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An exploration into the behavioural design of gamification and its power to motivate and trigger eco-consciousness.

BinGo: A gamified app to help the environment.

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Abstract

Climate change is the greatest threat to humanity that gamification is ready to battle by galvanizing people into taking action. Research has shown that gamification can affect people and morph their minds to abide by a healthier lifestyle. This paper aims to determine how far gamification can reach to tackle something as severe as climate change and develop a prototype gamified app to help engage players in eco-friendlier choices through a reward system. Building on existing work on gamification, the paper asks how video games could shape the player's mentality, what are the results and what immediate rewards will satisfy his needs to stay committed.

Based on a literature review on triggering environmental awareness through gaming, data were gathered from diverse sources to gain better insight into the effects of game design choices on a player's attitude. Analysis of the findings demonstrated that engagement and motivation are achieved by rewarding players for their actions and allowing them to cooperate with others, mainly when their common goal is significantly valuable.

In this regard, "BinGo", a location-based Augmented Reality (AR) gamified app, was created as a prototype to bridge the gap between research and development of ecological issues and the actions taken by games. It is an app that directly rewards players who throw rubbish in waste containers while enjoying multiple compelling AR games.

Finally, the gaming industry needs further research and development to effectively educate players and establish ways to challenge problems from the non-virtual world.

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1. Introduction

Video games have the power to shape players' mentality and motivate them into achieving more meaningful goals than those in virtual worlds. Previous research has established that games can change players' attitudes, and gamification can positively impact personal and social life. Games can lead to players being openminded, unbiased and highly collaborative while gamified applications prompt people to be more productive and socially and physically active. It comes as no surprise that the number of gamers continuously increases (projected 3 billion by 2021), with an average of 7 hours of gameplay each week. In this regard, what if a portion of this time is dedicated to a noble cause?

Climate change is a growing concern worldwide with gamers playing a significant role in the issue as a key to its potential solution. Games can save the environment if we choose to develop more gamified apps to motivate people and build their eco-consciousness.

Despite the existing state of gamification towards environmental issues at an early stage, some remarks are prominent. From Pokémon Go to Foursquare and from OPower to My Clean City, gamification attempts to persuade people into a healthier and greener lifestyle.

This dissertation intends to determine the extent to which gamification can help shift a player's mentality towards eco-consciousness and produce a gamified application that will motivate people to collect or throw rubbish in the containers. It uses a qualitative case study approach to investigate the impact games have on players and what gamification can achieve. The experimental work presented here provides one of the first investigations into how a simple app can reverse the environment's damage. However, it is beyond this study's scope to examine whether it helped the environment, as these results require much time.

The remaining part of the paper proceeds as follows: a literature review and methodology of the research and the development work of the app.

Games should not just be an escape to the digital world; they must lead us to the revival of the real world.

2. Literature Review

2.1. Game Psychology and Design

"The real-world needs more SEHIs". Jamais Cascio defines SEHIs as "Super Empowered Hopeful Individuals", which is someone who feels not just optimistic about the future, but also personally capable of changing the world for the better (McGonigal, 2011). These are the decision-makers who choose to create games for change, whether those are meant to motivate people to exercise or raise awareness of an issue. Games have the power to move people.

The influence games have on their players, is described as Behavioural Design. Behavioural Design is a systematic understanding of how people think and how they make decisions. This understanding forms the basis of thinking about interventions that lead to behavioural change (Groenewegen, 2019). Games or gamified apps can often strive for their users' behavioural change by seeking their attention, triggering their curiosity, changing their perception, behaviour, and habits (Mulcahy, Russell-Bennett and Iacobucci, 2020).

2.2. Effects of Game Design Choices

"We all need Fiero in our lives". Fiero, the Italian word for pride, is the feeling you get when you achieve something extraordinary in a game. The happiness you get will motivate you to play the game more, something that game developers are striving for. The same fulfilment and happiness often occur while working on teams to achieve something great. Co-op mode makes people happier and more productive while limiting aggression, anger, disappointment, or humiliation (McGonigal, 2011). However, aggression sometimes can have more power than Fiero.

Diving into video games more, questions arise related to violence. Studies found that those who played violent games showed more aggressive behaviours during the gameplay (Barlett, Harris and Baldassaro, 2007). For example, parts of the League of Legends community showed various insults like racism, homophobia, and sexism towards other players and websites like "The Bigot Gamer" and "Fat, Ugly or Slutty" gained popularity. On that note, creative decisions become harder. Jennifer Hepler, the senior writer on the Dragon Age series of role-playing games, threw her hands up and quit after abusive phone calls and death threats were levelled against her and her children based on some decisions she made with the game's story and characters. This breaks the digital barrier and shows how a person's feeling impacted the real world (Madigan, 2016).

On the bright side, there are many examples of Game Design choices used to shift a player's attitude for creating better outcomes. Many games introduced a system to obnoxious mute players of the opposite team; others introduced "Honour Points" system awarded to a team member while others banned effect, from a day to perpetuity. These simple Design choices led to a 32% decrease in negative chat and a 35% increase in positive (Madigan, 2016).

2.3. Gamification

Gamification is adding game-like elements to a task to encourage participation. It comprises of 8 Core Drives (Yu-Kai Chou, 2020).

1. Epic Meaning & Calling, where the player feels like the "chosen one".
2. Development & Accomplishment, where points and progress motivate the player to overcome challenges.
3. Empowerment of Creativity & Feedback, where players are creative and see the results of their creativity.
4. Ownership & Possession, where players are motivated because they feel like they own something.
5. Social Influence & Relatedness, where players are driven by mentorship, acceptance, social responses, companionship, as well as competition and envy.
6. Scarcity & Impatience, where players want something they cannot have triggering engagement.
7. Unpredictability & Curiosity, where players are intrigued by "what happens next".
8. Loss & Avoidance, where players avoid of something negative happening.

Although a gamified application can rarely contain all the core drives, it can still achieve remarkable outcomes. It is expected that the number of gamers would rise to 2.7 billion gamers by 2021 (Christina, 2019), each playing for 7 hours on average each week (Anderton, 2019). That is a unique opportunity for gamification to summon a collective action against climate change.

2.3.1. Gamification and Environment

"We need games for a larger cause". For a game to feel like a cause, two things need to happen. First, its story needs to be a collective context for action, attached to large online communities. And second, a player's actions need to feel like a service, benefiting all other players (McGonigal, 2011). To that extend, maybe it is time for gamification to teach us all how to live an eco-friendlier life. What more significant cause than that? It benefits everyone.

Climate change first appeared as news nearly 30 years ago, but we are still talking about it. Why has nothing been done? Maybe some gamification in our everyday life could save us some time or even reverse the damage done.

2.3.2. The Studies

"Games change how we think". There was a study conducted modifying the popular card game "cards against humanity" into something more "climate change" theme-related, called "cops arrest manatees" (World Economic Forum, 2018). The participants were given plastic cups and chose to recycle it or not on the way out. They found that 30% of the people who played "cops arrest manatees" threw the cup into the recycling bin. In comparison, only 10% recycled when they played the non-climate change game (Games for Change, 2017). That study shows that a simple card game impacted people only one day.

Another study, on the game Pokémon Go (*see chapter 2.3.3*) showed that the number of participants achieving a goal of 10.000+ steps per day increased from 15.3% before to 27.5% (Xian et al., 2017). Another critical study found that an average player, increased his/her steps by 1473 a day after the first month of playing. Pokémon Go has increased physical activity across men and women of all ages and weight status. These activity levels show that this form of gamification leads to increases in physical activity with significant public health implications (Althoff, White and Horvitz, 2016).

Finally, there are multiple studies on gamification and their Core Drives (discussed above), with notable results including 43% of the participants were more productive and engaged, Citibank's StepUp initiative saved 70000 plastic bottles in a year (Apostolopoulos, 2019), and lastly, participants who used a social gaming app saved an average of 20% of their energy use over the three months (Mazur-Stommen and Farley, 2016),

These results encourage us to think ways to gamify our everyday tasks and motivate us to achieve even greater goals.

2.3.3. Impactful Examples

World Without Oil is an alternate reality game which aimed to use its game structure to create a productive imaginative space where people felt free to express ideas and motivated to contribute to the greater whole (McGonigal, 2010). It is a serious game for the public good, addressing oil dependency and energy security in which players around the world lived their everyday lives as if there was an oil shortage. This type of gamification succeeded in tapping into the awesome problem-solving capabilities of an Internet "collective intelligence" and applying them to real-world problems (Serious ARG:: World Without Oil., 2007).

WeSpire has created a platform where users earn points for completing specific sustainability actions, such as recycling or using more environmentally friendly products. Points are shown on a leader board and achievements. Companies like MGM, Sony, and McDonald use it to launch their sustainability challenges and 6 million positive actions taking place to date (Team, 2018).

German software giant, SAP, is using gamification to reduce car emissions and the amount spent on company cars. They have developed and released an app, ***TwoGo***, to encourage their employees to carpool. Car-poolers can earn points, track their friends' progress, and donate the money they save through the initiative to charities of their choice. Users are matched up based on shared interests resulting in linking social benefits with financial and environmental ones (Team, 2018).

OPower works by utilizing gamification to encourage people to use less energy. They provide households with data on how much energy they are consuming, how they match up with neighbours, and if they are close to any new milestones. Compellingly, people are consuming 2% less energy on average, which in 2012 led to over 1 Terawatt of energy savings in the world. This equates to $120,000,000 in utility bill savings and decreased pollution equivalent of keeping 100,000 cars off the road (Chou, 2017).

Pokémon Go. This is a location-based Augmented Reality (AR) gamified game where you move around places to find Pokémon and "catch them all". One study found that after playing for two months, teenagers had greater social intelligence and cognitive performance (including selective attention and concentration levels). In this game, players put eggs into incubators to hatch them only after travelling a certain distance (up to 10km) (Chamary, 2018). This was a terrific way to promote a healthy and greener lifestyle.

