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Gamification design for enhancing user experience of rail travellers

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Xuefei Ni

Supervisor: Mika P. Nieminen, DSc, Aalto University

Thesis advisor: Anne Marlotte Akkerman, MSc, Eurail

Critical observer: Mariët Theune, DSc, University of Twente

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Author Xuefei Ni

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Abstract

Gamification is to add game-like elements, such as points and levels, into the non-gaming context to enhance the user's engagement and motivation. It is a trending topic in the tourism industry. This thesis adds the gamification design to the Rail Planner app of Eurail to enhance the rail travellers' user experience. Concrete outputs are initial UX research, gamification app design and usability testing results. The gamification design for the app was created based on the user research results and it can be divided into three parts, including 'record the journey', 'interactive quiz for learning language and culture of the travelling destination' and 'reward system'. A usability test was conducted to find out the design problems and users' attitude towards the gamification design. According to the test results, gamification design can enhance users' engagement and motivate them to collect points and level-up to unlock more benefits, if the rules of the gamification are easy to understand and benefits are attractive enough. The thesis provides an example for adding gamification design to the non-game app to enhance the rail travellers' engagement.

Keywords Gamification, Rail travel, UX/UI design

Table of content

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Abbreviations and definitions

User groups of Eurail
Eurail has three different kinds of users divided by age group. They are Youth, Adult and Senior users.

Youths: Users between 12 and 27 years old.
Adults: Users from 28 to 59 years old.
Seniors: Users equal to and above 60 years old.

Product of Eurail
The rail pass is the main product of Eurail, it permits users to travel through 33 countries on the railroads and several shipping lines. The rail passes are divided into the Interrail pass and Eurail pass.

Interrail pass: Interrail pass is for customers who reside in Europe.
Eurail pass: Eurail pass is for customers who reside out of Europe.
Rail planner app: it is the official app of Eurail. Users plan their trip, look up train times offline to match their plans, book seat reservations, get discounts and discuss with other users in the Eurail community in the app.

UX design abbreviations
MVP = Minimum viable product
HMW method= How Might We method

1. Introduction

1.1 Background

Nowadays, more and more people start to choose trains as their travelling transport method to decrease carbon emission and protect the environment (Loo & Comtois, 2015). The other benefits provided by trains, such as a more comfortable environment, safer journey and less traffic congestion, are also reasons for people's choices (Oliveira et al., 2019). With the increasing interest towards rail travel, it is necessary to enhance user experience to attract more users and help them enjoy the journey.

Gamification, which adds gaming elements, such as points and levels, to the non-game context as incentives to enhance the user engagement, (Deterding, Dixon, Khaled, & Nacke, 2011), is one of the methods to bring users fun and engaging travelling experiences. It is widely used to increase customers' participation and it is also a useful way to improve customer loyalty and brand awareness (Xu, Weber & Buhalis, 2013).

As a new approach to create dynamic interactions, gamification has become a trend topic for enhancing users' entertainment and engagement (Xu et al., 2016). It has already affected the tourism industry and a large number of travel companies, such as TrainPal and Trip.com, have already started to gamify their existing products and services. Hence, gamification is potential and suitable to improve the user experience and contribute to the higher satisfaction of rail travel.

This thesis will focus on researching how to use gamification methods to enhance rail travel experience. It will also explore how to use gamification elements and gaming thinking methods to make users more engaged and interactive. The main outcomes of this thesis are the initial UX research, gamification app design and usability testing results .

1.2 Introduction to the case company

This thesis is written in cooperation with the Eurail company and the research is built on the company's products and services. The UX & UI design of the prototype will follow the case company's design system and gamified elements will be added to the existing application of the company.

The case company, Eurail (Eurail, 2022), is a rail travelling company, which helps worldwide travellers experience borderless train travel among 33 countries. The main products of it are the train travel passes, including the eurail pass and the interrail pass. The Eurail pass is for customers who reside out of Europe and the Interrail pass is for those who live inside Europe. Eurail has also divided their customer group into three age segments, which are Youth, Adult and Senior users. Youths are those aged between 12 and 27 years old. Adults are people who are from 28 to 59 years old. Seniors are those who aged equal to and above 60 years old. Travellers from all ages can use the all-in-one passes to travel around Europe through the network of trains and ferry connections. The passes serve as a bridge of cultural exchange and enable travellers to explore the new destinations to challenge themselves.

Eurail has a Rail Planner app (see Figure 1) and official website to serve their users during their entire journeys. Users can plan their trips, look up train times offline to match their plans, book seat reservations, get discounts and discuss with other users in the Eurail community both in the app and website. They can buy the rail travel passes and also get inspiration from travel articles in the official website.

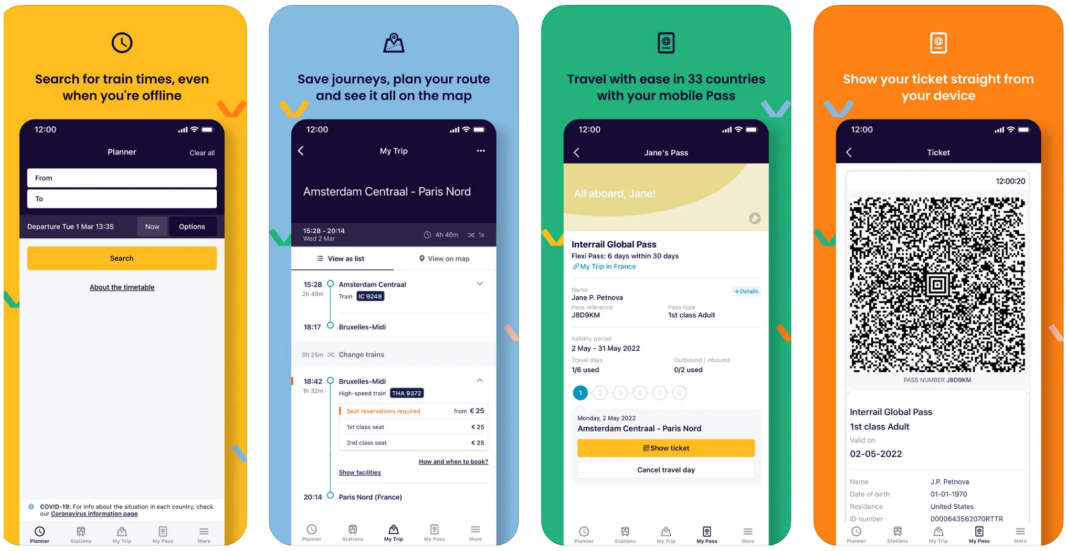

Figure 1. Eurail Rail Planner app

1.3 Research Question

This thesis aims to help rail travellers improve their travelling experience through gamification to make them feel more engaged, enjoyable and interactive. Therefore, the primary research question is: **how to use gamification methods to enhance the user experience of rail travelling to make it more engaging and interactive**?

To answer the research question, four sub questions were proposed:

- Q1: What are rail travellers' needs and pain points during the trips ?
- Q2: What gamification elements can be used to enhance user experience ?
- Q3: How to conduct gamification design in the rail planner app ?
- Q4: To what extent does gamification design enhance rail travellers' engagement and interaction?

1.4 Structure of the thesis

The thesis is divided into eight main parts: introduction, literature review, process & methodology, user research, gamification design, evaluation, discussion and conclusion.

- The introduction chapter introduces the background, motivation, case company and the research questions of the thesis.
- The literature review part provides the summary and critical evaluation of the gamification theory. It also summarises the Double Diamond model.
- The design process & methodology chapter describes the research process and methods, including survey, interview, persona, user journey map, prototype and final usability test.
- The user research chapter illustrates the data collection and result analysis of the survey and interview. It also shows the personas and a user journey map as the foundation of later design.
- The gamification design chapter shows the details of the design results, including UX & UI design and prototype.
- The evaluation part describes the process and results of the usability evaluation.

- The discussion section discusses the summary of key findings, limitations and possible future directions.
- The conclusion chapter makes the final summary of the thesis.

2. Literature Review

2.1 What is gamification

Games are interactive activities which are designed for entertainment. Game provides specific goals, clear rules to set what is possible and what is not, and it also has a logical structure (Tekinbas, & Zimmerman, 2003). The consequence of the games is quantifiable and there is always a clear outcome for players' behaviour. In a game, players try their best to win and put efforts to influence the results of the games (Juul, 2010).

Gamification is a technique to add gaming elements (e.g. points, levels, reward and rules) and activities (e.g. competition and challenges) to the non-gaming context of the product or service to improve users' motivation and engagement (Deterding et al., 2011; Hamari et al., 2014; Marczewski, 2013). It uses gaming mechanics and game-based aesthetics to influence people's actions. The term gamification first appeared in 2008 and it has been widely used both in the industry and academic field since the end of 2014 (Deterding et al., 2011).

Gamification has become a trending topic for customer engagement and it has been widely used to increase users' intrinsic motivations and enhance their productivity of actions (Deterding, 2012). A large number of companies have added the gamified elements to their existing services. Education, exercise and training are the most common contexts to be gamified. For example, Duolingo is a typical app with gamification design in the learning field. It gamifies the language learning process and adds gamification elements, such as levels and leaderboard, to enhance the learning experience.

The concept of gamification originates from the game, but there are still some differences between them (Brigham, 2015). Game and gamification have different aims and settings. The main goal for gamification is to drive motivation and engagement, while most games are just for pure entertainment. Unlike typical games that have complex systems and a complete storyline, gamification usually does not provide complex rules and it only has a few missions to complete (Brigham, 2015).

2.2 How gamification works

From the research, intrinsic motivation arises when people do something for pleasure, exploration and learning instead of having external rewards (Deci, Olafsen, & Ryan, 2017). Invoking intrinsic motivation is an important point to form habits and long-term engagement. Hence, it is necessary to understand the trigger of keeping and enhancing intrinsic motivation (Deci & Ryan, 2012). Self-determination theory studies what invokes humans' intrinsic motivation. In this section, the self-determination theory will be explored to find out how gamification triggers intrinsic motivation.

2.2.1 Self-determination theory

The self-determination theory was proposed by Richard M. Ryan and Edward L. Deci. It illustrates that humans have three psychological needs, which are the needs for autonomy, competence and social relatedness, to trigger and enhance intrinsic motivation (Deci & Ryan, 2012). Gamification can satisfy these three intrinsic needs of the self-determination theory to increase the intrinsic motivation to form the behaviour loop.

Autonomy

For autonomy, gamification gives users freedom to make choices to fulfil their personal interests. Users are self-determined for their behaviours, instead of being controlled by the gamified system (Deci & Ryan, 2012). They are free to choose various paths to upgrade their levels, edit their avatars to show their unique personality and have the ability to decide when to stop using the app. When users are less controlled by the system, they will have more autonomy to get more intrinsic motivation.

Competence

Competence makes users feel confident to realise the goals and master the gamified system (Deci & Ryan, 2012). Specifically, the goal in gamification will be separated into a series of small goals to make users feel that they have the ability to achieve them. Users can get positive feedback from the system to push them to learn new things through completing different tasks and challenges.

Relatedness

The relatedness of gamification is from the connection between the gamified system and social networking, which makes users feel they belong to social groups (Deci & Ryan, 2012). For example, users can share their

accomplishments, such as badges and levels, on social media to interact with their friends. Users can also compete with each other through the social leaderboard to get achievements in a friendly competitive environment. Therefore, it is important to build up the social connections between users to support their psychological needs.

In conclusion, successful gamification can be a powerful motivator for the behaviour changes and it can lead to the repetition of desired outcomes (Skinner, 1938). Good gamification design can provide users autonomy (e.g. freedom to make choices), competence (e.g. specific goals and immediate positive feedback) and relatedness (e.g. team-based interaction) to help users form habits (Eckleberry-Hunt & Tucciarone, 2011). With the consistent reinforcement of the behaviour, it will need less and less cognitive resources to reproduce the desired behaviour in the end (Duhigg, 2012).

2.3 Gamification principles

After reviewing how gamification works, gamification principles, the MDE framework (see Figure 2), is introduced to explore how to conduct gamification design into practice. The MDE framework, introduced by Robson et al. (2015), proposes that there are three principles to influence the gamification experience, which are mechanics, dynamics and emotions.

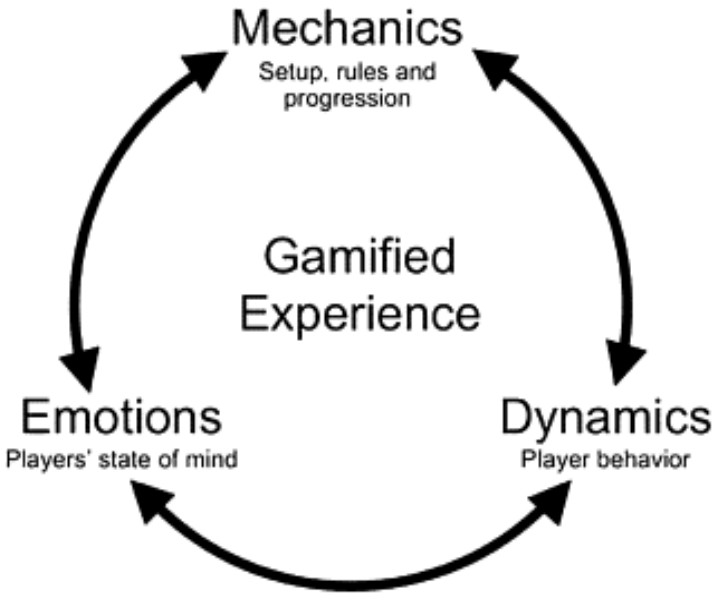

Figure 2: The MDE framework (Robson et al., 2015)

2.3.1 Mechanics

Gamification mechanics is the behaviour and controls in the gamified system, which is recognized as the foundation of gamification design (Hervás, Ruiz-Carrasco, Mondéjar, & Bravo, 2017). It contains game-related rules and elements, such as points, levels and progress. It can lead users to the next achievement and guide them to go through the whole process in a more engaged way (Aparicio et al., 2012). Designers can make decisions to set up the mechanics of the gamification to guide players in the gamified system.

Gamification mechanics can be separated into setup, rule and progression mechanics (Robson et al., 2015). To be specific, the set up mechanism is the initial setting of the gamified system, which influences the overall context. For example, setup mechanics can decide who the players are against and what competition types will happen (e.g. solo competition or group competition). The rule mechanics builds up the concept and the target of the gamification. It not only sets the permissible behaviours, but also defines the constraints of the gamified system. The progression mechanics use the progress elements, such as levels and progress bar, to enhance the possibility of repeated actions.

2.3.2 Dynamics

Gamification dynamics are the behaviours in which players react to the mechnicas. It shows the strategic behaviours which players interact with the gamification mechanics (Camerer, 2011; Bui, Veit, & Webster, 2015). For example, group game mechanics will lead to cooperation, while solo game mechanics will result in competition. The dynamics is hard to anticipate in advance, and it may cause positive or negative results (Leblanc, 2004). Hence, it is difficult to know what gamification dynamics will be. The challenge for designers is to predict the possible happening dynamics and design the mechanics to get the desirable experience.

2.3.3 Emotions

Emotions are the feelings and emotional reactions of the players during the playing, which are triggered by the gamification mechanisms and dynamics (Robson et al., 2015; Leblanc, 2004). The emotion evoked by the gamification should be fun and enjoyable. The emotional goal can also be separated into different positive emotion forms, such as excitement,

surprise, discovery and fantasy. The aim for designers is to create a fun-oriented experience to push users to continue playing and using the products.

In conclusion, the MDE framework shows the relationships of mechanics, dynamics and emotions, and how to use these principles to create the desirable experience. Designers should focus on the mechanics to set up the foundation at first, and then on gamification dynamics. At last, they need to think about the emotion to create a fun and enjoyable gamification experience.

2.4 Gamification design elements

Gamification elements are the fundamental blocks of gamification design. The elements can be divided into several categories, including story, tasks, points, levels, badges and leaderboard (Mekler et al., 2013; Seaborn,& Fels, 2015). In order to explore the specific methods of gamification design, these elements are illustrated below in detail.

The **story** can put the learning into an attractive narrative setting and it can have a compelling background, such as an adventure (Giakalaras, 2016). It can help to build up the emotional connection with users, which makes them immersive in role playing and experiencing the storyline.

Tasks and challenges, such as learning quizzes, can help users test their knowledge and keep them feeling active in exploring the whole gamified journey. They can provide practices to make users gain confidence while using the new knowledage. When levelling up, the difficulty of the subsequent tasks is supposed to enhance to make it challenging and attractive for the users (Groh, 2012).

Points, also known as score and xp, are one of the rewards and feedback gamification mechanisms. When executing tasks, users can accumulate points for rewarding their efforts. The points can record the progression through the progress bar to visualise how far it is to the next levels. It is also a way to unlock the rewards and more contents in the platform (Jung, Schneider, & Valacich, 2010).

Levels is the visualisation of the progress to tell users how far they have gone through and where they are now (see Figure 3). It can give the specific goal for users (Zichermann,& Cunningham, 2011). When finishing the tasks to get enough points, the new levels will be unlocked to get more rewards. Users will feel motivated about the level up and can get positive feedback about their skill development (Çeker, & Özdaml, 2017).

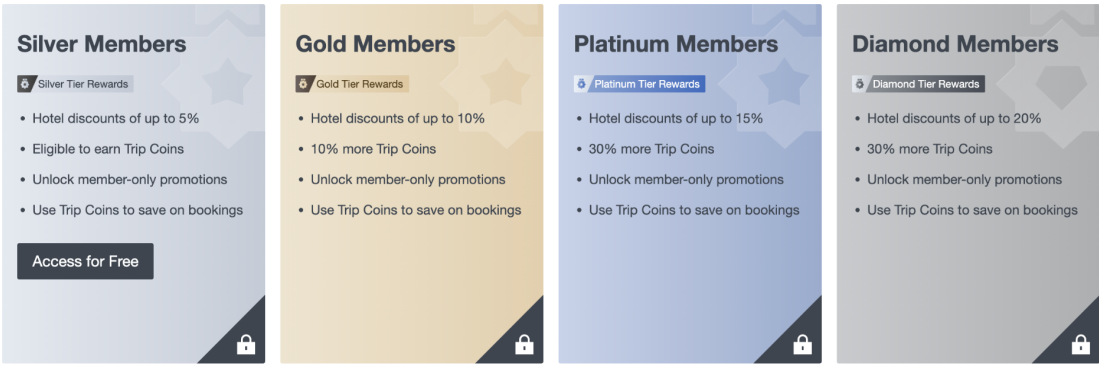

Figure 3: Different Levels and the benefits (Trip.com, 2022)

Badges (see Figure 4) are the symbol of status, which shows users' achievements in their profile. When completing challenges, users will be rewarded with a badge for their accomplishments. The badges design includes the signifying visual elements (e.g. colour and texture) and conditions for getting badges (Hamari,& Eranti, 2011).

Figure 4: Gamification badges of TripAdvisor (TripAdvisor, 2022)

Leaderboard (see Figure 5) is the ranking of users depending on their points and badges, which tells users how they compare to other players. Leaderboard creates a feeling of community to evoke social belonging and competition (Karami & Nickpayam, 2017). It is a useful method to motivate users through competition and it provides a social status element to inspire users performing better to go to the top of the list (Jia, Liu, Yu, & Voida, 2017).

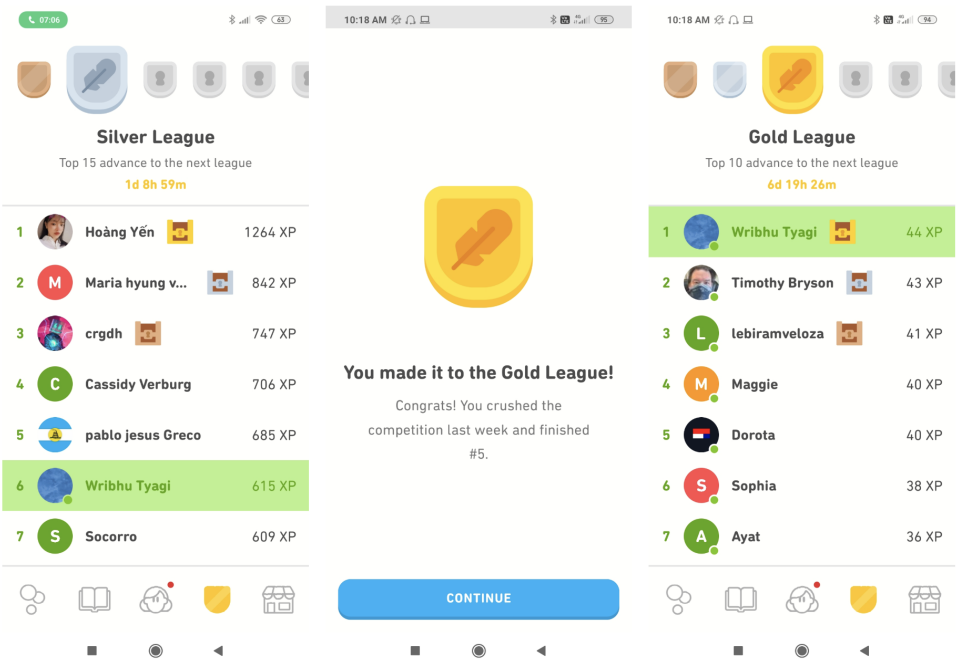

Figure 5: Gamification leaderboard (Duolingo, 2022)

2.5 Gamification in travel industry

As an innovative topic, gamification has become the major trend in the travel industry (WTM, 2013). Gamification can influence people's behaviour and it can attract people to repeatedly use the product to influence people's loyalty and build up the brand bond (Maan, 2015). Moreover, It can help to gain new users through social interaction. When users feel satisfied, they are likely to recommend it to their friends and family, which results in the spreading of the product and enhancing brand awareness. Gamification has possibilities to be applied in different aspects in the tourism context, such as marketing, customer engagement and internal training for tourism employees (Xu, Buhalis & Weber, 2017). There are some classic examples of gamification in the travel industry.

