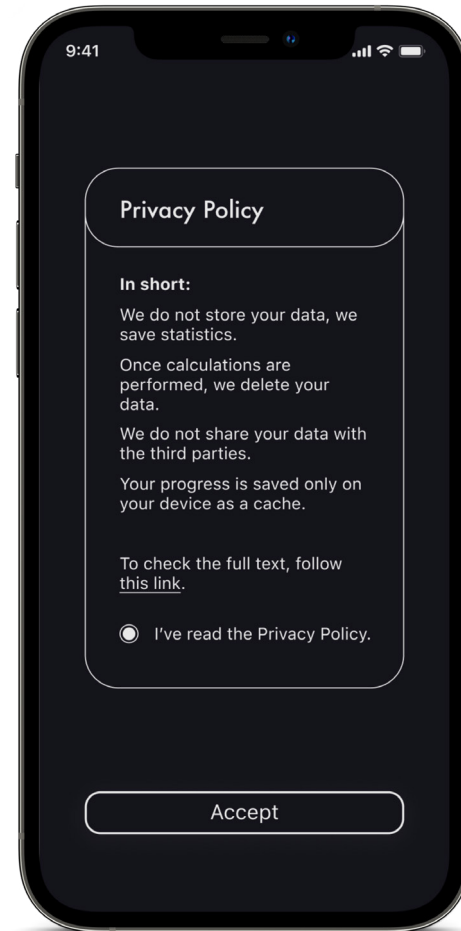
Since we changed the concept of the fundraising system and no longer collaborate with the artists, we changed the name of the section with past recipients from Gallery to History. To support the value of the service we decided to add a small notice at the top as a reminder with the information about the fundraising system followed by buttons with the links to donation and application forms. Here we also decide to shorten the number of screens and now all the details about the past recipient appear as a drop-down section under the title.

Another change related to the trust we made is an additional screen between the introduction to the service and the home screen with the short explanations of Privacy Policy and with the link to the full text. Based on the legal requirements, we also ask the player to consent since otherwise, we cannot collect any type of data.