Finally, ***My Clean City*** is a notable example of this study and how gamification and environment are intertwined. It is an app that bridges residents with the municipality in The Netherlands. It offers an uncomplicated way for residents to manage their household waste while maintaining their neighbourhoods clean and in compliance with waste management regulations. The user will report the status of the containers (clogged, full etc.) and in return, they are getting rewards like coupons and adopting a tree. (City, 2017)

3. Research Methodology

The research objective was to find evidence of whether games can shift people's attitude towards environmental awareness and discover ways to develop a game that can motivate people to fight climate change. Data were gathered from multiple sources of the last decade or so, to gain better insight into the effects of games and game design choices on the player's mentality. These data derived from books, journals, articles, and YouTube videos. Those sources used focus groups and participant observation to collect their data in which the length varied from a day to eight months of continuous observations.

4. Research Results

After conducting the research and collecting all data relevant to the topic, the results seemed promising. Gamification managed to change players' attitude towards recycling, motivated them into a greener life by offering in-game rewards, provided collaboration to tackle environmental issues strategically. There is no denial of what gamification can achieve; we need the tools.

5. Development Work

Utilizing the knowledge acquired by the literature review, a gamified app (***BinGo***) was created honouring the Core Drive (*CD)*[1] and the White Hat[2] values. The app intends to enable players to help the environment (*CD #1*). Its main functionality is to promote a greener lifestyle by collecting rubbish, walking instead of transport, and socializing. The app also offers location-based Augmented Reality games and the creation of teams and leader

[1] Core Drives of gamification (see chapter 2.3 for the 8 categories)
[2] White Hat" gamification is the less addictive type but more strategic in the long term because it's making people feel good about themselves (Chastan, 2016).

boards for a healthy competition. Finally, all honourable deeds are rewarded in the form of vouchers.

5.1. Tools

BinGo was created using Unity (v2019.4.8f1) game engine, alongside Mapbox (v2.1.1), an open-source mapping platform for getting location-based data (Mapbox.) Additionally, the service PlayFab SDK (v2.97.201014), a LiveOps platform for building and operating live games (PlayFab | Microsoft Azure.), was used for handing all data from players. Furthermore, the app's augmented-reality components were created using Google's ARCore SDK for Unity (v1.20.0). Finally, Visual Studio 2019 Community was used for coding, InVision Studio for designing the app's outlook, GitHub for version control, and MS Project to keep track of the production process.

5.2. Production

The artefact was divided into two phases. Phase one consisted of planning and researching, laying out how the app would look using InVision Design (see Appendix 9.1). Phase two, the development, started with problems.

5.2.1. Problems

With no previous experience on AR, experiments conducted using Vuforia for image tracking, OpenCV and Unity's Barracuda for tracking using neural trained models. It was impossible to use the latter for tracking, and Vuforia with Mapbox AR did not work as expected.

5.2.2. Gameplay

BinGo was separated into two unity scenes, the login scene, and the main game. The former gave logging options in, registering, and testing the app as a guest. Simultaneously, the latter had all the functionality like collecting rubbish, redeeming points checking leader boards and playing AR games. The main scene consists of a map with the player's current location and the location of all the bins. Whenever the player throws rubbish into the bin by scanning its barcode, the geolocation data are retrieved, rewarding him with points *(CD #2)*. These points can be redeemed as gift cards, tax, or transportation reduction or even as a donation *(CD #4, 6)*. The player can also access his progress in cities, countries, and the world and create a team with three other people *(CD #5)* and do daily challenges.

As mentioned above, AR games let users earn extra money. To begin with, there is a monster hunt that randomly appears *(CD #3, 7)* and lasts seven days *(CD #8)*, in which the user must follow directions to AR enemies scattered around the city and fight them. The user's ammo and shield are determined by the amount of general waste and recycle waste the user gathers. Moreover, there is a portal and a scanning game that the player might come across from which more coins can be acquired. Finally, the player can plant a virtual tree and grow it, while sharing it with others to create a digital green world.

5.3. Game Design

The MA Games Design course played a massive role in the birth and the decision-making process of BinGo. Game design and gamification are intertwined as they focus on mechanics, gameplay, and the user experience to elevate the product. Most of the Game Design principles taught, found their place in the app *(see list below)*.

- Clear objectives → Collect rubbish to help the environment while earning money.
- Clear mechanics → Scanning, walking, co-op, points, achievements, leader boards, levels/ progression.
- Interactions → Rubbish and bins, AR monsters, AR Portal, Image recognition
- Concise UI/UX → 3-coloured palette theme (Adjacent colours). More icons used with little text.
- Difficulty curve → Daily tasks, AR Enemies strength.
- Success criteria → Text, sounds and animations for rubbish collection and levelling up.
- Sound → Sound effects to "announce changes".
- Rewards → Redeemable points (real money, as vouchers).
- Competitions → Team competition, personal competition (leader boards)

6. Final Thoughts

6.1. Comparisons

Comparing the findings with those of other studies confirms that gamification can act as a tool to behavioural change towards eco-consciousness. Previous gamified apps *(see chapter 2.3.3)* reported excellent user engagement, energy sustainability, healthier and greener lifestyle. Comparing functionalities and objectives, BinGo makes recycling playful like WeSpire, uses entertaining AR games like Pokémon Go and promotes healthy

competition and socialization like TwoGo. BinGo attempts to unify many distinct aspects found on other apps, as a sole product - solution.

6.2. The Future

The gaming industry must tackle climate change by including environmentally friendly content in their games to "build" better people. They can do that by creating more gamified apps like "Pokémon Go" that promotes a healthy lifestyle, reduces emissions from unnecessary transportation, and gives players real-life 'Plus One (+1)' experience points to grow. Furthermore, this must be done on a global scale, and it must be something that everyone can have access to. To scale impact, the games must be mass media (Stokes, 2018).

To achieve mass media, everything needs to start local, from schools, towns, boroughs, countries, and the world (Stokes, 2018). To motivate people to engage with your game, there must be rewards, even better if they improve your real-life (TEDx Talks, 2013). Additionally, games must add collaboration. Collaboration is a unique way of working together. It is not just about achieving a goal or joining forces; it is about creating something that would be impossible to create alone (McGonigal, 2011).

That is exactly what the environment needs, a collaborative mass action to save it. Games are not leading us to the downfall of human civilization. They are leading us to its reinvention. The great challenge for us today is to integrate games more closely into our everyday lives and harness the power of games for real change, then a better reality is likely (McGonigal, 2011).

7. Conclusion

This study lays the groundwork for future research into the impact that gamification has on players' mentality and his choices towards the environment and the production of an app like BinGo. This study's scope was limited in terms of mass-producing BinGo and monitoring or concluding whether it helped the environment or not. As seen in the literature review above, a simplistic app with definite objectives like "Pokémon Go" or "My Clean City" can positively affect players and the environment in the same manner.

In the end, there will always be the need of conquering the "Fiero" so let a worldwide cooperative gaming action fight and stop the climate change. Let gamification create more SEHIs and build a society where climate change will be taught in history classes.

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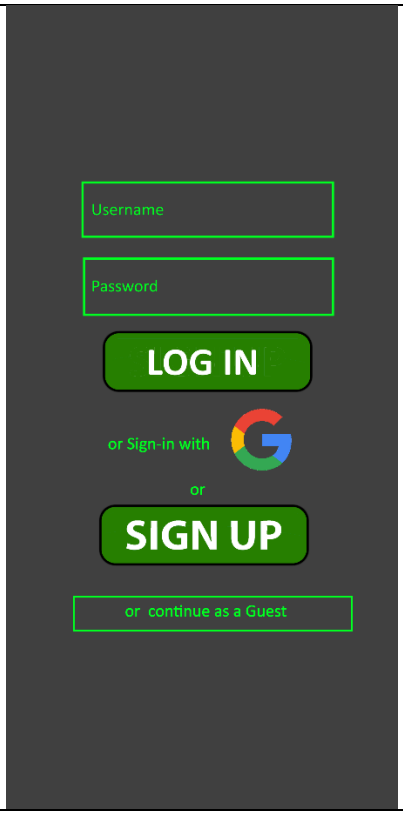
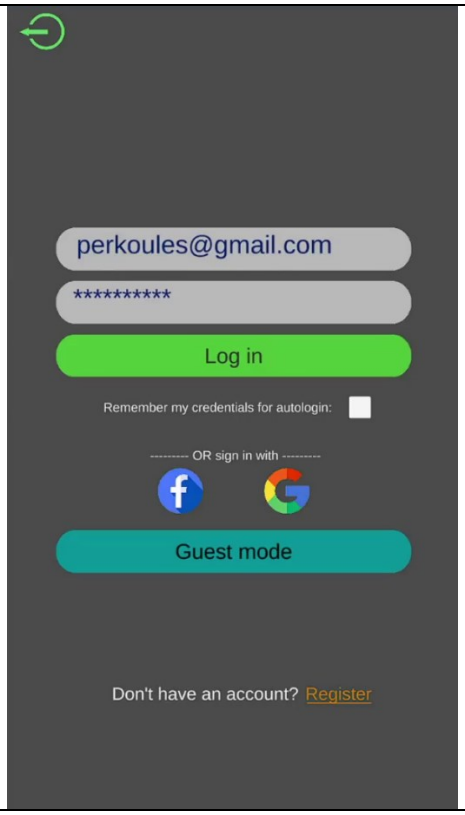
9. Appendices