2.5.1 Loyalty program

	Finnair Plus Basic	Finnair Plus Silver	Finnair Plus Gold	Finnair Plus Platinum	Finnair Plus Platinum Lumo
Equivalent oneworld tier status		oneworld Ruby	oneworld Sapphire	oneworld Emerald	oneworld Emerald
Required number of points / flights		30,000 points / 20 flights	80,000 points / 46 flights	150,000 points / 76 flights	450,000 points (at least 350,000 earned from Finnair flights) / 150 oneworld flights (at least 100 flown with Finnair)

Figure 6: Finnair loyalty program (Finnair, 2022)

The loyalty program of airline companies, such as Finnair (see Figure 6) is a common gamification method. It can build up the connection and enhance the interaction between users and the system (Crawford, 2011). The loyalty program lets users collect points by taking airlines and consuming during the journey to redeem the bonus in the end. The progress bar and badges in the app can show the current status of the users and visualise how far they are to get the bonus, which give users specific goals and motivates them to keep taking the airline.

2.5.2 Advergames

Figure 7: Brazil Quest

Advergames are branded games, which uses gamification for branding and marketing (Çeltek, 2010). For example, 'Brazil Quest' (see Figure 7) is designed for marketing promotion for Brazil's tourism. Travellers can learn more about their travelling places through overcoming the obstacles and finishing the challenges, such as taking interactive quizzes. There are three levels in the game and users can go to the next phase, when they collect enough points. It also has the leaderboard to rank the scores of the users to motivate them to keep playing and exploring.

2.5.3 Social-related gamification

Gamification can also help users to interact and connect with others. Users can tag their friends to share the experiences and also meet new friends during the journey. Foursquare (see Figure 8) is an example of gamifying check-in to enhance customer engagement. It is a location data platform and creates location-based social networks. In the app, users can check-in the places they have been to and share their locations in social media. When users check in a new places, they can get points and badges as reward (Frith, 2013)

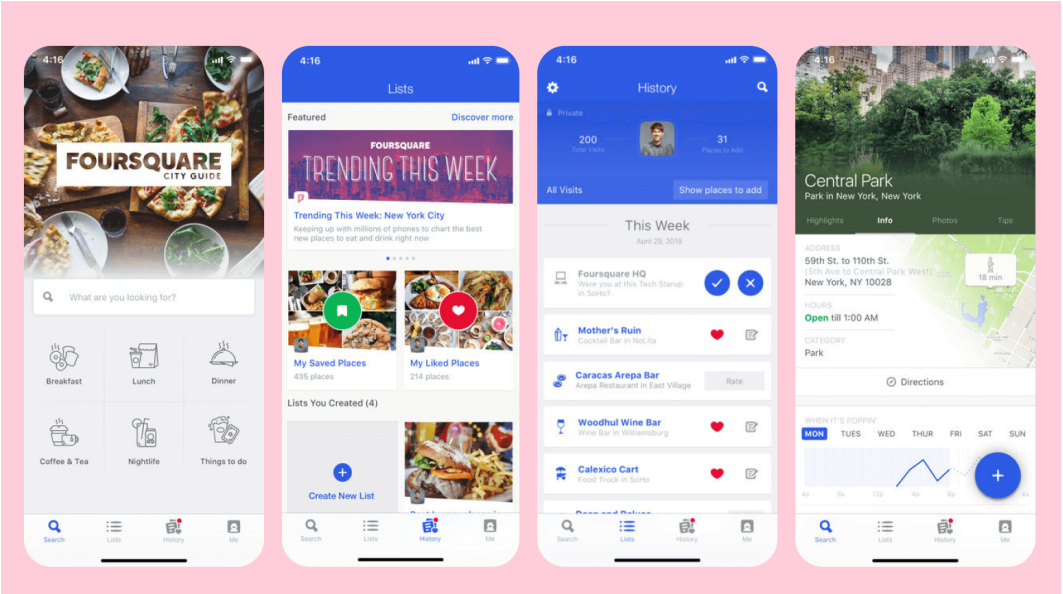

Figure 8: Foursquare App (Foursquare, 2022)

2.6 UX design process: Double Diamond model

The Double Diamond model is a design thinking process made popular by the British Design Council. From Figure 9, it can be seen that the model consists of two diamonds and four phases, which starts from an initial idea and develops into a solution in the end (Design Council, 2019). The first diamond is the research stage for problem definition and the second diamond represents the design session for solution creation. The four phases of the model are Discover, Define, Develop and Deliver, which help designers to organise their design process from initial discovery to the final validation (Design Council, 2019).

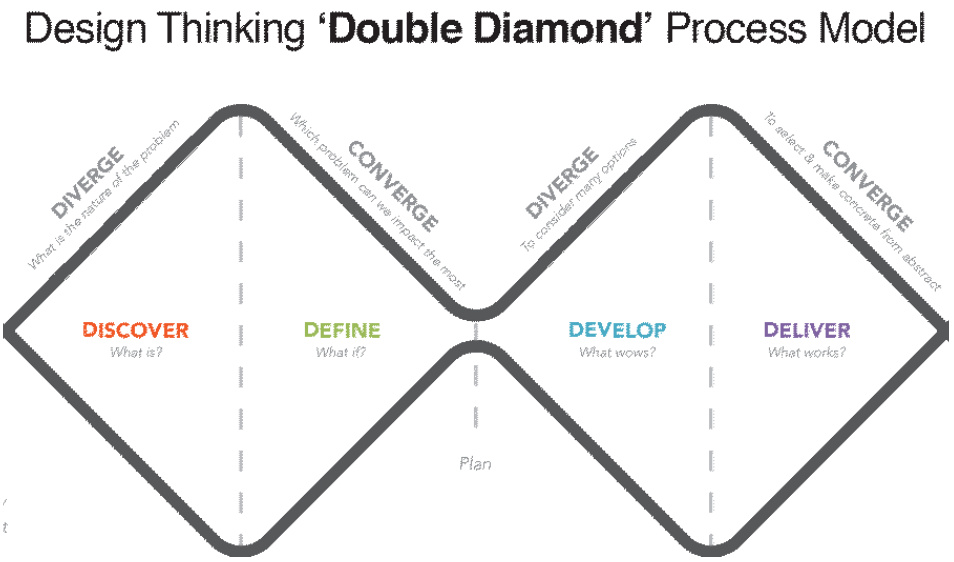

Figure 9: Double Diamond model (Design Council, 2019)

Through using the model, designers can obtain two different thinking modes, which are divergent thinking and convergent thinking. Divergent thinking means thinking broadly and brainstorming everything, while convergent thinking means narrowing the thinking and focusing on one or two specific problems and solutions. In the Double Diamond model, designers start in the discovery phase to diverge their thinking and then converge to narrow their problems. After that, they will go to the second diamond to brainstorm different possible solutions and identify the best solutions for delivery through usability evaluation.

Discovery
In the 'Discovery' phase, designers need to discover the problems and conduct in-depth research to explore users' needs, how users use the product and the current state of the product. Designers often conduct the survey, interview and market research to gather data in this stage.

Define
After collecting the data, it is the time to define the key problems. The 'Define' phase is to filter all the collected data and analyse the evidence to find out the most important problems for users.

Develop
The 'Develop' phase is to explore the potential solutions for the problems. In this stage, the prototype is built based on the research from the 'Discovery' and 'Define' stage.

Deliver
The Deliver phase is to analyse all the potential solutions in the 'Develop' stage and select the most suitable one. In this stage, designers conduct the usability evaluation to test the prototypes and collect the feedback from users to enhance the products. The designs are also iterated to eliminate the design problems and retain the best features.

3. Design process and methodology

3.1 Research and design process

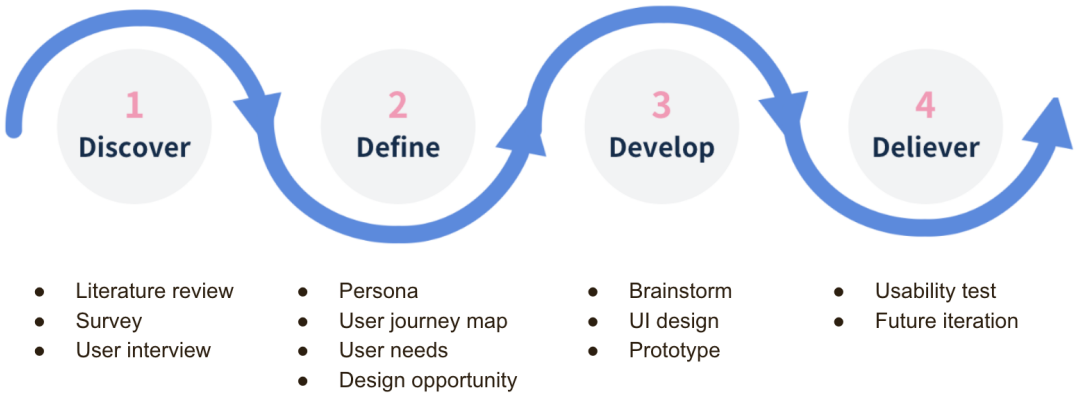

Figure 10: Design process

The research and design process of the thesis research follows the Double Diamond model (see Figure 10), which has four phases: Discover, Define, Develop and Deliver.

In the 'Discovery' stage, the literature review and case study of gamification and rail travel were conducted. Moreover, the research of case companies was also investigated. The outcome of the initial research was used as background information.

During the 'Definition' stage, the survey and interview with target users were conducted to collect users' views and analyse their pain points. What is more, target users' persona and user journey maps were created as the foundation of the later design.

In the 'Develop' stage, the gamification design and prototype were created based on the outcomes of the user needs and design opportunities.

In the 'Delivery' stage, the usability tests were conducted. Specifically, some tasks were given to the testing participants for collecting data, such as design problems and attitudes towards gamification.

3.2 Methodology

With the aim of exploring users' needs and evaluating the user experience of design results, mixed methods study have been conducted.

3.2.1 Surveys & interviews

In order to understand users' thoughts, a survey and interviews were conducted.

Survey is a research method conducted for gathering data from a large group of people to obtain information and insights in a structured method (Courage, Baxter, & Caine, 2015). A survey can be conducted through asking both quantitative questions (e.g. rating scales) and qualitative questions (e.g. descriptive questions) to collect user data (Phillips & Aron, 2013). The contents of survey questions include demographic questions, behavioural questions and attitudinal questions (Kuniavsky, 2003). Demographic questions are those related to participants' characteristics, such as age and education. Behavioural questions are about participants' habits of using products, such as what product features do participants use. And attitudinal questions are about the satisfaction, preference and desire of participants.

A user interview is often a one-to-one research method, in which a researcher asks one participant at a time about a series of questions related to one topic in 30 to 60 mins. It usually happens before the design to collect users' thoughts and at the last part of the usability test to collect users' attitude of the design. The user interview uses qualitative methods to gather user data (Morse, 2012).

The questions of user interviews usually start with warm up questions and then step into the general issues, such as experience, expectation and attitude towards products. The questions can be narrowed from broad questions to deep focus questions during the interview. Researchers should also ask for details based on participants' answers. In the end, it moves into a retrospective phase and then has a final wrap-up to conclude the entire interview (Kuniavsky, 2003).

The interview can be conducted in structured, semi-structured and unstructured (Courage et al., 2015). The structured user interviews are to

ask questions in a set order and the questions are also prepared in advance. For the semi-structured use interview, part of the questions are predetermined and others are unplanned, while all of the questions are unplanned for the unstructured interview. Semi-structured user interviews are the most commonly used compared to the other two variations.

3.2.2 Persona & user journey map

Persona and the user journey map are conducted based on the data analysis results.

Persona is a fictional character who has the same features and goals as the target users and it is created based on user research data to help understand the real users' needs and motivations (Wolf f& Seffah, 2011). The descriptions of the persona include background information, skills, needs, pain points, goals and behaviours of the character to make it more like a real person.

User journey map is the visualisation of the process of target users' journey to realise the goals (Howard, 2014). It shows the overview of the touchpoints and interaction on a timeline and it is used to better understand users' pain points in different stages to find out opportunities. The key components of the user journey map are :

- Actor who experience the journey
- Scenario and goals
- Different journey stages
- Actions and emotion
- Opportunities

3.2.3 Prototyping

Prototype is the early interactive sample, used to evaluate the UX and UI design for getting the iteration feedback (Courage et al., 2015). It shows the visual appearance and the interaction logic of the user interfaces. The prototyping can be paper, low-fidelity and high-fidelity prototype. The concept of Minimum Viable Product (MVP), which is the modest version of the product with core features (Lenarduzzi, & Taibi, 2016), is commonly used to create the prototypes. This is because it is quick to test and easy to change to save time for iteration.

3.2.4 Usability testing

Usability test is a user research method to evaluate the user experience of a product. It can help designers find out the uncover problems and also discover design opportunities to update the initial design. Researchers can also learn about users' thoughts and behaviours through usability testing.

There are three main elements in a traditional usability test: facilitator, tasks and participants (Lewis, 2006). During the test, the facilitator guides participants to go through the process and observe their behaviours while performing the tasks, which are the activities users would do in their real life with the evaluated product on service. Participants play with the prototype and narrate their behaviours at the same time through a think aloud method to help the facilitator record their actions. Think aloud is to ask participants to consistently verbalise their thoughts, such as what they are doing and where they encounter problems, when they are performing a task. This method is flexible and easy to help facilitators understand participants' actions (Van Someren, Barnard, & Sandberg, 1994).

In a usability test, both quantitative data and qualitative data can be collected for analysing the design problems (Courage et al., 2015). Qualitative usability testing is conducted to collect insights, findings and design problems, while quantitative usability testing collects statistical data, such as success rates and time on the tasks.

4. User research: Survey & interview

4.1 Survey methods

A survey was conducted to know more about Eurail users' valuable opinions. It used fun & entertaining ideas to replace the term 'gamification' to avoid misunderstanding for participants while answering the questions. The survey took participants, who were Eurail's users, around three minutes to fill in. It was sent out through the Rail planner app's notification and Eurail's community platform.

4.1.1 Survey Questions

The survey used mixed methods (Arnon & Reichel, 2009), which asked both quantitative questions (e.g. rating scales) and qualitative questions (e.g. descriptive questions). The contents of the survey were divided into three parts:

1. Basic information of the participants
2. Attitudes on gamification related ideas
3. Open questions for further interviews.

The full survey questions and consent form is included as Appendix A. The users were sent a consent form along with the survey questions. After reading the information brochure and consent form, they signed it online and sent it to the researcher.

The first part of the survey was aimed at collecting demographic data, such as participants' age, residence places and times of using the Rail Planner app. The results of the demographic questions can also be analysed with scales and open questions to find out different age groups' preferences.

The second part was used for analysing users' attitudes towards entertaining ideas. In the survey, eight gamified design ideas, which could enhance users' travelling experience, were brainstormed based on literature review and case study. The ideas originated from Eurail's previous user research results and refer to the most commonly used gamification themes from the competitive products. These ideas were illustrated for users to rate and rank.

Specifically, these fun and entertaining ideas are:

- Collect digital postcards/stamps in different countries which you can share with others
- Visualise your travel countries/cities/routes to record and remember your journey
- Travel via a 'green route' and show your eco- friendly achievements
- Learn how to say a few sentences in the language of your travel countries through playing games
- Learn history/culture of your travel countries through playing games
- Share travel routes and answer others' questions to earn bonus points to get discount
- Enter a lottery game to get bonus points after finishing travelling challenges
- ' Geocaching' to explore the cities during your trip

Apart from ranking and rating, users could also share how interesting they were in adding these ideas to the rail planner app.

In the last part, an open-ended question was asked to collect participants' ideas, which can be used for choosing the active people for the further interviews. The last question was used for finding potential interview participants. It told survey participants that a follow-up interview would be conducted and let them provide their emails if they wanted to take part in.

4.2 Survey Result analysis

4600 results were collected in 3 days between 18th May and 20th May.

4.2.1 Demographic data

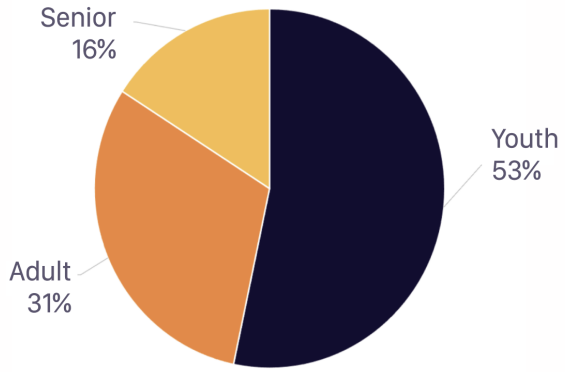

Chart 1: Percentage of different age groups

From the result (see Chart 1), Youth participants are the largest group, which is 53%, and Adult participants make up 31% of participants, while Senior participants are the least group, which is only 16%.

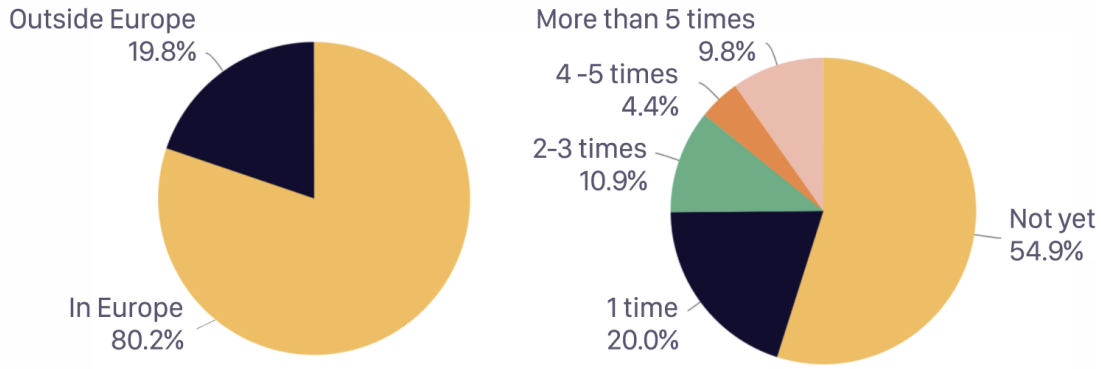

Chart 2. Percentage of interrail & Eurail users (left) and proportion of the times for users using Rail Planner app (right)

80% participants reside in Europe, who are interrail users and only 20% of them live outside of Europe, who are Eurail users (see Chart 2). More than half of the participants (55 %) are potential customers of the app who have not yet travelled with the Rail Planner app, while others have at least one experience with the app for their train travelling.

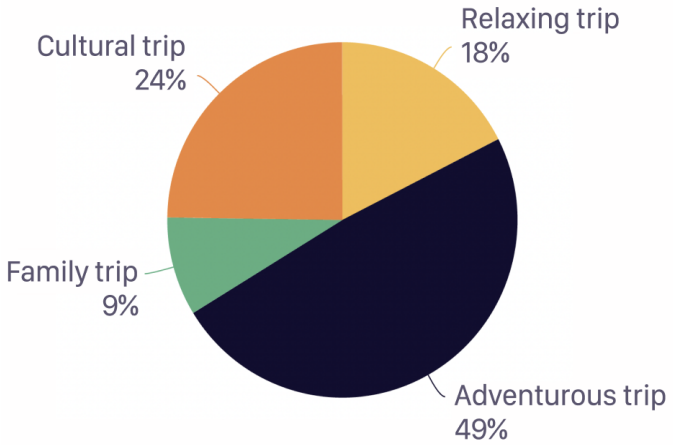

Chart 3. Percentage of favourite travel types

From the results of participants' favourite travel types (see Chart 3), around half of the participants (49%) prefer adventurous trips to explore their destinations. 24% of the participants like the cultural trip the best, which means they are willing to visit some historical attractions and learn related

knowledge. As for the remaining people, 18 % of them would like to take a relaxing trip and 9% of them want to stay with their family members during the journey.

