

Methods and toolkits for better user experience

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<p>With the growing development and advancement in all the sectors even user experience is taking its positive curve and is in high demand during every product creation process. Users are always considered as top priority before starting to develop services or products for them. User experience has always been existing but changing its process and objectives. It is important to understand the concept of user experience as well as the toolkits that help to create user experience. Users can be associated with gaining experience in every kind of thing, the measures must be applied everywhere.</p> <p>This report consists of the toolkits that are associated in creating user experience from ideation to development phases. With the theoretical explanation a case study has also been studied implementing those theoretical measures and showing how different methods can be carried out to understand users and create good user experience when using the outcome.</p> <p>History of the user experience is studied thoroughly and some existing metrics such as factors affecting user experience, design processes, usability testing is done to justify the main research issue of the thesis which is about the methods and toolkits for creating better user experience.</p> <p>The report consists of both qualitative and quantitative methodologies which involves some potential users during the case study.</p>	
Keywords: User Experience, Methods, Toolkits, Design, Usability, Testing	

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Terms and Abbreviations

UX- User Experience

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1 Introduction

User experience is a long-discussed topic, and it turns out that creating a better user experience is very important to maintain the sustainability and success in the business. And sustainability is achieved once the users are satisfied with the product deliverables. Hence, effective user experience drives success and increases profits for any business.

The term “**User Experience**” or **UX** in short, is itself an explanatory word. According to Barnum (2021, 18), all the involvement that a user makes for using a product and the phases carried out by that creation is referred to as user experience. User needs and goals must always be prioritised when it comes to creating a product or services. A thorough study is done on users’ goals and the usability aspects following different methodologies and toolkits. Right tools and methods should be followed to effectively create better user experience.

Currently, it is very important to create better user experience for any products or businesses since people are more into doing online work and interactions with computers. The pandemic situation demanded for more and better understanding of user experience as it widely encouraged and supported people to work remotely. They are entirely dependent on computers and networks for social interactions and to get their work done remotely. To make the time easy and to encourage people to work through these mediums efficiently, it is important to take care of the experiences they get from using these products and new services developed for their needs. To solve the issue, this report highlights some basic toolkits and methods that should be considered to understand user needs and their requirements.

This report also covers the theories of user experience with a sample study to clarify the theoretical parts using practical and real time approaches.

1.1 The research problem

Currently, User experience is considered as one of the most important factors when building a product or creating services. So, it is very essential to know basic phases and toolkits to create a better user experience. Due to lack of user experience theories many products have failed to attract users, and, in some places, users are facing difficulties in using these services or products. Here, the study comprises some basic factors when implemented for evaluating user experience can give better results at last.

1.2 Research Objectives and Goals

The main objectives and goals for the thesis are:

- To create a better user interface through different methods and user experience toolkits.
- To explain different processes involved in designing a good user experience.

1.3 The research method

The methodology followed for writing this report is qualitative. The research is based on theoretical studies of existing research and theories and collaborating into a single report that clarifies the main goal of this report. Many online journals and books related to user experience studies are referred to in this report.

1.4 Research Scope

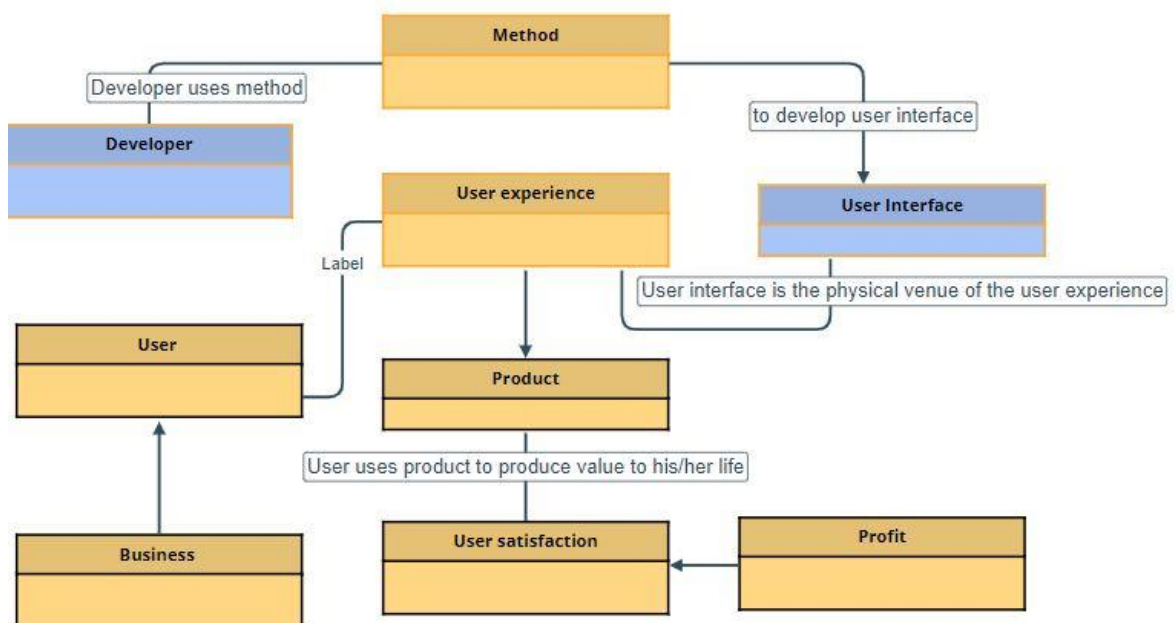


Figure 1. The core concepts of the research: the entities and their relationships.

UML class diagram. The diagram illustrates a subject (user) working on an object (user satisfaction) using a tool (user experience). (Engerström, 2001, 134-135)

The figure 2 describes about the main scope of my research. My focus is on designing good products that will give good experience to users. The product will provide satisfaction to the

user, and which is always profitable to business. For this user satisfaction it is important to study about them, their needs and what kind of interface give them good experience.

1.5 Thesis structure

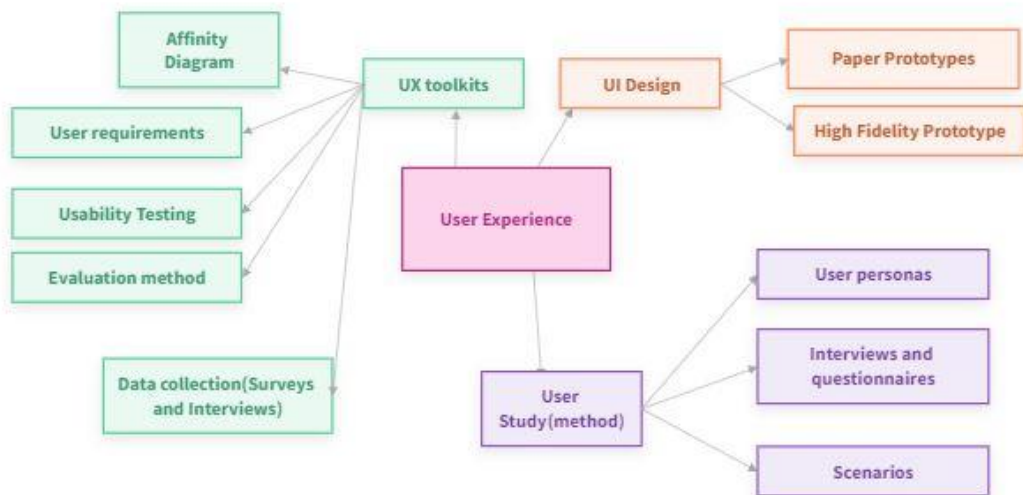


Figure 2. Research plan mind map.

Mind map. (S.C Evercoder Software S.R.L., 2020; G2.com, Inc., 2020; Moqups, 2021; S.C Evercoder Software S.R.L., 2021)

Here, figure 1 is about the research plan of my thesis. My core subject matter is user experience and describing the design toolkits that will help to create better user interface. This approach will in return create good user experience. Here, the **green** color expresses the main toolkits involved in studying about the user data and requirements. The **purple** color is about describing users and getting to know them and the **orange** color is about the interface that is created out of user data and different methods.

2 Theoretical framework

2.1 History

User experience has been a topic of interest since ages. There have been different eras and context which have thought about studying user experience and making the user journey comfortable. A fascinating history has been established in this subject matter since 4000 BC. Don Norman introduced the terminology in 1993, but this subject area has been existing in service and product industry forever (Vieira, 2021). A study of brief history of user experience is discussed with a figure below.