9.1. App outlook iterations (InVision Design to Production)





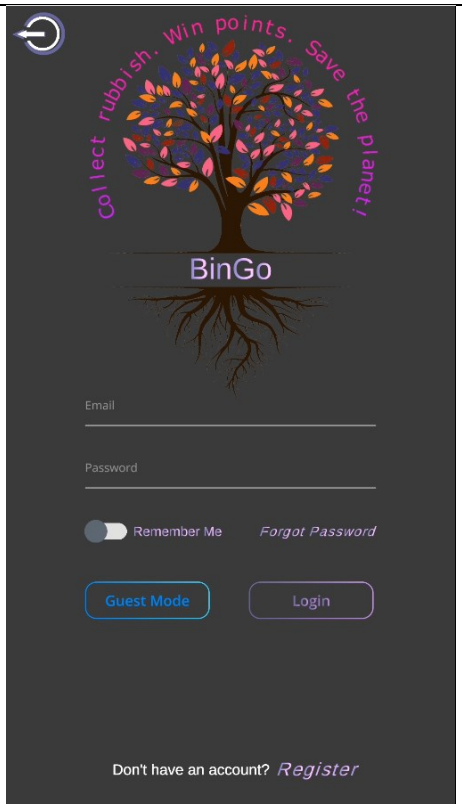
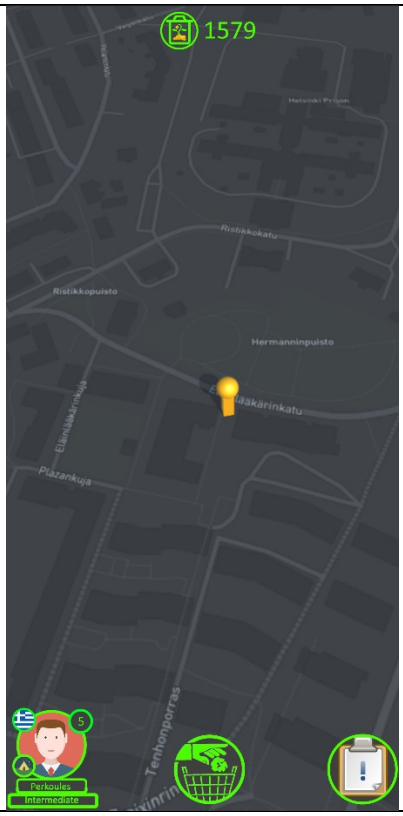
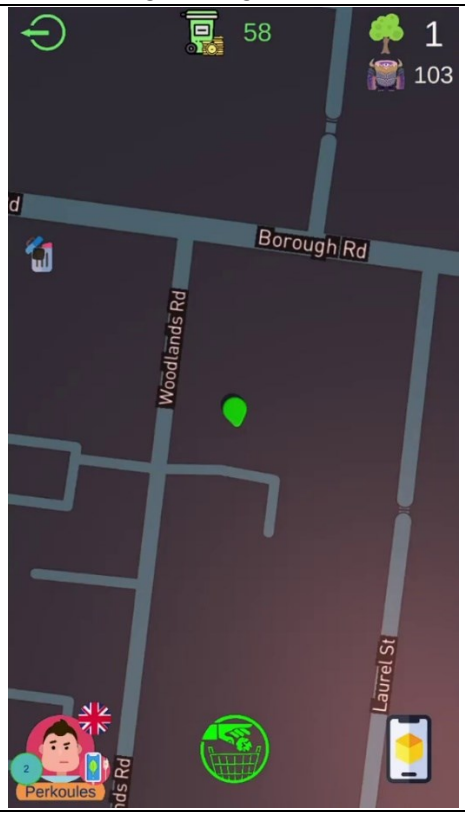