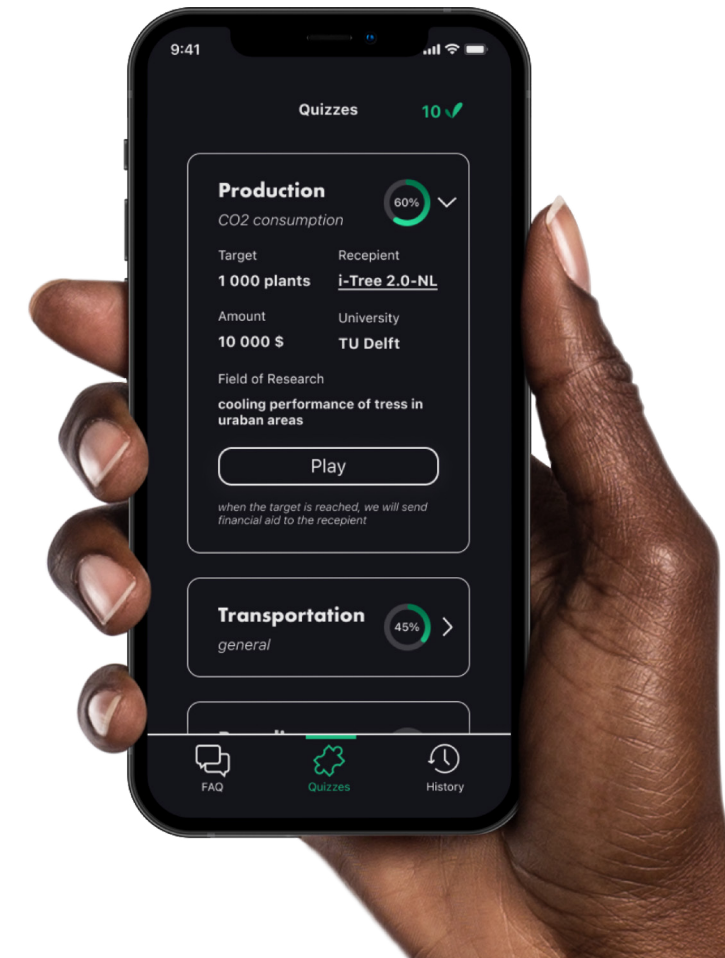




pic. 46, History Screen



pic. 47, Privacy Policy Screen



pic. 48, Quiz Target Screen

Because we got rid of the collaboration with the artists and our wish to provide clear explanations about the financial aid and possible recipients, we decided to change the way we introduce the target. Now after the user taps on the box with the quiz, we expand this block and display below the information about the related recipient with the CTA button to play with the caption text that the funds will be sent only after the target is reached. This approach allows us not only to provide clear explanations but also to strengthen the relationships between the service and players.

This prototype was changed not only from the sides of service design and user experience design but we also redefined some visual elements. For example, in the introductory cards, we changed the illustrations to the ones that support the texts better. An-

other change to the appearance of the interface we added is that we replaced the pop-ups with drawers. Due to the requirements of sustainability, our interface avoids the usage of transparency. In this case, pop-ups are not clearly visually separated from the main content on the screen, which leads us to a decrease in the quality of user experience. When the drawer does not have the same problem. Moreover, for drawers, we can provide a different type of interaction if the user wants to skip the explanations provided on it by the vertical swipe.

As it was mentioned in the previous chapter, based on the visual surveys performed we decided to change the visual appearance of the scoring system by using the symbol of the plant. This change also allowed us to provide easier explanations about the





pic. 49, Gameplay with and without Drawer

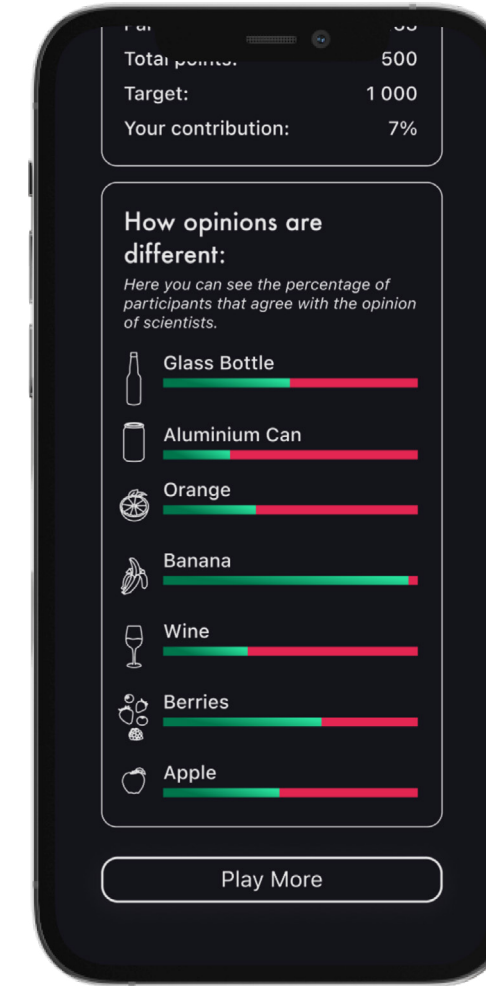
targets. Moreover, this symbol also reflects the selection of the accent color used in the application.

For the active gameplay buttons, we also changed the symbols from the “x” and “heart” to “thumbs down” and “thumbs up”. This mental model showed a better user performance because it has clear good and bad meanings.

During the discussion with the development team, we identified another issue of the previous prototype policymakers are interested in the opinions of people in general and not in the past time changes. To keep the trust between the service and players we display to them the same data as we share with policymakers.

We decided to change the last section with the data visualization from “How opinions have changed in the past 24h” to “How the opinions are different from the scientist”. This change enables us to simplify the data collection, and the data visualization, we can avoid the animation here and this approach is easier to understand for all interested groups of people.

Another significant change was related to the colors, we decided to provide darker background and to change the shades of green and red colors used as accents and feedbacks. Moreover, we also decided to introduce a combination of fonts instead of using a sin-



pic. 50, Data Visualization Screen

gle font. For the titles, we decided to change the device font to Futura which is preinstalled on iPhones and Android Smartphones too to differentiate the visual weight of the elements.