4.2.2 Attitudes towards fun & entertaining ideas

Rating scale task

In the rating scale task (see Table 1), the users scored each idea to show how interested they were in the different gamified ideas. The average score of each idea is calculated through the overall score divided by the number of participants.

No.	Idea	Average Score
1	Visualise your travel countries/ cities/ routes to record and remember your journey	7.8
2	Learn how to say a few sentences in the language of your travel countries through playing games	7.1
3	Learn history/culture of your travel countries through playing game	7.1
4	Travel via a 'green route'	6.7
5	' Geocaching' to explore the cities during your trip	6.6
6	Enter a lottery game to get bonus points	6.4
7	Share travel routes and answer others' questions to earn bonus points to get discount	5.7
8	Collect digital postcards/stamps in different countries which you can share with others	5.2

Table 1 : Results of scoring gamified ideas

The results show that ‘Visualise your travel countries’ gets the best average score, which is 7.8. ‘Learn the language of your travel countries through playing games’ and ‘Learn history of your travel countries through playing games’ both get 7.1 for the average score. However, ‘Collect digital postcards/stamps in different countries’ gets the lowest average score,

which is only 5.2. Participants also rate the idea ‘Enter a lottery game to get bonus points ’ with a low score, which is 5.7.

As for different age groups, Youth and Adult participants show more interest in gamified ideas than Senior participants. The results of Youth and Adult people are similar to the overall results, while Senior participants rate lower than 6 of average scores for most of the ideas and the lowest average score is even 3.3. With regard to the results of Eurail and interrail people, there are less differences between them.

Ranking questions

In the ranking questions, participants were asked to prioritise the three most important ideas. The score of the ranking item is a weighted calculation. The score, which shows in Table 2, is the sum of all the weighted values. The number of rankings illustrate how many participants prioritise the items to the three most important ideas. And the distribution shows the percentage for the higher rank and lower rank. The red colour in rank distribution shows higher rank, while the green colour shows the lower rank.

Item	Overall Rank	Rank Distribution	Score	No. of Rankings
Visualize your travel countries/ cities/ routes to record and remember your journey	1		7,219	3,077
Learn how to say a few sentences in the language of your travel countries through playing games	2		4,458	2,327
Travel via a 'green route' (visit sustainable cities and take the least polluting means of transport) and show your eco-friendly achievements	3		4,065	1,922
Learn history/culture of your travel countries through playing games	4		3,498	1,961
Share travel routes and answer others' questions to earn bonus points (to get discount)	5		2,953	1,602
Collect digital postcards/stamps in different countries which you can share with others	6		2,811	1,331
' Geocaching' to explore the cities during your trip	7		2,383	1,309
Enter a lottery game to get bonus points after finishing traveling challenges	8		884	540

Table 2: Result of prioritising the three most important ideas

From the result, it can be concluded that 'Visualise your travel countries' has been ranked first and the score of it is much higher than other ideas. 'Learn the language of your travel countries through playing games' and 'Travel via a 'green route' has been ranked second and third, which shows participants also feel interested in these ideas.

Interrail participants show more interest in the green route and sustainability, while Eurail participants rank it to the sixth place. As for the findings of different age groups, Youth people feel less interested in learning history and care more about the discounts.

Attitude towards gamified ideas

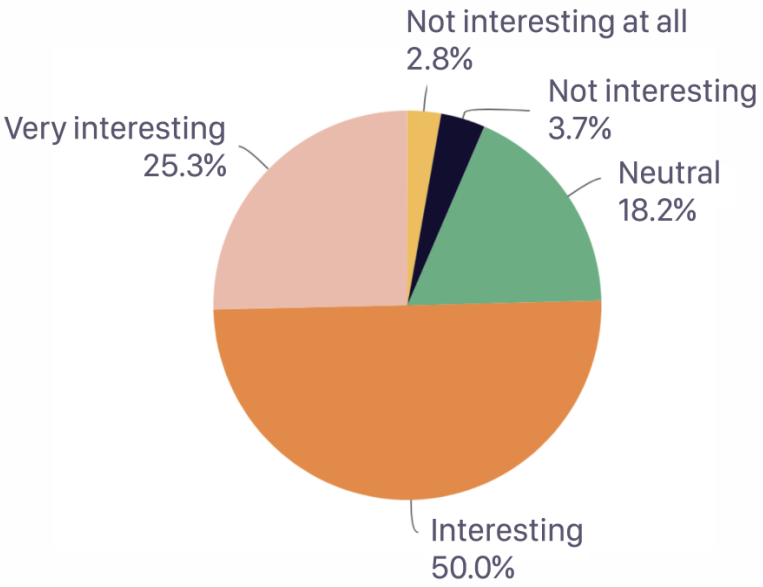

Chart 4: Result of users' attitudes towards gamified ideas

The result of users' attitude towards gamified ideas for Rail Planner app (see Chart 4) shows that 75.3% of participants support adding these gamified ideas to the app. Specifically, half of the participants think that these ideas are interesting and 25.3% of participants choose very interesting. Compared to different age groups, Senior people show a more neutral attitude towards the ideas. Both Eurail and Interrail participants show a positive attitude towards these gamified ideas.

4.2.3 Open question

As for the open question about users' own ideas, around 2000 valuable opinions were received. The results of gamified ideas could be divided into seven topics:

1. Connect with other Rail Planner app users, aimed to meet new friends, find travel partners and share experience with each other.
2. Create a reward system to help users get discounts.
3. Give a customised travel plan to users who can not decide their destinations. Users can get some suggestions for their travel destinations based on their answers to the quiz in the app.
4. Playing games and challenges during the trip, such as landmark bingo game and treasure hunt of the city
5. Carbon emission calculation and data visualisation for sustainable travelling.
6. Record the journeys to visualise users' travel places and have a diary mode to add pictures to their trip
7. Interactive maps to add users' favourite spots, food and accommodation on the map to share and rate them.

4.2.4 Conclusion of the survey result

In conclusion, most people gave positive feedback to the proposed ideas. Compared to the Senior people, Youth and Adult people showed more interest in these fun and entertaining ideas. Six ideas were chosen for further research based on the results of ranking, rating scale and open questions. These ideas are:

1. Plan the journey,
2. Record and remember the journey,
3. Learn language of the travelling countries
4. Travel via green route
5. Meet new people
6. Reward system

4.3 Interview method

After collecting the data from the survey, interviews were conducted to explore further about users' behaviours, motivations and needs. The interview was semi-structured, which asked open-ended questions in a flexible way without strictly following the predetermined question list (Schmidt, 2004). It adopted qualitative research methods to collect in-depth information from users. The interview was conducted in online mode in Teams platform and it lasted for around 45 minutes with each participant. All the interviews were recorded and transcripted for later analysis.

4.3.1 Interview questions

The specific questions of the interview are listed in Appendix B. It was based on the survey conclusion to explore further of the highly ranked ideas and the most commonly mentioned topics. The research topics were introduced and the consent form was shown to users at first. After reading the information brochure and consent form (see Appendix B), users signed the consent form online and sent it to the researcher.

After introducing the interview aims, six main topics were discussed with participants, including 'plan the journey', 'record and remember the journey', 'learn language of the travelling countries', 'travel via green route', 'meet new people' and 'reward system'.

In the **trip planning** topic, participants' journey plan process were asked at first to know participants' behaviours and touchpoints in the planning session. After collecting users' needs, two design ideas, including interactive quizzes to get customised suggestions and a random button to recommend random places for users, were inquired to get some feedback and insights.

In the **recording trip memory** topic, participants were firstly asked about their methods to record and remember the journey and then let them answer what they would like to see in their journey memory as follow-up questions. At last, their sharing habits were also collected as the reference for the later design.

As for the **language learning** topic, it was about learning the language of travelling countries through gamified methods. In this part, participants' attitude towards learning and gamified methods were inquired to verify the assumptions. After that, the contents of language learning were also asked as the design reference.

The **sustainable travelling** topic was related to sustainable travelling. Participants were asked about their views on the sustainable trip, such as taking trains and going to the sustainable city. They were also asked about to what extent the sustainable route will affect their choices of travelling destination. Moreover, their attitudes towards carbon footprint calculating and sustainable accomplishment sharing were also inquired to find out their needs.

With regard to the **meet new people** topic, participants' thoughts and attitudes towards meeting new people in the same train or cities were asked. Apart from it, ideas, such as visualising travellers in the same train and its related privacy issues, were also discussed with them.

For the **reward system** topic, participants were asked about their thoughts on the reward system. After it, a question about to what extent the reward system and accomplishment ranking would motivate them were asked as follow-up questions to discover how gamified elements would influence participants' motivation.

4.3.2 Interview participants

In order to get opinions from different kinds of users, six participants were chosen based on their ages, residence countries and gamified ideas. The participants were two from each age group. As for the residence countries, four people live in Europe and the other two people live outside Europe.

With regard to the gamification ideas in the open question of the survey, all participants provided specific suggestions to enhance the UX of the Rail Planner app. It showed that they had their own views and were active in sharing their opinions. Two participants mentioned that they would like to have a reward system to get a bonus. One participant cared about the carbon footprint of a trip. One person wanted to add travel logs and photos to record the journey. Moreover, one participant would like to know his

travel achievements. The last participant wanted to know more about the destination before travelling.

In order to protect participants' privacy, they were coded from P1 to P6 for the result analysis.

4.4 Interview result

The interview results were summarised by affinity diagram method (see Appendix C), which organised various data through finding the relationship among them and grouped the similar user needs to find representative ones (Takai & Ishii, 2010). Specifically, interview notes of six topics from each participant were recorded on sticky notes in the Miro platform. After that, researchers looked for the sticky notes with similar thoughts from different participants and then group them in a new Miro board. Researchers also named each group and summarised the insights.

4.4.1 Trip planning

All the participants chose the eurail pass for reducing the flying impact. Participant P1 and P5 mentioned that they preferred the flexibility of the eurail pass and the comfort of the train. Participant P3 said that he liked to see the beautiful view while taking the train.

Most participants thought that they usually had the ideas for the destination and they also did some research before travelling. For example, they would view the seat 61 website (seat 61, 2022) to plan the trains and also get inspiration from travel books and friends' recommendations. The travel cost, such as seat reservation fees and hotels, was the most important factor that influenced their trip plans. Beautiful scenery during the road and events, such as music festivals, would also influence them making travel decisions.

When it came to the two design ideas, most participants thought that they were good ideas, but they were more suitable for travellers with two or three months travel plans. Participants said that they normally had ideas of their destinations and preferred to explore the inspiration on the websites and read travel articles as they always did.

4.4.2 Recording trip memory

Most of the participants mentioned that they always took pictures to record the places they have been to and people they met on the road. They would share the pictures with their family and friends during the travelling, and post photos along with some descriptions on social media to share their travel experience. They would also collect train tickets, postcards, fridge magnets and stamps to look back on their travel experience. Participant P4 even created a website to record the journey, which visualised the travel routes on the map and could be filtered through the date.

With regard to recording journey memories in the app, they would like to share photos and travel notes for different trips. They also wanted to see the trip summary, such as how many countries they have travelled and how long have they taken the train, and know what achievements they have achieved during the trip.

4.4.3 Language learning

All the participants said that they would learn some common languages of their destinations, such as 'hello' and 'thank you', before arriving at the travelling countries. It was also helpful to learn the words and sentences related to the hotel, train station and shop. For example, they wanted to learn how to say delay in another language to avoid missing the train. Participant P3 mentioned that it would be useful to download a handy book, which listed words and sentences, to help learning.

Most participants tried language learning apps to learn in a gamified way before. They thought it was more effective and interactive for learning language in a gamified method, especially for long-term learning and in-depth learning. However, they were not willing to take too much time in learning language in the Rail Planner app and preferred the succient contents. Apart from language, participants also would like to learn the culture and travel attractions information before travelling.

4.4.4 Sustainable travelling

All the participants cared about sustainability and thought that it was the default option for rail travel. They would prefer to know the consumed carbon footprint compared to other transport, instead of the specific

number of the carbon footprint during the trip. Apart from it, participant P3 also mentioned that she would like to get positive feedback and encouragement when she is doing some good things for the environment.

4.4.5 Meet new people

Participants thought that it depended on people's character. Some people preferred to travel with their friends and only had small talk with new people on the road, while others would like to find a travel buddy in the community and travel with the people they met on the road.

Participant P2 and participant P3 said that they would like to meet local people or those with the same experience as them. It would be interesting for them to meet people in the same location or on the same train. But it might have privacy problems, so it was important to make people choose whether they would like to show up or not. Other participants said that they preferred to travel with family and friends, and they might not want to meet new people.

4.4.6 Reward system

Most participants thought the reward system could be positive and it would motivate them to continue buying the pass if the bonus was attractive enough. For example, they could reserve the seats for free or get some coupons if they were VIP customers. They also enjoyed the feeling of unlocking the reward through doing certain things to earn points and level up, which was similar to playing computer games. Levels and points could also show how experienced users were, and it also added credibility to users' answers in the community.

As for the leaderboard, participant P4 said that the ranking mainly depended on how much money and how much free time people had. And the name on the top of the leaderboard was hard to change, so he would not feel interested in the leaderboard in the system.

However, not all people showed a positive attitude to the reward system. Participant P6 said that it would be more attractive to younger people, and the reward system might not influence how she used the app.

4.4.7 Conclusion of interview results

For **trip planning**, most participants thought that they had ideas about choosing a destination, so they only needed inspirational articles in the app instead of more interactive functions.

For **recording the journey,** participants wanted to share photos, travel notes and collect souvenirs to record their trip memories. They also wanted to see the trip summary and achievements.

For **Language learning,** participants would like to learn the daily language, railway related words, culture and travel attractions of their destination in a fun and gamified method.

For **sustainable travelling,** participants cared about how much carbon footprint they saved compared to other transport rather than the specific number. The original design related to this in the app was enough for them.

For **meeting new people,** most participants showed less interest in it and thought it depended on the users' personality. The privacy problem also needed to be considered.

For the **reward system**, most participants showed a positive attitude towards it and thought it could be motivated if the bonus was attractive. They enjoyed earning points and levelling up to unlock the benefits, but did not want to see the ranking of people's spendings in the leaderboard.

In conclusion, recording the journey, learning language during the journey and reward system were chosen as the main needs of the participants with higher priority and were conducted into design in chapter five.

4.5 User research outcome

Based on the user research results and Eurail's previous research outcome, the persona and user journey map have been created to represent the typical Rail Planner app's target users and their travel journey.

4.5.1 Persona

From Figure 11, a persona of the typical eurail user has been created. He is a 28 year-old developer and travels with Rail Planner apps twice or three times a year. The details of his information, core needs and frustrations are shown below.

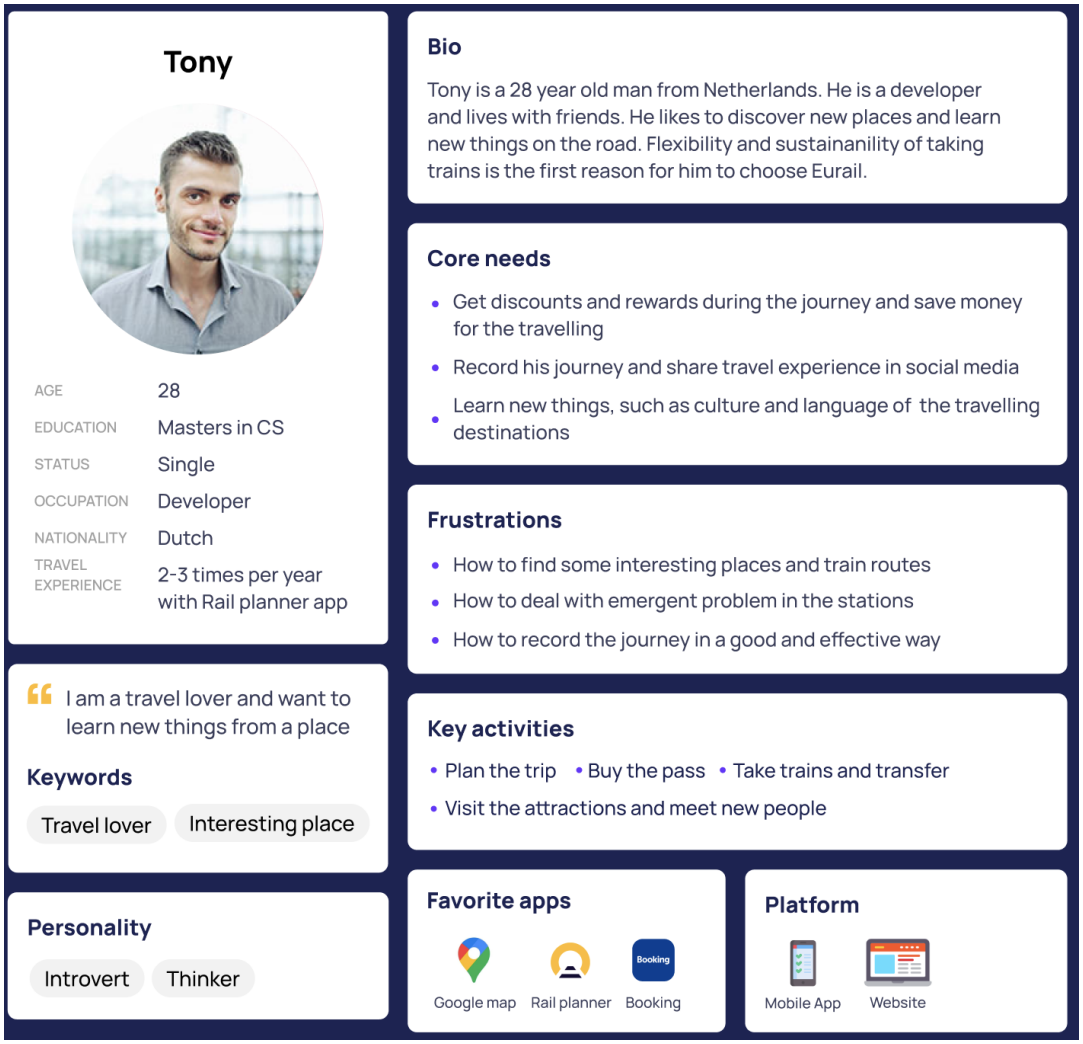

Figure 11: Persona

4.5.2 User journey map

The journey of Tony can be separated into three stages (see Appendix D), including before the trip, during the trip and after the trip.

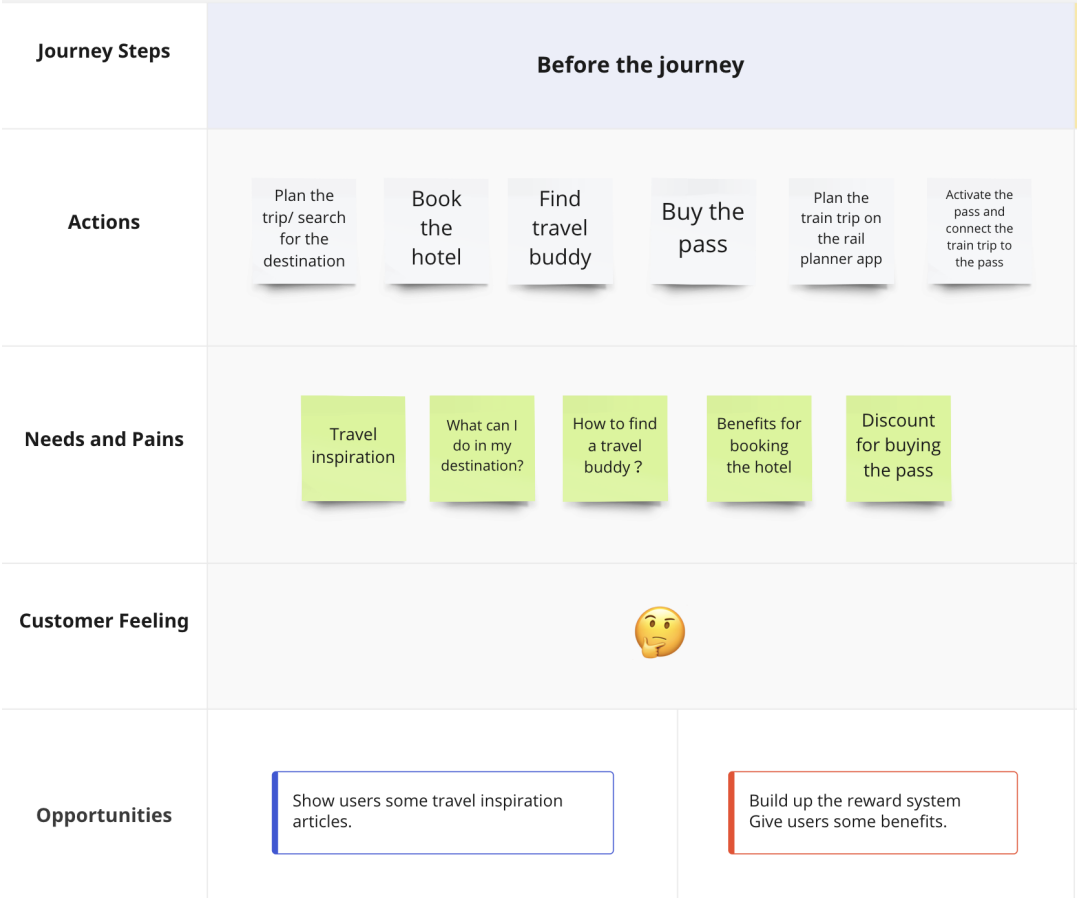

Figure 12: User journey map of before the trip

Before the trip (see Figure 12), he may plan his trip, search for the routes and book the hotels. He also buys the travel pass, plans the train trip on the Rail Planner app, activates the pass and connects the train trip with the pass to get a valid ticket. In this stage, He may need to get some travel inspiration, research his destinations, find a travel buddy and get discounts for buying the pass.