Figure 1: Login window





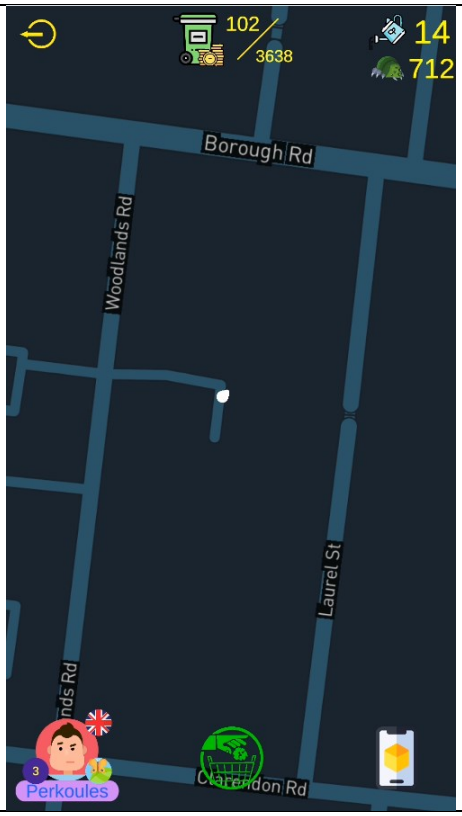


Figure 2: Main game window

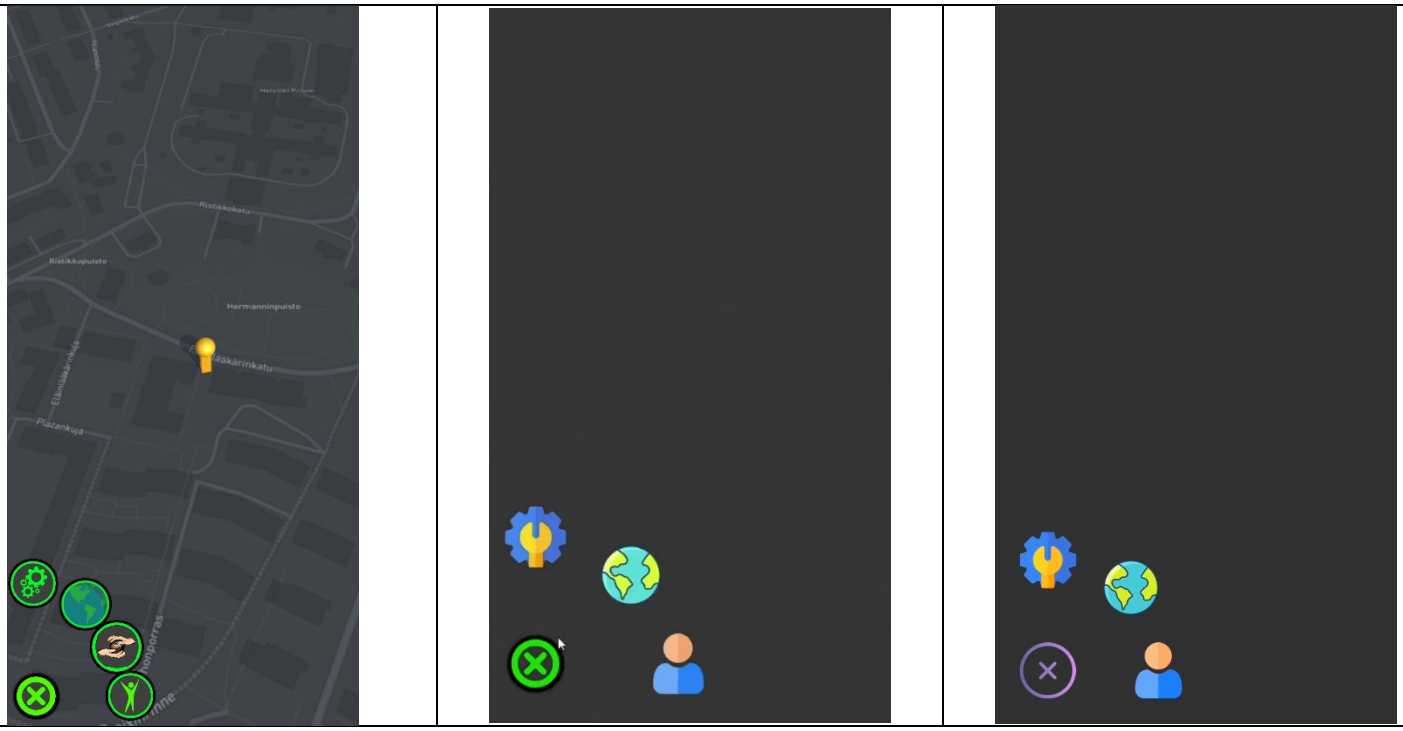


Figure 3: Pre-Menu

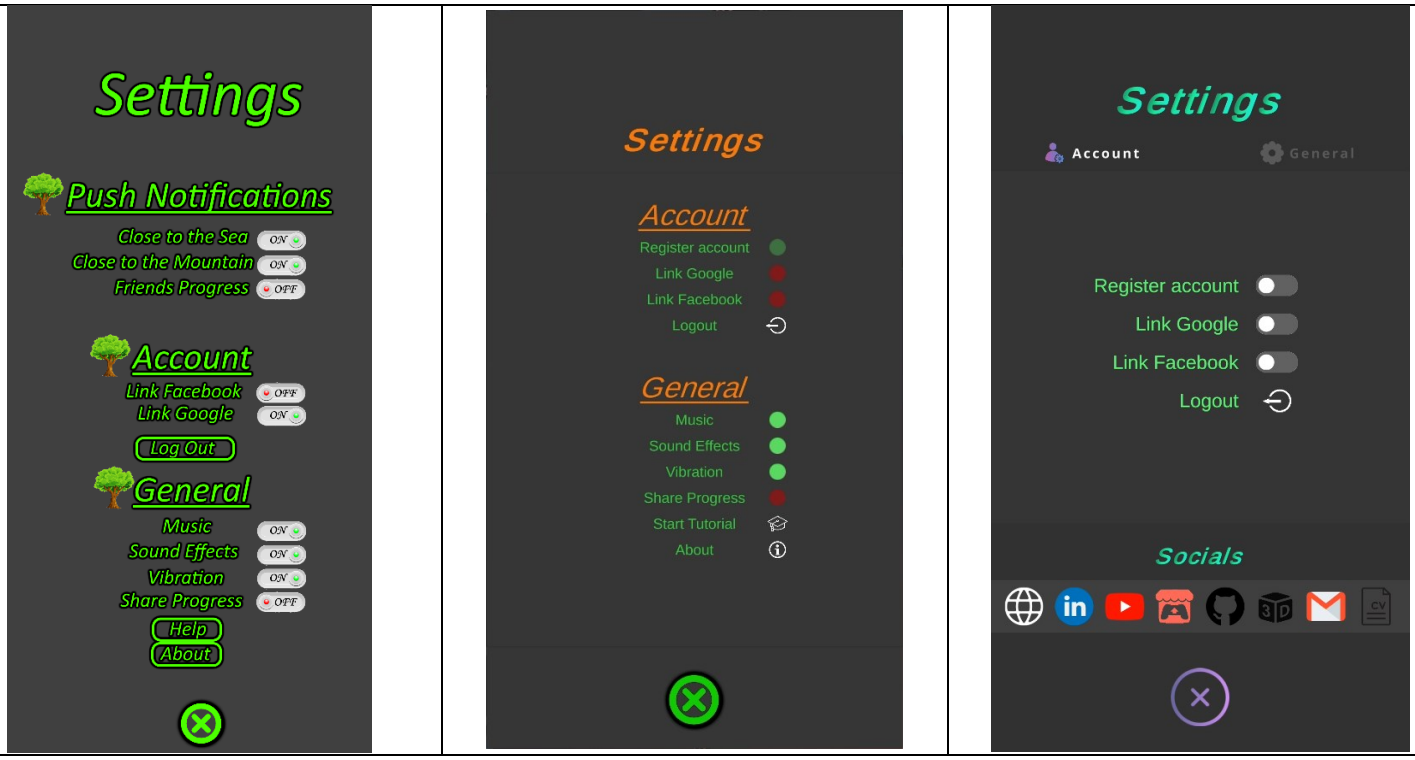


Figure 4: Settings window

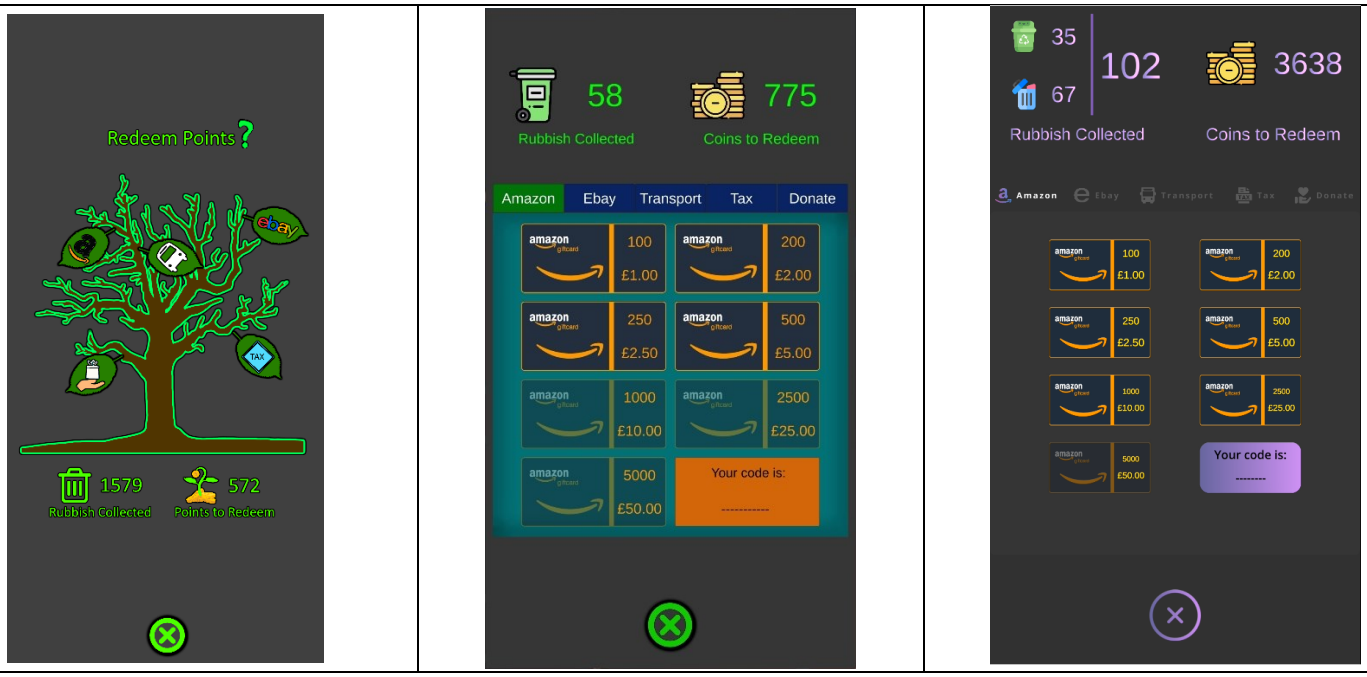


Figure 5: Coins Window (Redeem points)

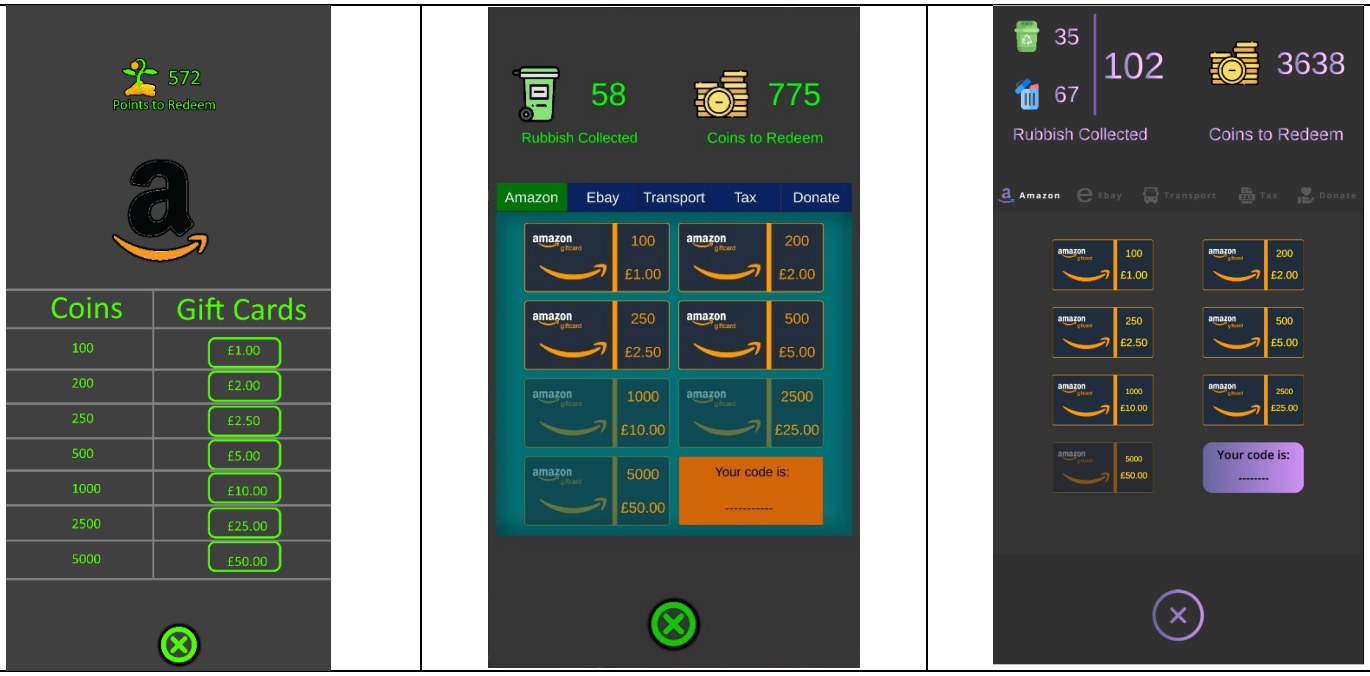
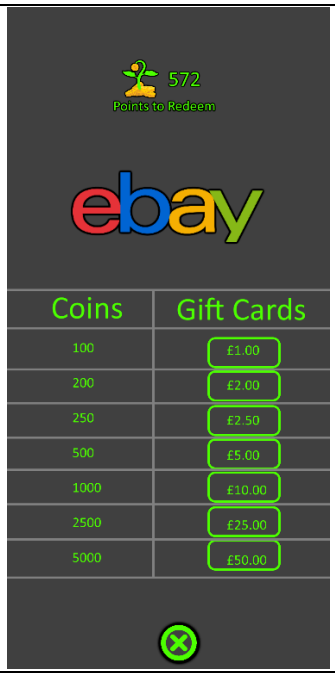
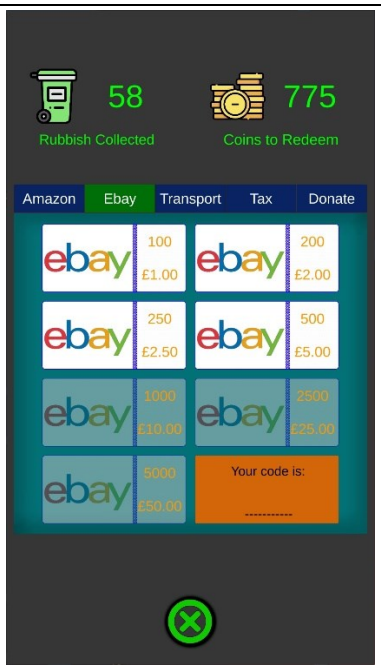


Figure 6: Amazon redeem window





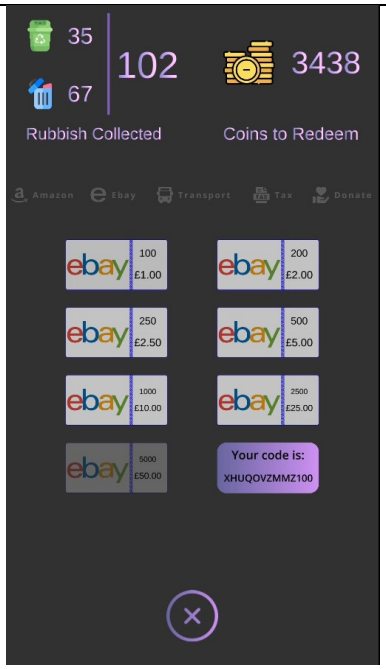
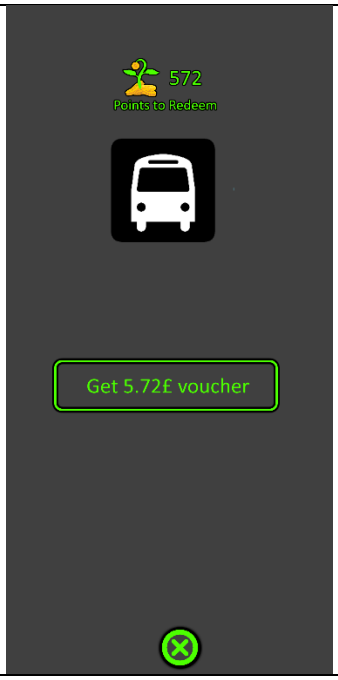
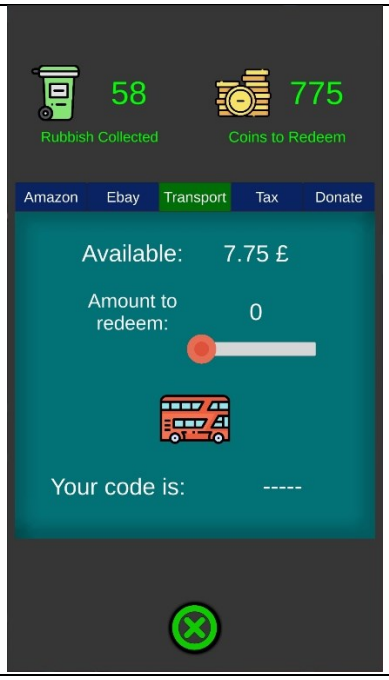


