Czech University of Life Sciences Prague

Faculty of Economics and Management

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Master's Thesis

UX design of an online store

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DIPLOMA THESIS ASSIGNMENT

Bc. Natalia Mosunova

Systems Engineering and Informatics
Informatics

Thesis title

UX design of an online store

Objectives of thesis

The main objective of the thesis is to design and evaluate an e-shop using selected user experience (UX) methods.

Partial objectives of the thesis are:
- to characterize the main methods, rules, and tools for UX, usability, and UX design,
- to design a website for online store,
- to find appropriate methods for testing and conduct the testing,
- to evaluate the obtained results.

Methodology

The methodology used in the theoretical part of the work is based mainly on the study and analysis of professional information resources related to UX design, UX and usability testing.

The practical part of the thesis will be focused on conducting different qualitative and quantitative research using selected methods (e.g., Interview method, Personas, A/B test, 5-second test).

Based on the synthesis of theoretical knowledge and the results of the practical part, the conclusions of the work will be formulated.

The proposed extent of the thesis

60 – 80 pages

Keywords

user experience, UX, UX design, usability, web design

Recommended information sources

Goodman, E., Kuniavsky, M., Moed, A. Observing the User Experience: A Practitioner's Guide to User Research. Second Edition. Morgan Kaufmann, 2012. ISBN 9780123848697.

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Expected date of thesis defence

2022/23 WS – FEM

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Prague on 27. 03. 2023

Declaration

I declare that I have worked on my master's thesis titled "UX design of an online store" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 31.03.2023 _____

Acknowledgement

I would like to thank Ing. Jan Masner, Ph.D. and my friends for their advice and support during my work on this thesis. And also, many thanks to all the participants in the usability study for their contribution to this work.

UX design of an online store

Abstract

This diploma thesis aims to design and evaluate a high-fidelity prototype for an online store using selected User Experience methods. The thesis includes a comprehensive analysis of the existing literature on the main techniques, rules, and tools for User Experience, User Experience design, usability testing, and design principles in the literature review. The practical part involves the application of the knowledge gained from reviewing relevant information sources from the literature review. During the practical work, user research is carried out, low-fidelity and high-fidelity prototypes are designed, usability testing is conducted, and the obtained results are evaluated. The findings from testing and evaluation contribute to a deeper understanding of User Experience design for online stores and provide practical recommendations for enhancing the UX and usability of the designed prototype. By performing a detailed analysis of the literature and practical evaluation of a high-fidelity prototype, the thesis provides evidence to support the importance of UX design in the e-commerce industry.

Keywords: User Experience, UX design, usability, web design, high-fidelity prototype, wireframes, usability study, UX research, online store, Figma

UX design internetového obchodu

Abstrakt

Tato diplomová práce si klade za cíl navrhnout a vyhodnotit high-fidelity prototyp pro internetový obchod pomocí vybraných metod Uživatelských zkušenosti. Práce obsahuje komplexní analýzu odborné literatury o hlavních technikách, pravidlech a nástrojích pro Uživatelskou zkušenost, design Uživatelských zkušeností, testování použitelnosti a principy designu v teoretických východiscích. Praktická část zahrnuje aplikaci poznatků získaných z přehledu relevantních informačních zdrojů z teoretických východisek. Během praktické práce se provádí uživatelský výzkum, navrhují se low-fidelity a high-fidelity prototypy, provádí se testování použitelnosti a vyhodnocují se získané výsledky. Zjištěné informace z testování a hodnocení přispívají k hlubšímu pochopení designu Uživatelské zkušenosti pro internetové obchody a poskytují praktická doporučení pro zlepšení UX a použitelnosti navrženého prototypu. Podrobnou analýzou literatury a praktickým hodnocením high-fidelity prototypu práce poskytuje důkazy na podporu významu UX designu v odvětví online obchodování.

Klíčová slova: Uživatelská zkušenost, UX design, použitelnost, web design, high-fidelity prototyp, drátěný model, studie použitelnosti, UX výzkum, internetový obchod, Figma

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1 Introduction

The e-commerce industry has experienced a significant surge in growth in recent years, particularly during the COVID-19 pandemic. This growth can be attributed to the increasing trend of consumers preferring to purchase goods and services online from the comfort of their homes. As a result, companies that have an online presence have benefited from a surge in demand for their products and services. However, non-web-based firms have had to quickly adapt to meet changing consumer preferences.

Due to the increasing number of online stores, competition is fierce, and businesses must differentiate themselves by offering a usability-focused experience. User experience design plays a crucial role in developing an online store since it directly impacts how users interact with a website, influencing their decision to purchase a product or service.

This thesis aims to explore the fundamental principles of UX design and demonstrate how they can be applied to design a website prototype that creates a better user experience for potential users. Many businesses may focus solely on the aesthetic of their interface, while others may not prioritize either attractiveness or convenience. This thesis serves as a practical guide for small e-commerce business owners who seek to create an interface that is both user-friendly and visually appealing. Specifically, it examines how to design a clothing store website with limited resources.

2 Objectives and Methodology

The main objective of the thesis is to design and evaluate a high-fidelity prototype using selected user experience (UX) methods.