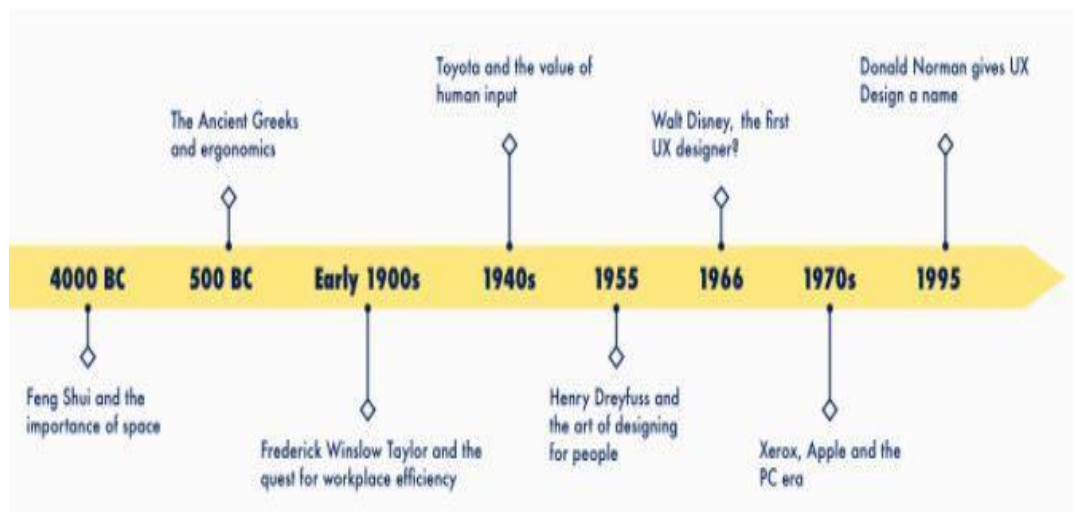


Figure 3. User experience timeline (Vieira, 2020; Stevens, 2021)

According to the **Figure 3**, it seems that user experience has been a crucial factor in every sector that is user oriented and whose focus is to satisfy the user journey. Talking about the very beginning, user experience was focused by Chinese philosophy in the prehistoric period. During 4000 BC, Feng Shui was introduced which meant arranging the environment and the surrounding objects according to the direction of energy flow. This was to create peaceful and user-friendly surroundings. It related to user experience because it was done with an objective to arrange things according to the vibes created by the flow of energy and everything was arranged accordingly for instance colours of objects, materials and so on (Stevens, 2021).

The great ancient Greek civilisation also seems to have followed the traces of UX during 500 BC. During those times human factors such as ergonomics were much considered for better wellbeing. Scientific principles and theories were applied to create tools and workstations that would optimize the principles of ergonomics and these theories were also said to have been applied to surgeons. The surgery place was set up in such a way that

surgeons would reach out to the required things and do their work productively. This does mean creating better user experience since it is related to human factors (Vieira, 2020).

In the early 1900s, Fedrick Winslow Taylor gave initiation to Taylorism which refers to managing working tools scientifically to decline inefficiency of labour in the workplace. This did get some criticism but the facts he showed were thoughtful and did reflect UX principles. The next time frame led us to the time when Toyota focused on making the working environment such that it would give optimal efficiency. Toyota's production unit valued human input and could manipulate the production line according to the needs of the people. So, it encouraged high respect to the interaction between humans and machines which also delivered the objective of user experience. (Stevens, 2021)

Then in 1955, Henry Dreyfuss encouraged art of design for improving the usability and he introduced iconic designs for telephones, vacuum cleaners, and typewriters. His writing, which depicts design for people, explains much about his focus on usability issues and user experience (Stevens, 2021). Then comes Walt Disney who was famous and regarded as the first UX designer. He was encouraged to create designs that were in accordance with user requirements, and he would create designs by placing himself in the user's footsteps. He also encouraged the people working with him to focus on the user experience and create immersive as well as magical designs.

In the 1970s, the personal computer age got introduced and became a pioneer of amazing graphical user interfaces and human centred hardware devices such as the mouse. Apple made initiation to personal computers, screens and mouse and became the creator of next level user experience. Later it also developed amazing devices such as mobile phones and iPod that satisfied user needs. (Vieira, 2021)

Then later in 1995, the name 'UX DESIGN' got coined by Donald Norman and this field got its value in the market. All aspects of user experience were studied and UX design got its new shape with a book called 'The Design of Everyday Things'. Since then, UX has been evolving into a new shape with better techniques and toolkits to create user experience. User needs and goals are ever since valued and prioritized before moving to any other stages. Now we can figure out the initiation of UX and know the value of user centred creations and their inputs. (Vieira, 2021)

2.2 User Experience (UX)

Experiences gained when using any services or products by a user is termed as user experience. It focuses on the user and their interaction with the substances then making of the substances. To gain better visibility of user experience all we must consider is to study the interaction of users when using different services and products, whether they are satisfied not and if the products or services please them and fulfill their requirements. When these things are located then it is easy to create better experiences for users since we get to know them, their preferences and suitability. Once you understand your user and be able to measure their attitudes and behaviour then it is possible to create services that create better user experience. "According to Barnum, if you want to create a better user experience then focus on the user rather than focusing on the product (2021, 18)." This is one of the sustainable approaches to create user experience. User experience is an idea that can be measured and observed. So, there are always some potential factors that can lead to finding out ways to study the experience of a user. (Tullis & Albert 2013, 4)

As we understand, user requirements take different shapes according to technological evolution. So, the factors affecting user experience also could also get renewed. However, there are some factors that have been existing and working well in measuring user experiences for a long time. Experts and web designers call it honeycomb according to (Barnum, 2021, 14).

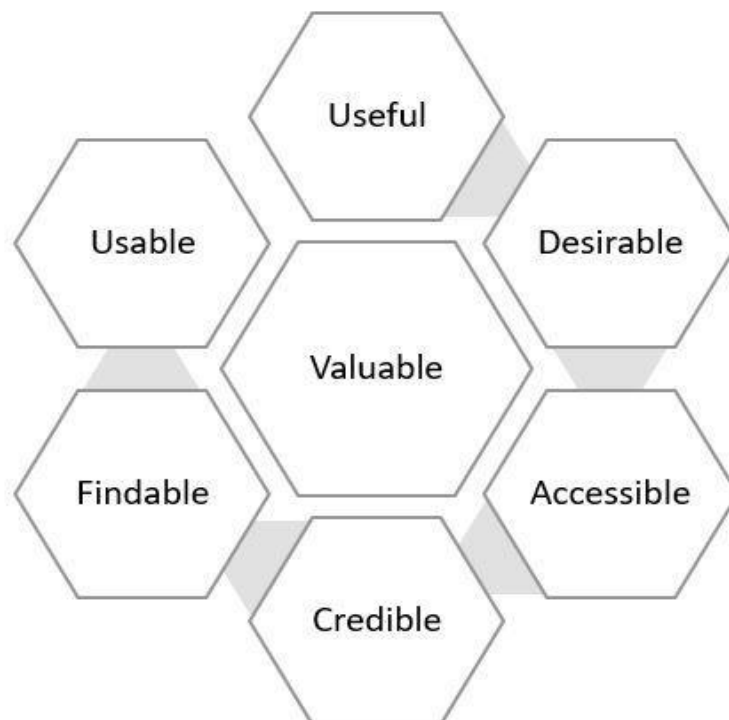


Figure 4. Factors affecting user experience (Morville, 2004)

Figure 4 is about the factors that affect user experience and shows the qualities that should be addressed when designing user experience. These seven factors incorporate all the patterns of users that they build when using the products or services. When these things are considered during the phases of user experience mostly when conducting usability testing then it gives extensive studies of user's behaviour and determines what are the most important factors for your products. Hence, this creates a milestone for your products. (Morville, 2004)

When we are capable of determining how **useful** the product is and what are its potential uses then we can drive our solution keeping those usages in mind that will, at the end, meet the basic goals of the product. The products designed for the users must be **valuable** and give them satisfaction contributing better deliverables of the product. And without compromising its value, creative features could be added to the product and make it a desirable one. Nowadays, **accessibility** has become a very essential attribute in every product. There are different kinds of users using the products and they could be old people, physically impaired or many more. The product should not be offensive to any groups and a standard should be maintained so that it is common to use between every group. These deliverables depict the moral behaviour of the product. Similarly, you should also maintain a trust with users by making sure the elements shared on the products are **credible**.

The products should be understandable and easily **usable**. It can be as painless as possible so that the user would want to use the product. Their learning curves should be taken into consideration and should not be difficult to understand the things that are designed for them, and users should not get lost when using the system or products. There should always be a possible solution if any problem arises. Users should be able to **find** what they are searching for in the product then only their experience will be better in using the product.

2.3 User Experience Design Processes

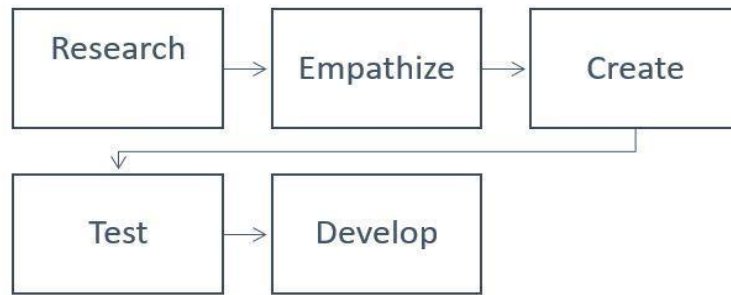


Figure 5. UX Design Process (Urse, 2021)

Figure 5 explains the processes that are involved in creating step by step solutions to design better user experience. Creating user experience is not an easy task. Often in the companies, this work is either overlooked or not focused on at all. Therefore, the basis for creating better products or services for the user, it is very important to understand the user, their needs, and expectations. Before stepping any further it is important to untangle the problems and start building strategies to solve the problems. The making of any products or services after this approach will assure the achievement of the goals. (Urse, 2021) Let's dive more into the processes involved in creating effective user experience:

- **Research:** The first and foremost thing is to do research on the users and define their requirements. Make a study of demographics of the user and try to understand their motives regarding the products. Different age groups and genders have different levels of understanding about the product, and their ways of usage could also vary. So always make thorough study on the user and their goals before proceeding further.
- **Empathise:** After conquering the user study you can apply them in user personas and different user scenarios to fit in their shoes before dropping down the ideas. User journey can be created referring to the similar products or services that have been existing and figuring out the list of requirements. Those requirements can be finally organised by prioritising them and proceeding further.
- **Create:** Then comes the next phase which is about putting all the ideas collected so far into a design. There are different kinds of designs, where the ideas can be interacted such as creating wireframes or prototypes which could include paper low fidelity and

high fidelity. Nowadays, people prefer minimalism so it is better to follow this trend and create a simple and understandable design which can be altered easily before going to the development phase. The most crucial factor is we should assure all the requirements are included and a better user mapping can be done with the design.