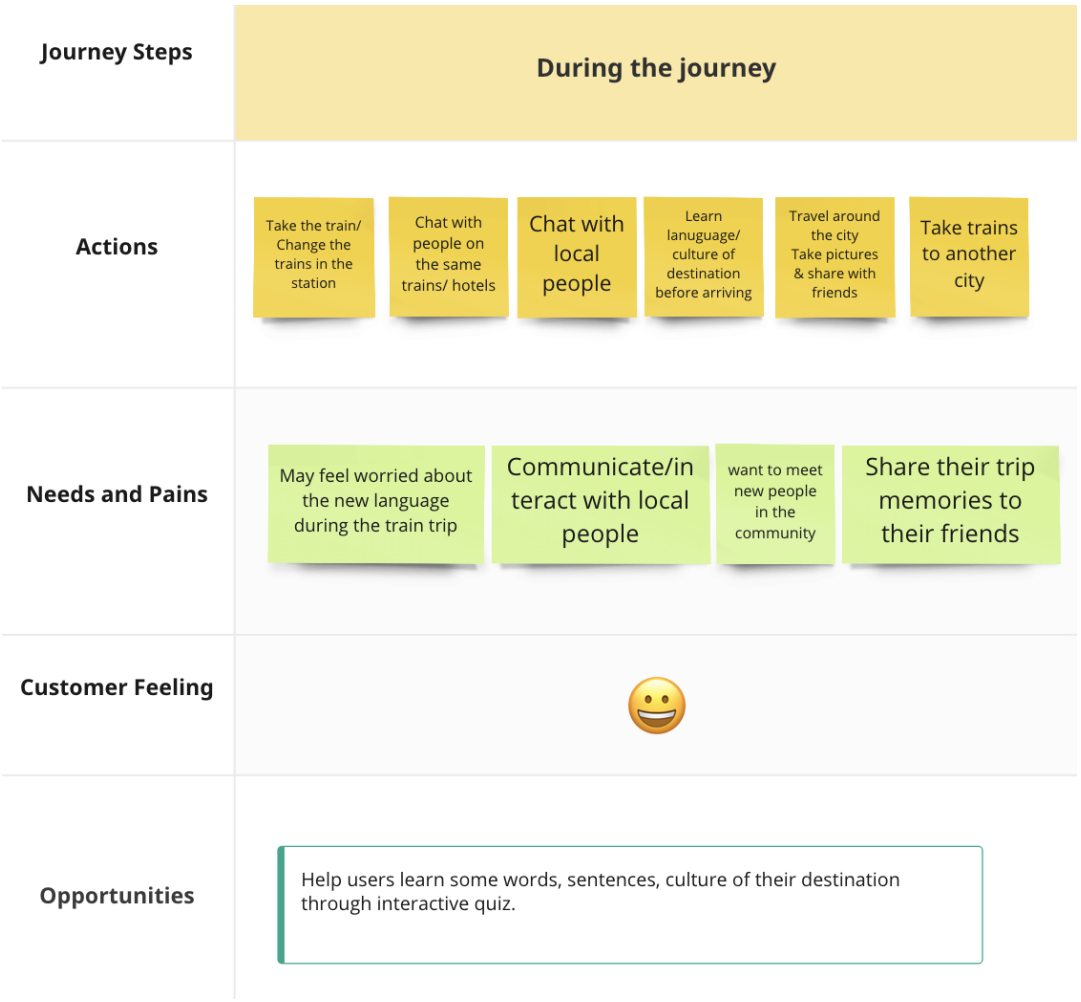

Figure 13: User journey map of during the trip

During the trip (see Figure 13), Tony will take the trains to travel around different cities. He will chat with new friends on the train and meet some local people at his destinations. To record the journey, he takes pictures and writes some contents to share with his family and friends or post them on social media. In this phase, he may want to learn some daily language of his travel cities to help him talk with local people in the shops, restaurants and hotels. He may also feel worried about the different situations when transferring the trains. Learning some railway related words, such as how to say 'delay' in the languages of their destination, may be a good way to help him solve problems in the transferring stations. In order to have a better travel experience, He may be willing to learn the culture and travel-related knowledge during the trip.

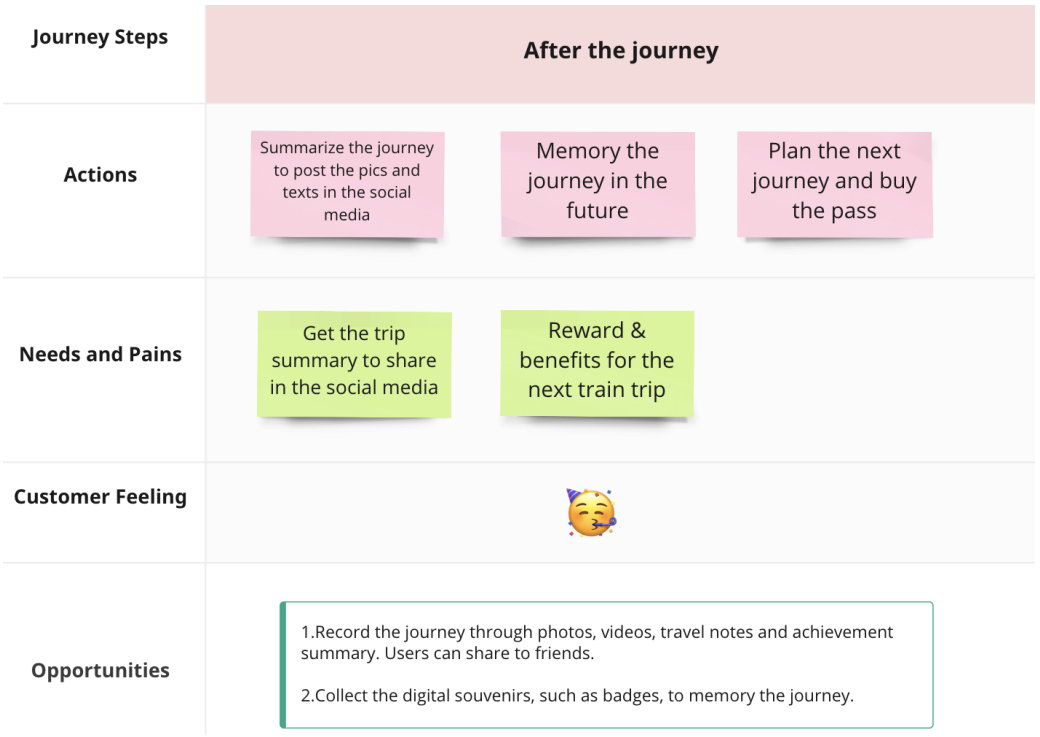

Figure 14: User journey map of after the trip

After the trip (see Figure 14), Tony will summarise his travel experiences and achievements, and then post them on social media. In the future, he can reminisce about their previous trips through reviewing travel records and souvenirs collected on the road. He may also want to get benefits for the next journey.

From analysing the journeys of the typical user, opportunities in three stages were found. specifically, opportunities contain:

- Show users some travel inspiration articles while planning train trips
- Build up the reward system. Users can earn points and level up to unlock more benefits
- Help users learn some daily languages, railway related words, culture and travel related information of their travel destinations through playing the interactive quiz.
- Collect the digital souvenirs, such as badges, to memory the journey
- Record the journey through photos, videos, travel notes and achievement summaries.

These opportunities will be transferred to app features and designed in the next chapter.

5. Design

After collecting and analysing the user data, the design is presented in chapter five. In the design phase, the information architecture was firstly used as a tool to define the application's framework and functions. A high-fidelity prototype was also created for the user test to collect the design problems for future iteration.

5.1 Design system

Design system is a shared design language in the company to help keep visual consistency and it can allow designers to manage the user interface design at scale (Vesselov & Davis, 2019). Design system lists a series of standards, including the typography, colour, components, logo and mobile guidelines to build up the user interface design library.

The UX design of the thesis project follows Eurail's design system. As for the typography, the font uses the SF Compact and the font sizes range from 10pt to 32pt in the system. The font weights use regular, medium and semi-bold, when designing the app. The medium and semi-bold are used for emphasis.

The primary colour of Eurail is Night Sky Blue (#140A33), Sunny Yellow (#FEB22) and White (#FFFFF) to represent the brand (see Figure 15). The Night Sky and White work as alternate backgrounds and font colours, while the Sunny Yellow is used as an accent colour in the interfaces and logo.

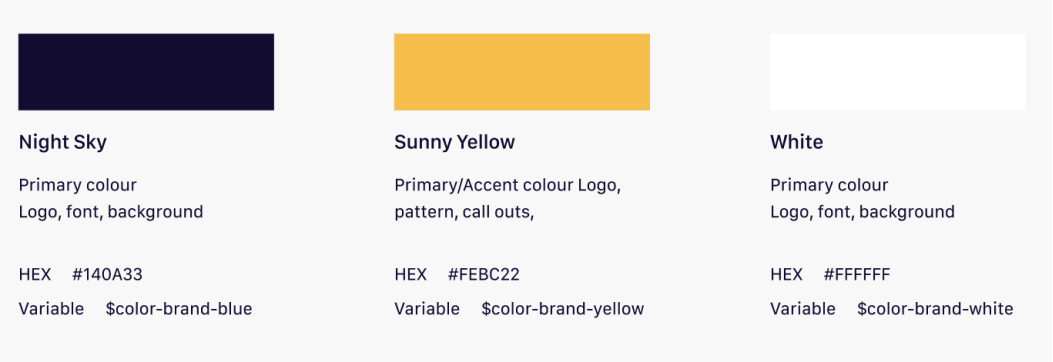

Figure 15: Eurail brand colour Night Sky, Sunny Yellow and White in the design system

5.2 Structure of previous Rail Planner App

The Rail planner app, which was developed by Eurail, can help users from planning their trips to ticket inspection through mobile pass during the journey. In the Rail Planner app, there are five tabs in the bottom app bar, which are Planner, Stations, My trip, My pass and More (see Appendix E).

From the structure of the Rail Planner app in Figure 16, it can be seen that users can search for the trains to plan their trips and then save journeys to My trip in the Planner. As for the Stations, users can check the arrival and departure time of trains at their chosen stations.

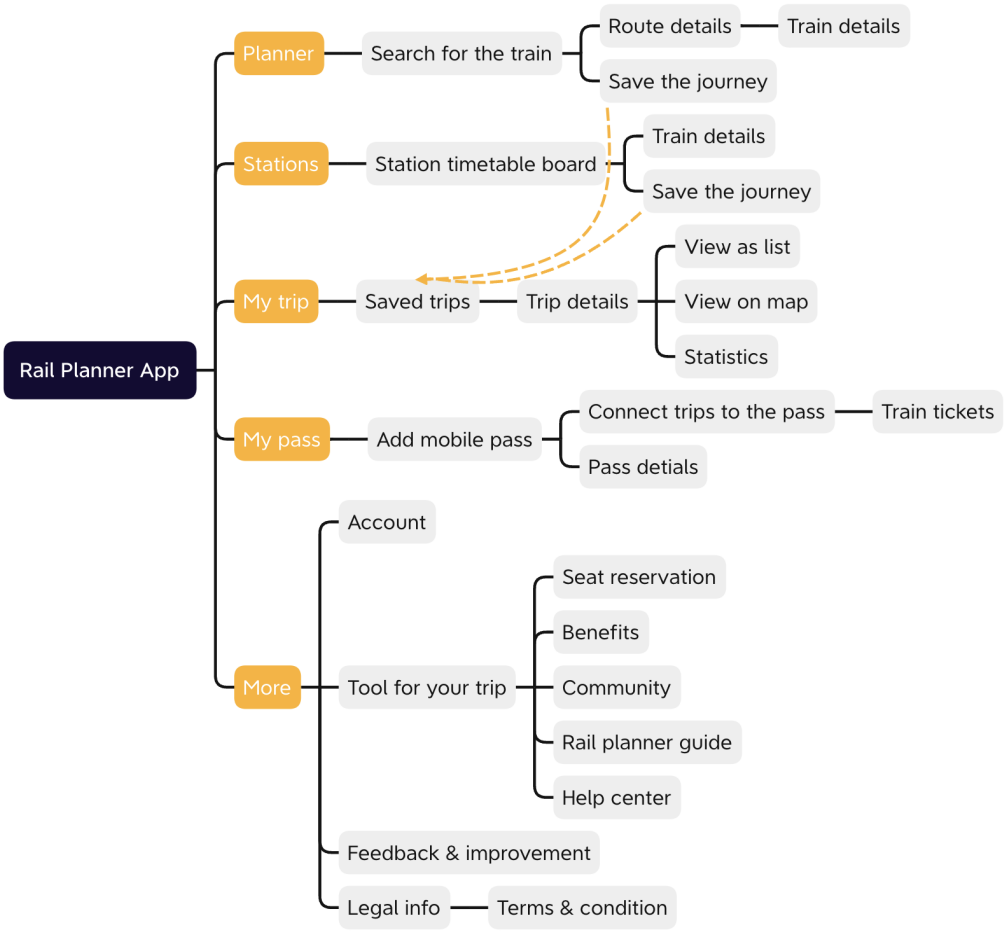

Figure 16. Structure of Rail Planner app

In My trip, users can track the journeys, get itinerary information and see the routes on the map. With regard to My pass, users can add their mobile passes, connect their planning trips to the passes and show their tickets to

take the trains. In More sections, users can view their profiles, book seat reservation, see discounts information and get tips in the community.

5.3 Design & Prototype

5.3.1 Overview of new design

Based on the analysis of design opportunities in Chapter 4, the new design can be divided into three parts, including interactive quiz, reward system and trip memory. From the structure of the new Rail planner app in Figure 17, the new design has been added in pink colour.

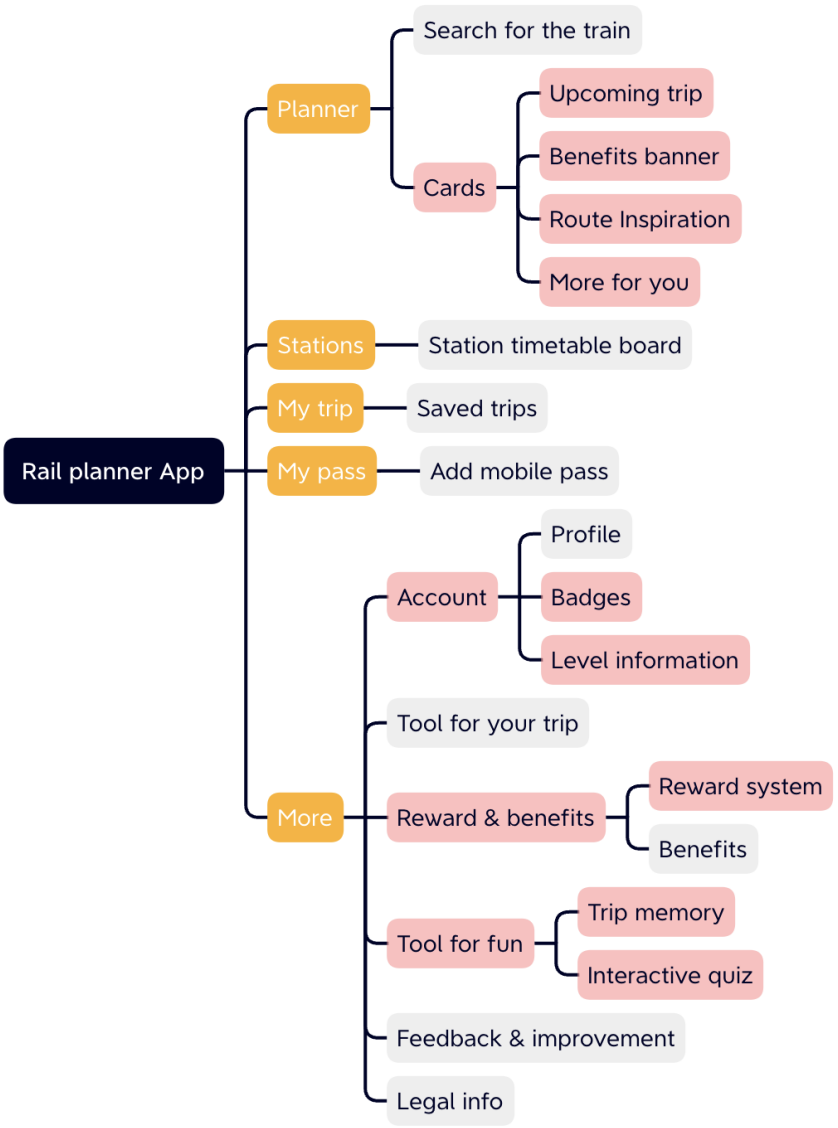

Figure 17: Structure of new Rail Planner app, pink ones show new functions

In the new design, some cards (e.g. reward & benefits, inspiration and more for you) have been added in the Planner interface, which is the first interface when users enter into the app (see Figure 17, 18). The aim of it is to help users find the upcoming trip easily, view the inspiration articles while searching for the trip, explore the reward system and notice newly added gamification features.

Gamified elements, such as badges, level and points, were added to the More tab. Users can view the number of their badges in the profile part. The level information has also been visualised. Users can see their current level and points, how far they are from the next level through progress bars and understand they can get benefits by earning points. Apart from it, two new sections, which were rewards & benefits and tools for fun, were added in the More page too (see Figure 17, 18). The entry place of the reward system was placed in the reward & benefits section. The trip memory and interactive quiz were put in the tool for fun section.

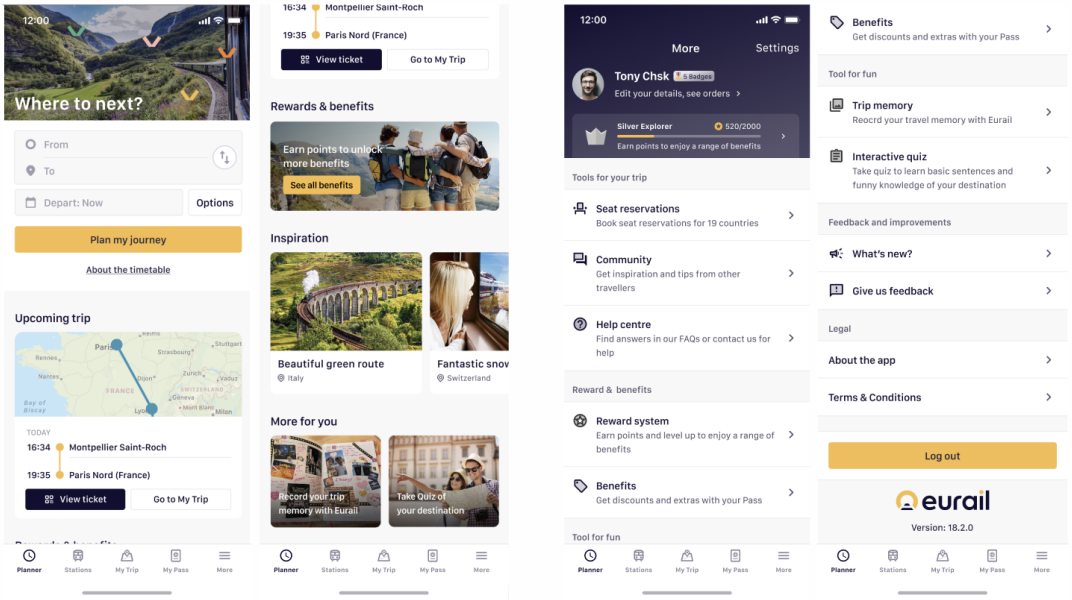

Figure 18 : Adding gamification design to the Rail Planner app

5.3.2 Reward system

The reward system was added in the new design and the gamified elements, such as levels, points and badges, were introduced. In the system, users can earn points through buying the Eurail products and finishing various tasks, to level up and unlock more benefits. The system has four levels, which are

Bronze beginner, Silver explorer, Gold adventurer and Diamond VIP. Higher levels have better bonuses and discounts.