2.1 Objectives

Partial objectives of the thesis are:

- To characterize the main methods, rules, and tools for User Experience, usability, and UX design.
- To design a high-fidelity prototype for online store.
- To find appropriate methods for testing and conduct the testing.
- To evaluate the obtained results.

2.2 Methodology

The methodology used in the theoretical part of the work is based mainly on the study and analysis of professional information resources related to UX design, UX and usability testing.

The practical part of the thesis is focused on conducting different qualitative and quantitative research using selected methods (Surveys, Personas, Competitive Analysis, Information Architecture, User Flow, Wireframing, Low-fidelity prototyping, High-fidelity prototyping, Usability study, Heuristic Evaluation, UX metrics).

Based on the synthesis of theoretical knowledge and the results of the practical part, the conclusions of the work are formulated.

3 Literature Review

3.1 User Experience (UX)

The word "user" is the nominal form of the word "to use"; the word comes from the Latin verb "oeti", which means to apply or use something, exercise or perform. Conversely, the term "experience" is derived from the Latin term "experienta," which denotes the knowledge attained through persistent practices and experiments. (Deacon, 2020)

The significance of user experience in human life exceeds general awareness. Interactions with an extensive array of products and services on a daily basis can provoke a wide range of emotions and reactions, including empowerment, agitation, facilitation, and complexity. The inquiry about the experience of product or service usage is synonymous with the concept of user experience. All products used by individuals result in a unique user experience, including items as mundane as books, ketchup bottles, cardigan sweaters, and even luxurious reclining chairs. (Garrett, 2011) The user experience considers the individual’s entire interaction with a thing, as well as thoughts, feelings, and perceptions resulting from this interaction. (Tom Tullis, Bill Albert, 2013)

User experience encompasses all the events and phenomena occurring during a user's progression from a starting point (point A) to a desired end point (point B) in their interaction with a company, its products, and services. UX involves the implementation of a diverse range of methodologies and techniques to explore and understand the needs and desires of users. An optimized UX can significantly reduce the resistance between the user's desired objective and the tools or resources they utilize to achieve that objective. However, the end user experience results from an array of highly intricate factors so extensive that no individual, team, or technological solution can singularly assume full responsibility for it. (Buley, 2013)

3.1.1 UX Design

This thesis centers around the enhancement of the digital experience concerning interactive media, including e-commerce websites. The efficacy of user experience design in achieving success requires a comprehensive consideration of the project's business objectives, the user requirements of the product, and potential constraints that could potentially impact the feasibility of implementing desired product features, such as technical constraints or project budget and time limitations. (Unger, et al., 2012)

3.1.2 User-Centred Design (UCD)

The significance of user-centered design (UCD) lies in its ability to promote an exceptional digital experience through the comprehensive evaluation of the end user throughout all stages of the design and conceptualization process, wherein the user is placed at the forefront of the design framework. The UCD practice facilitates the creation of better decisions by testing designs with real users. In order to prioritize the user, it is imperative to take into account their history, emotions, and collected ideas. (Allen, et al., 2012)

User-centered design is characterized by an iterative process that resembles a virtuous circle, wherein research and design are continually interchanged. The design continually evolves to reflect the knowledge and insights gained from the user research. At the outset of the project, understanding how the user experiences the product is critical. This necessitates a comprehensive research effort to ascertain the end user's requirements. Based on the research, the range of end-user tasks that need to be prioritized is narrowed down, and solutions to end-user problems are developed. This is where concepts about the product's appearance are first formulated, and the creation process commences. After the design is complete, it is subjected to testing and evaluation. The research, design, and testing cycle can be repeated as necessary to achieve the desired results. (Allen, и др., 2012)

3.1.3 Frameworks

There are many UX design frameworks, and over time they evolve or become outdated due to the rapidly changing world of technology. Two modern frameworks used in UX design are the five planes and the design thinking framework.

3.1.3.1 The five planes

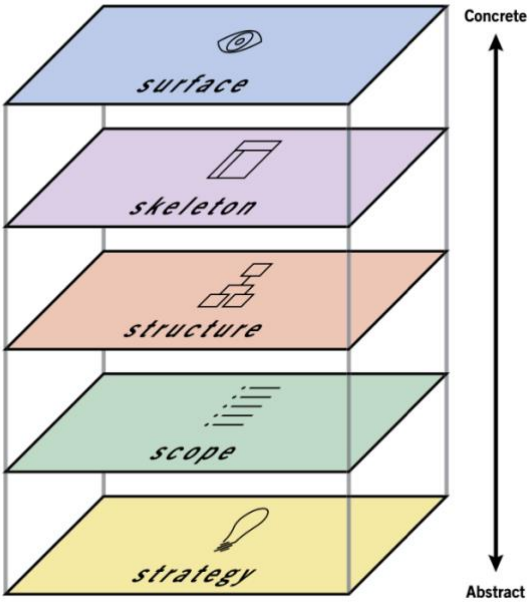
The user experience is the result of a whole set of decisions — both small and large — about how the site looks, how it behaves, and what it allows to do. These decisions are interconnected and interdependent, shaping every aspect of the user experience. Deconstructing this experience enables a comprehensive comprehension of the decision-making process involved. (Garrett, 2011)

The five elenents of UX design delineate the sequential stages undertaken by a designer to transform an idea into a functional product. These components are strategy, scope, structure, skeleton, and surface. They furnish a theoretical structure for identifying and addressing user experience issues and the instruments employed for their resolution.