Figure 7: eBay redeem window





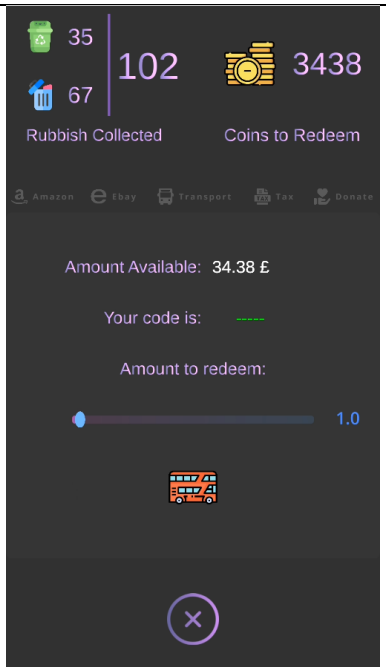
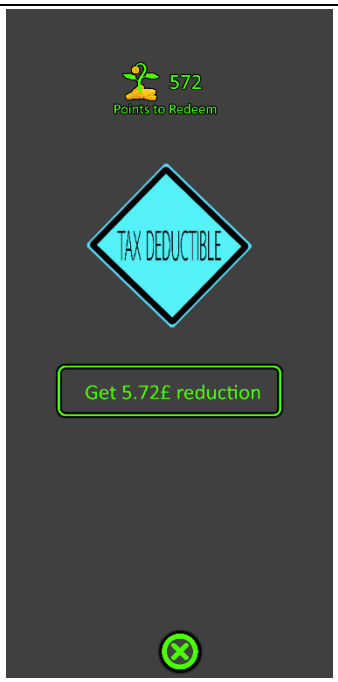
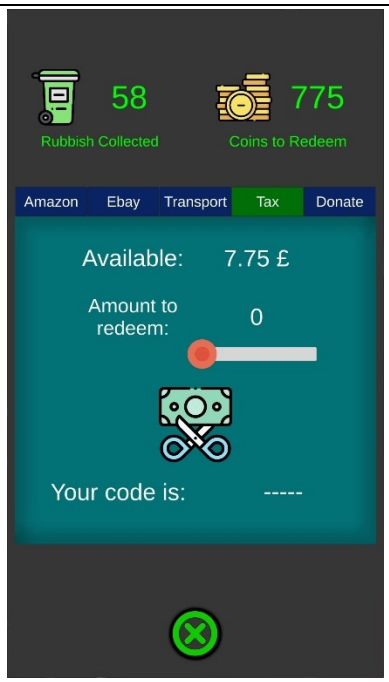


Figure 8: Transport redeem reduction window





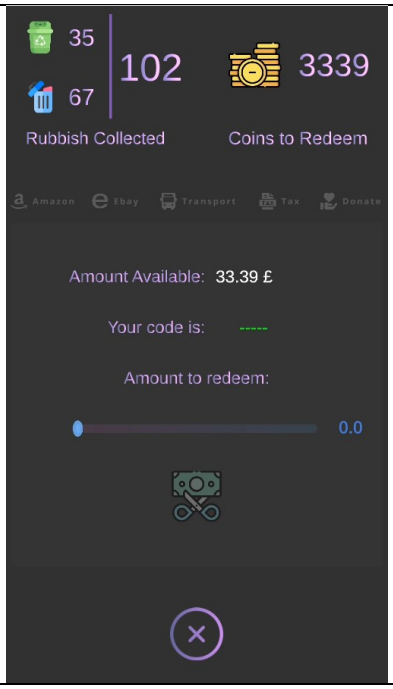
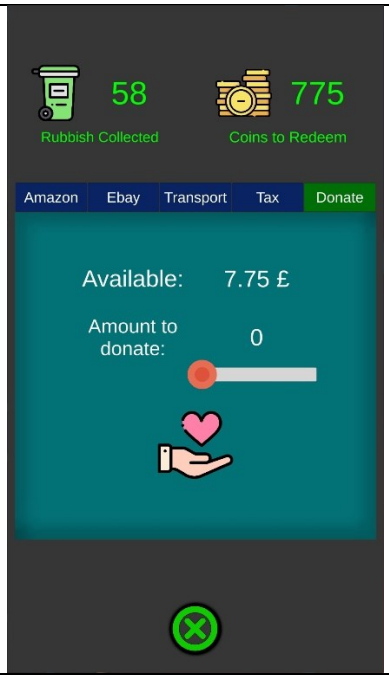