From Figure 19, it can be seen that the card shows their current level. Users can know how far they are from the next level and how well they are towards their goals in the card. They can also see the benefits of their current level and learn how to earn points to level up. Users can slide the card to check the benefits of the other levels. For example, they will see the Gold adventurer level card and the benefits of it when they swipe right. When clicking the 'view more' clickable text in the benefits part, users can see the overview of the levels. They can see their position in the level system from the level progress bar and also know the benefits of different levels.

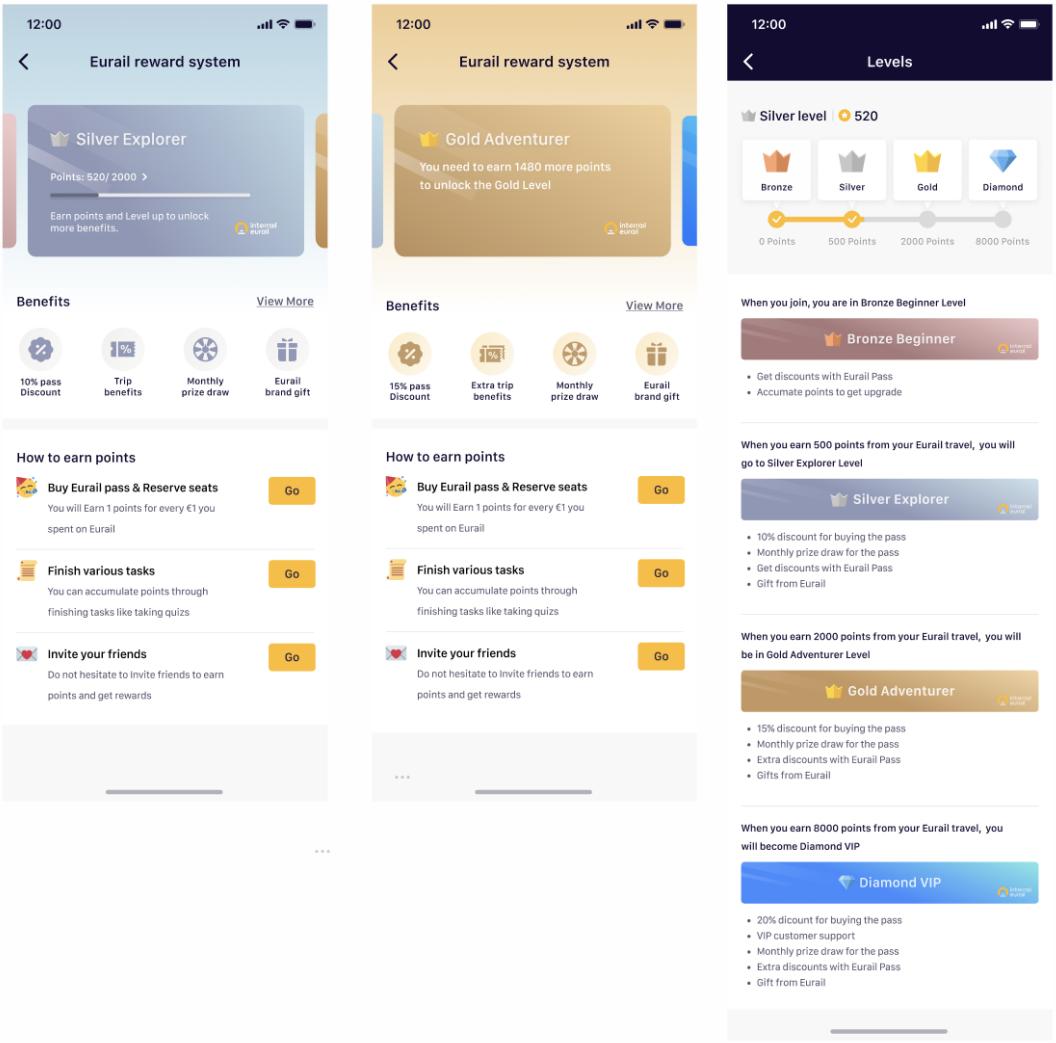

Figure 19: Eurail reward system interfaces, Silver explorer show page (left), Gold adventurer show page (middle), levels overview (right).

Users can also see the history through clicking the little arrow in the level cards. The history interfaces are separated into points history and level history (see Figure 20). Through it, Users can easily track the situation in the system.

In the 'How to earn points' part (see Figure 19), it can be seen that users can earn points through spending money in the Eurail products, finishing tasks and inviting friends. Through clicking the yellow 'Go' button, they can enter into the corresponding interfaces. For example, they will enter the point tasks interface (see Figure 20) when they click the yellow button in the 'Finish various tasks' part. In the Point tasks interface, users can see their current points and the points earned by completing different tasks. When clicking the 'Go' button, it will jump to the interfaces of the tasks.

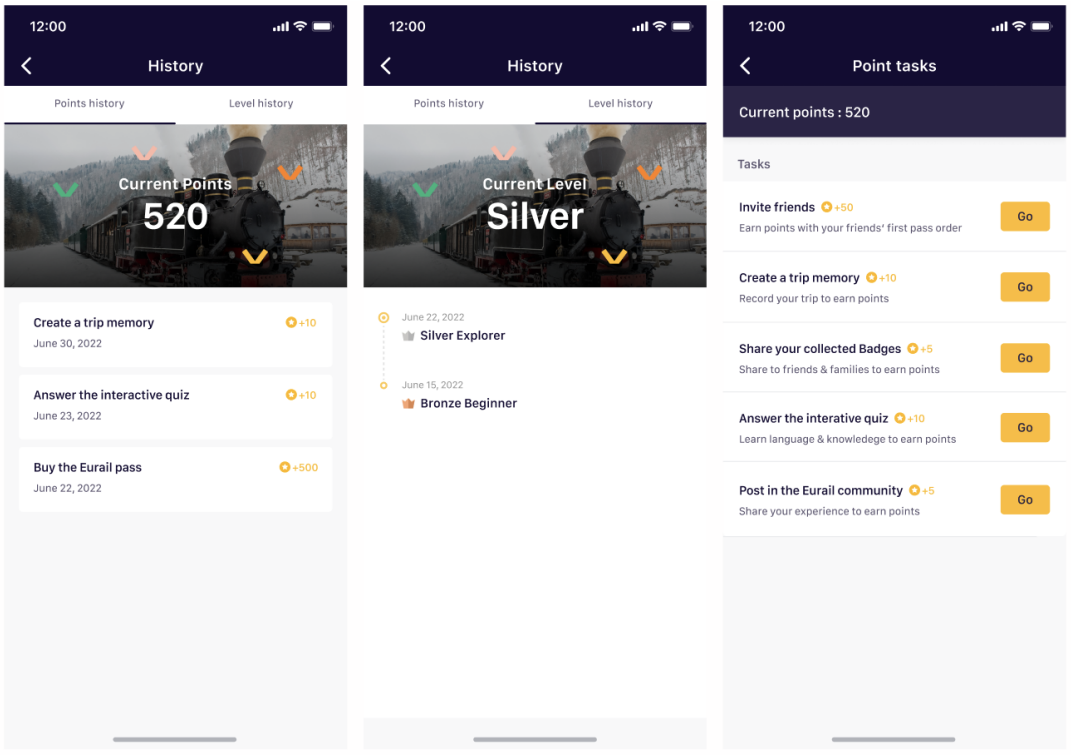

Figure 20: Point history interface (left), Level history interface (middle), Point tasks interface (right).

During the trip, users can also collect badges (See Figure 21) , which can be divided into achievement badges and country badges. The trip achievement badges are those related to users' achievements. For example, users will get the 'Train travel explorer' badge when they use the pass to take the train for the first time. As for the country badges, users can collect one country's badge after taking the trains to it. They can enter into My badges interface through clicking the button near the profile part.

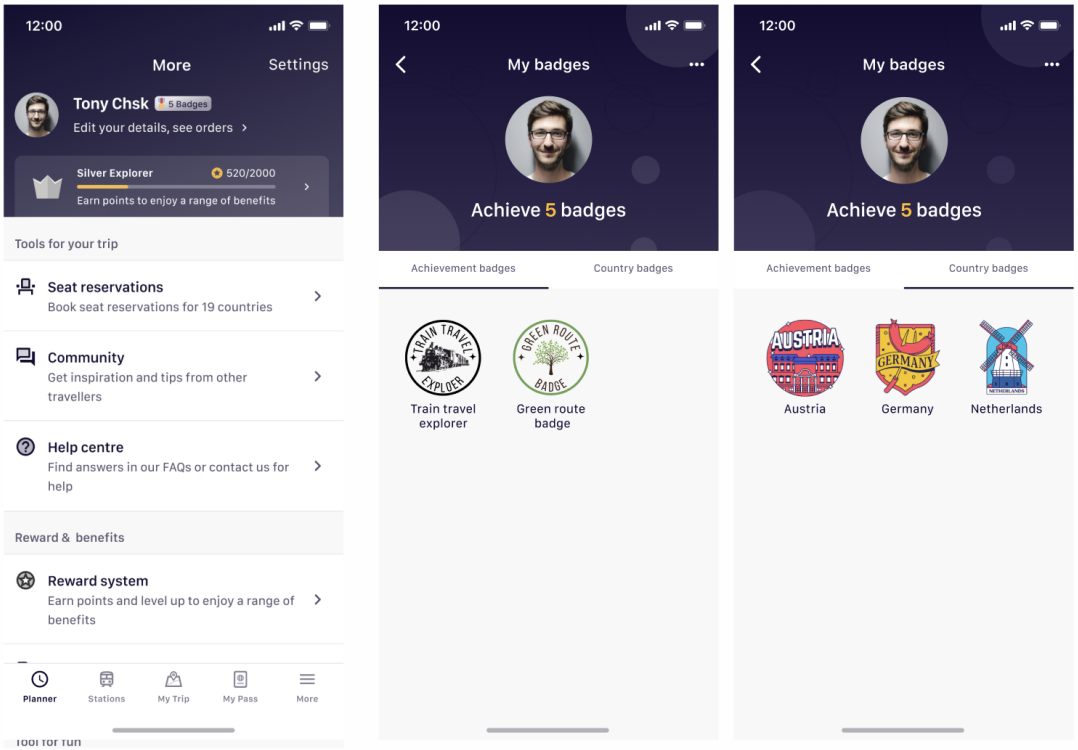

Figure 21: Entry place of My badges interface (left), My badges page, achievements badge (Middle) and country badges (Right),

5.3.3 Interactive quiz

Based on the users' needs of learning basic language and funny information about their travelling countries, the interactive quiz was designed. The interactive quiz of Finland (see Figure 22) is chosen as an example for explanation.

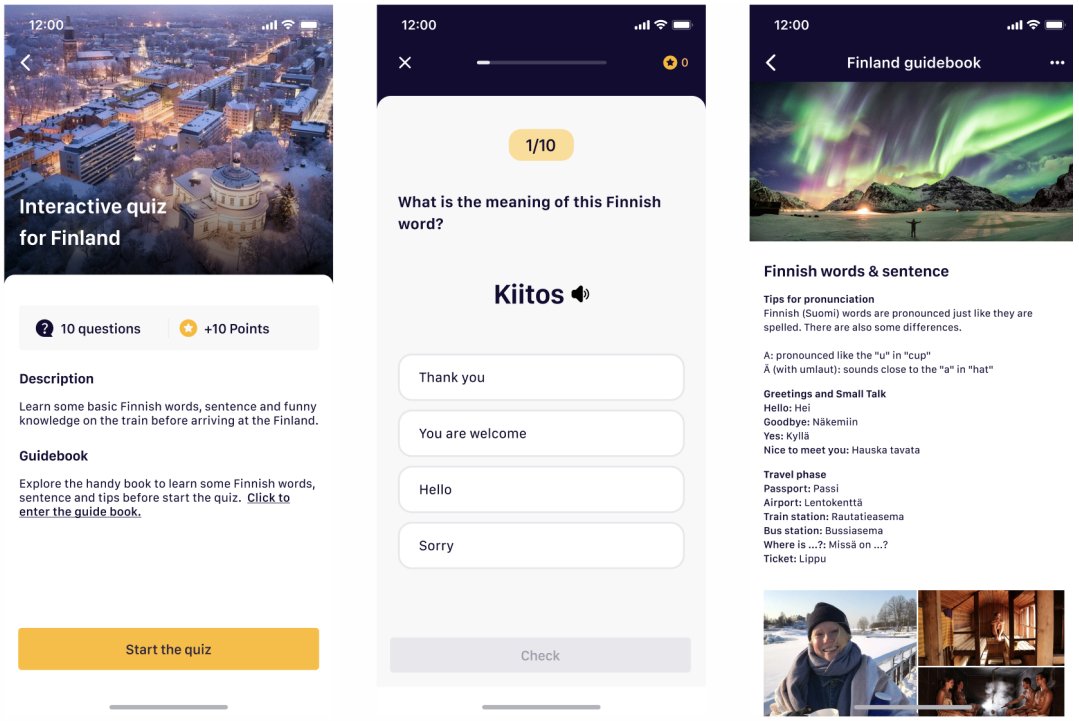

Figure 22: Interactive quiz of Finland, quiz introduction (left), quiz questions (middle) and quiz guidebook (right).

Users can choose their travelling destination countries at first and then go into the quiz detail. In the quiz interface, users can see the basic information of the quiz, which are the question numbers, points, quiz description and guidebook. After going through the information, users can download the guidebook to explore the knowledge at first. The contents of the guidebook include tips of Finnish pronunciation, basic Finnish words, train related words and sentences, Finnish cultures, travel places in Finland and Finnish transport system. Users can take the quiz to review the knowledge and explore the funny language, culture and travelling tips afterwards.

When playing with the quiz, users can know the procession through the progress bar and will get feedback to help them learn and explore their travelling countries easier (see Figure 23). For example, users will get positive feedback, such as the checkmark icon and rising points when they make the right choices in the quiz. Instead, they will get an error icon, encouraging text and right answers when they make wrong choices. At last, users can get the quiz summary page to see their correct rates, earned points and check the answers.

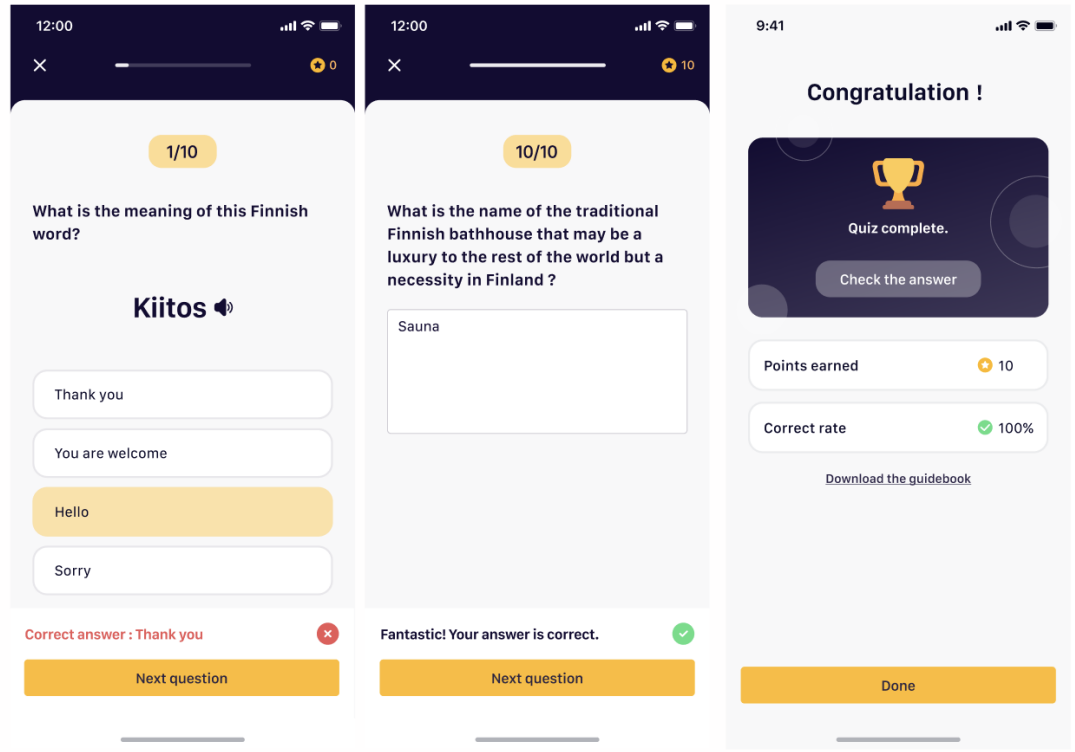

Figure 23: Feedback when answering wrong (left), feedback when answering right (middle) and quiz summary (right).

5.3.4 Trip memory

In order to help users better record their trips and organise their travel memories, the Trip memory function was created. Users can connect their train trips from My trip with the Trip memory. After connecting the data, travelling countries, cities and travel days will be automatically imported and visualised in the Trip memory section.

From the figure 24, it can be seen that users can view their travelling countries as a list and on the map. If users choose to view it as a list, travelling cities and creating memories are shown in the cards of each country. When users click the right arrow in the card, they can enter the trip details of each country. When viewing on map, travelling countries will be marked in yellow colour and the map pins with country pictures are clickable. It will enter into the trip details of the country when clicking the map pins. The statistics of the trip, including travel days, countries, cities and created memories, are also shown in the bottom card for users to track their journeys.

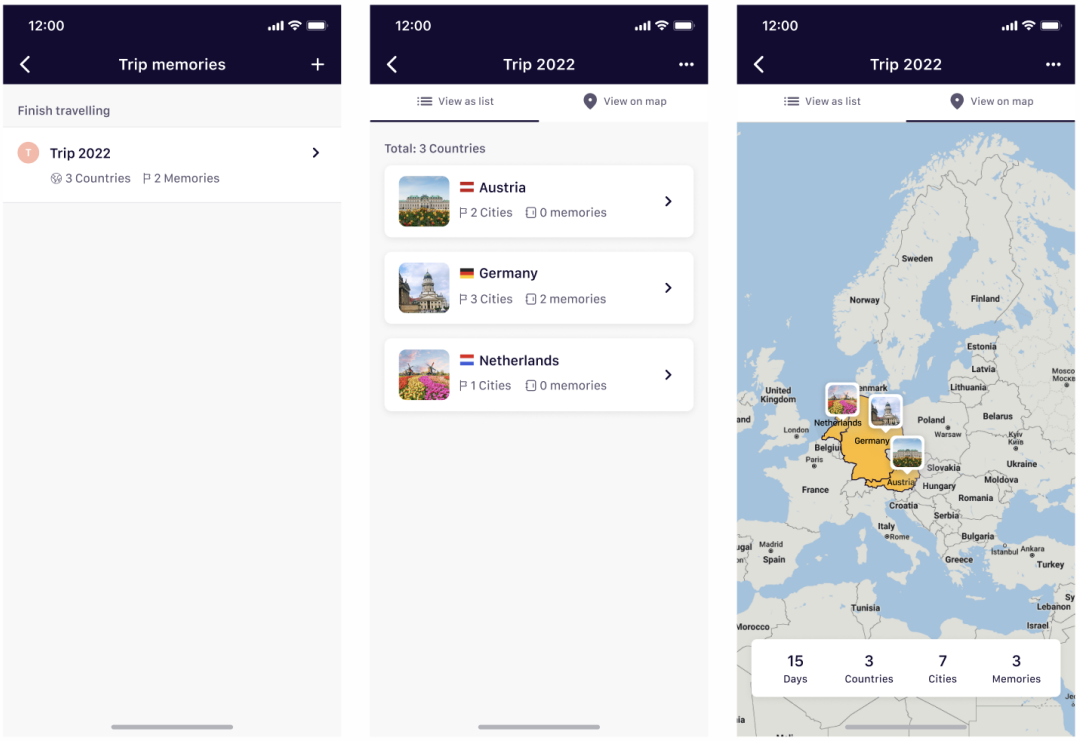

Figure 24: Interfaces of trip memory section: trip overview (left), view as list (middle), view on map (right)

When entering into the trip details, users can see their train routes and time periods in the trip map (see Figure 25). They can create their unique trip memories, such as beautiful pictures and notes, through clicking the add button. They can also share them with friends and family. Users will earn 10 points and the 'Trip recorder' badge when they record the trip memory for the first time.