Each element belongs to a specific layer involved in creating user interaction, and each level depends on what is underneath it.

- **Surface** – Refers to the visible and interactive components of an interface that are presented to the user. This layer typically consists of graphical elements such as images and text arranged in web pages or other interactive displays.
- **Skeleton** – The skeleton plane is responsible for organizing and optimizing the arrangement of interactive elements like buttons, controls, images, and text blocks for optimal effectiveness and efficiency. This plane specifies the inner workings of the design, and much like the skeletal system of a living organism, is not directly visible to users.
- **Structure** – Is the middle layer. This layer determines the navigational structure of a design, including the path users follow to arrive at a specific page and the links they can use to navigate away from it. It outlines how to organize the design and facilitates user interaction with the product.
- **Scope** – The following layer is scope, which refers to determining the type of product to be developed. During this stage, the features and functions to be incorporated into the product are taken into account.
- **Strategy** – The bottom layer is strategy. The scope of the project is essentially determined by the strategy of the site. The objectives of the strategy plane are based on the user's needs and the business goals of the product. (Garrett, 2011)

Figure 1Five Planes *(Garrett, 2011)*



3.1.3.2 Design Thinking

Design thinking is a widely recognized approach to generating solutions that address tangible user needs while ensuring functionality and accessibility. Design thinking consists of five main steps: empathize, define, ideate, prototype, and test. To elaborate further, these stages entail understanding the user, identifying the problem, conceptualizing ideas to address the problem, generating a prototype of the solution, and conducting user testing to assess its effectiveness. (Malewicz, 2022)

The first step of the design thinking process, empathize, aims to comprehend the problem. The objective is to grasp the user's requirements, perceptions, and emotions. (Malewicz, 2022) This encompasses extensive user research, which entails conducting surveys and interviews to gain a precise comprehension of the users' characteristics and the issues they encounter.

In the define stage of the design thinking process, the objective is to determine the problem at hand. This is achieved by consolidating and analyzing the information collected during the empathize stage, with the aim of identifying patterns and trends. (Malewicz, 2022)

In the ideation stage, the aim is to generate a multitude of creative ideas that are tailored to meet the unfulfilled needs of users identified during the definition stage. It

involves brainstorming and divergent thinking to explore a wide range of potential solutions to the problem at hand. (Malewicz, 2022)

In the context of design thinking, prototyping is the act of constructing a preliminary version of the best concepts generated during ideation with the aim of evaluating their feasibility and viability. (Malewicz, 2022)

In the test stage, user feedback is collected on the selected prototype, which is then utilized to make multiple iterations of changes and improvements to the project. (Malewicz, 2022) During this phase, various metrics and analytical tools can be used to quantify user behavior and interactions with the prototype, which can provide valuable insights for improving the design.

Depending on the feedback received during the testing stage, it may be necessary to return to the beginning of the design process, come up with new ideas for solutions, or develop new prototypes.

3.2 User Research Methods

User research is a systematic and evidence-based process of understanding the needs, behaviors, and motivations of the users. Usually, it involves various methods to collect data, which is then analyzed to form insights and inform design and development decisions. User research is a critical component of the design process as it helps to ensure that the final product aligns with the users' expectations and meet their needs effectively.

In order to create products that satisfy user needs, it is essential to possess comprehensive knowledge about users and their requirements. Rather than relying on subjective experiences and assumptions, it is crucial to adopt a research-oriented approach that employs statistical methodologies to obtain insights about users. Therefore, conducting UX research on the target audience is a fundamental step towards acquiring data that can inform the product design process. (Chipman, 2021)

Basic steps of user research:

- Define your primary user groups – involves constructing a framework that outlines the primary user types based on a variety of factors such as demographics, behaviors, and needs.
- Plan for user involvement – this includes selecting one or more methodologies for engaging user groups in research.

- Conduct the research – encompasses fundamental techniques, such as interviews and surveys, aimed at obtaining reliable and accurate data about the target user groups.
- Validate user group definitions – leverage the insights gathered from the research to refine and consolidate the user group model.
- Generate user requirements – refers to the process of formulating explicit statements describing the specific needs and expectations of users in terms of the site's functionality and features. (Unger, et al., 2012)

3.2.1 User Groups

One way to get started is to create an initial or provisional definition of users. It defines the primary user groups of the site, aiding in directing the efforts towards identifying the appropriate roles, demographics, or other variables that influence the user perception of the site.