- **Test:** Then comes the testing phase where the created designs or wireframes are sent over the usability test and feedbacks are collected. Mostly this includes the user themselves so that true results are derived. The outcome of the test should be studied and changed if required or make the design more explainable before sending it to the development phase.
- **Develop:** The final approved design should be sent to develop. It is important to follow the designs created after the long procedures but if some alterations are needed then a collaborative effort can be invested as well. It is always good to give the effort for making better results. If these all procedures are followed, then users will get better products for their use and their experiences could be effective.

3 Designing User Experience

3.1 User Study

User study is one of the crucial factors in this subject. If you understand the user base then you can easily make guidelines of their preferences regarding the product or the services. A good UX researcher always knows about the nature of the product whether it is the existing product or a new concept. Depending on the product and services, the user who uses it could vary according to geography, gender, environment, or age. So, it is important to do market research on focus groups and analyse their behaviour patterns. After finding out the potential user it will be easy to gather their requirements for using the products. Before starting to ideate the initial creation phase of the product, clarify the profile of the user according to the need of the product or services. (Adhav, 2020)

3.2 Market research

If you must sell your product in the market, then you need to find out the potential competitor. It is important to study and discover unique traits which can be implemented in products or services that can attract users more than the existing competitor. User experience also depends upon the trends that are being followed. Market study also helps to figure out the

focus groups that use the product. To understand the basic needs of the user, market research is important. By doing market research, we figure out the behaviour patterns of the user, market size to launch the product, trends for similar products and can use those findings for creating better user experience. (Adhav, 2020)

3.3 Interviews and surveys

Making inquiry about the contextual matter is important as well. Taking interviews and collecting surveys are among the most reliable methods to study about the user environment in detail. We can conduct interviews with users by creating a structured set of questionnaires about the products. For this, questionnaires can be constructed according to the existing product experience of the user or by analysing some semi structured requirements of the users with the products or services. (Barnum,2021)

Nowadays, there are many ways of conducting interviews. We can send a set of constructed questionnaires through different communication channels such as zoom, email, teams, or different social mediums. If we want to collect the user's viewpoint regarding a product, we can send a survey form. Survey forms can be constructed through different online mediums. One of the most effective mediums is **SurveyMonkey**. (Barnum,2021)

3.4 Affinity Diagram

Affinity diagram is also known as '**organising diagram**'. It helps to organise large groups of unsaturated data into a saturated one. When we research about users, market, existing products, and interviews, we end up with a huge number of brainstormed ideas, information, user needs and so on. These make it difficult to focus on what is relevant to the product that creates a better user experience. So, an affinity diagram helps in clustering data according to its priorities and relationships with one another. It is important to address every possible idea, insights and user needs that could be relevant. Those outcomes processed from affinity diagrams assist in collecting user goals, requirements, making user profiles and user scenarios. And many other things that help to design products or services. (Friis Dam and Yu Siang, 2020)

Ways to make affinity diagram are:

- Take sticky notes.
- Arrange the cluster data into categorizations of similar data.
- Then, give labels for those categories.

- At last, prioritise the groups accordingly.

3.5 Requirement Analysis

After taking interviews and making affinity diagrams, we have a bunch of requirements that are essential for users. It is important to understand these requirements. Hence, all the needs are fulfilled in the product we create so that users are satisfied. User requirements play an important role in making a product success. According to the requirements, designs are implemented in the products.

To analyse the requirements, differentiate them into functional, non-functional and user requirements. According to Shneiderman, Plaisant, Cohen, Jacobs, Elmqvist (2018,133), **Functional Requirements** are those which states the specific behaviour of the product, **Non-Functions Requirements** mentions about the overall activity or observations of the product and **User Requirements** includes all the non-functional requirements that are involved in making user interactions. Once the requirements are analysed, they can be prioritised and implemented in the product or services we create for the user. This gives good inputs in the product and helps in designing better user experience.

3.6 User Persona and Scenario

Now, implementing the outcomes of affinity diagram, user study and requirements analysis, a user profile can be created. This helps to understand users more closely and will be able to find out some missing information as well. We imagine a user and create his persona that is helpful for the product or services to be created.

Creating user personas also assists in making a user mapping and makes us stand in the place of the user and think like him. We understand the needs and goals of someone better if we stand in his place. After creating a user persona, we can create a user-scenario involving the user and define his problem in more details and figure out what are his needs and how can we make his experience better with more clarity.

3.7 Usability Studies

When we make our study about user experience then one of the words that comes in our mind is usability studies. This is because usability studies play an important role in creating better user experience. The definition of usability given by (ISO, 2020), " Usability is the extent to which a system, product or service can be used by specified users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use". This definition is more convincing because it emphasizes important topics for creating user experience such as users, their goals and the usage of the product or the services. It also focuses on sensitive parts of usability : Efficiency, Satisfaction and effectiveness which are obtained by determining the experience of the user.

According to the author, **effectiveness** and **efficiency** are those measures which assist to identify users and their goals. It is also used to measure the value of the product which is necessary to know if it is adding value to the user performances when using the product. There is no point in using the product further if it does not add any value.



Figure 6. Critical measures of Usability (adapted from Barnum 2021,12)

Beyond these features, comes the **satisfaction** which is considered to be one of the most crucial measures to identify if the product of services is useful and satisfies the objectives. It is very important to read the expressions and emotions of the user when using the product. If that reading comes to be positive then the user would like to carry on with the products and that satisfies the user's goal. These critical measures are useful in usability in order to

know if the final product is more desirable and if any further changes have to be made. It is also regarded as one of the important measures by developers and owners of the product. (ISO, 2020)

3.7.1 Usability objectives and measures

When we are measuring or dealing with user experience, understanding user goals and the study goals is an important factor as well. We should know why UX study is being carried out. Are we focusing on the functionality for creating a new product and simply trying to make some updates on the existing services or products? Our UX study will vary according to the purpose of making the product or services. Not only this but it is also essential to know the goals of the user. What do they want to do with the product? Is the product or service just to satisfy their few needs or they are going to be using it for various other reasons as well? When you understand the objectives of the user and the study then you have crossed one step in creating a better user experience. Later, there are the presence of many factors to get the accurate results such as collecting data from user's perspectives and testing the main system. (Tullis & Albert 2013, 42)

3.7.2 Formative and summative studies

We collect data for planning better user experience and based on these data we create some designs to fulfil the requirements and needs of the products. We always need to know whether the creation we made will deliver a good outcome. For that, we don't take it directly to the market or in the hands of users, but we go through various usability phases. For the study of usability, we have two categories according to Tullis & Albert ,2013, and they are formative usability and summative usability.

- **Formative Usability:** The test that we do since the beginning product creation is formative testing where we check on product periodically and provide solutions if needed to make the adjustments. Professionals involved in creating the solution, dive into the problems, recommend changes, evaluate, and check throughout the development phases in an iterative approach. Our goal is not only to finish the product in time but also to make a platform where users get better experience when using them so formative usability aids in shutting the loopholes and making products and services as fine as possible. It is necessary for formative testing to impact on the product lifecycle and considering the time and budget that is given for creating

the product. This is also called qualitative usability testing since it makes sure to keep the quality of the product before it is launched. (Tullis & Albert 2013, 42)

- **Summative Usability:** Summative usability means evaluating the status after it has been made. Summative usability test is carried out when the product is ready and launched in the market. It is done to summarise on the quantity of the product rather than the quality. Test cases are created and then products are tested according to those cases to figure out if the goal of the project is fulfilled and the product is good enough to beat the competitive edge. The outcomes that come from these testing procedures should be followed up so that it is essential to improve the product or implement into the new project. This testing method is also known as quantitative testing since the quantity matters the most for instance rather than focusing on improving the design it focuses on collecting the functionality issues and the number of users using it. (Tullis & Albert 2013, 42)

3.8 Dimensions of usability testing 5E's to understand the users

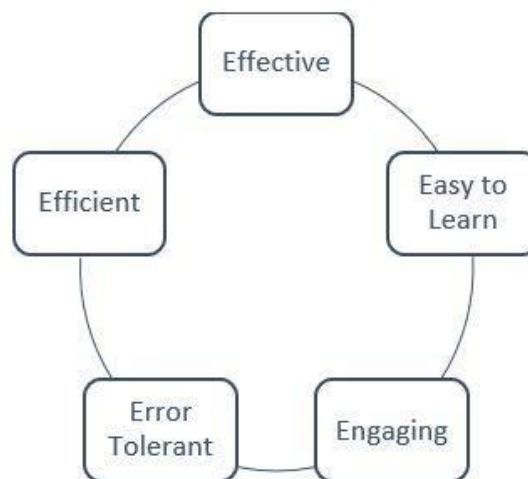


Figure 7. 5E's to understand users (Adapted from Quesenberry, W. 2003)

These dimensions of usability in **Figure 7** are reliable in conducting usability tests. Making the product user friendly is only not the objective of usability. Detailed explanation and actionable approaches are expected to be done to understand usability of the product. The measures applied when reading the test cases and its outcome helps in creating a product with qualitative results that results in creating a good user experience. So, these steps should be studied thoroughly during the testing. (Quesenberry, W. 2003.)