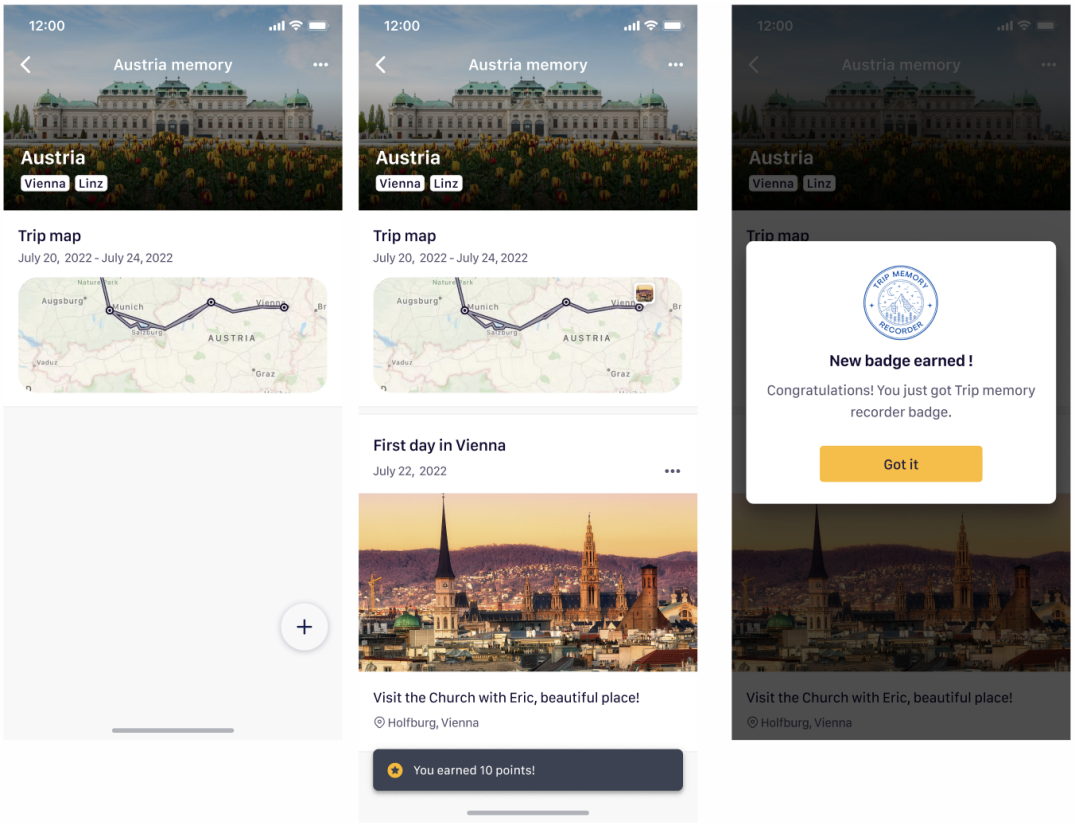

Figure 25: Austria trip memory interface before adding travel memory (Left), adding trip memory in Vienna and earn 10 points (Middle), earn 'Trip memory recorder' badge (right)

5.3.5 Prototype

The prototype was made in Figma platform, and it showed the main flows and interactions of the new design. It was clickable for users to interact with the UI interfaces to explore the new functions.

6. Evaluation

6.1 Usability testing

Usability testing is an evaluation method, in which test participants perform tasks under observation and speak out their thoughts while performing the tasks to help researchers get information of their actions' intentions (Barnum, 2020). With the aim of evaluating the usability and exploring the research question, the usability testings were conducted online.

6.1.1 Participants

The target users are Eurail's Rail Planner app users. The criteria for the participants was to choose those who had rail travel experience and used the Rail Planner app before. The five participants were recruited from the Facebook group. With the aim of testing with people from different user groups, chosen participants were three Youth and two Adult users. With regard to the residence countries, two people live in Europe and the other three people live outside Europe. For their experience with the Rail Planner app, three participants have used the app for one time before. Another two participants travelled with the Rail Planner app twice to three times. The participants were coded from P1 to P5 to protect their privacy.

6.1.2 Test procedure

During the test, five participants evaluated the clickable Figma prototype with high-fidelity user interfaces and shared their screens on the Teams platform to show how they interact with the prototype. The researcher acted as the facilitator to guide the test and observe to record participants' actions. The video of the user test (e.g, participants' screen, face and voice) were recorded for analysis and users were reminded to disable the pop ups to avoid of accidently capturing any personal information.

There were three main steps of the test, which were introduction, tasks and quick interview. The outline of the user test can be seen in Appendix G.

In the first step, the researcher gave participants a general introduction about the process and test aims. Participants were also asked to introduce themselves at first to help researchers know more about them. At last, participants were sent the consent form (see Appendix F), which got ethics

approval from University of Twente (RP 2022-172). After reading the information brochure and consent form, participants signed it online and sent it back to the researcher.

In the second step, participants were asked to perform the tasks on the online prototype and speak out their thinking while interacting with the prototype. The researcher guided the participants to finish the tasks and recorded their actions for analysis. There were three main tasks to help participants go through the main flows of the design to collect data, such as design problems. Specifically, the tasks contained three parts, which were:

1. Explore the Eurail reward system
2. Try the interactive quiz
3. Try to record the trip memory.

In the reward system task, participants were asked to see the benefits of different levels, discover how to earn points, see the collected badges and explore how many points they could earn through finishing different tasks. As for the quiz tasks, participants were asked to try the quiz of Finland, see the guidebook of the quiz, and find out the feedback. With regard to the trip memory tasks, participants were asked to view trip memories of Trip2022, add a new trip memory to Austria and find out a newly collected badge.

In the last step, participants were asked about their findings. They were also asked about their attitude to the different gamified elements, such as points, levels, badges and tasks, of the new features. After that, they were asked to what extent the new design made them feel engaged to answer the research questions.

6.2 Result analysis

6.2.1 Task result analysis

In the 'Explore the Eurail reward system' tasks, there are two main problems of the design, which can be seen in Figure 26. Firstly, participants found it a little hard to notice the entry place of the badge, which is located near the profile name. For 'viewing your badges', only participant P1 found the badge entry place quickly, others had no idea about it at first and then found it after a few trials. Participant P2 and P4 assumed that the badges might be placed in the reward system interface. Another problem is that

participant P2 and participant P3 mentioned that they would like to see how many points they should earn to level up directly in the level cards instead of calculating by themselves.

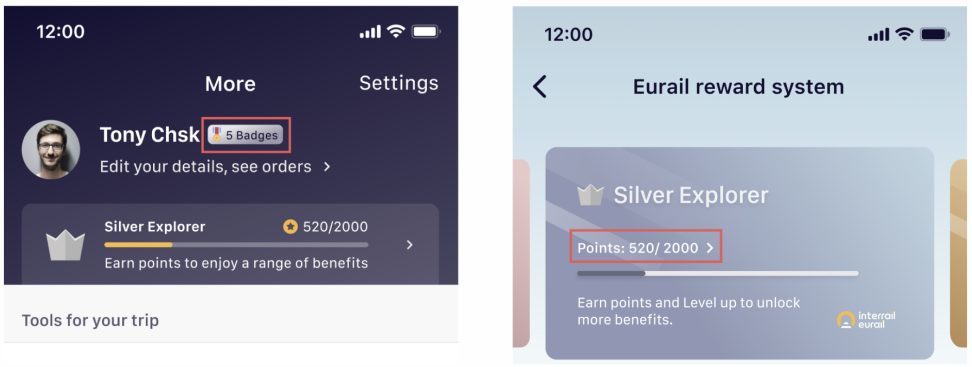

Figure 26: The problem of the entry place of the badge being hard to notice (left) and the problem of needing to calculate how many points they should earn (right).

For the 'Try the interactive quiz' task, most participants could finish the tasks fluently without hesitation. They could notice the feedback easily, such as changes of points and progress bar, the positive and negative feedback of their answers. Participant P2 mentioned that the guidebook was easy to be neglected and it would be better to highlight the guidebook (see Figure 27). Participant P3 suggested that some pre-requirements to take the quiz could be set to enhance engagement. For example, only users who had gotten the train tickets of France could play the interactive quiz of France.

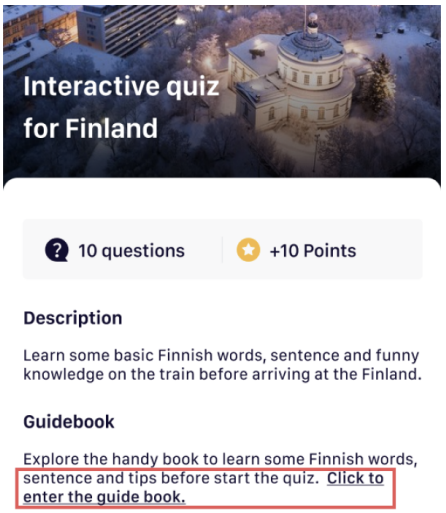

Figure 27: The problem is that the guidebook is easy to be neglected

With regard to the 'Try to record the trip memory' task, the biggest problem was that most participants chose to search for the entry place of the trip memory in the My trip tab instead of in the More tab (see Figure 28). Therefore, a connection should be built up between My trip interface and trip memory function. For example, an entry button should be added for the trip memory in the My trip tab to enable users to add trip memories for their ongoing and completed train trips. Participant P2 and Participant P5 also suggested it would be better to share the trip memories and trip plans in the Eurail community, which would enhance the interaction among users. For example, users can view others' trip memories and refer to other users' train trip plans to copy them directly in the Rail Planner app.

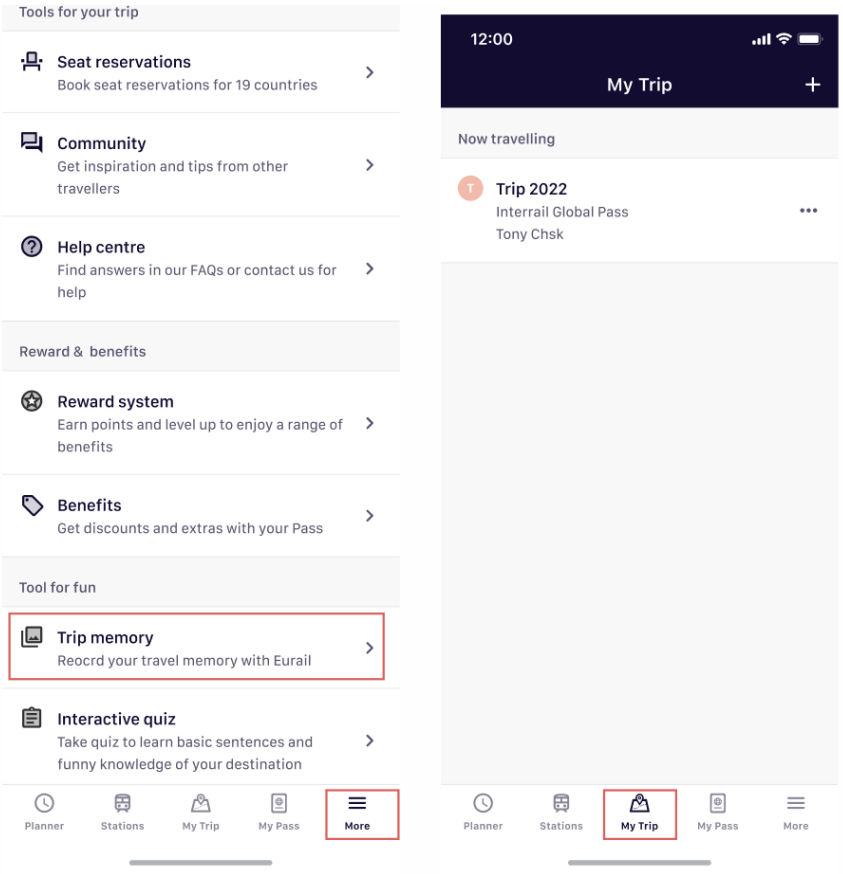

Figure 28: The entry place of trip memory is placed in the More tab (left), while most of the participants search for it in the My trip tab (right)

6.2.2 Attitude towards gamification

All the participants have experienced apps with gamifying elements before, such as Duolinguo, Booking and Finnair, which meant that they were familiar with gamification. As for their attitudes to different gamifying elements, all the participants thought that the reward system could enhance the engagement and motivate them to earn points to unlock more benefits. Participants emphasised that the most important part for the reward system was the benefit itself. They would compare the fares and discounts on different platforms and then choose the one with the best deal. Participants also mentioned that the rules of the level system should be easy to understand and it would reduce their motivations if the reward system was too complex.

Apart from the discounts, they would also be attracted by the badges, especially for the ones with special patterns and not easy to get. As for the tasks, they said it depended on how many points they could earn and how interesting the tasks were. For example, the interactive quiz might attract users to take at first and then it would be less attractive after a few trials because it only earned little points.

Achievement summary and annual report were also mentioned by the participants. They said that they would like to see their annual summary about train trips, such as how many countries they have been to, how many users they surpassed, what the farthest country they travelled to was and what their longest train journey was, and share it on social media.

7. Discussion

7.1 Key findings

There are some key findings from the user research and usability testing to answer the research questions **'how to use gamification methods to enhance the user experience of rail travelling to make it more engaging and interactive?**' The four sub research questions are answered separately below.

7.1.1 What are rail travellers' needs and pain points during the trips?

The rail travellers have three main needs during their journey, which are recording the trips, learning the language and culture of their destinations, and getting benefits through the reward system. They also want to get inspiration while planning their journey and meet new people during the trips.

For recording their trips, rail travellers would like to take pictures and write some contents to share with their family and friends or post on social media. They are also willing to collect souvenirs to remember their trips and want to get their travel achievements summary in an effective way. With regard to learning language and culture of their destinations, they want to learn some daily language to communicate with local people and railway related words to deal with the problems in the train stations. They also want to learn some culture knowledge and travelling related information of their destinations to enhance their travelling experience. The benefits during the trip are also the essential needs for the travellers. They would like to have a reward system to unlock more benefits when they buy the rail pass for a few times.

7.1.2 How to conduct gamification design in the Rail Planner app?

Firstly, it is necessary to understand what gamification is, what elements and principles gamification has through literature review and competitive analysis to learn the basic knowledge and examples. From the research, gamification is a technique to add gaming elements and principles to the non-gaming context to improve users' engagement (Deterding et al., 2011).

Gamification elements are the foundation for the gamification design. Levels, points, tasks, leaderboard and progress bar are the essential elements for the gamification. It is also necessary to set up the rules (e.g. the rules for earning points) and constraints (e.g. such as the countdown to the tasks) to follow.

Secondly, it is necessary to research users' needs and explore the design opportunites. And it is also important to analyse the features and structure of the app. After that, gamification elements and principles can be added to the app to satisfy users' needs. From the research, users' want to record their journey, learn language and culture, and have a reward system. To build up the reward system, gamification elements, such as levels, points and tasks can be added to the app. Badges of cities and achievements can also be designed to help users record and remember their journeys. The progress bar and points can be used in the quiz part to give users immediate feedback.

As for the app structure, it has five sections, which are Planner, Station, My trip, My pass and More. From the analysis, new designs are suitable to be placed in the Planner and More section. This is because the Planner is the first interface users can see when they open the app and it can attract users to try the new functions. The More section has the user profile part, so it is suitable to put the level system there to help users check their current levels and related benefits. The entry places of other fun functions can also be placed in More sections. Apart from it, the Rail Planner app has its own design system, so the UI design of new features should follow it to keep design consistency.

7.1.3 What gamification elements can be used to enhance user experience ?

In the project, levels, points and tasks and progress bars are chosen to build up the reward system. The main rule for the gamification design is that users can earn points to level up to unlock more benefits. They can earn points through buying the product, finishing tasks, such as recording their trip memory, and inviting friends to use the product. Users can also earn badges, which can be divided into achievement badges and countries badges, in the system. The achievement badges are those related to users' travel achievements and country badges are collected when users travel to those countries. Users can also know how far they are from the next level

and their progress when they take quizzes through the progress bar. They will also get feedback when they earn points, level up and earn badges in the system to encourage users and make them know their situation in the system.

7.1.4 To what extent does gamification design enhance rail travellers' engagement and interaction?

There has been a positive response to the gamification design from the majority of users. They thought that gamification design, such as a reward system, could enhance the engagement and motivate them to earn points and level up to unlock more benefits. The digital badges can satisfy their desires as well, especially for limited editions. Progress visualisation in the level system can also show users how far they are from the next level to motivate them to earn more points. The gamified elements can also increase the interaction between users with the Rail Planner app. Users will enjoy more functionality, such as record their journey and answer the interactive quizzes, to interact more with the app.

It is worth mentioning that users will still compare the products on different platforms to find the best deal, although gamification may motivate users to purchase the product. The benefits themselves are the most important part for users, while the gamification is only a bonus. So, it will reduce the engagement if the benefits in the reward system are not attractive enough.

7.2 Limitations

There are some limitations for the validity of the result of the interview method in the user research stage and usability test after design. Firstly, the sample size of the participants are limited for the research, which are six participants for the interview and five participants for the usability test. The thoughts of a small number of participants might not represent all the users' thoughts.

Secondly, the diversity of the participants, such as different age, gender and residence place, could also influence the results. For example, no Senior participants participated in the usability test due to scheduling problems. It may result in missing some potential design problems. Apart from it, all the participants of the usability test had used an app with gamifying elements

before, which may lead to the falsely high success rate and falsely good attitude to the gamification design.

Thirdly, the lack of research on what kind of benefits users need in the reward system may lead to less attraction of the system. It may influence users' attitude to the gamification design.

Lastly, the online testing environment in the Figma platform may also influence the test result. Participants interact with the prototype in the computer instead of in their phone as they always do. The clickable places in the prototype are also limited and participants can not explore all the functions as the app does.

7.3 Future work

In the future, the design will be iterated based on the usability test result. For example, the trip memory function will be connected to the My trip part to satisfy users' expectations. The entry place for My badges will also be reconsidered to make it easier to find. Apart from correcting the design problems, more participants from different backgrounds, such as age groups, will also be invited to take part in the usability test to get more insights. In order to better measure if the gamification increases the engagement, the statistical measurement method will be conducted in the future. A survey will be sent after the usability test to ask to what extent the gamification increases the engagement. The data will be analysed and visualised through the pie chart.

I will also investigate what benefits users really need through sending a questionnaire to enhance user experience. And the possibility of the benefits will also be discussed with the Eurail to find the balance between the user needs and the business profit. The content of tasks and challenges will also be researched further to make it more attractive for users.

Some new gamified designs will also be explored in the future. For example, the social-related gamified functions, such as meeting new people in the same train and finding travel buddies in the community, will be researched. The privacy problem will be considered to enhance the safety and users can choose to show up or hide themselves to avoid privacy leakage.

The current design is only a prototype implemented with the Figma platform with limited clickable places for showing the interface design and

interaction. In the future, the new design will be further discussed with the Eurail's developers and product owner to make sure of the technical feasibility. It will be iterated and put into development in the future.

8. Conclusion

This thesis researched how gamification methods could be conducted in an existing non-gamified app to enhance the user experience of rail travellers. The literature review was the first step to learn about the gamification theory, principles and elements as the foundation for the gamification design. After reviewing the gamification theoretical information, the user research was conducted to collect user data to analyse the needs and pain points of users. In this stage, eight ideas were brainstormed for users to rank and rate to choose the best of them. The chosen ideas and commonly mentioned ideas from open questions were discussed further in the user interview. Persona and the user journey map were also created to transfer the user needs to the design opportunities.

Based on the user research outcome, the gamifying elements, including levels, points, badges and tasks, were added to the original Rail Planner app. The new design had three main functions, which were the 'reward system', 'record trip memory' and 'interactive quiz'. With the aim of finding out the design problem and discovering users' attitude to the gamification, a usability test was also conducted. Users were given tasks to find the design problems and share their attitude towards gamification design in the interview after the tasks were completed. The design iteration based on the usability testing will be conducted in the future due to the time limitations.

From the research, most users show a positive attitude towards gamification. They thought the reward system could enhance the engagement and motivate them to earn points and level up to unlock more benefits. Digital badges can be a symbol of achievements to motivate users. However, not all the gamified elements are suitable for the system. For example, the leaderboard does not work for the Rail Planner app.

The gamification mechanics, such as the rules of the reward system, should have a logical structure and be easy to understand to lower the cognitive loads of the participants. Apart from it, although the gamification design may attract them to continue buying the product, users will also compare the fares and discounts on different platforms to choose the one with the best deal. This means that the most important part for users are the benefits themselves and the gamification design is only a plus. So, it is important to

enhance the attraction of the benefits in the system to attract users instead of only adding more and more gamified elements and rules to make the system complex.

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Appendix

Appendix A: Survey questions & consent form

No	Section	Questions	Question types
1	Demographic data & warm-up questions	1. How old are you? 2. What is your current country of residence? 3. How many times did you travel with the Rail planner app? 4. What is your favourite trip of these 4? ● Relaxing trip ● Adventurous trip ● Family trip ● Cultural trip	**Close ended questions** : Multiple choice - Q1 & Q2 &Q3 &Q4
2	Attitude on fun & entertaining ideas	1.We are considering 8 new ideas for the app and we want to know how interesting/important this is for you. (0= Not interesting at all 10=very interesting.) 2. Prioritise the 3 most important ideas from 1-3 3. how interesting are improvements for the App like this	**Close ended questions**: Rating scale - Q1 Rank order - Q2 Like scale - Q3

3	Open questions & further interview	1. Do you have any other creative ideas for the App to enhance your travelling experience in a fun and entertaining way during your trip? 2. Thanks for taking time to complete the survey. If you would like to attend a follow-up online interview (approx. 40 min.) to discuss fun and entertaining ideas for the App, please provide your email address. If you are selected we contact you via email.	**Open ended question** -Q1 **Close ended question**: multiple choice - Q2

Information brochure for survey of Gamification design for enhancing user experience of rail travellers

Experiment context

You are being invited to take part in the thesis research study about adding some fun & entertaining ideas to the Rail Planner app**.** The survey will last around 3 mins and it will take place online in the Alchemer platform. The content of the survey can be divided into three parts, demographic questions, attitude towards fun & entertaining ideas and open questions.