Basic steps for defining the user groups:

1. Formulate a list of attributes that can aid in the classification of distinct user groups on the website.
2. Engage with relevant stakeholders within the organization who have direct interaction with the respective user groups to discuss and validate the identified attributes.
3. In order to determine which attributes of potential users are most influential in terms of their likelihood to use a site or application, it is necessary to prioritize them based on their perceived impact.
4. Establish user groups that will receive attention during the research and design phases. (Unger, et al., 2012)

3.2.2 Research Techniques

Research techniques center around comprehending user behavior, requirements, and incentives via the process of observation and feedback. The design process must rely on empirical evidence and research, rather than unfounded presumptions. User experience research is conducted to compare the designer's perception of the user's necessities against the actual requirements of the user.

- **Primary research** refers to original research that is carried out by the researcher themselves. It entails obtaining information through direct engagement with users, such as conducting interviews, surveys, or usability studies, which are categorized as primary research data. (Buley, 2013)
- **Secondary research** is a form of research that involves utilizing pre-existing data and information collected by other researchers or sources. This type of research involves using sources like books, articles, journals, or databases to gather and analyze data, and is referred to as secondary research. (Buley, 2013)
- **Qualitative research** is a type of research that is primarily focused on gathering data through direct observations and conversations. This method of research allows for the exploration of the "what," "how," and "why" of complex real-world situations, offering a rich level of detail that captures the intricacies of human behavior and experience.
- **Quantitative research** is a research approach that emphasizes the collection and analysis of data that can be measured or counted. This type of research relies on numerical data, which is frequently obtained through large-scale surveys, experiments, or other standardized data collection methods. While quantitative research can provide precise and objective answers to questions about "how much" or "how many" along specific dimensions, it may not capture the complexity of human experiences and behaviors that qualitative research can offer. (Cooper, et al., 2014)

3.2.3 Interviews

This research technique is employed to gather comprehensive information regarding people's opinions, thoughts, experiences, and emotions. Researchers have access to individuals, but the mode of access, such as in-person interviews, telephone interviews, or online surveys, may vary depending on the nature of the study. The goal of this approach is to obtain rich, in-depth insights into the subjective experiences and perspectives of participants. (Unger, et al., 2012)

3.2.4 Surveys

User surveys are a valuable tool for identifying and prioritizing key themes related to a product. This research technique involves posing the same set of questions to a large

number of people in order to gauge their opinions and perspectives on the product in question. By collecting and analyzing the data obtained through user surveys, researchers can gain a better understanding of the opinions and attitudes of a broad sample of users, allowing them to prioritize themes and issues of significance. (Hartson, et al., 2018)

Surveys represent an effective means of evaluating the success of a product throughout its development and after its launch. For instance, administering surveys after the product launch can help measure its effectiveness and provide insights for future improvement. Surveys may incorporate open-ended questions for qualitative research, enabling participants to elaborate on their answers, as well as closed-ended questions for quantitative research that yield numerical data. (Still, et al., 2016)

3.2.5 Focus groups

A focus group is a research technique that involves a small group of selected users or stakeholders who are representative of the larger population being studied. During a focus group session, participants engage in a guided discussion led by a moderator who asks open-ended questions to elicit their opinions, attitudes, and perceptions related to specific topics or themes. (Hartson, et al., 2018)

3.2.6 Job Shadowing

Job shadowing is a user research technique that involves a UX specialist observing the user in their natural environment, typically during their daily routine. (Hartson, et al., 2018) By observing the user's workflow and pain points, UX specialists can identify opportunities to improve the product or service on a more fundamental level, such as changing the overall design or introducing new features. (Lukas, 2011)

The following questions are good note-taking prompts while shadowing users:

- What do users have to do?
- What do they want to do?
- How do they perform their tasks?
- What knowledge about the tasks do users need before performing them?
- What aspects of the tasks are simple or difficult?
- How do users use products, or how would the products be used to perform particular tasks?
- What do users navigate, confront, or mitigate while completing tasks? Are

there distractions? Is the user multitasking?

- Do users like the tasks? (Still, et al., 2016)

3.2.7 Subject-matter expert

A subject-matter expert (SME) possesses profound comprehension of a particular work domain and the various work practices encompassed within that domain. Interviewing SMEs instead of users is definitely a faster technique to consider. They can provide deeper insights into variations of the work practice across that domain. (Hartson, et al., 2018)

3.2.8 Diary Studies

Diary studies are a research technique used to collect qualitative data about user behaviors, activities, and experiences over a period of time. During a diary study, users are asked to keep a log, or diary, of their daily activities and provide information about their behaviors and needs related to a specific product or service. (Goodman, et al., 2012)

3.2.9 Contextual Inquiry

Contextual inquiry is a user research method that involves conducting on-site visits with participants to observe and learn about how they work in their everyday environment. This technique is particularly useful when the project team has little information about the target users and when users work in a unique environment with complex tasks or workflows. (Unger, et al., 2012)

3.2.10 Card Sorting

Card sorting is a technique employed to comprehend how users organize information and concepts. The procedure, which encompasses a range of variations, generally involves the sorting of a deck of cards. Each card typically contains a distinct element of functions or information pertinent to the product or website. (Cooper, et al., 2014)

3.2.11 User Journey

The purpose of creating user journeys is to ensure that users' tasks are optimized and easy to complete. User journeys serve as a valuable tool for designing a product's flow. (Allen, et al., 2012) A user journey map shows the user's steps from the beginning of the process to the end of the process. In this context, the term "process" denotes a purposeful endeavor undertaken by individuals to attain their objectives. (Travis, et al., 2019)