- **Effective:** How are the test cases performed and how many problems are faced by the user doing the test?

- **Efficient:** How long does a task take to complete and can the users navigate easily through the product?
- **Engaging:** Does the features of the product interest the user and make them use it for longer? How attractive are the features of the interface to the user?
- **Easy to learn:** How often does the user make questions and how easily can the experienced user travel through the lifecycle of the product? Can they read the flow of the program easily?
- **Error tolerant:** How frequent are the errors seen and how do the user navigate through the errors? Can the product assist in passing through the errors effectively without testing the patience of the user?

3.9 Evaluation methods

Evaluation is that phase, where review from the experts are concerned. It is mainly associated with evaluating the interface and finding out the issues related to the interface than other technicalities of the product. This is carried out once the design of the product is ready. Here, at least 3 evaluators are involved in making comments to the design because according to Nielsen Norman, who revealed the insights regarding heuristics evaluation which nowadays are followed as a systematic approach widely for decision making, 3 people can see things in 3 different ways than one person searching the faults. Heuristics is the method to discover an issue and solve it. So heuristic evaluation is a methodology to study design interface and make some analysis. Then, the issues addressed after the analysis are solved by the designers. (Nielsen Norman Group, 2021.)

Heuristic evaluation is one of the tools to evaluate the interface of the product. Evaluation also plays a vital role in measuring user experience and creating optimum benefit by improving user interface. When evaluating the interface or the state of the product, you should always define users and the task they perform. And the measures should match the research objectives. It is necessary to know the existing status of the product to identify the future changes and to assure if the efforts have been made to improve the experience of the user. After all the changes are made, the final state of the product must be evaluated as well so that the product achieves the goals set for it. (Jeff Sauro, 2021)

3.10 Prototypes

Prototype is a simulation designed by UX professionals to test if the product possesses all the functionalities and fulfil user goals. To measure user experience, we need to see users using the product and it is difficult to make changes when the final product is launched in the market. It demands more time and budget in that case. So, UX professionals take prototypes as their tool to measure user experience before the product reaches to the mass. In this way, fault can be determined, and the products could be more refined fulfilling the user needs and requirements.

There are certain features that need to be considered when making prototypes. Prototype should **represent** a product simulation and it can be either paper based, or digital. It should have a quality of **precision** which means to what extent the simulation can be reproduced that matches the product. It can be better defined with the term fidelity, which means the exactness to the product. We can create a low fidelity prototype or high fidelity depending on the product. It should also include different levels of **functionality**. Some prototypes can be completely functional where user testing can be done with every element possible and some can be semi functional, just describing the basic parameters of the product to the user. **Lifecycle** is also an important quality where some simulations are created and replaced with better versions quickly. This is also termed as “rapid prototype”. and some are created slowly along with the product. (Uxpin Sp., 2021)

1. **Paper Prototype:** This is a kind of prototype which can be designed in paper and pen. Paper prototype is basically used for ideation process where concepts are drafted and explored using paper version. This process helps in brainstorming ideas in a form of sketch. Paper prototype is a fast and inexpensive way of exploring concepts of the product. It is team focused where creativity exercises out of mind with collaborative effort.
2. **Digital Prototype:** Prototype that is created digitally which includes different applications for its creation. Digital prototypes are usually clickable and are used for testing the product in its different stages. Digital prototypes usually have different fidelity approaches. Making a similar copy of the original product with fulfilling most of the clickable functionality are termed as **High-fidelity** prototypes and those that create simulation but with lower functionalities are termed as **low-fidelity** prototype. High-fidelity prototypes have functionality of the product and the look and feel of the

product is a lot similar whereas low fidelity focuses on testing the functionalities more than the actual look and feel of the final product. (Babich, N. 2017.)

Depending on the size of the product and how important the interface is, we can create digital prototypes with different levels of fidelity. Currently, there are various applications and tools that make it easier for people to create digital prototypes for example: **Adobe XD, Figma, Webflow, Sketch, InVision, Marvel, Origami Studio** and so on.

4 Case study: Trip planner

After going through all the toolkits, to make it more explainable, a case has been explained. We all are very familiar with different mobile apps for travellers that have been making life easy. Those successful applications have been able to exist in the market because of the experience it creates for the users. Here, user experience studies have been carried out to design the user interface of a travel app that helps in creating better experience for users when using it. Users have been focused more and requirements have been collected accordingly.

4.1 Ideation

Navigating through maps has been a life saver since ancient times. Planning a trip beforehand is a common trend and mobile apps with maps and other features have made it better and easier. For a traveller, to reach places and get maximum experience, it is very necessary to measure the distance and time. We need to look at different apps for collecting this information about time, total distance , transportation mediums and ticket price. Therefore, here a travel app has been created that helps to do all these things in a single application. This app also allows people to pay for the tickets that can be used in different transportation locally. The application will give great value to people using it and make their life easier.

4.2 User study

4.2.1 User profile

User study is done to get to the ideal user base. This data collected will assist in creating the needs and requirements of the ideal user. The user experience professionals collaborate to make all the functionalities required by the user by using the requirements and needs of user. Later, a simulation is created to develop the application.

Here, in **Table 1**, we are going to categorise our user base into different traveling traits. To generalize the user base and their traits, a survey with 7 questions were circulated over the social media and emails. The attachment of the survey can be found at the **appendices**. Here is the analysis of the survey result.

Table 1: User base and their traits

Age	Gender	Occupation	Planner/ Spontaneous	Type of traveller	Frequently travels	Travel application used mostly
20-25	Male	Student	Spontaneous	Active	International	Booking.com, Skyscanner
25-30	Female	Employed	Spontaneous	Active	Domestic	TripAdvisor
30-35	Female	Student	Spontaneous	Inactive	Domestic	Booking.com
30-35	Female	Unemployed	Planner	Active	International	Booking.com, TripAdvisor
35-40	Female	Employed	Planner	Active	Domestic	Booking.com
25-30	Male	Employed	Spontaneous	Active	Business	Momondo
30-35	Male	Student	Spontaneous	Inactive	International	Booking.com

4.2.2 Interviews and Questionnaires

After making the user base for the product, a set of semi structured questions were constructed to take user interviews. The questions were open ended where users were free to elaborate their answers. We asked them about the situation and scenarios when they would like to access travel applications and what their travel experience is. This is an important part for creating a better user experience for travel applications. With this, we can know users more closely and be able to stand in their situation.

Interviews are transcribed and are attached at the end in **appendices** here with this report. Those transcriptions were helpful in identifying user requirements.

Sample of the open-ended questions during interviews:

- How often do you travel?
- Are you an active planner for the trips or a spontaneous traveller?
- Do you visit a lot of places or just a few?
- How do you travel around and what mode of transport do you use?
- What travel application do you use and what do you look for in the travel application?
- What are the features of travel applications that you like and what you feel must be in travel applications in future?
- What is your level of satisfaction when using the travel app and what do you want to change?
- How long have you stayed in flight transit and what have you done during those times?

4.3 Affinity Diagram

The interviews and the user viewpoints collected from the interview were utilised for creating an affinity diagram in **Table 2**. We analysed the data collected and determined how important different tasks in the travel application are for the user. This will further assist in determining the requirements and needs of the user. The metrics for calculating the task value are High, **Medium**, and **Low**.

Table 2: Affinity Diagram

Tasks	User 1	User 2	User 3	User 4
Planning the trip	MEDIUM	HIGH	MEDIUM	HIGH

Research about places	HIGH	HIGH	HIGH	MEDIUM
Social media information of destination	HIGH	LOW	MEDIUM	HIGH
Touristic destination	MEDIUM	HIGH	HIGH	MEDIUM
Use of mobile apps (travel)	HIGH	MEDIUM	HIGH	HIGH
Exploring unknown destination	MEDIUM	HIGH	HIGH	MEDIUM
Prefer to use mobile apps with better functionality	HIGH	MEDIUM	HIGH	MEDIUM
Using your time actively	HIGH	MEDIUM	MEDIUM	HIGH
Watching vlogs before trip	LOW	HIGH	MEDIUM	MEDIUM
Calculating time for every route	MEDIUM	LOW	MEDIUM	HIGH

4.4 List of requirements

A list of requirements has been finalised after the Affinity diagram got constructed. Those are as follows:

- Easy to navigate.
- Location information hidden.
- Recommended short trips.
- Time setting for the trips.
- Time reminder.
- Places recommended locally.
- Maps option.
- Offline maps feature.
- No unwanted ads.

- Easy to buy tickets.

4.5 User Persona

Here, a dummy user according to the identified user base where his basic information is given. The frustration our users have regarding the travel apps is also explained in short and the goals of users for using travel applications are stated as well.