Personal information security

Participants' residence country and age range will be collected in the survey. The collected data will only be used for thesis research and the deposited data will be anonymised through using participants' numbers to store. The access restrictions will apply to the data during the thesis research period. All the data will be destroyed by the end of the thesis research. Besides, the participants have the right to request access to, rectification or erasure of personal data.

Usage of data

All collected data will be anonymized and are only accessible to the researcher to protect the personal information of the participants during the study. All data will be archived in the researcher's laptop and destroyed at the end of the thesis research.

Contact details of the researcher

The research is mainly supervised by Mika Mika P. Nieminen (mika.nieminen@aalto.fi). If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study, please ask the researcher Xuefei Ni (x.ni-1@student.utwente.nl). And if you want to discuss with someone other than the researcher, please contact the Secretary of the Ethics Committee Information & Computer Science: ethicscommittee-CIS@utwente.nl.

Consent Form for the survey of Gamification design for enhancing user experience of rail travellers

YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information dated [DD/MM/YYYY], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	□	□
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	□	□
I understand that taking part in the study involves a survey.	□	□
Use of the information in the study		
I understand that the information I provide will be used for the thesis.	□	□
I understand that personal information collected about me that can identify me, such as my age range and residence country, will not be shared beyond the study team.	□	□
Future use and reuse of the information		
I give permission for the survey database that I provide to be archived in the researcher's computer, so it can be used for Xuefei Ni's thesis research. The deposited data will be anonymised through deleting all the private information. All the data, which might identify individuals, will be destroyed by the end of the thesis research.	□	□

Signatures

_____	_____	_____
Name of participant [printed]	Signature	Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____	_____	_____
Researcher name [printed]	Signature	Date

Study contact details for further information:

Xuefei Ni, x.ni-1@student.utwente.nl

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee Information & Computer Science: ethicscommittee-CIS@utwente.nl

Appendix B : Interview questions & consent form

Warm-up question

Hello! My name is Xuefei Ni, UX/UI design intern at Eurail. I am now writing my thesis in the company to explore some fun and entertaining gamified ideas to improve the UX of the rail planner app. The interview will be 45 mins to discuss the topics. Here is the consent form of the interview. If you have no other questions could you sign it?

Can I start to record the meeting? It will be only for internal usage and will be deleted after a while.

Could you introduce yourself ?

- What do you usually do during your Eurail trip?
- Which app do you use during your travels?
- Where do you plan to travel in the future?

Plan the journey

We are planning to design some new functions to help users plan their journey in a more convenient way. So, I want to know your experience about journey planning.

- Firstly, May I ask what you usually do to plan your journey?
- How do you think about customised trip recommendation, for example taking quiz at first and then recommend route plan based on the quiz result
- What do you think about the trip random button, recommending random routes/places based on your interests and distance?

Record/remember the journey visualise your travel places

- What do you usually do to record and remember your journey? (such as, share pics on instagram and write the blog)
- What info do you want to see in your journey summary?
- What kind of thoughts and feelings do you have when recording your trip?

- What do you think about sharing your trip memories with others (family & friends & other travellers?)

    - Where do you usually share them?
    - Do you want to share them in our community?
- Have you used the app with similar functions before?

Learn some sentences of new language

- What do you think about learning a few sentences of a new language of your travelling countries before starting your journey?
- What kind of sentences do you want to learn in your travel places' language?
- What do you think about learning a new language through playing games?
    - Do you have some gamified ideas?

Green route

- What do you think about a sustainable trip (such as taking trains and going to sustainable cities)?
- To what extent does it influence your travel plan when making choices?
- What do you think about the carbon footprint of your trip? What do you want to know related to sustainability during your trip?
- How do you feel when sharing sustainable accomplishments to other people?

Meet new people

- What do you think about meeting new people in the community during your trip? Why?
  (find trip partners & share travelling experience)
- Which kind of people do you want to meet during your trip? What will you do together?
- Do you want to know how many eurail/interail users in the same train/cities?
- What do you think about having some challenges with other travellers?

Attitude to reward system

In the future, we will have a reward system and users can collect points while using the app and get rewards from it.

- What do you think about the reward system?
- To what extent do you think the reward system motivates you to use the app or finish the tasks? Why?
- Do you think the elements of the reward system such as points, levels and accomplishment ranking will make you motivated?

Thanks for your participation. After finishing all the interviews, we will raffle a winner from all the participants and send the result to you through email.

Information brochure for interview of Gamification design for enhancing user experience of rail travellers

Purpose of the research

You are being invited to take part in the thesis research study about using gamification methods, which is to add game mechanics, such as level, points, badges and tasks, into the non-game Rail Planner app to improve user experience. The purpose of this project is to research how to use the gamification methods to enhance the travelling experience of the rail travellers to make them feel more engaged and enjoyable.

Experiment context

The main goal of the interview is to find out users' attitude towards fun & entertaining ideas. The interview will last around 45 mins and it will take place online in the Teams software. The video of the interview, including your screen, your face and your voice, will be recorded for the research analysis. The procedure can be divided into three parts, introduction, discussion for six topics related to fun & interesting ideas and wrap-up. All the participants will have the chance to raffle a rail pass as reward after finishing all the interviews.

In the first step, the research will give you a general introduction about the process and test aims. At last, you will be asked to sign the consent form.

In the second step, you will discuss six topics, including 'plan the journey', 'record and remember the journey', 'learn language of the travelling countries', 'travel via green route', 'meet new people' and 'reward system'.

In the last step, we will have a final wrap-up of all the discussions.

Risks of participating

For the interview participants, there is a risk of accidentally capturing personal information, such as pop-ups from messages and emails, during the screen recording tests. Thus, to mitigate risk we ask participants to only share the browser window. If researchers capture the information out of the scope of the study, the data will be removed from the dataset as soon as possible.

Withdrawal from the study

The participant can discontinue participation in the ongoing research study, without penalty. The participant can leave a research study at any time. When withdrawing from the study, the participant should let the research team know that he/she/they wishes to withdraw. It is optional for the participant to provide the researcher with the reason for leaving the study.

Personal information security

Participants' residence country and age range will be collected in the interview. The collected data will only be used for thesis research and the deposited data will be anonymised through using participants' numbers to store. The access restrictions will apply to the data during the thesis research period. All the data, which might identify individuals including video recordings, will be destroyed by the end of the thesis research. Besides, the participants have the right to request access to, rectification or erasure of personal data.

Usage of data

All collected data will be anonymized and are only accessible to the researcher to protect the personal information of the participants during the study. All data will be archived in the researcher's laptop and destroyed at the end of the thesis research.

Contact details of the researcher

The research is mainly supervised by Mika Mika P. Nieminen (mika.nieminen@aalto.fi). If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study, please ask the researcher Xuefei Ni (x.ni-1@student.utwente.nl). And if you want to discuss with someone other than the researcher, please contact the Secretary of the Ethics Committee Information & Computer Science: ethicscommittee-CIS@utwente.nl.

Consent Form for the interview of Gamification design for enhancing user experience of rail travellers

YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information dated [DD/MM/YYYY], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	□	□
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	□	□
I understand that taking part in the study involves a video-recorded interview. The recording of the interview will be transcribed as text and it will be destroyed after analysis.	□	□
Risk associated with participating in the study		
I understand that taking part in the study involves the following risk: accidentally capturing personal information during the screen recording tests. To mitigate risk, I know that I will only need to share the browser window where I visit the Figma platform.	□	□
Use of the information in the study		
I understand that the information I provide will be used for the thesis.	□	□
I understand that personal information collected about me that can identify me, such as my name, age range and residence country, will not be shared beyond the study team.	□	□
I agree to be video recorded, including my screen, my face and my voice.	□	□
Future use and reuse of the information		
I give permission for the user test's video recording that I provide to be archived in the researcher's computer, so it can be used for Xuefei Ni's thesis research. The deposited data will be anonymised through deleting all the private information. All the data, which might identify individuals including video recordings, will be destroyed by the end of the thesis research.	□	□

Signatures

_____	_____	_____
Name of participant [printed]	Signature	Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____	_____	_____
Researcher name [printed]	Signature	Date

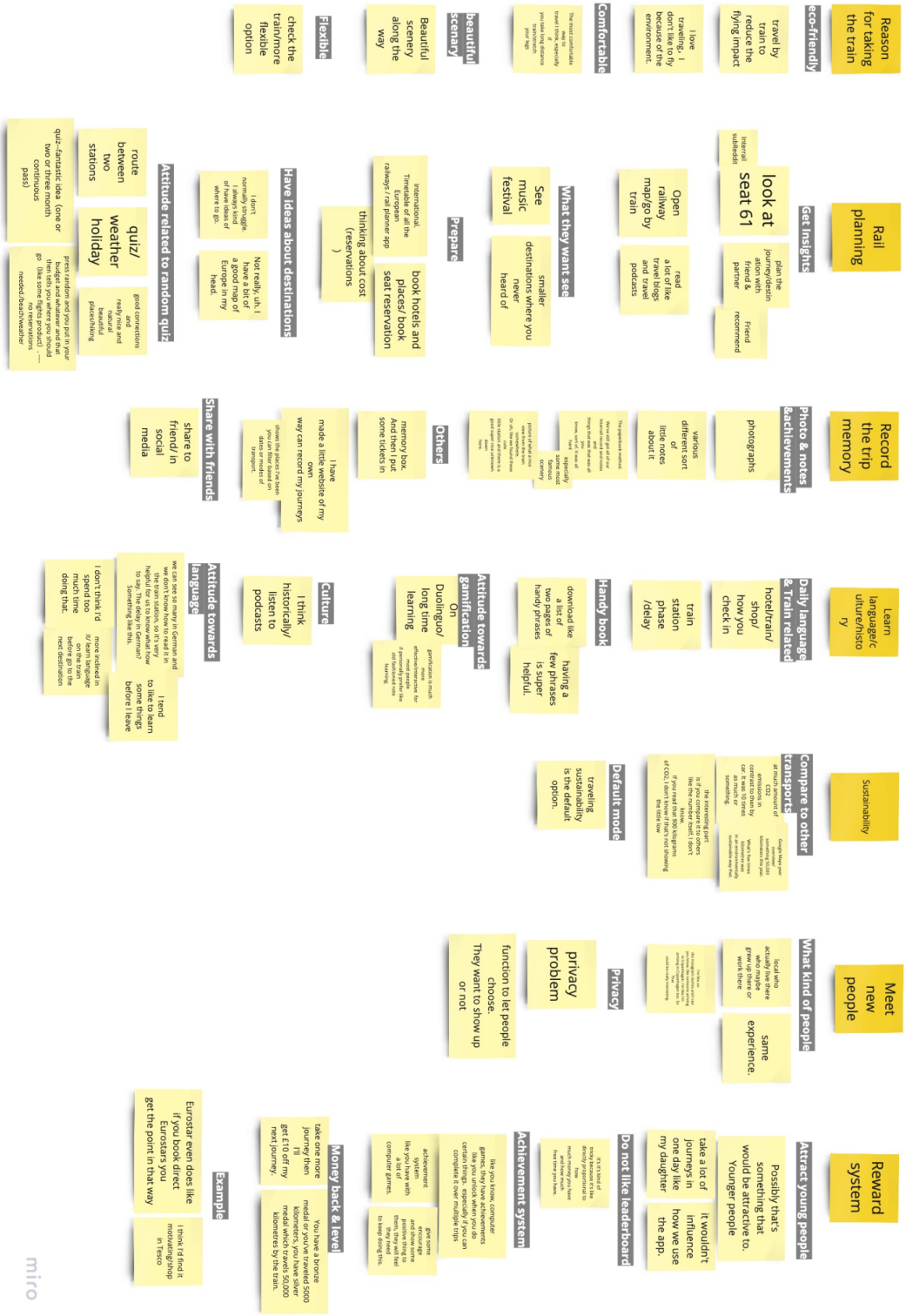
Study contact details for further information:

Xuefei Ni, x.ni-1@student.utwente.nl

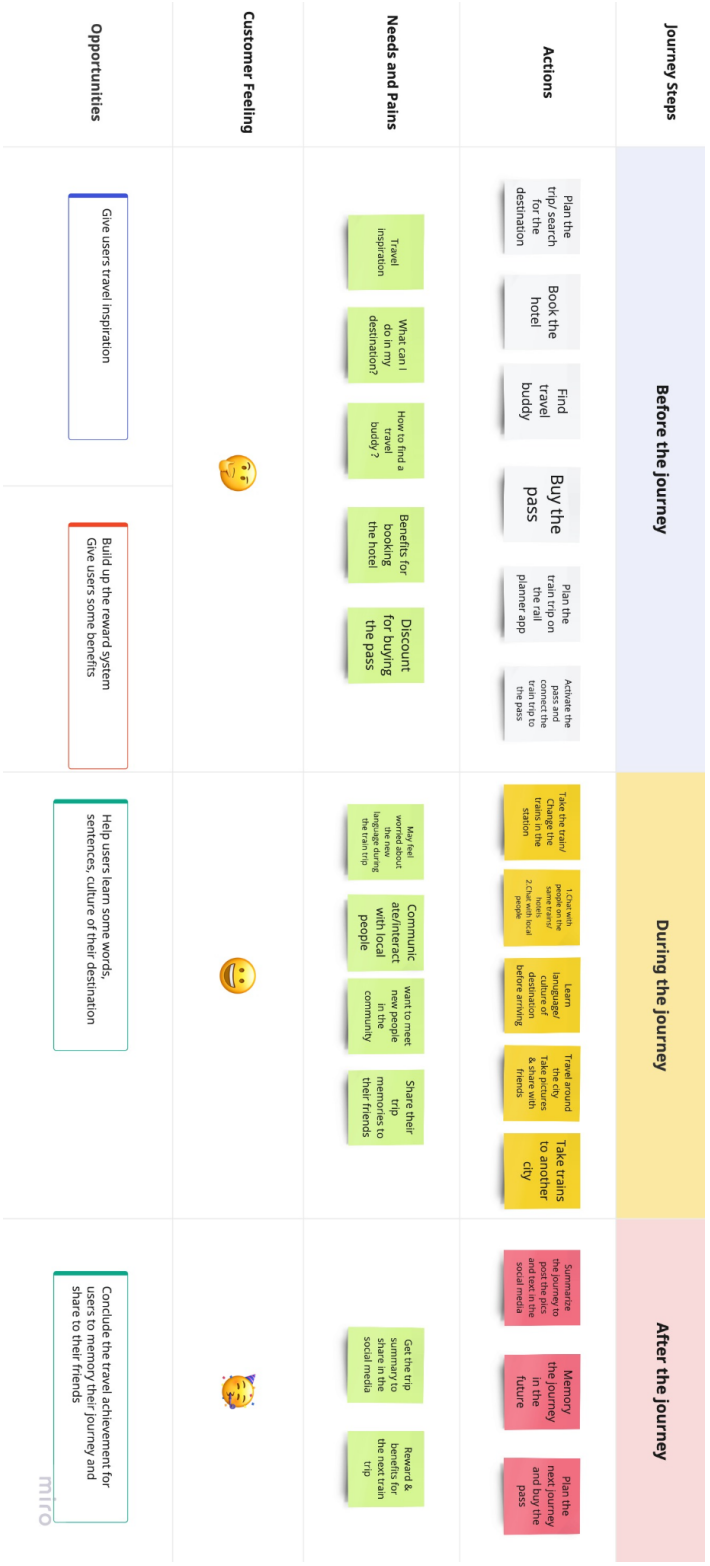
Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee Information & Computer Science: ethicscommittee-CIS@utwente.nl

Appendix C: Affinity diagram for analysing interview results

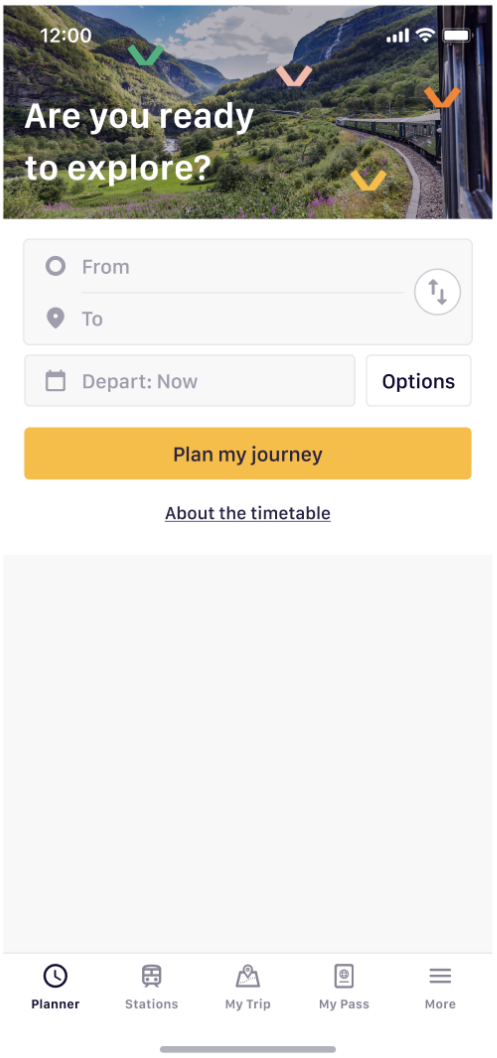


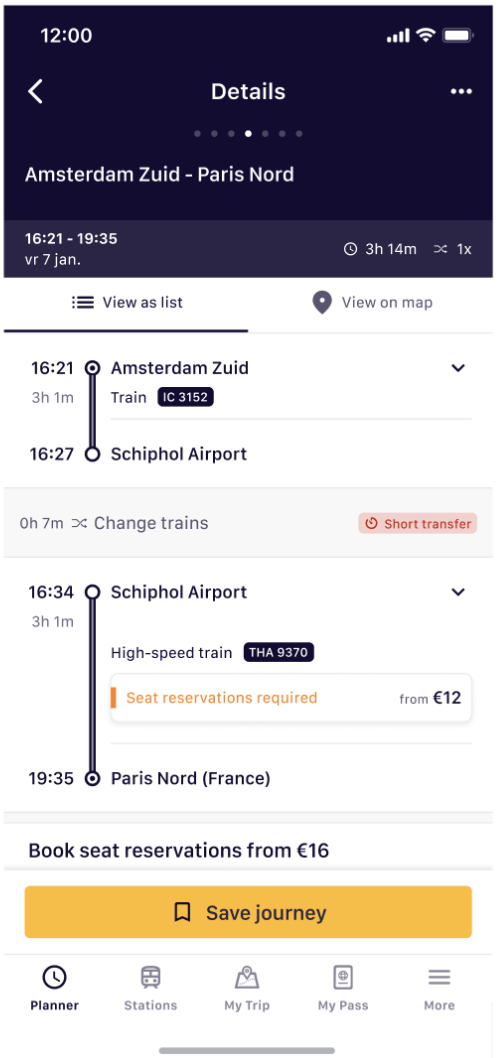
Appendix D: User journey map



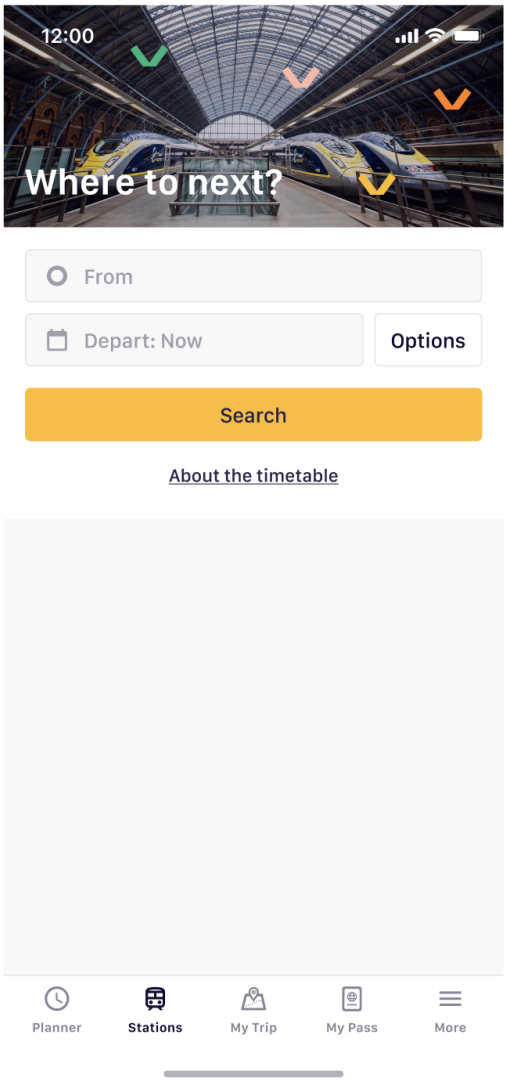
Appendix E: Main interfaces of the original Rail Planner app