Figure 9: Tax redeem reduction window



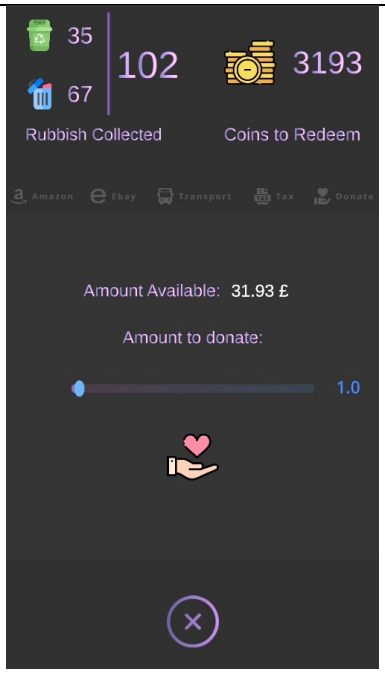


Figure 10: Donate window

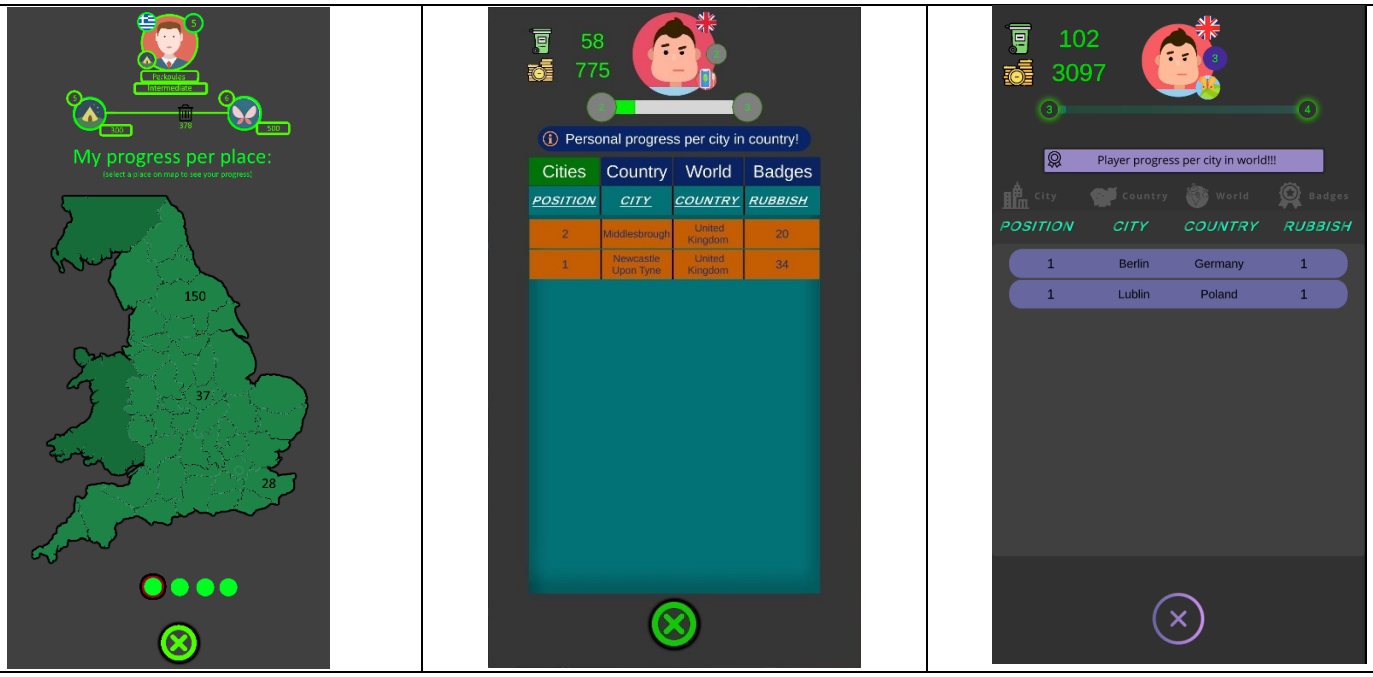


Figure 11: Personal progress per city in country

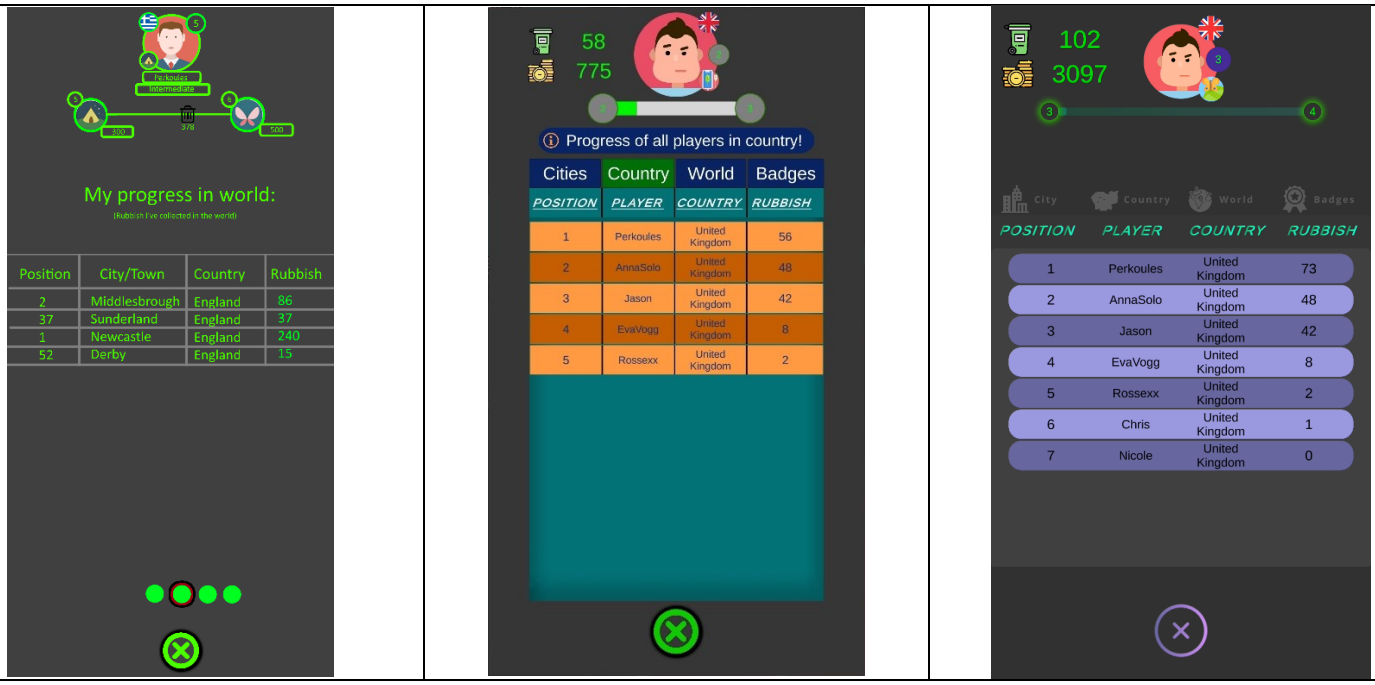
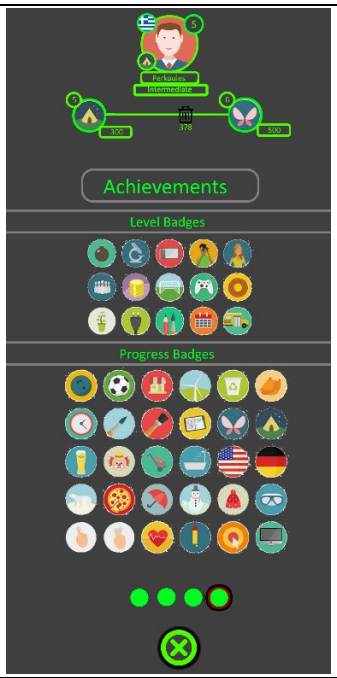
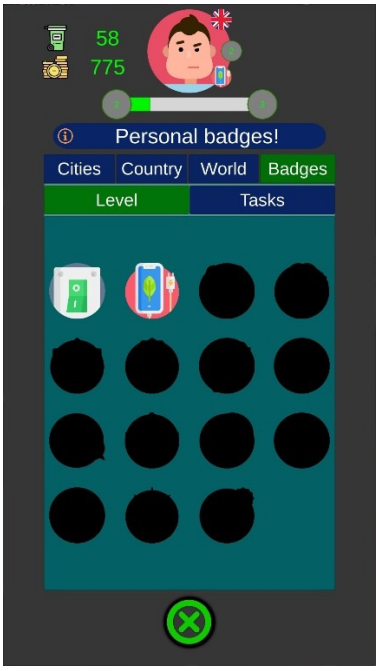


Figure 12: Personal progress of all player sin country

Figure 13: Personal progress in other countries





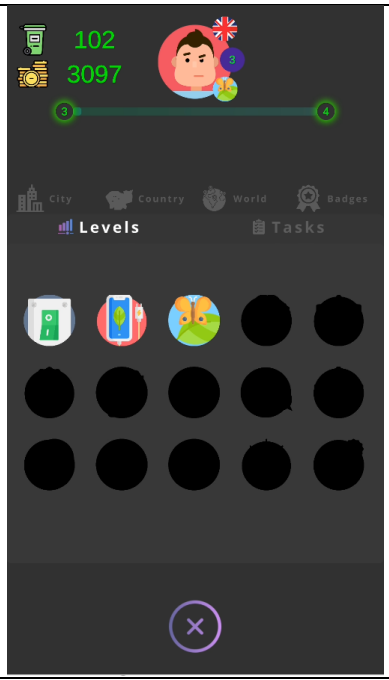
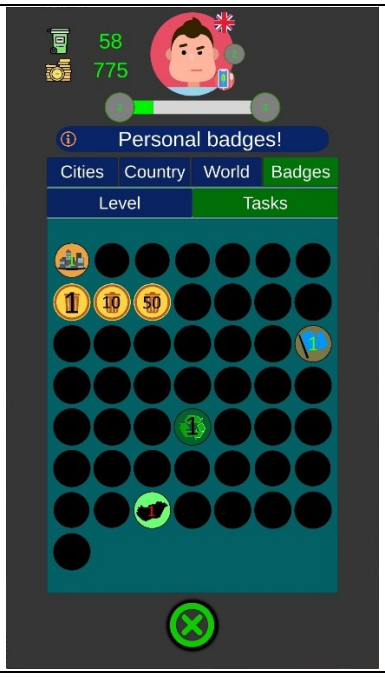


Figure 14: Personal progress badges (level badge)



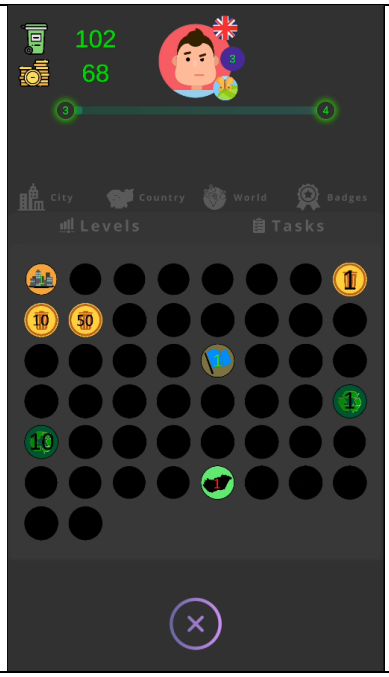


Figure 15: Personal progress badges

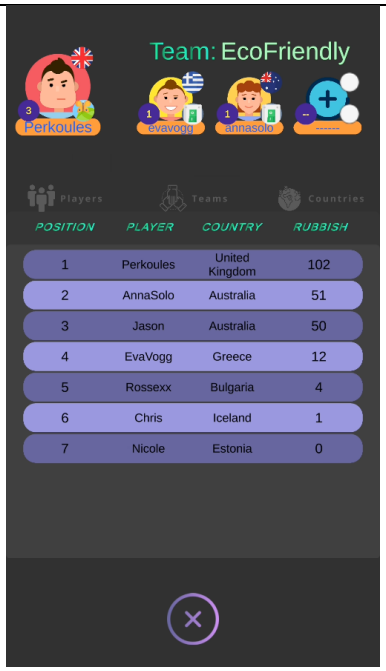
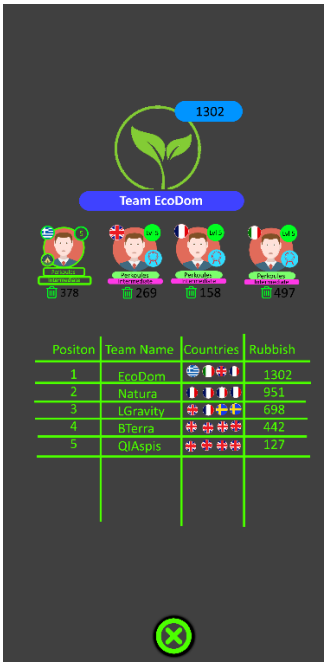


Figure 16: World ranking by player



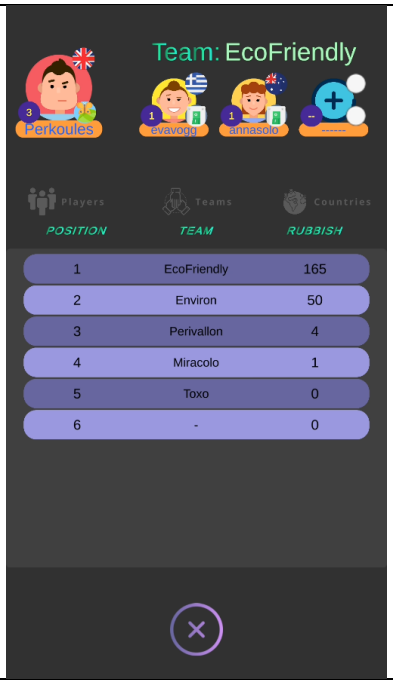
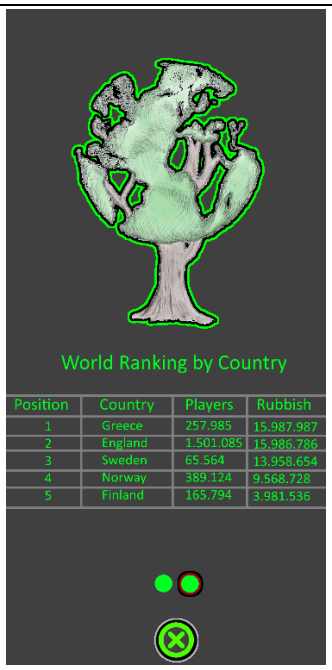