<p>PERSONA</p>  <p>Age: 28 Gender: Male Education: Masters in Computer Science Occupation: Project Manager Location: Tampere</p>	<p>Bio</p> <p>James is a young and active person who travels 2 to 3 times a month. Most of his trips are related to business and sometimes with his friends.</p> <p>Frustration</p> <ul style="list-style-type: none"> • Longer transit time. • Online maps are time consuming. • Difficult to plan short trips. • Have to access varieties of apps to plan short trip. <p>Goals</p> <ul style="list-style-type: none"> • To make use of unused time. • Take a short trips during longer transit. • Travel smoothly with no hustle.
--	---

Figure 8. User Persona (Picture adopted from Pixabay.com)

4.6 Scenarios

User scenarios are used to ideate the design context and visualize the goals of the product into more depth. It helps to notice the needs of the users into more clear vision. It is created after finding out the user base of the product and creating the persons then later the dummy user used during the persona and taken further to explore their background, goals, what steps they take when using the product, how they use it and what challenges they face when using the product. (The Interaction Design Foundation, 2021)

James is a young and active person who travels a few times a month and most of his trips are business and occasionally with friends. James has got a business trip to Nepal, and he

has 5 hours transit time in Amsterdam. He is an active traveller and he planned to utilise his time productively. There was nothing much to do at the airport, so he planned to make a short trip around the city. He opened his travel app: **PlanURtrip** and started planning a short trip. He first sets his location and time of 5 hours. Then the application shows him recommendations of places he can make within that time. James then chose a place with better sightseeing with a café nearby and started getting transportation tickets through the application. He pays for his ticket using his debit card and starts his trip. The ticket is not started until and unless he checks it through a machine available in the transport. The app starts a timer so that James is reminded of time as well. He navigates through the app around the places, and spends some quality and refreshing time. The app reminded him about his return, and he navigated himself back.

4.7 Paper Prototype

These paper prototypes were simply drawn on paper with a pen. The Result drawn from requirements analysis, affinity diagram, interviews and scenarios are drafted here in these prototypes. It helped in get the basic idea of what the user wants and how can we make their experience better.

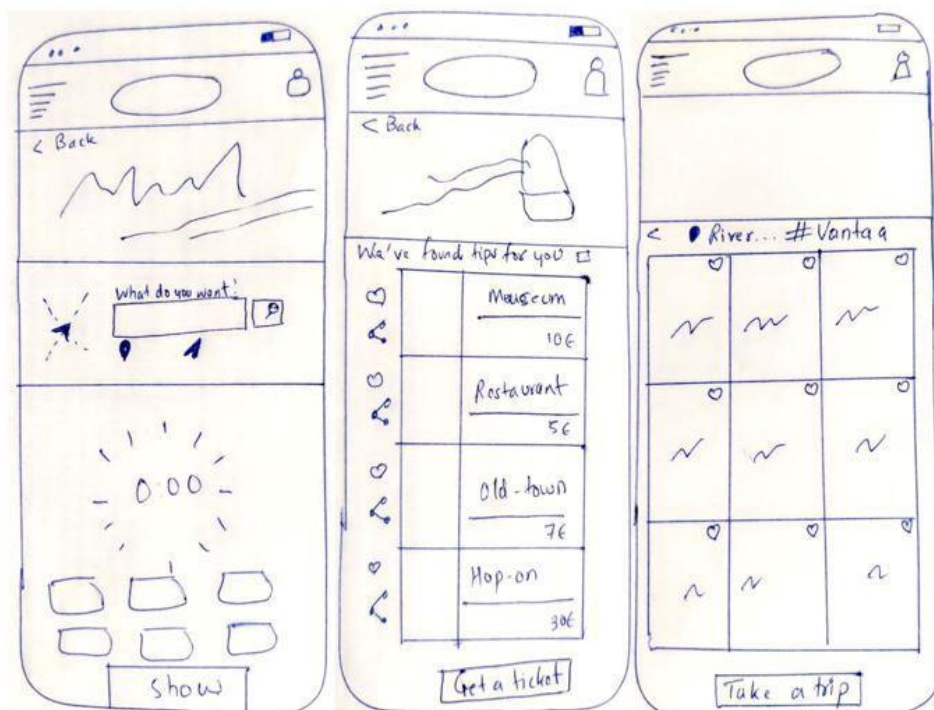


Figure 9. Paper prototype 1

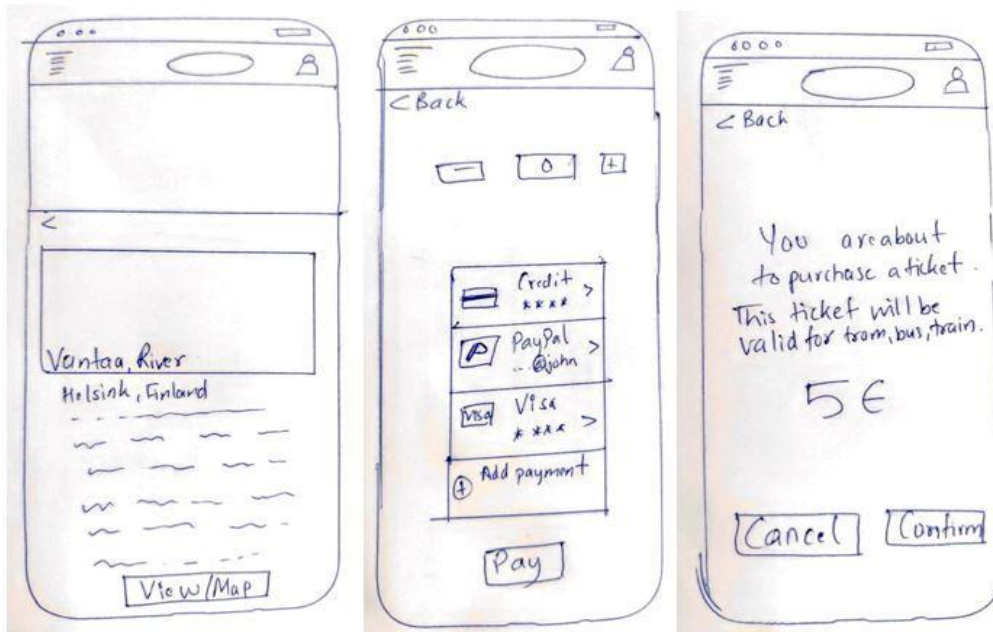


Figure 10. Paper prototype 2

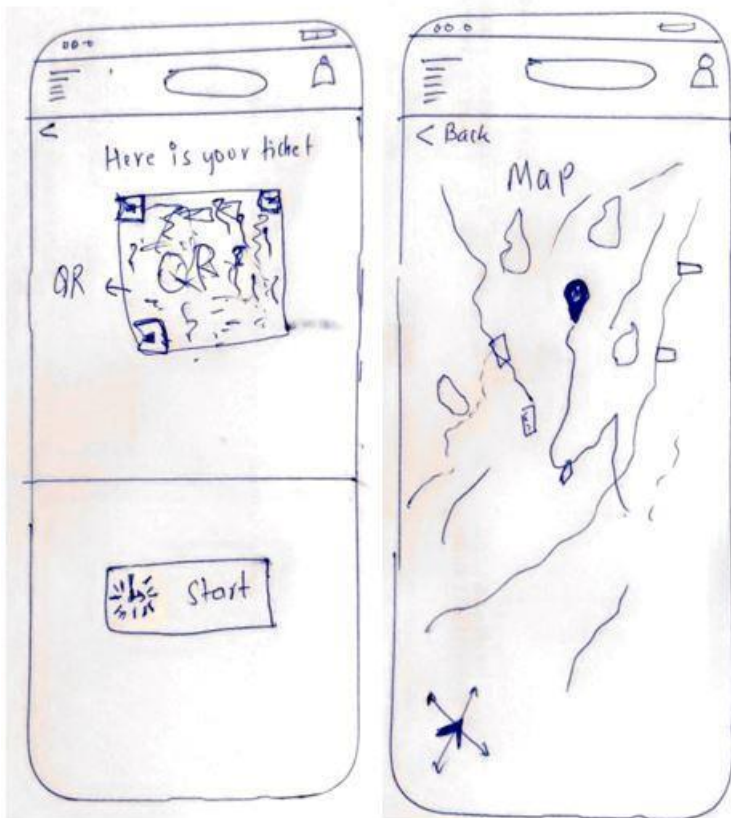


Figure 13. Paper prototype 3

4.8 High Fidelity Prototype

High -Fidelity prototype is created using **Adobe XD**, which is a prototyping tool designed by Adobe. All the basic functionalities can be clicked. This will help for testing users and get their reaction regarding the product functionality. It helps us to record their time of completion for a task and how easily they can navigate, how often they get lost or how easily they could get what they want. It helps us to identify the success rate of the product.