3.2.12 Personas

In UX design, the user always comes first. Personas refer to fictitious representations of typical target users, which are developed based on pertinent research and descriptive information. Personas serve to construct a coherent image of the users who are employing the website or application and may even provide insights into the manner in which they engage with it. The creation of personas is a crucial aspect of the design process as it enables a profound exercise in empathy. Personas afford a reflection of users' lifestyles, thereby offering guidance on how best to address their needs and issues. (Unger, et al., 2012)

3.2.12.1 Building Personas

The creation of personas is predicated on user research that seeks to identify recurring pain points representing UX issues, which impede the user's attainment of their desired product experience. The process of creating personas involves scrutinizing the user data to pinpoint the most frequent themes and grouping users who embody these themes into personas.

The number of personas to create may vary depending on the specific circumstances. Typically, a minimum of three personas is recommended, although it is not uncommon to develop as many as seven. While it is crucial for personas to closely align with actual users, it is impossible to meet every individual user's unique needs. Personas should also be contextualized to the product, with a focus on the behaviors and goals of users who interact with it effectively. (Unger, et al., 2012)

3.2.13 User Stories

An additional approach to gaining insight into users is by developing user stories, which are based on their interactions with the product. User stories are brief, one-sentence narratives that are fictitious and used to guide and inspire design decisions. They embody the user, highlight a challenge or obstacle faced by the user, and specify the user's ultimate goal. User stories are generated from user research data and may emerge from issues encountered by users with an existing product or reflect requirements for new features in a new design. (Hartson, et al., 2018)

User stories have a particular structure:

“As a user, I want to ___ so that I can ___” (Travis, et al., 2019)

Personas and user stories provide a representation of the requirements of the target users for whom a particular design is being developed. The degree of elaboration and precision embedded within the personas and user stories correlates with the degree of ease involved in crafting products that adequately cater to the users' needs. In essence, meticulousness and fidelity in constructing these models can significantly facilitate the process of producing products that align with users' demands.

3.2.14 Affinity Diagrams

Affinity diagramming constitutes a valuable technique for addressing the query, "What do we know?" It involves grouping data points into clusters based on common themes or associations, a technique known as synthesis. This approach is frequently employed by teams to efficiently and expeditiously organize research data.(Still, et al., 2016)

During the application of affinity diagramming, understanding the interconnections between the ideas and concepts unearthed during data collection is crucial. The process typically begins by focusing on broad concepts, such as user characteristics, and then proceeds to narrow the scope even further as additional rounds of testing are conducted. (Still, et al., 2016)

What is advantageous about affinity diagrams is that they foster the amalgamation of ideas and concepts in an impartial manner that does not confer any undue advantage to any participant involved in the process. (Still, et al., 2016)

3.2.15 Competitive Analysis

Conducting a competitive analysis constitutes a fundamental component of the idea generation process. This analysis entails scrutinizing the features of rival products in the market and provides a detailed comprehension of their respective advantages and disadvantages. This approach serves as an effective means of acquiring insights into user expectations and requirements. Evaluating the competitors' brands, products, or companies that offer similar products can provide a comprehensive knowledge base regarding the market. (Allen, et al., 2012) "*The real goal of competitive user experience research is to figure out how to creatively differentiate your product from the competition—not just fix other people's mistakes*." (Goodman, et al., 2012)

Competition is divided into two categories: direct and indirect. Direct competition pertains to companies that offer similar products to your own and target the same audience,

making them the focal point of the analysis. In contrast, indirect competition encompasses companies that provide comparable products to a dissimilar audience or diverse products to the same audience. Examining both direct and indirect competitors can yield valuable insights into user requirements and preferences, as well as potential design directions.

Key factors to consider when assessing the user experience design of various websites:

1) Navigation – evaluate the ease of use and intuitive nature of the navigation structure. Consider whether users can easily find what they are looking for and if the navigation is consistent across the website.
2) Search functionality – assess the functionality and reliability of the search users can perform. Consider the types of searches users can perform and the accuracy of the results.
3) Product pages – evaluate the information provided on product pages, including images, product descriptions, and pricing. Consider whether users have the necessary information to make informed purchasing decisions.
4) Checkout process – evaluate the ease and security of the checkout process. Consider the number of steps involved, the required information, and the options for payment.
5) Load time – evaluate the speed at which the website loads and how long it takes for pages to load. Consider whether users will become frustrated with a slow website and whether this affects their overall experience.
6) Accessibility – evaluate the website's accessibility for users with disabilities, such as those who are visually or hearing impaired. Consider whether users can easily navigate and use the website without assistance.
7) User feedback – gather feedback from users about their experiences with the website. Consider what users like and dislike about the website and how it can be improved (can be done through online reviews).
8) Branding and Visual Design – evaluate the branding and visual design of the website, including the use of color, typography, and imagery. Consider whether the branding and design are consistent with the brand's identity and whether they appeal to the target audience.
9) User flow – evaluate the user flow of the website, including the path that users take to complete tasks and reach their goals. Consider whether the flow is logical and efficient and whether it supports the user experience.