Figure 17: World progress by teams



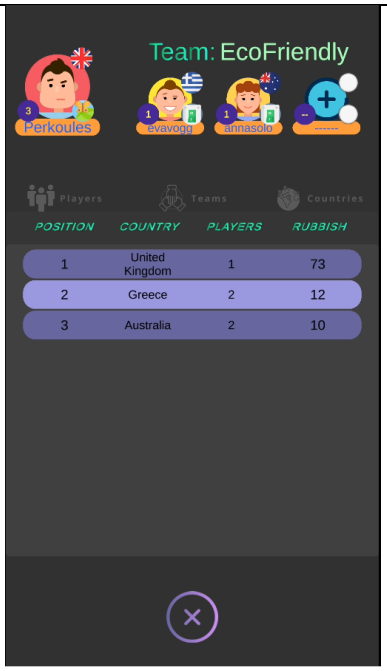
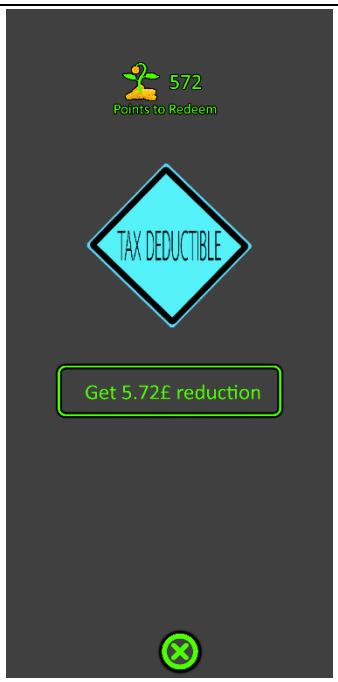
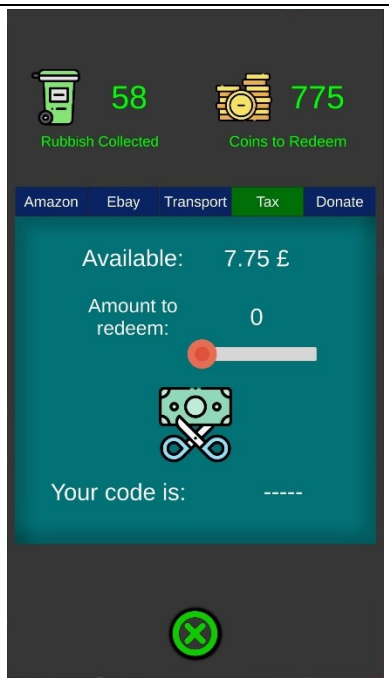


Figure 18: World ranking by countries





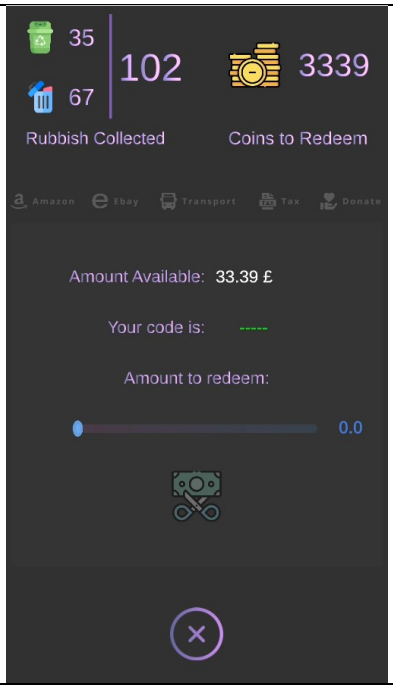
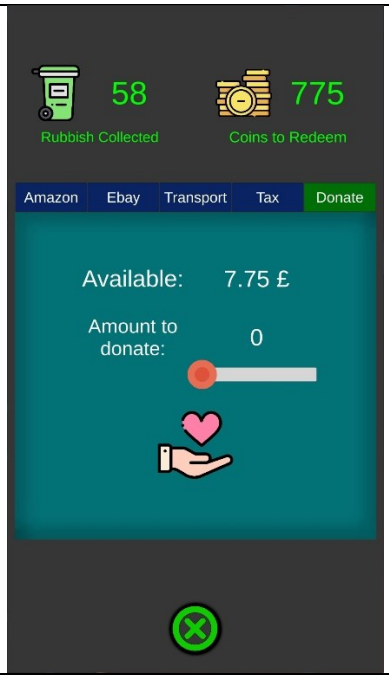