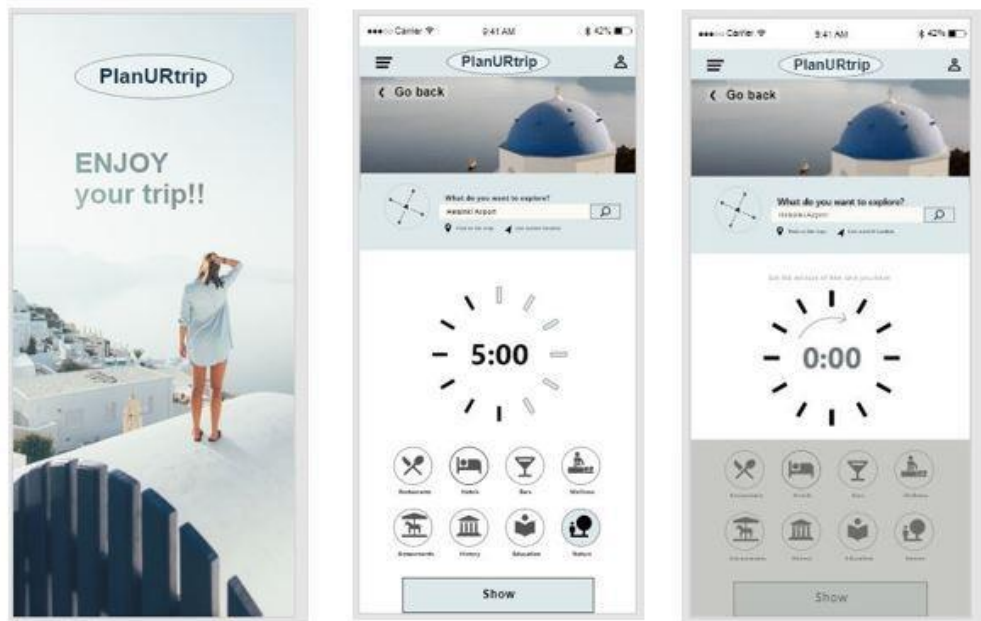


Figure 14. High-fidelity prototype 1

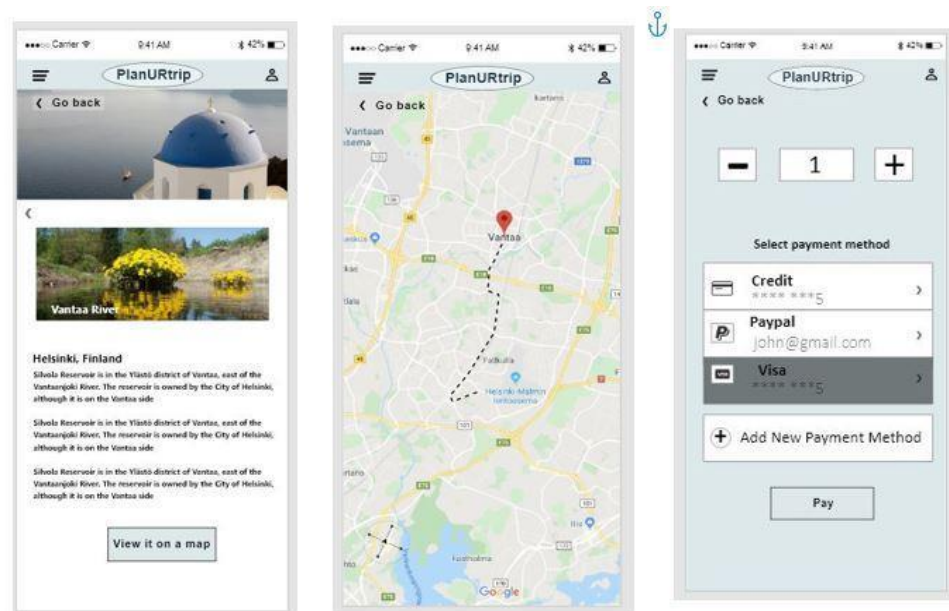


Figure 15. High-fidelity prototype 2

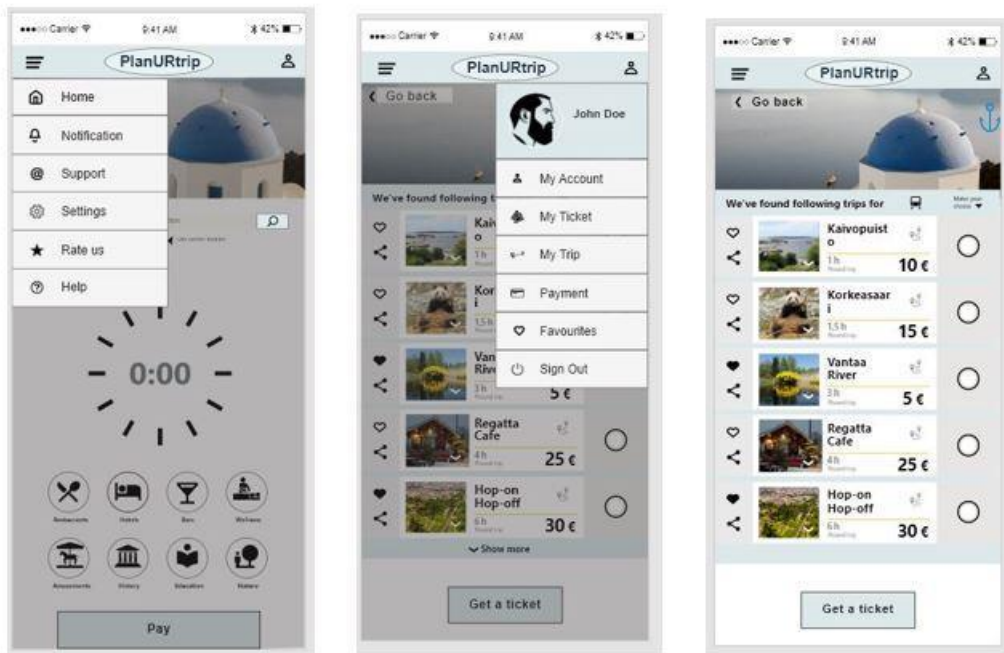


Figure 16. High-fidelity prototype 3

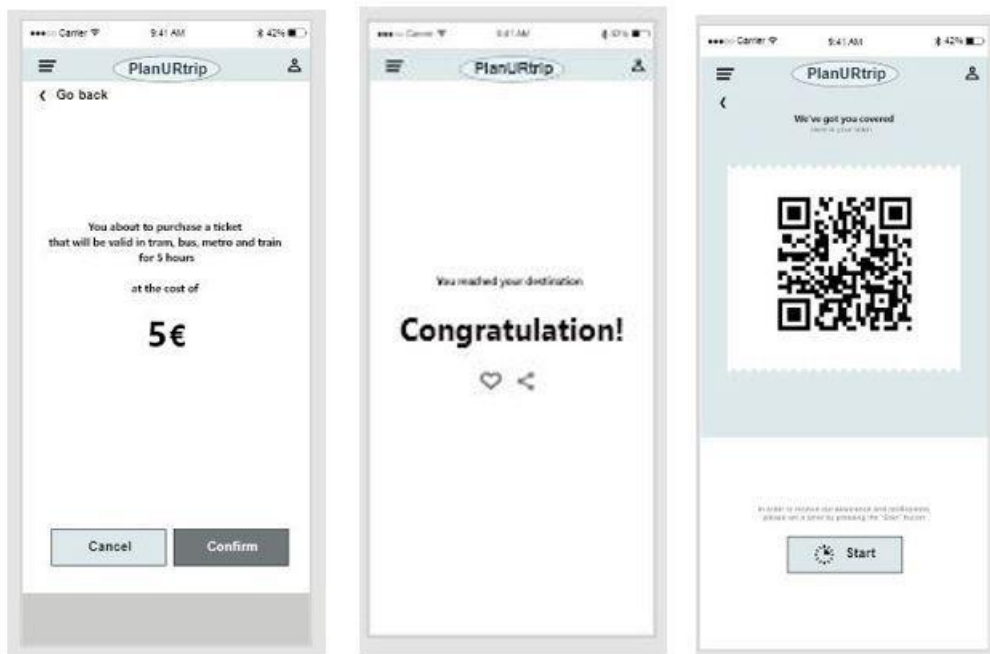


Figure 17. High-fidelity prototype 4

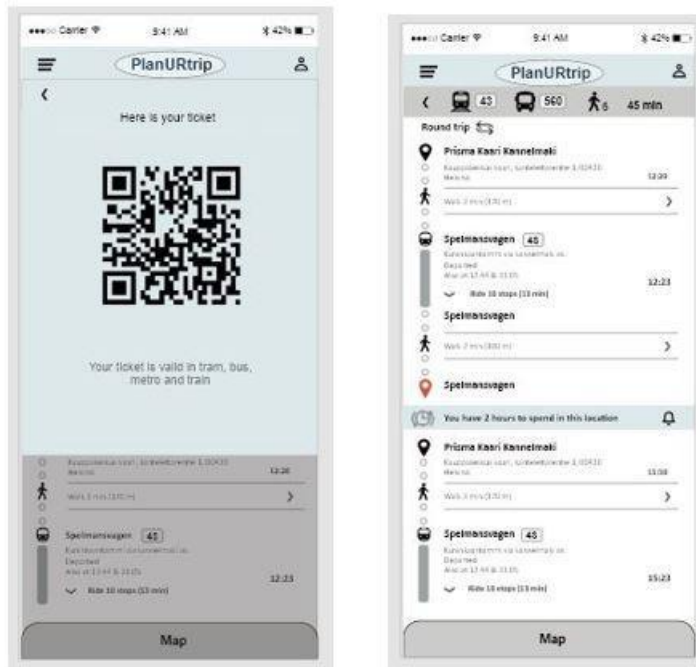


Figure 18. High-fidelity prototype 5

5 Usability Testing

5.1 Testing Plan

- a. **Location:** Online (Due to pandemic situation)
- b. **Participants:** The participants were selected according to the user base explained in **Table 1** for the product.
 - Age groups: 20-40 Male /Female
 - Occupation: Student/ Employed/ Unemployed
- c. **Required training:** All the participants were computer literate and had heard about testing simulations so it was not difficult to explain the process.
- d. **Methodology:** The methodologies implemented were Quesenberry's 5E's tools. (Quesenberry, W. 2003.)
 - Effective: Are users able to complete the test cases?
 - Efficient: Are users able to perform the task without getting lost?
 - Engaging: Are the users attracted with the features of the travel app?
 - Easy to learn: Are the users able to understand the flow of the application step by step?