10) Interaction design – evaluate the interaction design of the website, including the use of buttons, links, and other interactive elements. Consider whether the interactions are intuitive and whether they support the goals of the website.

3.2.16 User Flow

In order to develop a product that effectively meets the needs of its users, a comprehensive understanding of the users and their requirements is crucial. Armed with this knowledge, UX designers can anticipate user needs and behavior when interacting with a product that is yet to be created. One effective method for visualizing and communicating this process is through the creation of a user flow.

A user flow delineates a sequential arrangement of actions that a typical user performs through an application or website to achieve a goal. Prior to user testing, UX designers commonly construct user flows to elicit further knowledge about users. The delineation of user flows is often done during the early stages of design, as it assists UX designers in visualizing and predicting users' interaction with the digital product. The complexity of a user flow is positively correlated with the probability of encountering problematic user interfaces in the design. (Still, et al., 2016)

3.2.17 Storyboards

In the context of UX design, storyboarding refers to the creation of a sequential series of visual frames or panels that depict a user's interaction and experience with a product. Storyboarding leverages the visual medium to convey the user's journey, which can be more impactful than using words alone.

How to build a storyboard in six steps:

- Gather all relevant materials for the storyboard, including any previously conducted user research.
- Select a representative user to feature in the storyboard.
- Begin at the start of the user's interaction with the product. Depict this initial interaction in the first frame.
- Create additional frames for each significant step and emotional response by the user. Ensure that your storyboard has a clear beginning, middle, and end.
- If necessary, indicate the sequential order of the narrative through frame numbering or directional arrows.

- Continuously revise the storyboard as you collect additional information through brainstorming, research, and design prototypes. (Still, et al., 2016)

3.2.18 Designing the information architecture

The structuring and arrangement of the data is crucial for optimal user experience and engagement with the application or website. The discipline of organizing and categorizing this data is referred to as information architecture, which involves the development of hierarchical and navigational strategies to facilitate the efficient and effective exploration of site content by users. (Garrett, 2011)

Information architecture structures:

- **Organic**: the structure lacks a consistent and rigid organizational scheme. This type of architecture may be appropriate when the relationships between a set of topics are unclear or still developing. However, due to the absence of a clear and structured concept of sections, users may experience difficulty in understanding their position within the architecture.
- **Hierarchical:** the hierarchy is a structure commonly referred to as a "tree structure" or "hub-and-spoke" structure. This structure involves placing a broader category at the top, with specific categories related to the overall category placed at the bottom. Information that is of equal importance is placed side by side, or at the same level as each other, creating a tiered system of information organization.
- **Sequential**: This is the most fundamental type of information architecture. It is commonly used for smaller-scale structures such as individual articles or sections, as well as large-scale structures that guide users through an app or website via certain orders or steps.
- **Matrix:** Matrix structures are frequently employed to enable users with varying requirements to navigate the same content, with each user need associated with one axis of the matrix. This approach enables the content to be sorted and displayed according to multiple dimensions, facilitating navigation for a wide range of users. (Garrett, 2011)

3.2.19 Sitemaps

Site maps serve as visual aids that help to delineate the underlying structure of websites and applications. Through the representation of hierarchies and relationships, site maps enable users to easily comprehend where content can be found. Site maps can be utilized for any type of application, not solely limited to websites. It provides a comprehensive outline of website navigation and interpage relations. (Unger, et al., 2012)

Basic elements of site maps:

- Page
- Pagestack
- Decision point
- Connectors and Arrows
- Conditions (Unger, et al., 2012)

3.2.20 The difference between information architecture, user flow and sitemap

Information architecture (IA) refers to the organization and structure of information within a digital product. This includes the design of navigation, labeling, and categorization systems that make it easy for users to find and access the information they need. IA is a high-level concept that informs the overall design of a digital product.

User flow, is a visual representation of the steps that a user takes to accomplish a specific goal within a digital product. User flows help designers understand how users interact with the product and identify areas that can be improved to enhance the user experience. User flows often include different paths that users can take to achieve their goals, and they may include different user scenarios and use cases.

Site map, on the other hand, is a visual representation of the structure and hierarchy of a website or application. It shows the pages, sections, and content that make up the digital product and how they are connected to each other. A site map is often used as a tool for planning and organizing content, and it helps designers and stakeholders understand the overall structure of the digital product.

In summary, information architecture refers to the overall organization and structure of information within a digital product, site map is a visual representation of the hierarchy and structure of a website or application, and user flow is a visual representation of the steps that a user takes to accomplish a specific goal within a digital product.