For this prototype, we introduced a new animation for positive feedback during the game.

The previous one was a simple scale up and down of the symbol of points. In the new version, we replaced this animation with a blink animation around the score and symbol of the plant by circles similar to the radio signal symbol animation. The negative feedback is kept as the change of color of score to red and back green with haptic with an additional shake movement of the plant symbol.

Based on the comments from the previous playtests, another feature we decide to add to this prototype was the drawer that can be called by a small button with the metrics for the current quiz since some players could forget them during the play.



pic. 51, Informational Architecture

## Playtests

To understand the success of the hypothesis, we decided to test the Hi-Fidelity Prototype too. The tests were going to discover, what are the outcomes of the performed work, how successful can be the concept if we managed to solve all previous issues, and what are possible next steps.

These tests helped us to validate the concept and to confirm that the communicated values are understood by the participants, the trust between the users and the service is built and the prototype provides all necessary information to the users.

If the tests would not be performed, we would risk developing a subjective view and missing the bugs in the prototype. The main concept of this prototype was to verify the entire experience it provides to users and to ensure that the information provided can build trustful relationships between the service and the users.

The tests were conducted in person among 5 different people. As for all previous prototypes, every person was a part of the target audience of the game. For the tests, we used the laptop with a webcam to record the session and an iPhone with the prototype installed. Before the test, we introduced the concept of the service to each participant explaining the procedure and tasks that should be performed.

Users were asked to play at least one quiz and to understand the game rules on their own. Then they had to support one of the participants after they finish one of the quizzes and to find the information about at least one past participant. The players had to understand the data usage and what is going to be shared with policymakers. To avoid biased results during the play experience, users were not given any hints from the conductor of the test.

After the test was finished the participants were interviewed about the experience. Every interview was improvised to be personalized due to the complexity of the prototype.



*Young female student, specializing in Digital Design, Italian, 24 years old*

This participant met our service for the first time, but she is highly involved in different initiatives that support sustainable development. The rules of the game were clear for her, as well as the values of the service from the onboarding and additional explanations provided within the app. During the play, she got surprised by certain feedback, which was clear to her. She was not paying attention to points and in her experience, the main motivation was to get a piece of new knowledge. She got additionally inspired by the fact of possible influence on the researchers and policymakers.



*Young male student, specializing in Digital Design, Honduran, 26 years old*

The participant has tested the previous version of the prototype, so in that case, we were mainly interested if we manage to increase the quality of the user experience. This participant at this time could understand all the values of the service including the money flows, so we managed to communicate all necessary information. Moreover, this time the player was more focused. In his experience, we also noticed that we might need to move the active gameplay buttons a bit upper since some hands are slightly bigger.



*Young male student, specializing in Management Engineering, Russian, 24 years old*

This participant has tested the previous prototype too. He played the game but has not noticed any changes there. But he deeply investigated the FAQ section, he was interested in most of the questions in all 3 tabs. He was able to understand the values of the service from the onboarding, but still had more precise questions, and only after he claimed that would have even proceeded with the financial support functionality of the service.



*Young female student, specializing in Digital Design, Serbian, 27 years old*

This participant has tested a previous iteration of the app. For us, it was important to verify, how the experience has changed in comparison. During the test, she was not confused with the tasks and managed to proceed with all of them. She never expressed negative comments. At the end of the test, she could explain, how the service operates in all the details that were communicated. This participant confirmed that all the doubts she had with the previous version of the prototype were illuminated.



*Young male student, specializing in Digital Design, Argentinian, 29 years old*

This participant met this project for the first time. At the very beginning, he expressed that he liked the aesthetics of the app. For him, the onboarding was too long and he started to lose the attention. The gestures of the gameplay involved him in the game and in the end the play experience was positive as well as the positive feedback was given on the social part of the service.

As the result, we can confirm that we achieved the MVP, and the prototype can be developed into a real application. All the participants enjoyed the game experience and claimed that they would love to support the researches in this way. Moreover, they mentioned that they would play this game occasionally to gain new knowledge and might promote it among their circles.