- o Error tolerant: Does the user encounter any error and how does he/ she pass through this error?
- e. **Procedure:** A set of tasks will be given to the users and they will be assisted throughout the testing. Their experience and performance will be observed and evaluated by the observer.
- f. **Objectives:** The main goal of this testing is to find out if the user gets a good experience using the product. It also helps to identify small errors and functionalities that bothers users and can be changed accordingly. This is just a simulation so changes can be made before the product reaches the final stage. So, this helps to make the product meaningful by fulfilling all the requirements set for the product.
- g. **Timings:** Approximately 30 minutes.
- o Preparation: 5 minutes
 - o Testing cases: 20 minutes
 - o Feedback session: 5 minutes
- h. **Moderator and observer:** Deepti Kandel

5.2 Testing and results

Link to the prototype:

<https://xd.adobe.com/view/adfa55c1-dd22-4bae-8fae-fcb96594375c-f8a9/>

Test Case 1: Landing Page

Pre-condition: System starts after installation at the welcome page.

Steps	Action	Expected System display	Pass/ Fail		Feedbacks	
			User 1	User 2	User 1	User 2
1	Click on welcome page	Landing Page	P	P	Attractive landing Page	Good

Post-condition: Search location at location bar

Test Case 2: Search location

Pre-condition: Landing Page

Steps	Action	Expected System display	Pass/ Fail		Feedbacks	
			User 1	User 2	User 1	User 2
1	Use current location	Location on and location suggestion	P	P	I don't want to make location on	Don't want to enable location .
2	Type address in the location bar	Address suggestion nearby and address found	P	P	Good	Good

Post-condition: Selects total duration and category test

Test Case 3: Set time and category

Pre-condition: Location found

Steps	Action	Expected System display	Pass/ Fail		Feedbacks	
			User 1	User 2	User 1	User 2
1	Set time	Time set for 5 hours	P	F	Good feature	How do I do it?
2	Select category and press show button	Categories selected and page with pages appear	P	P	Nice	Good

Post-condition: Page with places shown

Test Case 4: Places recommendation page

Pre-condition: categories chosen

Steps	Action	Expected System display	Pass/ Fail		Feedbacks	
			User 1	User 2	User 1	User 2
1	Places chosen to view attraction there	Page with all attraction and photos of that place open	P	P	Aweso me	Good
2	Press on "Take a trip"	Ticket purchasing option comes	P	P	Now I pay?	So easy and fast.

Post-condition: Payment method

Test Case 5: Payment method

Pre-condition: Places chosen to take a trip

Steps	Action	Expected System display	Pass/ Fail		Feedbacks	
			User 1	User 2	User 1	User 2
1	Selects total no. ticket to purchase	Number of tickets get selected	P	P	Good	Good
2	Chose payment method	Payment method gets selected	P	P	Easy	Satisfactory

Post-condition: Pay for the trip

Test Case 6: Pay for the trip and get ticket

Pre-condition: Choose payment option

Steps	Action	Expected System display	Pass/ Fail		Feedbacks	
			User 1	User 2	User 1	User 2
1	Click on "Pay"	Ticket is bought	F	P	Do I need to save	Easy to get tickets.

					my card here?	
2	Click of "confirm"	Confirm the ticket in the next page.	P	P	Nice	Good

Post-condition: Get ticket and map

Test Case 7: Map is shown with time reminder

Pre-condition: Bought ticket

Steps	Action	Expected System display	Pass/ Fail		Feedbacks	
			User 1	User 2	User 1	User 2
1	Go to "Map"	Map is opened.	P	P	Good	Good
2	Navigate through map and routes page	Navigation page and route page is shown	P	P	Good	Nice

Post-condition: "Congratulations your trip is successful "message shown after reaching to airport back following the time reminder and navigation feature.

5.3 Feedback review after testing

Certain things were noticed and that needed to be revised in the prototype. Some comments given by users are as follows where some of them could be improved in the prototype but some of them were not revisable:

- How to choose time in the clock?
- Payment feature is secured or not?
- Not all the features were clickable.
- Location sharing option was not available in case of emergency.
- Walking trip option if there are places nearby and do not have to worry about purchasing tickets.
- For taxis it is a one way ticket.

6 Measuring emotional user experience

User experience is the value created by products or services when users use it. This is the thing we often end up thinking when it comes to understanding user experience. But we always forget the fact that user experience is not created by designing a good product or good services, but it is the users' feelings and emotions that play a vital role. Therefore, it is important to make user's feel inclusive in all the parameters we set for creating user experience and selling the products. (Rintoul, 2014)

Here is the table with different phases that evaluates how the user's **feeling of being** in the product is presented. The feeling of being is **analysed** from the **feedback** given by users during the **testing**.

Table 3: Evaluating the emotional factors users get from Travel App (Dirin, Laine, Nieminen, 2017)

Emotional factors	Feelings of being
Trust (Do not lose data)	<i>"My data is protected and backed up in my user account in case I might need it for future access."</i>
Excitement (Features that thrills)	<i>"I like the timer functionality. That is really amazing since I am reminded about the time throughout my trip."</i>
Empowerment (Can control the use of app)	<i>"I do not have to enable location to find places and I can purchase tickets for any transportation mediums I like."</i>
Effectiveness (Findable functionality)	<i>"From starting the app to the end, I can reach my destination and navigate throughout the app easily."</i>
Security (Data is secured)	<i>"The app traces my data, but it does ensure authentication and data consistency since it can be walked through without having to sign up before purchasing the tickets."</i>

7 Conclusion

The report demonstrates all the toolkits of user experience referring to different researches made on varieties of toolkits and measures by user experience experts. This thesis expanded the boundary of my knowledge regarding user experience to another level. Being able to do a case study applying all the theories was a good learning experience. It was challenging to do all the testing and collecting data online but time saving. All the users corporated well during the process. Since all of them were computer literate it was easy to explain the details and make them do the task accordingly.

With the limitation of time and requirement of the thesis, many concepts are left unexplored in details such as **Human Computer Interaction** and **Emotional User Experience**. These are also part of user experience which helps to see the interaction of users from another bigger aspects. The most interesting part of the research was studying existing theories and carrying user study approaches with real participants. Studying users' behaviour with the methods explained in the report such as interview, was quite a tedious task but the outcome gave valuable insights regarding user experience.

Here, the **tools and software** used for carrying out tests and researches are:

- UML class diagram: Moqups (online software)
- Mind Maps : Moqups (online software)
- Paper prototypes: Paper and pen
- High-Fidelity prototype: Adobe XD (Prototyping tool)
- Testing: Video conference (Zoom, Teams)
- Survery: SurveyMonkey
- Sharing tools for questionnaires and survey through online: (facebook, WhatsApp)

7.1 Future scope

As part of further studies to be done in the thesis topic, it would be Human Computer interaction and the user domain constraints. It is important to understand users deeply to understand what they want. So, all the demographic information and geographical conditions of the users have been left untouched in this report which will be fulfilled in further elaboration of the research in near future.

Along with this, emotional user experience is another important topic that was touched very little in this report but not explored to greater extent. Studying emotional user experience is also another factor for understanding what users want. So, my aim is to study about different levels of emotional design such as Visceral design, a subconscious level that users get when coming across the product; Behavioural design, physical feel of the product play vital role and Reflective design, where various aspects are reflected in the design of the product and such as features, cultural aspects and impact of the product in near future.

8 Work Plan

	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Project Plan									
Supervisor Meeting									
Report Writing									
Case Study									
Data Collection									
Data Analysis									
Review the project									
Thesis Seminar									
Evaluation									
Maturity Test									
Thesis Submission									

9 References

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10 Figure references

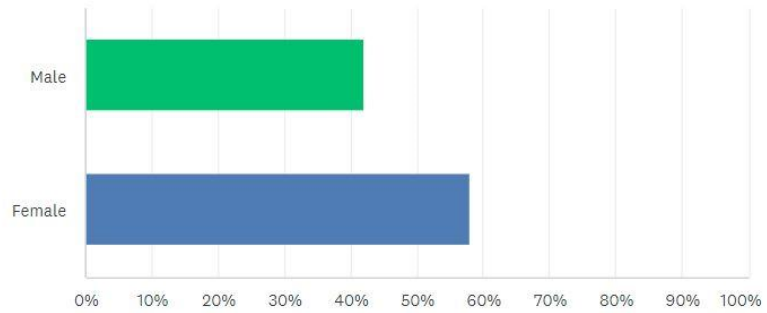
- Figure 2: Online Mockup, Wireframe & UI Prototyping Tool. 2021. Available at: <https://app.moqups.com/OkTbISClqj/edit/page/aa9df7b72>. Accessed: 25 October 2021
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- Figure 7: Quesenbery, W. 2002. Using the 5Es to understand users. Available at: <https://www.wqusability.com/articles/getting-started.html>. Accessed: 1 December 2021.