3.2.21 Wireframes

Wireframes are visual representations of the structure and functional elements of a digital product that focus on interaction design and information architecture. (Benyon, 2019) Wireframes are used to define the content, approximate the visual layout, and illustrate high-level concepts of a web page or screen, providing an overview of the digital experience. (Hartson, et al., 2018)

"*Wireframes are typically created in black and white or shades of gray, use placeholders for images, and do not get into specifics of fonts. They come in all shapes and sizes—from the very basic to so advanced that they nearly replicate full-screen design."* (Unger, et al., 2012)

Purposes of wireframes:

- Establish the basic structure of a page
- Highlight the intended function of the product
- Save time and resources

3.3 Prototyping

Prototyping is a valuable methodology for iteratively designing, evaluating, and verifying proposed designs and features prior to committing significant resources to full-scale development. Prototyping serves as an exploratory medium to generate innovative ideas and collaborate with teams or users, particularly for complex interaction patterns or page view streams. (Unger, et al., 2012)

Prototyping is an iterative and incremental process because prototypes are often constructed to detect issues or assess user interactions. The prototyping process yields valuable internal and external feedback on concepts that can facilitate design improvement. The production of a functional prototype can serve as a milestone for project advancement to subsequent stages of the development lifecycle. (Unger, et al., 2012)

3.3.1 Paper prototyping

Paper prototypes are commonly used in early designs to explore various ideas and concepts. As long as you have pencils and pens, paper, and scissors, you can create as many scenarios as you need. (Allen, et al., 2012)

The process is simple:

- Sketch a piece of functionality that you want to test

- Present the functionality to the user(s)
- Document the feedback
- Then go to the next user or make updates and start over (Unger, et al., 2012)

3.3.2 Low-Fidelity prototyping

- Focus more on broad underlying design ideas such as content, form and structure, key functionality, and navigational structure.
- They are designed to be produced quickly and thrown away as quickly.
- Cover the earliest design thinking and should help in creation and evaluation of many possible design solutions. (Benyon, 2019)

3.3.3 High-Fidelity prototyping

High-Fidelity prototypes are similar in appearance to the expected final product. They are produced in software, whether in the development environment that will be used for implementation. Hi-Fi prototyping has the following features:

- It is useful for a detailed assessment of the main design elements (content, visual effects, interactivity, functionality and media).
- This is often a crucial stage in the client's acceptance.
- As a rule, it is worked out quite well in the project when ideas begin to strengthen. (Benyon, 2019)

3.4 Design Testing

Design testing is carried out during the design process. After creating a prototype, it needs to be tested in order to gather user feedback, meet their needs, and reduce risks. Every time a new version of the design is created, further research is conducted to assess what works well and what needs to be changed. (Still, et al., 2016)

Here are some decisions to make to end up with the right data to solve the problem:

- Qualitative Research vs. Quantitative Research.
- In-Person Research vs. Remote Research.
- Moderated Techniques vs. Automated Techniques. (Unger, et al., 2012)

3.4.1 Moderated vs. Automated techniques

Moderated techniques have a person known as the facilitator (or moderator) who speaks directly and guides the participants during the study. Moderated techniques create a rapport between the moderator and the participant, which can help the participant open up and share their feedback on the design. A moderated study is best for going into detail because additional questions can be asked throughout the session, but this can be time-consuming and limited in scope. (Unger, и др., 2012)

Automated techniques allow participants to test prototypes online. Participants go through the research at their own pace and often in their own environment. Automated tests are set up by the researcher in advance, and the results are analyzed after a specified period of time. Unmoderated research can be beneficial because it more accurately simulates how a user would interact with a product in the real world. (Unger, et al., 2012)

3.4.2 Usability Study

Usability studies are conducted to evaluate the ease of use, efficiency, and overall satisfaction of a product or service. Usability testing answers the question, "*Can people use the thing we've designed to solve their problem?"* (Travis, et al., 2019)

The most common method of design testing is usability study. Usability testing helps to evaluate the product by testing it on users. The goal is to determine if users can perform tasks using product prototypes to fix issues before launching the product. This helps to demonstrate whether the product is on the right track, or the design needs to be adjusted. (Still, et al., 2016)

Usability studies can and should be conducted at every stage of the UX design process. The number of studies depends on the project's timeline, goals, and budget. But usability studies can be conducted when there is a low-fidelity prototype, a high-fidelity prototype, or even a finished product.

When performing usability testing, there are five usability quality components to understand:

- Memorability – Assesses how well users can remember how to complete tasks and whether they can use this information to perform new tasks.
- Efficiency – Evaluates how long it takes for users to complete tasks and whether this duration is reasonable. This component also seeks to identify factors that hinder users from performing tasks efficiently.

- Errors – Aims to identify the errors users make while performing tasks and their severity. It also investigates whether users can easily recover from errors or if errors cause tasks to fail.
- Learnability – Assesses how effectively users can learn to use the system. It also evaluates whether users perform tasks more efficiently in later tasks after they have had an opportunity to learn the system.
- Satisfaction – Measures users' perception of the system, their likes and dislikes, and whether they find the system user-friendly and enjoyable to use. (Still, et al., 2016)

3.4.2.1 How many participants to involve

For a quantitative usability test, plan for a larger number of participants - 20 participants per study round. For a qualitative usability study, five to eight users per group are usually enough for each round of research. (Unger, et al., 2012) Typically, a usability test involves a small number of participants — five has become the industry standard. Five participants give an 85% chance of finding a problem that affects every third user. But some significant usability issues affect a small number of users. Sometimes, testing of five participants may reveal only 10% of the total number of issues because the remaining 90% of problems affect less than one in three users. (Travis, et al., 2019)

3.4.2.2 How to increase chances of finding usability problems?

- Include people with low digital skills in the research.
- Ask participants to complete more tasks. The number of tasks turns out to be a decisive factor for identifying problems in the usability test.
- Invite people from the development team to observe the test and take notes on issues found. Research shows there is a 50% chance of finding a usability problem. (Travis, et al., 2019)

There are many ways to test usability, both in person and online. It is recommended to record usability sessions, whether audio or video, to reference user data when making design decisions later in the process.