# Conclusion

To sum up we developed a gamified service that provides 3 main values: it educates, it allows to support the researchers working in the field of sustainable development and it communicates the opinions and interests of people with policymakers. All these values are activated by the act of play. The concept had different stages, when at the beginning we started with the serious game design, and we ended up with a complex service. Still, the game is the main part of this project.

Play is known as a preliminary learning tool. The mobile game market has a significant growth in past years. The target audience of this application was selected as students and recent graduates living in Europe as a design constraint. In this age group, most people own smartphones and play occasionally on them. To communicate with our target audience, we decided to develop a mobile game with simple mechanics. Our concept is a collection of quizzes that are divided by topics. Every topic is a set of cards that the player has to sort with a familiar dating applications gesture. The user is given two metrics at the very beginning based on which they have to decide if the item on the card is sustainable or not and express it by the right or left swipe accordingly. If the user replies correctly the score is increased by one point. When the quiz is finished to educate the player we display all their replies with the color indication to express if it was correct and with a small explanation.

After the act of the play, the user may decide to support a related project. Every quiz is assigned a certain research group that will get funds from the service when the support target is reached. This mechanic allows us to collect additional information about the interest of our users and to involve more players. If the us-



er decides to support the project we also show them the data that will be communicated to policymakers as a small graph with the percentage level of agreement of people about sustainability mentioned in the quiz items with scientists. The communication of this statistic might help to improve the education related to sustainable development and to verify if the law design is correlated with public opinion.

Another goal that we managed to reach is to design an application that has a reduced environmental impact on the user experience and interface designs without a significant compromise in its performance.

For the future development of this project, we can consider designing the promotion scenario, expanding the target audience, increasing the number of quizzes, designing the fundraising system and the requirements for the possible fund recipients, and the promotional website of the service, to introduce the project to possible investors and develop the fully functioning application for iOS and Android devices.

The main challenges we faced during this project were to select and apply proper motivations for the players, to research the guidelines for the sustainable design and development of the app, and to apply them properly.

To be additionally mentioned, during the research phase we faced a lack of publications about sustainable interface design, which can be a part of my future career as a researcher.



# Appendix

## Survey Sample 1

### Sustainable Development and Games

Hey! I am Polina, a student of Politecnico di Milano, finishing my master's as a Digital and Interaction Designer. My master thesis is mainly focused on the game design and growing sentiments toward nature among youth people studying/ed in the EU. For that, I need to get more in touch with my target audience. All data is collected anonymously and will be used for educational and research purposes. Thank you for your help!

#### Age \*

- 18 – 20
- 21 – 23
- 24 – 26
- 27 – 30
- 31 – 35
- 36+

#### Level of education \*

*Please, select the highest degree that you have now*

- Study at/finished high school
- Study Bachelor

- Finished Bachelor
- Study Master
- Finished Master
- Study/Finished Ph.D. and higher

Home Country \*

*Please, type here the country (in ENG), where you spend the most time in your live*

Current country \*

*Please, type here the country you live in now (in ENG)*

Country of Bachelor \*

*Please, type here the country you study/studied for your Bachelor's (in ENG)*

Country of Master \*

*Please, type here the country you study/studied for your Master's (in ENG)*

Did you have any topics on sustainability in your study program/s? \*

- Yes
- No

Which topics do sound familiar to you? \*

*Here is the list of not related topics, please, select every topic that you know something about*

- Stormwater management
- Biodiversity
- Sustainable IT
- Pollutions
- Sustainable energy sources

- Question of actual sustainability of e-cars
- EU 2050 targets
- 17 Sustainable Development Goals
- Waste Separation

Do you play video games? \*

*Even once a year, on any device (incl. smartphones, etc)*

- Yes
- No

Do you think that games can influence attitudes? \*

- Yes
- No

Have you ever felt that your attitudes were influenced by games? \*

- Yes
- No

Do you think that a positive influence from games is possible? \*

- Yes
- No

Do you think the world needs more information about sustainability issues? \*

- Yes
- No
- Maybe

Do you think that some topics of sustainability are not discussed enough? \*

- Yes, there are some topics not on the stage

- No, all are well discussed
- Not sure

Which topics of sustainability do need more discussion? Type here all topics you have in mind, please:

---

Have you ever played games that expressed any sustainability issues? \*

- Yes
- No
- Not sure / Do not remember

How much time per day do you spend on your smartphone? \*

- 10-20min
- ~30min
- ~1h
- 1-2h
- ~3h
- >3h

Do you consider yourself as a person, who behaves mostly in a sustainable way? \*

- Yes
- A bit
- Not really

Do you think if people would know more about current sustainable issues, they would start to care more? \*

- Yes
- Maybe
- Not really

Ideas/proposals:

*If you have something else to say, please, write it here*

---

\* Obligatory questions

## Survey Sample 2

*Both Groups*

Age, education, nationality

Do you have at least one game on your smartphone?

On which occasions do you play?

Do you think that sustainability is not enough discussed?

What would you personally suggest to do about the ecology?

*Group A*

Name 3 associations with Tinder?

What comes to your mind, when I say "Sustainable Tinder"?

*Group B*

Name 3 associations with Spaceship?

Do you know how many satellites surround the Earth?

Do you know which sources of energy are Green and which are not?

### *Both Groups*

Do you think that games can influence attitudes?

Do you think that your attitudes might be influenced by games?

## **Survey Sample 3**

### *General Info*

Age, education, nationality

Do you have at least one game on your smartphone?

On which occasions do you play?

Do you think that sustainability is not enough discussed?

What would you personally suggest to do about the ecology?

### *About the Game*

Would you like to play the game again?

Were the explanations clear?

What are the stars used for?

Why there are some artworks? What do you think?

Was the UI clear for you?

Is the pointing system clear for you?

Were you surprised by something?

### *About the service*

The involvement of famous people and specific artists would in-

crease the trust in the service?

Do you feel being a part of the impact is a high motivation to play?

Do you think that service can present the statistics to the government if the entire DB is deleted?

## **Introductory script of the 1st test**

Hello, I am Polina.

Thank you for taking out time to participate in this test. I have my master's thesis about game design that might help to educate society more about sustainability. With this playtest I want to gain insights into the interests and liked mechanics of my target audience and to check the main concepts and metaphors. The main goal is to see if you enjoy and reflect on some topics mentioned in the game.

Before we start, I would like to ask if it is OK if I record this discussion to see how you feel during playtesting. Thank you again for joining this session and for your willingness to share your point of view with me. Note that there are no right or wrong comments; you can express your experience as per your understanding.

All the data will be used only for educational and research purposes.

Great, let's get started!

## Introductory script of the 2nd and 3rd tests

Hello, I am Polina.

Thank you for taking out time to participate in this test. I am developing my master thesis about gamified service design that might help to educate society more about sustainability, to support the communication between the public and policymakers, and to provide a tool to impact the sustainable development of the public.

With this playtest I want to gain insights into the interests and attitudes of my target audience and check the main concepts and metaphors. The main goal is to see if you enjoy the game and reflect on some topics mentioned in the game.

Before we start, I would like to ask your permission to record this discussion and also make the recording of the screen of the device during the playtest. All the data will be used only for educational and research purposes.

The session will be conducted in 3 steps: at first, I will describe to you a bit more about the service, the game, and its rules, I will also describe a little the prototype since it is not the final solution; then I will give you the prototype and ask you to play; afterward, I will perform a small interview to get a better idea about your experience and the opinion about the service.

Thank you again for joining this session and for your willingness to share your point of view with me. Note that there are no right or wrong comments; you can express your experience as per your understanding.

Great, let's get started!

## Introductory script of the 4th tests

Hello, I am Polina.

Thank you for taking out time to participate in this test. I have my master thesis about gamified service design that might help to educate society more about sustainability, build communication between the public and policymakers, and to provide a support tool for researchers working on projects related to sustainable development.

With this test session, I want to gain insights into the interests and attitudes of my target audience about the service, to check if the app can communicate the values of the service and if the app provides an engaging experience. Moreover, I would like to check if the current prototype is missing some points. The main goal is to see how you will reflect on some topics mentioned in the game as well as on the values of the service.