11 Appendices

11.1 Appendix 1. Survey result

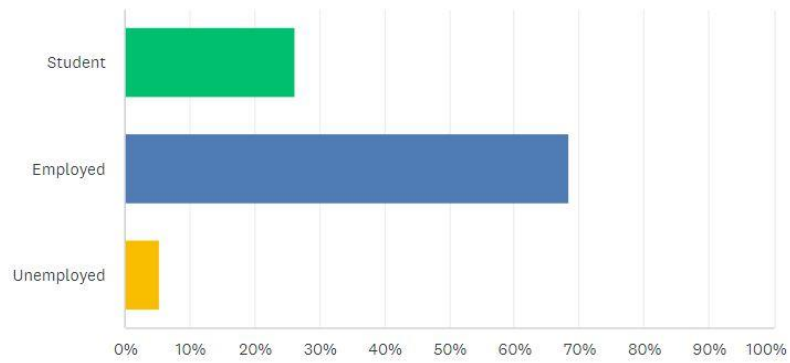
Gender

Answered: 19 Skipped: 0



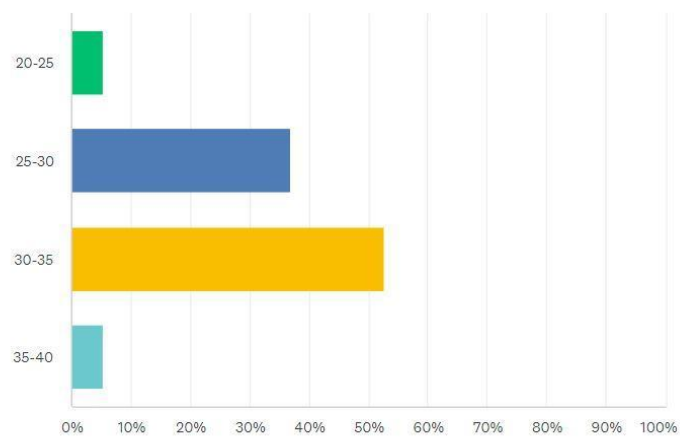
Occupation

Answered: 19 Skipped: 0



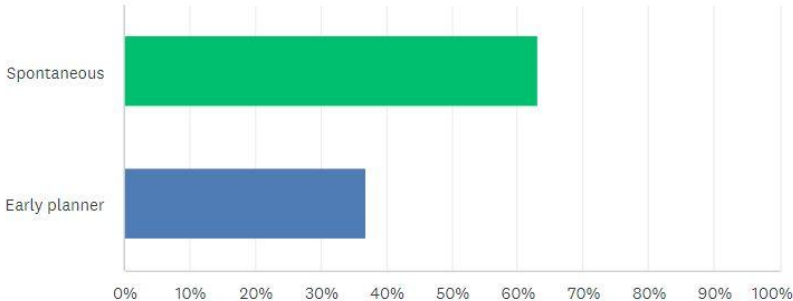
Age

Answered: 19 Skipped: 0



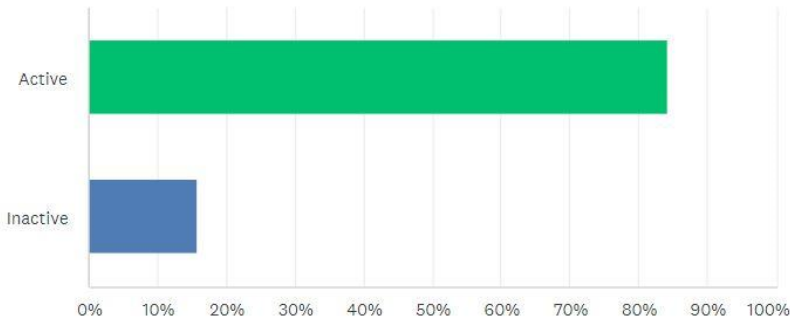
What kind of trip planner are you?

Answered: 19 Skipped: 0



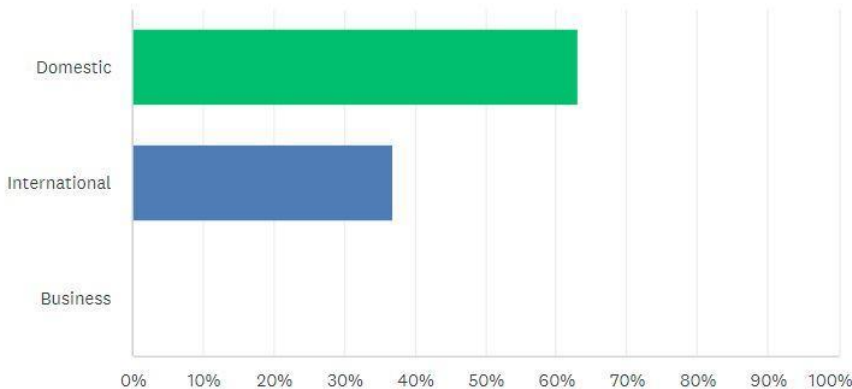
What type of traveler are you?

Answered: 19 Skipped: 0



Where do you travel frequently?

Answered: 19 Skipped: 0



What application do you use to plan your trip? ...

Answered: 19 Skipped: 0

Booking.com, Momendo,

Google

.

Booking.com

None

Skyscanner

Non

Google

No application

What application do you use to plan your trip? ...

Answered: 19 Skipped: 0

...

Online tickets

In drive

Trip advisor

Tripadvisor

Booking.com

Booking.com

Trip advisor

Trip Advisor

Booking.com

11.2 Appendix 2. Interview Transcription

Interviewer: Hello! How are you? And thank you for participating.

Interviewee A: *I am good and thanks for having me.*

Interviewer: Lets proceed without delay. How often do you travel, and do you plan your trip?

Interviewee A: *I am a frequent traveller and like to plan but sometimes go for instant trip as well.*

Interviewer: Do you believe in promotions made in social mediums about places?

Interviewee A: *Yes. Sometimes that leads me to plan a trip.*

Interviewer: Do you like visiting touristic destination or local places.

Interviewee A: *Well, I go for both and love to explore touristic destination more.*

Interviewer: How often do you use mobile travel apps?

Interviewee A: *Every time. I plan my trip through mobile travel apps.*

Interviewer: Would you like to get travel apps with better functionality in the market or satisfied with what is existing.

Interviewee A: *I would love to have an app which have many features than the one that is existing currently.*

Interviewer: How active traveller are you and do you use all your time productively?

Interviewee A: *I am very active, and I do not like to waste my time sitting idle when I am traveling.*

Interviewer: Do you watch vlogs before starting or planning for trips.

Interviewee A: *No, I don't. Because I don't want to get biased about things before reaching there.*

Interviewer: Do you calculate time for every route?

Interviewee A: *Yes, I do. But sometimes I don't since I might stay long in those places for some attractions.*

Interviewer: Hello! How are you? And thank you for participating.

Interviewee B: *It's my pleasure.*

Interviewer: Lets proceed without delay. How often do you travel, and do you plan your trip?

Interviewee B: *I always plan my trip before travelling and I so travel a lot.*

Interviewer: Do you believe in promotions made in social mediums about places about places?

Interviewee B: *No, I don't. I like to see my places through my eyes to know about the places and its beauty because everything is edited in these sites.*

Interviewer: Do you like visiting touristic destination or local places.

Interviewee B: *Yes, I do. It is touristic destination because it has some importance to show.*

Interviewer: How often do you use mobile travel apps?

Interviewee B: *Sometimes when I need to look for transportation and location.*

Interviewer: Would you like to get travel apps with better functionality in the market or satisfied with what is existing.

Interviewee B: *Yes, that would be nice, I guess.*

Interviewer: How active traveller are you and do you use all your time productively?

Interviewee B: *It depends how restful I am.*

Interviewer: Do you watch vlogs before starting or planning for trips.

Interviewee B: *Yes, I do watch. Because vlogs do provide real information.*

Interviewer: Do you calculate time for every route?

Interviewee B: *No. I don't. I just look at the maps of the places and don't care about the time.*

Interviewer: Hello! How are you? And thank you for participating.

Interviewee C: *You are welcome.*

Interviewer: Lets proceed without delay. How often do you travel, and do you plan your trip?

Interviewee C: *I travel sometimes, and I plan when it is short day trip.*

Interviewer: Do you believe in promotions made in social mediums about places?

Interviewee C: *Yes, sometimes depends on what page is making recommendations.*

Interviewer: Do you like visiting touristic destination or local places.

Interviewee C: *Yes, I do. I like to see why it is a touristic place.*

Interviewer: How often do you use mobile travel apps?

Interviewee C: *I always use it for booking hotels to getting routes and navigating.*

Interviewer: Would you like to get travel apps with better functionality in the market or satisfied with what is existing.

Interviewee C: *Yes, I would like that. Sometimes I must go through thousands of sites to plan my trip. I wish everything was easy in one single app.*

Interviewer: How active traveller are you and do you use all your time productively?

Interviewee C: *I do use my times but sometimes I want to just relax.*

Interviewer: Do you watch vlogs before starting or planning for trips.

Interviewee C: *Yeses. I watch vlogs when it is new places and have heard less about it.*

Interviewer: Do you calculate time for every route?

Interviewee C: *Not every route but only some routes if I must reach somewhere in right time.*

Interviewer: Hello! How are you? And thank you for participating.

Interviewee D: *I am good. Thank you.*

Interviewer: Lets proceed without delay. How often do you travel, and do you plan your trip?

Interviewee D: *Well, I do travel sometimes, and I always plan trip whenever I make it.*

Interviewer: Do you believe in promotions made in social mediums about places?

Interviewee D: *Yes. I believe since I also research abased on that information.*

Interviewer: Do you like visiting touristic destination or local places.

Interviewee D: *Both depending on the attractions and local reviews these places have.*

Interviewer: How often do you use mobile travel apps?

Interviewee D: *I use it to book, navigate and look for the pictures.*

Interviewer: Would you like to get travel apps with better functionality in the market or satisfied with what is existing.

Interviewee D: *Yes, that would make me want to use it more.*

Interviewer: How active traveller are you and do you use all your time productively?

Interviewee D: *Very active. Since I travel my trip to explores places I don't stop anywhere.*

Interviewer: Do you watch vlogs before starting or planning for trips.

Interviewee D: *Yes, I do. But only food vlogs of that places.*

Interviewer: Do you calculate time for every route?

Interviewee D: *I do since I want to visit a lot of places during my trip.*