Figure 9: Tax redeem reduction window



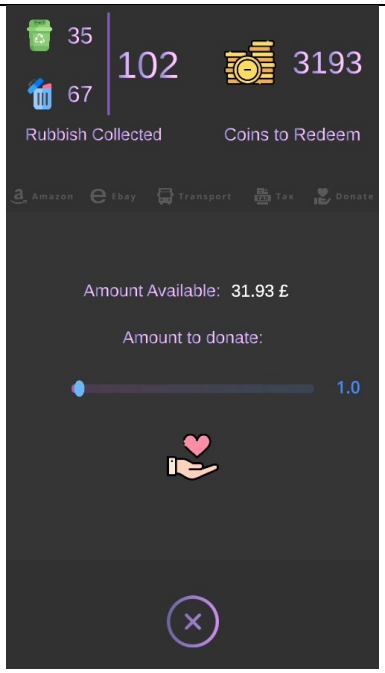


Figure 10: Donate window

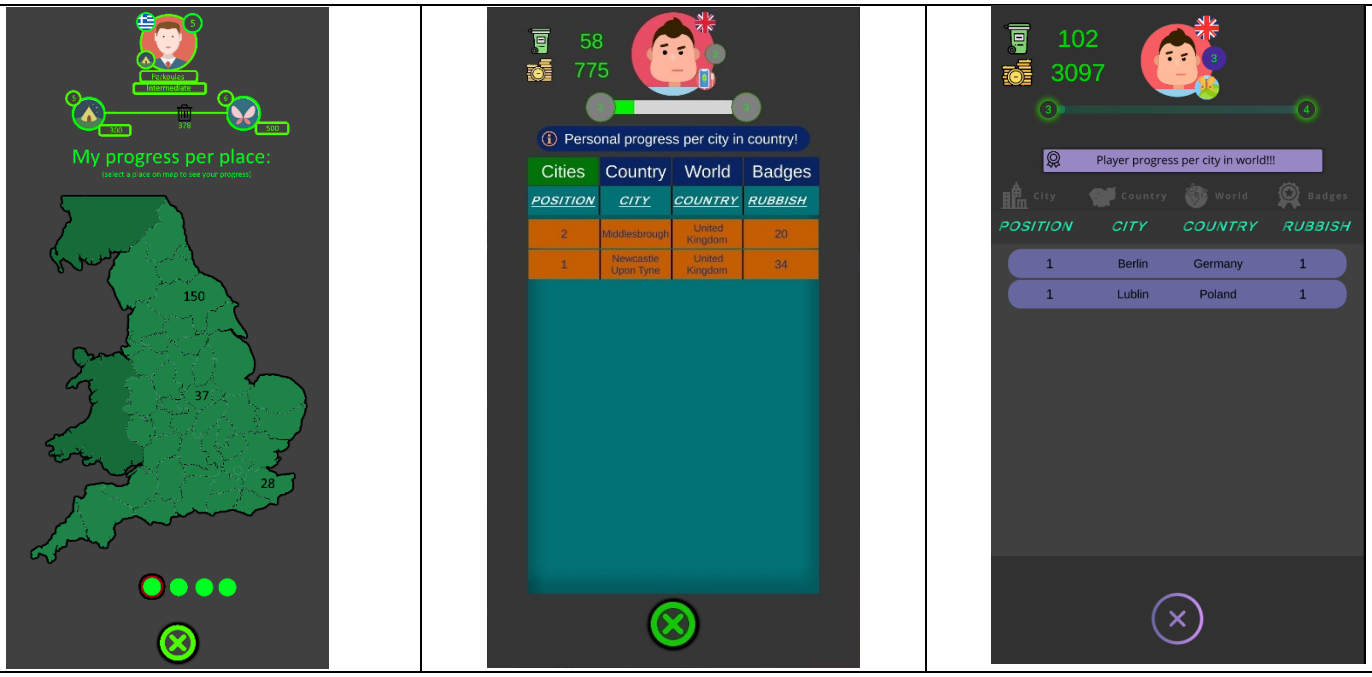


Figure 11: Personal progress per city in country

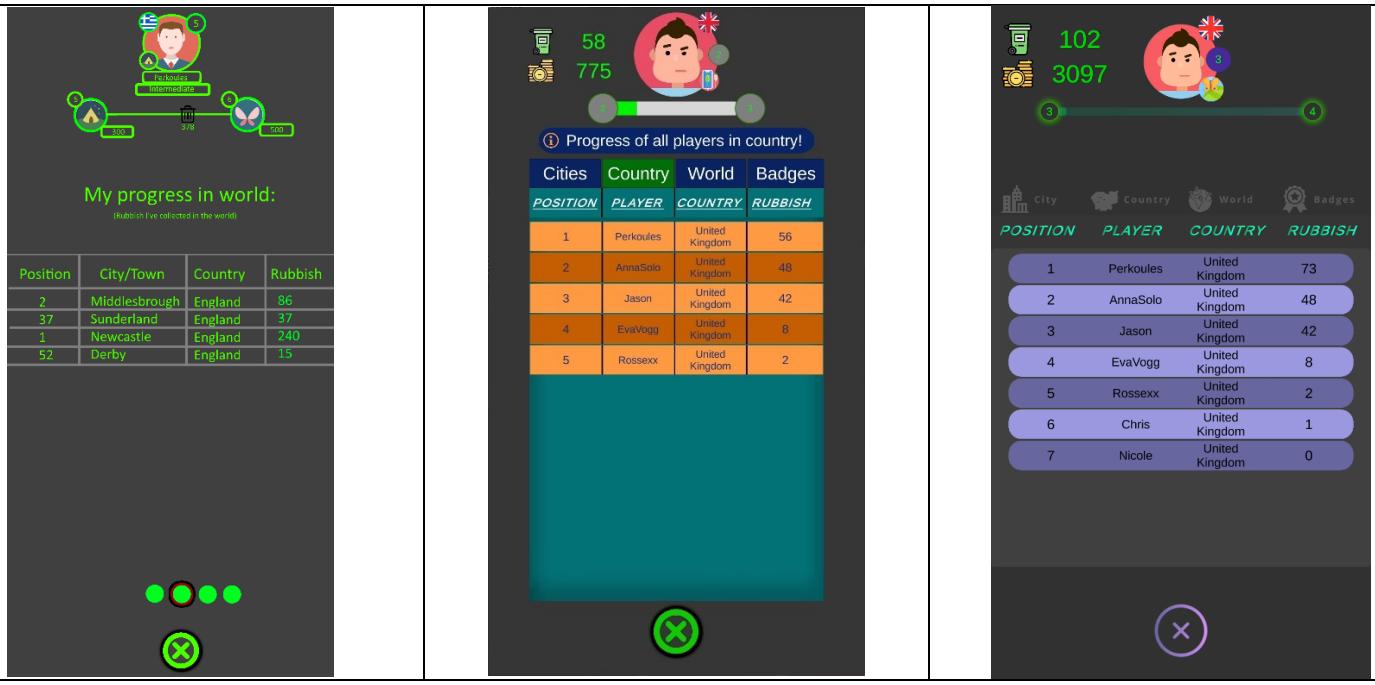
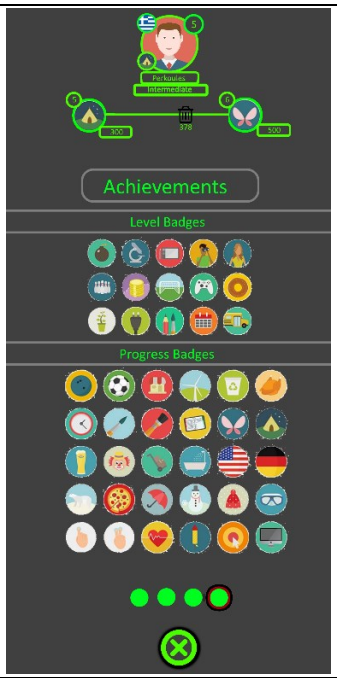
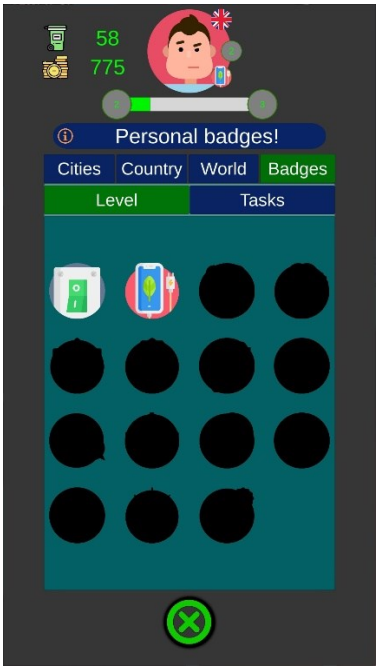


Figure 12: Personal progress of all player sin country

Figure 13: Personal progress in other countries





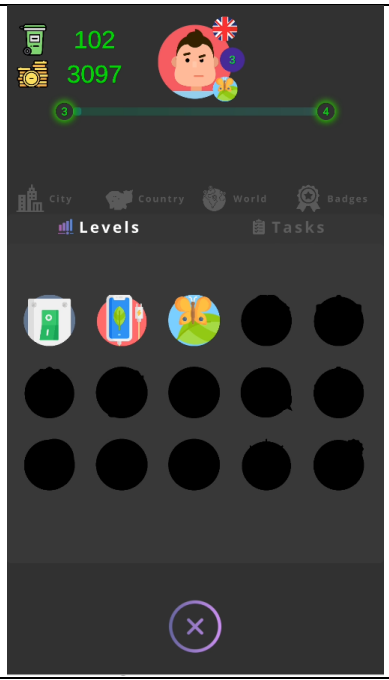
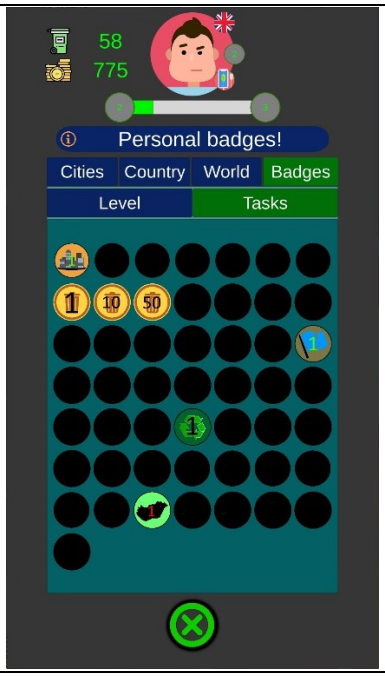


Figure 14: Personal progress badges (level badge)



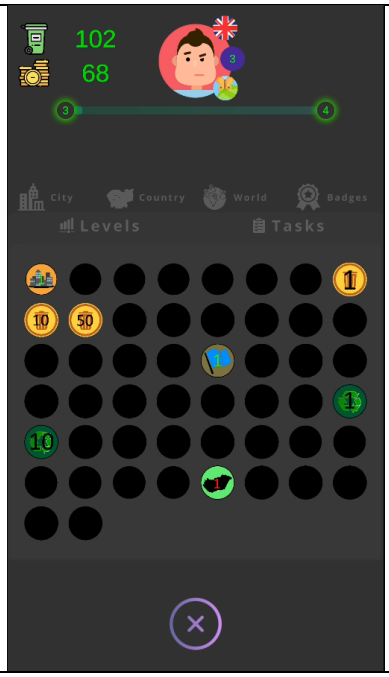


Figure 15: Personal progress badges

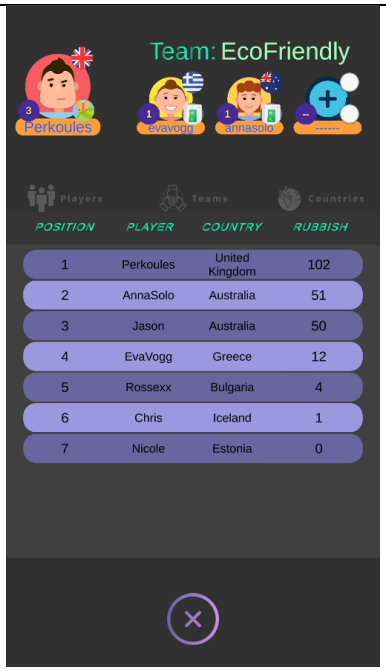
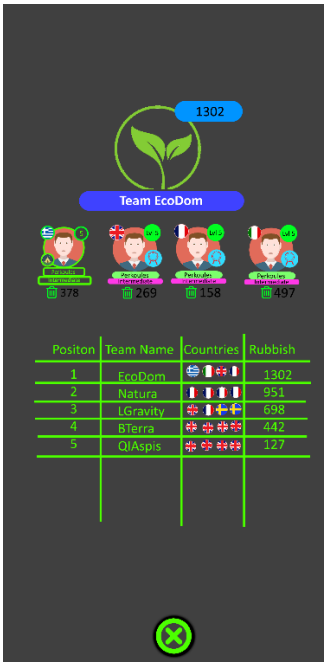


Figure 16: World ranking by player



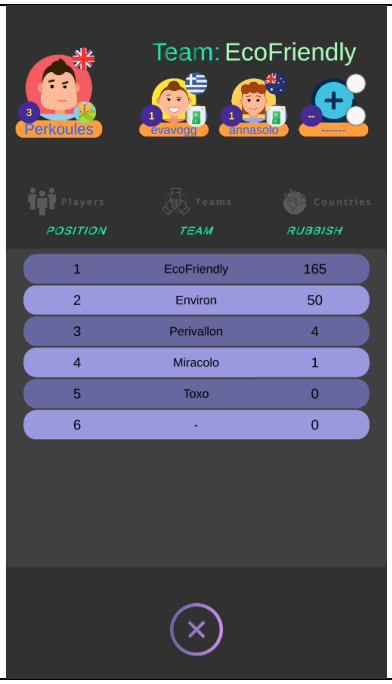
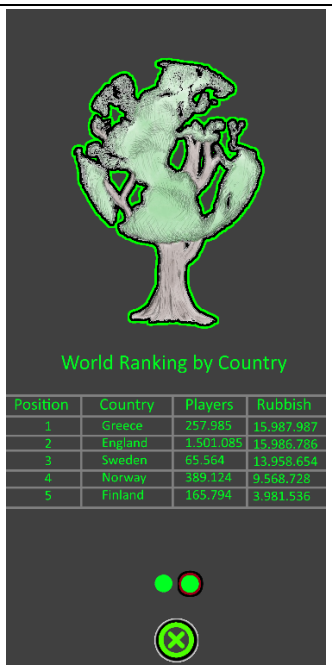


Figure 17: World progress by teams



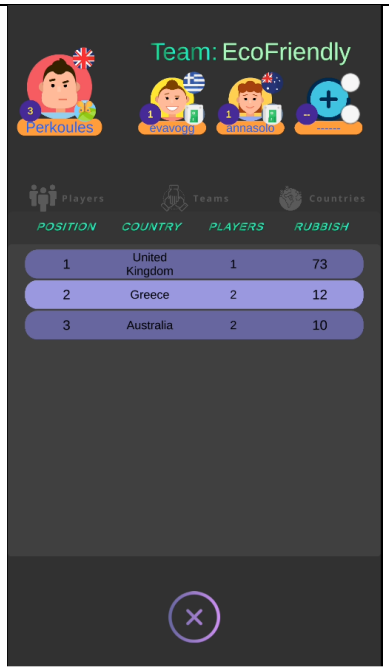


Figure 18: World ranking by countries

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"What you leave behind is not what is engraved in stone monuments, but what is woven into the lives of others." – Pericles