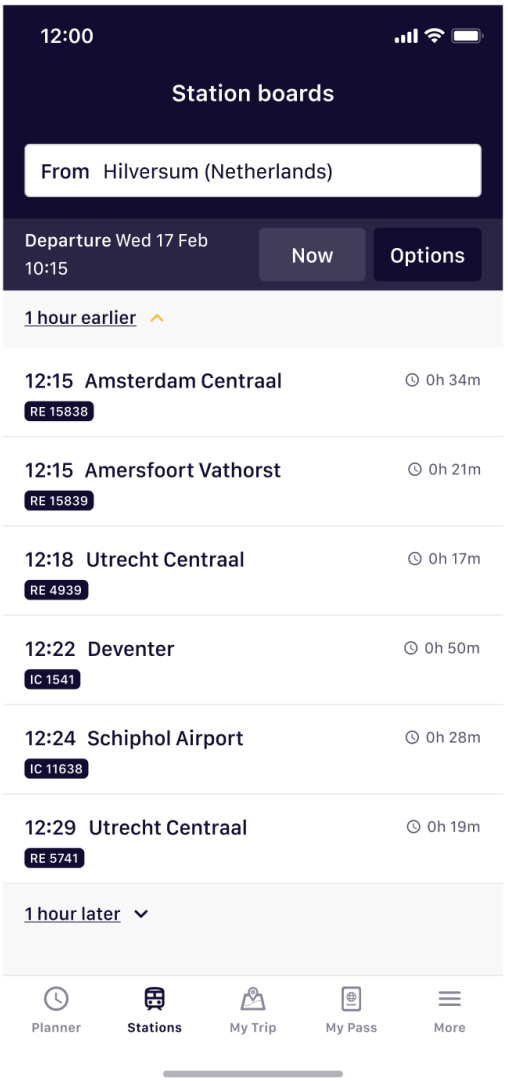
- My planner page and train details page



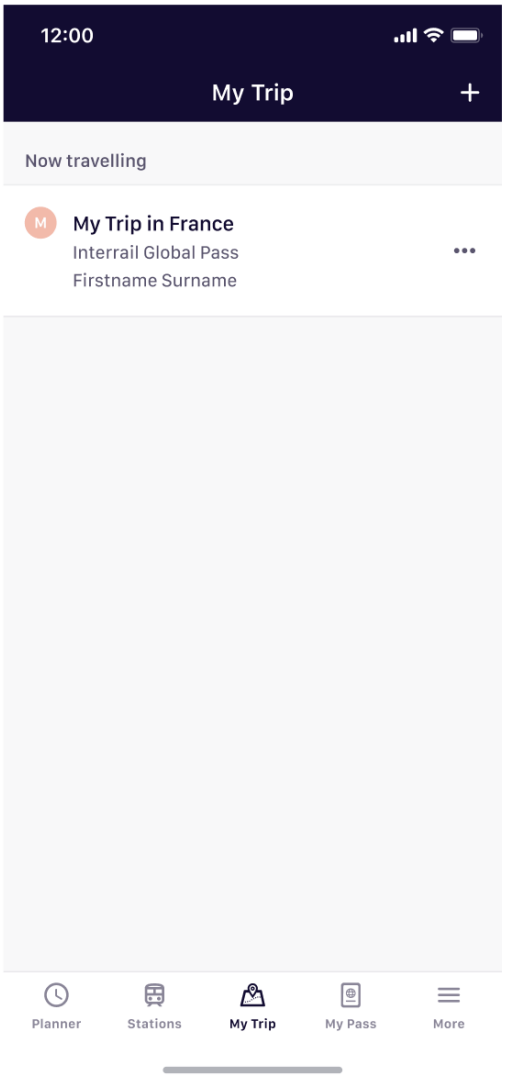


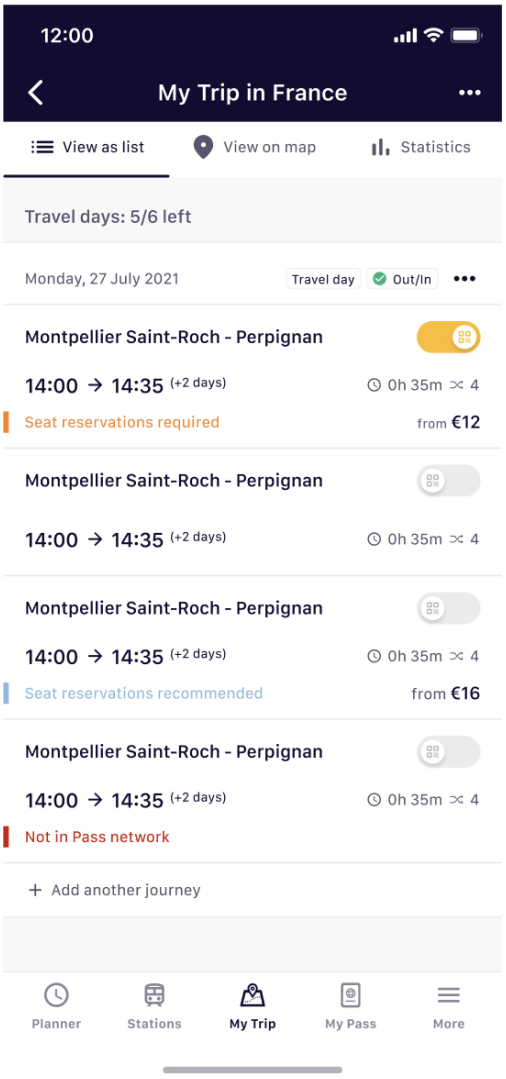
- Stations page and station boards page,



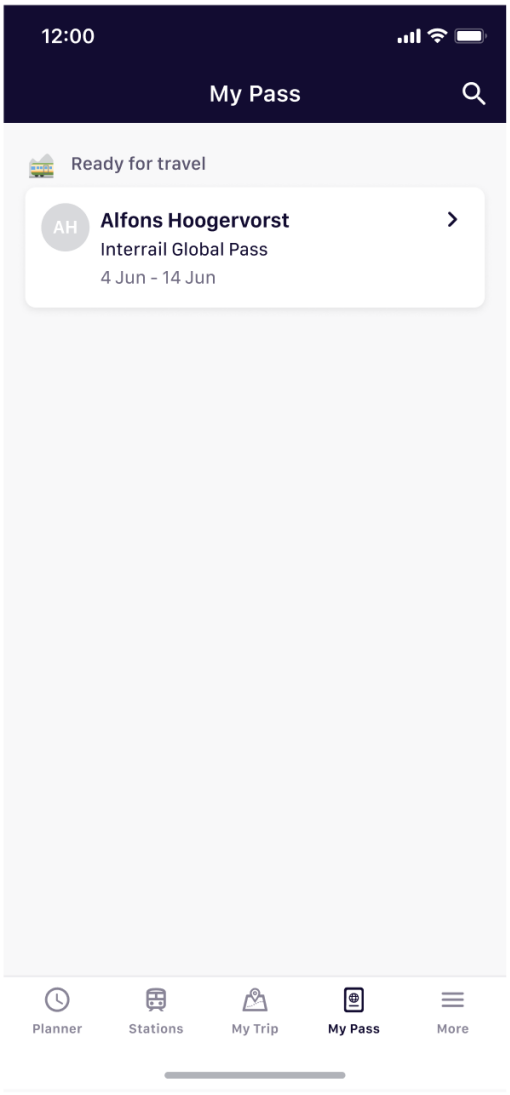


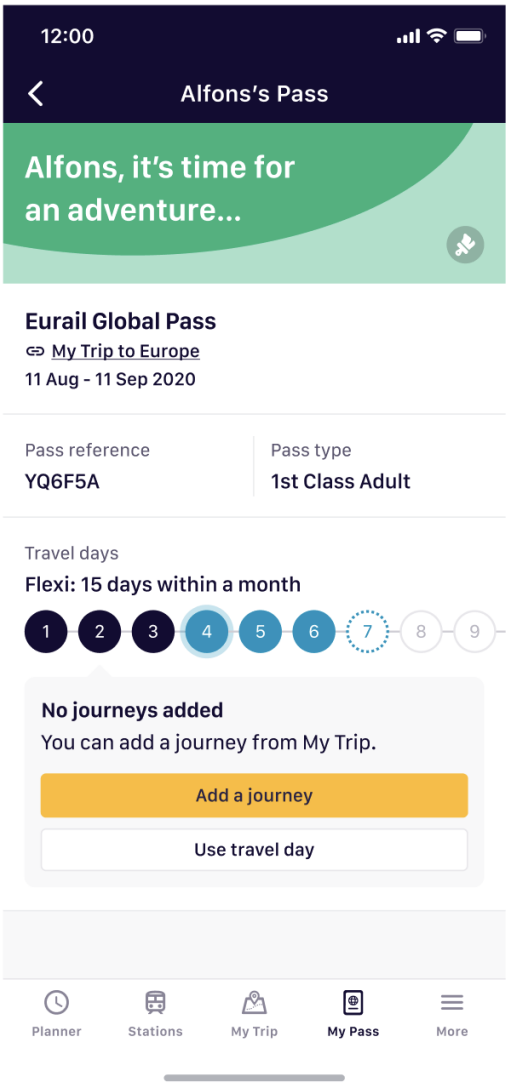
- My trip page and Details of My trip in France page, when users open the yellow button in the right page, the train trip can be connected to the Pass.



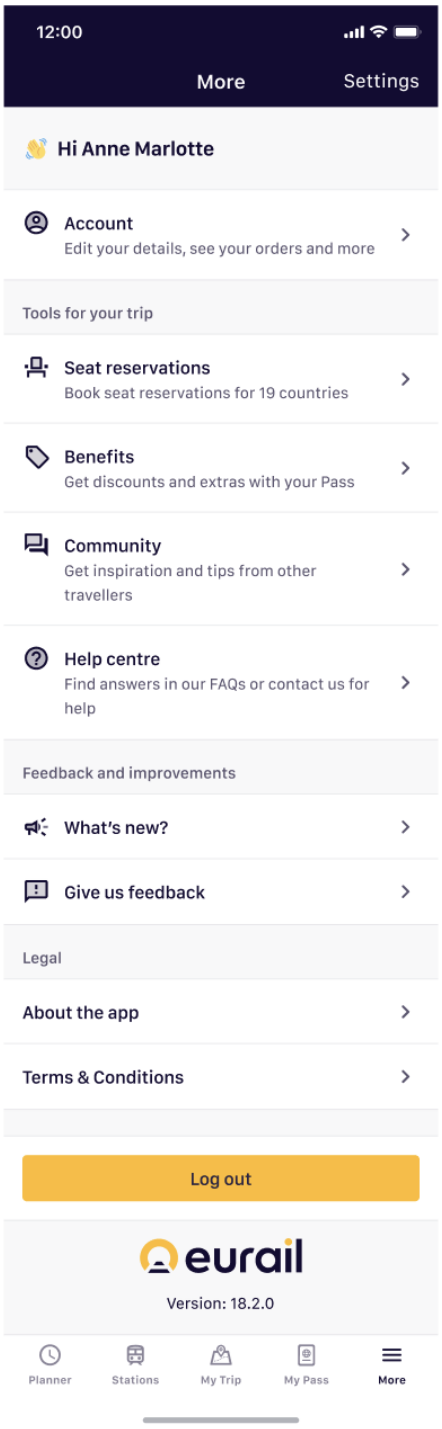


- My pass page and Details of Alfons's pass, the details page shows the information of the Pass and users can use the travel day to connect the trip with the pass to generate the available tickets





- More page


12:00
More
Settings
Hi Anne Marlotte
Account
Edit your details, see your orders and more
Tools for your trip
Seat reservations
Book seat reservations for 19 countries
Benefits
Get discounts and extras with your Pass
Community
Get inspiration and tips from other travellers
Help centre
Find answers in our FAQs or contact us for help
Feedback and improvements
What's new?
Give us feedback
Legal
About the app
Terms & Conditions
Log out
eurail
Version: 18.2.0
Planner
Stations
My Trip
My Pass
More

Appendix F: Information brochure & consent form of usability test

Information brochure for Gamification design for enhancing user experience of rail travellers

Purpose of the research

You are being invited to take part in the thesis research study about using gamification methods, which is to add game mechanics, such as level, points, badges and tasks, into the non-game rail planner app to improve user experience. The purpose of this project is to research how to use the gamification methods to enhance the travelling experience of the rail travellers to make them feel more engaged and enjoyable.

Experiment context

The main goal of the user test is to evaluate the UX design to find the problems for iteration and explore users' attitude towards gamified design. The user test will last around 45 mins and it will take place online in the Teams software. The video of the user test, including your screen, your face and your voice, will be recorded for the research analysis. The test procedure can be divided into three parts, introduction, finish tasks to explore the design and quick interview.

In the first step, the research will give you a general introduction about the process and test aims. You will be asked to fill in a questionnaire at first to collect your basic information (e.g. residence country, age range, and your experience with the rail planner app) to help the researcher know more about the participants and divide the user group for analysis.At last, you will be asked to sign the consent form.

In the second step, you will be asked to perform three tasks, including' Explore the Eurail reward system', 'Try the interactive quiz' and ' Try to record the trip memory' on an online clickable prototype (see Figure 1) and speak out your thinking while interacting with the prototype. The researcher will guide you to finish the tasks and record your actions for analysis.

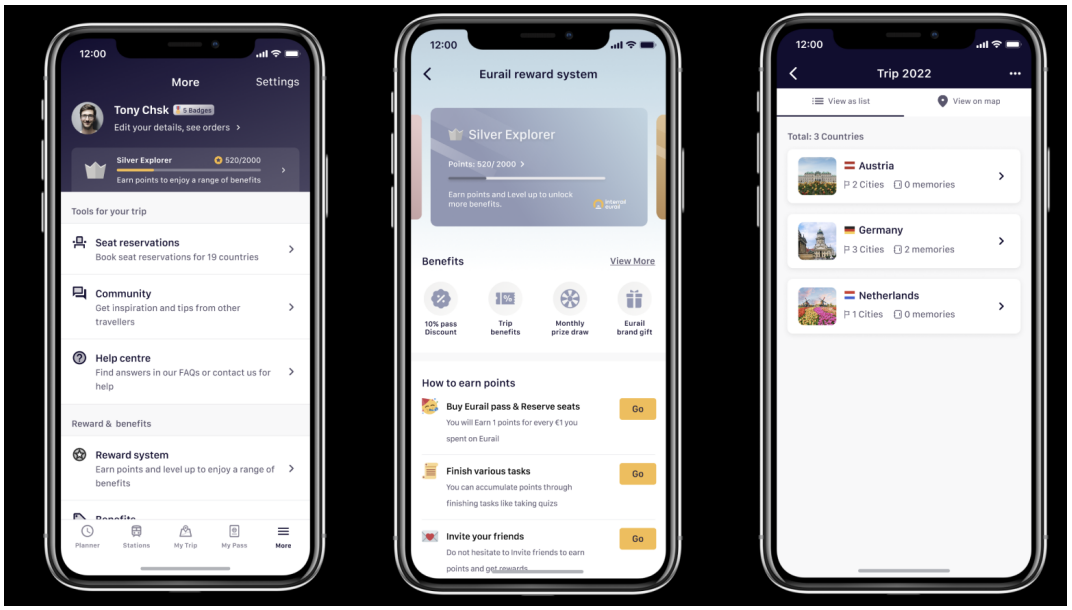


Figure 1: prototype of the user test

In the last step, You will have a quick interview with the researcher. Specifically, you will be asked about the problem you face and views on the gamified design to help improvement.

Risks of participating

For the user test participants, there is a risk of accidentally capturing personal information, such as pop-ups from messages and emails, during the screen recording tests. Thus, to mitigate risk we ask participants to only share the browser window where they use to visit the Figma platform.If researchers capture the information out of the scope of the study, the data will be removed from the dataset as soon as possible. The research project has been reviewed by the University of Twente.

Withdrawal from the study

The participant can discontinue participation in the ongoing research study, without penalty. The participant can leave a research study at any time. When withdrawing from the study, the participant should let the research team know that he/she/they wishes to withdraw. It is optional for the participant to provide the researcher with the reason for leaving the study.

Personal information security

Participants' residence country and age range will be collected in the questionnaire. The collected data will only be used for thesis research and

the deposited data will be anonymised through using participants' numbers to store. The access restrictions will apply to the data during the thesis research period. All the data, which might identify individuals including video recordings, will be destroyed by the end of the thesis research. Besides, the participants have the right to request access to, rectification or erasure of personal data.

Usage of data

All collected data will be anonymized and are only accessible to the researcher to protect the personal information of the participants during the study. All data will be archived in the researcher's laptop and destroyed at the end of the thesis research.

Contact details of the researcher

The research is mainly supervised by Mika Mika P. Nieminen (mika.nieminen@aalto.fi). If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study, please ask the researcher Xuefei Ni (x.ni-1@student.utwente.nl). And if you want to discuss with someone other than the researcher, please contact the Secretary of the Ethics Committee Information & Computer Science: ethicscommittee-CIS@utwente.nl.

Consent Form for Gamification design for enhancing user experience of rail travellers

YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information dated [DD/MM/YYYY], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	□	□
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	□	□
I understand that taking part in the study involves a video-recorded user test. The recording of the user test will be destroyed after analysis.	□	□
Risk associated with participating in the study		
I understand that taking part in the study involves the following risk: accidentally capturing personal information during the screen recording tests. To mitigate risk, I know that I will only need to share the browser window where I visit the Figma platform.	□	□
Use of the information in the study		
I understand that the information I provide will be used for the thesis.	□	□
I understand that personal information collected about me that can identify me, such as my name, age range and residence country, will not be shared beyond the study team.	□	□
I agree to be video recorded, including my screen, my face and my voice.	□	□
Future use and reuse of the information		
I give permission for the user test's video recording that I provide to be archived in the researcher's computer, so it can be used for Xuefei Ni's thesis research. The deposited data will be anonymised through deleting all the private information. All the data, which might identify individuals including video recordings, will be destroyed by the end of the thesis research.	□	□

Signatures

_____	_____	_____
Name of participant [printed]	Signature	Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____	_____	_____
Researcher name [printed]	Signature	Date

Study contact details for further information:

Xuefei Ni, x.ni-1@student.utwente.nl

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee Information & Computer Science: ethicscommittee-CIS@utwente.nl

Appendix G: Usability test tasks & interview

Aim of usability test:

In the usability test, you will interact with a clickable prototype and share your screen on Team's software to show their interaction process. During the test, you need to speak out your thinking while performing the prototype to help researchers understand your actions.The new design has three main flows for you to explore, including reward system, interactive quiz and trip memory.

The design link is:
https://www.figma.com/proto/K1Ld8VCrYU98tqCl4Yiwtd/Untitled?node-id=1%3A8740&scaling=scale-down&page-id=0%3A1&starting-point-node-id=1%3A8740

===Scenario===

Your name is Tony Chsk and you are from the Netherlands. Recently you bought an interrail pass and you would like to explore the new functions of the Rail planner app during your trip.

===Task===

1. Explore the Eurail reward system and try to answer the questions

a) View system levels and see the benefits of different levels
What level am I now? How many levels does the system have?
What benefits do these levels have?

b) View badges
What badges do I have?

c) Explore the methods of earning points
How does the system work? and How to earn points?
How many points should I earn to go to the next level?
What kind of tasks can I do to earn points?
How many points will I have when answering the quiz?

2. Try the interactive quiz and try to answer the questions

a) Try the quiz of Finland

b) View the quiz introduction and guidebook
Why should I download the guidebook?

What can I learn from the quiz?

d) Finish the quiz and see the result

What feedback will I get when I answer the quiz questions?

What is my quiz result?

3. Try to record your trip memory

a) View trip memories of Trip2022

How many countries do I travel to? How many trip memories did I record?

b) Try to view on the map

c) Add a new trip memory to Austria

What will happen when I add a trip memory?/ What feedback do I get after adding a trip memory?

e) View your new badges in the app

===Random Play===

1. Try to explore the app freely and find different places to enter the trip memory recording, interactive quiz and reward system

=== Quick interview after the test===

1. Do you find some problems with the design? Could you tell me some details of your findings?
2. Have you used the app with a reward system before (e.g. like duolingo app with levels, badges and points elements) before?
3. To what extent does the reward system (different levels, points, tasks and some positive feedback in the quiz) enhance your engagement and interaction?