Before we start, I would like to ask for your consent to record this discussion and also make the recording of the screen of the device during the test session. Thank you again for joining this session and for your willingness to share your point of view with me. Note that there are no right or wrong comments; you can express your experience as per your understanding.

All the data will be used only for educational and research purposes.

Great, let's get started!

# References

Android (2018) *Android Dev Summit 2018* [online]. Available at: <https://www.youtube.com/watch?v=UljafaxRcEE&t=4536s> (Accessed on: 21 March 2022).

Apple (2016) *Energy Efficiency Guide for iOS Apps* [online]. Available at: <https://developer.apple.com/library/archive/documentation/Performance/Conceptual/EnergyGuide-iOS/> (Accessed on: 17 March 2022).

Apple (2021) *Apple Design Award 2021* [online]. Available at: <https://www.apple.com/newsroom/2021/06/apple-announces-winners-of-the-2021-apple-design-awards/> (Accessed on: 29 November 2021).

Apple (2021) *iPhone 12 Pro - Technical Specifications* [online]. Available at: [https://support.apple.com/kb/SP831?locale=en\\_GB](https://support.apple.com/kb/SP831?locale=en_GB) (Accessed on: 22 November 2021).

Apple (no date) *Human Interface Guidelines, User Interaction, Gestures* [online]. Available at: <https://developer.apple.com/design/human-interface-guidelines/ios/user-interaction/gestures/> (Accessed on: 08 December 2021).



Aubert H.A., Bauer R. and Lienert J. (2018) 'A Review of Water-Related Serious Games to Specify Use in Environmental Multi-Criteria Decision Analysis', *Environmental Modelling and Software*, 105, pp. 64–78.

Bell Telephone Labor INC (1960) *Electrographic transmitter* [online]. Available at: <https://worldwide.espacenet.com/patent/search/family/022108688/publication/US3016421A?q=pn%3DU-S3016421A> (Accessed on: 08 December 2021).

Bogost I. (2007) *Persuasive Games*. Massachusetts: The MIT Press.

Bogost I. (2007) *Microsoft Research Meet-Up* [video]. Available at: <https://www.microsoft.com/en-us/research/video/persuasive-games-the-expressive-power-of-videogames/#!relatedinfo> (Accessed on: 20 November 2021).

Cairney P. and Kwiatowski R. (2017) *How to communicate effectively with policymakers: combine insights from psychology and policy studies* [online]. Available at: <https://www.nature.com/articles/s41599-017-0046-8> (Accessed on: 05 March 2022).

Center for Behavior, Institutions and the Environment (no date) *Center for Behavior, Institutions and the Environment* [online]. Available at: <https://complexity.asu.edu/cbie/> (Accessed on: 05 December 2021).

Chen B. (2010) *iPhone Sensation Angry Birds Grabs 50 Million Downloads* [online]. Available at: <https://www.wired.com/2010/12/iphone-angry-birds/> (Accessed on: 21 October 2021).

Clement J. (2021) *Mobile gaming market in the United States - statistics & facts* [online]. Available at: <https://www.statista.com/topics/1906/mobile-gaming/#dossierKeyfigures> (Accessed on: 10 November 2021).

Clement J. (2022) *Gaming revenue worldwide 2022, by segment* [online]. Available at: <https://www.statista.com/statistics/292751/mobile-gaming-revenue-worldwide-device/> (Accessed on: 10 November 2021).

Costikyan G. (2002) 'I Have No Words & I Must Design: Toward a Critical Vocabulary for Games', *Proceedings of Computer Games and Digital Cultures Conference*, ed. Frans Mäyrä. Tampere: Tampere University Press, pp. 9 – 33.

Cruz L. and Abreu L. (2019) *Catalog of Energy Patterns for Mobile Applications* [online]. Available at: <https://doi.org/10.48550/arXiv.1901.03302> (Accessed on: 17 March 2022).

Dal Y.J. (2017) 'Mobile Gaming in Asia: Politics', *Culture and Emerging Technologies*, 2017, pp. 6 – 8.

Deci E. L. and Ryan R.M (1985) *Intrinsic Motivation and Self-Determination in Human Behavior*. Berlin: Springer Science & Business Media.

Djaouti D., Alvarez J. and Jessel J.-P. (2011) *Classifying Serious Games: The G/P/S model* [online]. Available at: [https://www.ludoscience.com/files/ressources/classifying\\_serious\\_games.pdf](https://www.ludoscience.com/files/ressources/classifying_serious_games.pdf) (Accessed on: 20 November 2021).

Entertainment Software Association (2015) *Essential Facts about the Computer and Video Game Industry* [online]. Available at: <https://templatearchive.com/esa-essential-facts/> (Accessed on: 09 October 2021).

Flanagan H. and Nissenbaum M. (2014) *Values at Play in Digital Games*. Massachusetts: The MIT Press.

Fuad-Luke A. (2014) Design(-ing) for Radical Relationality: 'Relational design' for confronting dangerous, concurrent, contingent realities. in MA Jin & LOU Yongqi, (eds), *Emerging Practices in Design. Professions, Values and Approaches*. Shanghai, China, pp. 42-73.

Games4Sustainability (2014) *Games4Sustainability* [online]. Available at: <https://games4sustainability.org> (Accessed on: 21 November 2021).

Games for Change (2021) *Games for Change* [online]. Available at: <https://www.gamesforchange.org> (Accessed on: 21 November 2021).

Gottschalk M., Jelschen J. and Winter A. (2014) 'Saving energy on mobile devices by refactoring', *EnviroInfo*, 2014, pp. 437-444.

Gurak L. J. (2001) *Cyberliteracy: Navigating the Internet with Awareness*. New Haven: Yale University Press.

Helmets M. and Hill Ch. A. (2004) 'Introduction' in Hill Ch. A. and Helmets M. (ed.) *Defining Visual Rhetorics*. N. J.: Lawrence Erlbaum Associates.

Helmets M. and Hill Ch. A. (2004) 'The Psychology of Rhetorical Images' in Hill Ch. A. (ed.) *Defining Visual Rhetorics*. N. J.: Lawrence Erlbaum Associates.

In The Loop Games (no date) *In The Loop Games* [online]. Available at: <https://intheloopgame.com> (Accessed on: 22 November 2021).

Jiang Y., Jachna T. J. and Dong H. (2020) 'Game for Complete Care: A Means of Connecting 'User-Centered Design' with Sustainability', *Sustainability*, 12(24), 10555 [online]. Available at: <https://doi.org/10.3390/su122410555> (Accessed on: 02 November 2021).

Johnson E.A. (1965) 'Touch Display - A novel input/output device for computers', *Electronics Letters*, 1 (8), pp. 219 - 220.

Kennedy G.A (1999) *Complete Rhetoric and Its Christian and Secular Tradition*. Chapel Hill: University of North Carolina Press.

Kriz W.C. (2004) 'Creating Effective Learning Environments and Learning Organizations through Gaming Simulation Design', *Simulation & Gaming*, 34, pp. 495 - 511.

Lavrysen T. H. M. (2010) *Saving Energy Through Family Fun: Parents and Children Playfully Reducing Energy Consumption Together* [online]. Available at: <http://resolver.tudelft.nl/uuid:95055299-7ce3-491b-8662-f132c0c5809b> (Accessed on: 22 November 2021).

Lewis P. (2013) 'Policy thinking, fast and slow: a social intuitionist perspective on public policy processes', *American Political Science Association Annual Meeting 2013*.

Malone T. (1981) 'Toward a theory of intrinsically motivating instructions', *Cognitive Science*, 4, pp. 333 – 369.

Manne S. B. (2020) *Examining the Carbon Footprint of Devices* [online]. Available at: <https://devblogs.microsoft.com/sustainable-software/examining-the-carbon-footprint-of-devices/> (Accessed on: 15 November 2021).

Montagliani B. (2020) *Green IT: A Sustainable Approach to App Development* [online]. Available at: <https://medium.com/swlh/green-it-a-sustainable-approach-to-app-development-1ef4234faf51> (Accessed on: 17 March 2022).

New European Bauhaus Prize (2021) *New European Bauhaus Prize 2021* [online]. Available at: <https://prizes.new-european-bauhaus.eu> (Accessed on: 23 October 2021).

Nokia (2009) *Story of Nokia, Snake is born: a mobile game classic* [online]. Available at: <https://web.archive.org/web/20090209232201/http://www.nokia.com/A4303014> (Accessed on: 28 October 2021).

O'Dea S. (2021) *Smartphone Usage in the United Kingdom (UK) 2012-2020, by age* [online]. Available at: <https://www.statista.com/statistics/300402/smartphone-usage-in-the-uk-by-age/> (Accessed on: 10 November 2021).

Pereira R. et al (2017) *Energy Efficiency across Programming Languages. How Do Energy, Time, and Memory Relate?* [online]. Available at: <https://greenlab.di.uminho.pt/wp-content/uploads/2017/09/paperSLE.pdf> (Accessed on: 19 March 2022).

Philco Corp (1946) *Electronic pointer for television images* [online]. Available at: <https://worldwide.espacenet.com/patent/search/family/024793442/publication/US2487641A?q=pn%3DUS2487641A> (Accessed on: 08 December 2021).

Plato (1977) *Complete Works*. New York: Hackett.

Rieber L.P., Smith L. and Noah D. (1998) 'The Value of Serious Play', *Educational Technology*, 38, pp. 29–37.

Schell J. (2008) *Art of Game Design: A Book of Lenses*. Boca Raton, FL: CRC Press.

Sustainable Learning (no date) *Sustainable Learning* [online]. Available at: [sustainablelearning.com/](https://sustainablelearning.com/) (Accessed on: 08 November 2021).

Technical University Delft, The faculty of Industrial Design Engineering (no date) *Persuasive Game Design* [online]. Available at: <https://studiolab.ide.tudelft.nl/studiolab/persuasivegamedesign/> (Accessed on: 08 November 2021).

The European Commission (2009) *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Mainstreaming sustainable development into EU policies: 2009 Review of the European Union Strategy for Sustainable Development* [online]. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52009DC0400> (Accessed on: 22 October 2021).

The European Commission (2010) *Europe 2020* [online]. Available at: <https://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf> (Accessed on: 22 October 2021).

The European Commission (2015) *Sustainable Development Goals* [online]. Available at: [https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals\\_en](https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals_en) (Accessed on: 22 October 2021).

The European Commission (2019) *A European Green Deal* [online]. Available at: [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en) (Accessed on: 24 October 2021).

The European Commission (2020) *2030 Climate Target Plan* [online]. Available at: [https://ec.europa.eu/clima/eu-action/european-green-deal/2030-climate-target-plan\\_en](https://ec.europa.eu/clima/eu-action/european-green-deal/2030-climate-target-plan_en) (Accessed on: 22 October 2021).

The European Commission (2021) *Delivering the European Green Deal* [online]. Available at: [https://ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal\\_en](https://ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal_en) (Accessed on: 24 October 2021).

The European Commission (2021) *The EU and the United Nations – common goals for a sustainable future* [online]. Available at: [https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals/eu-and-united-nations-common-goals-sustainable-future\\_en](https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals/eu-and-united-nations-common-goals-sustainable-future_en) (Accessed on: 22 October 2021).

The European Commission (no date) *2030 Climate & Energy Framework* [online]. Available at: [https://ec.europa.eu/clima/eu-action/climate-strategies-targets/2030-climate-energy-framework\\_en](https://ec.europa.eu/clima/eu-action/climate-strategies-targets/2030-climate-energy-framework_en) (Accessed on: 23 October 2021).

The United Nations (2015) *17 Sustainable Development Goals* [online]. Available at: <https://sdgs.un.org/goals> (Accessed on: 22 October 2021).

Unknown (2019) '21% of young people spend six hours or more on their phone daily', *Irish Examiner* [online]. Available at: <https://www.irishexaminer.com/news/arid-30940600.html> (Accessed on: 15 October 2021).