3.4.3 Usability metrics

The table shows some common usability metrics and ways to measure them, adapted from the list provided in the ISO 9241 part 11 usability standard, and using the definition of usability "efficiency, effectiveness and satisfaction" adopted in the standard. Most of them have a task — something that the participant has to do - and it's easy enough to decide whether the task was completed successfully or not. The evaluation team must determine whether the metric is relevant. (Benyon, 2019)

Figure 2 Common Usability Metrics (Benyon, 2019)

Usability objective	Effectiveness measures	Efficiency measures	Satisfaction measures
Overall usability	• Percentage of tasks successfully completed • Percentage of users successfully completing tasks	• Time to complete a task • Time spent on non-productive actions	• Rating scale for satisfaction • Frequency of use if this is voluntary (after system is implemented)
Meets needs of trained or experienced users	• Percentage of advanced tasks completed • Percentage of relevant functions used	• Time taken to complete tasks relative to minimum realistic time	• Rating scale for satisfaction with advanced features
Meets needs for walk up and use	• Percentage of tasks completed successfully at first attempt	• Time taken on first attempt to complete task • Time spent on help functions	• Rate of voluntary use (after system is implemented)
Meets needs for infrequent or intermittent use	• Percentage of tasks completed successfully after a specified period of non-use	• Time spent re-learning functions • Number of persistent errors	• Frequency of reuse (after system is implemented)
Learnability	• Number of functions learned • Percentage of users who manage to learn to a pre-specified criterion	• Time spent on help functions • Time to learn to criterion	• Rating scale for ease of learning

3.4.3.1 KPIs

Key Performance Indicators (KPIs) are important metrics used to assess the effectiveness and success of a product or prototype. The following are some common KPIs used during usability studies:

- **Task success rate** measures the number of successfully completed tasks by users.
- **Time on task** measures the time it takes for a user to complete a task.
- **Navigation vs. search** indicates the percentage of users who use the website or app's navigation compared to those who use the search function.

- **User error rate** measures the number of errors made by users while using the product, indicating areas of the design that need improvement.
- **Drop-off rate** shows the percentage of users who abandon the product or prototype during use, indicating issues with the design or user experience.
- **Conversion rate** measures the percentage of users who complete a desired action, such as making a purchase or signing up for a service.
- **System Usability Scale** (SUS) is a questionnaire that gathers participants' opinions about the product, which are then used to measure the usability of the design.
- **Net Promoter Score** (NPS) measures the likelihood that a user would recommend the product or service to a friend or colleague, indicating user loyalty. (Mithoon, 2020)

3.4.4 Script

A script, also called a discussion guide or protocol, is a list of instructions and follow-up questions that a moderator asks participants during an interview as part of a usability study. Using the script in the research plan gives a clear idea of what the user is trying to do, what they think and feel, and what their problems are. A script generally has three parts: the introduction and preliminary interview, the tasks, and the wrap-up. (Goodman, et al., 2012)

- **Introduction:** The introduction sets the level of comfort regarding the process and its role in it. The style of the script should remind the moderator that the tone of the interview should be casual and casual. Telling evaluators that a product is in development helps them relax and gives them more freedom to comment on the product as a whole.
- **Tasks:** It may be helpful to ask participants to try some of the tasks on their own, without a moderator in the room. This can provide valuable insight into how people solve problems without an available source of knowledge. Including a specific list of issues helps ensure that all required questions are answered. The moderator should feel free to ask follow-up questions whenever appropriate during the interview.
- **Wrap-up:** Wrapping up the results is valuable for observers and analysts to get an idea of the main points of the discussion. In addition, a heated discussion of

the product can be a good conclusion for the evaluator and generate some good ideas. (Goodman, et al., 2012)

3.4.5 A/B testing

A/B testing is a research method that tests the effectiveness of two versions of a product. This testing requires a larger sample size and can be valuable in understanding how users respond to different design options. For instance, a hypothesis states that changing one element of the page will improve performance, user testing should be done for design A and design B. At least 20 users are required for A / B testing, which is considered quantitative research. After testing, statistical analysis is carried out to determine which design shows a significant change (usually, a 90% confidence level is sufficient to determine a significant difference). (Still, et al., 2016)

A/B testing has its limitations. In the study, only one parameter can be selected, otherwise, the test will not be reliable. The use of A/B testing should be balanced with additional usability testing that includes both quantitative and qualitative data. (Still, et al., 2016)

3.4.6 Heuristic evaluation

Heuristic evaluation is a usability engineering method used in UX design to evaluate the user interface of a digital product or system. The method involves a small group of evaluators, usually three to five, who systematically examine the UI and identify any usability problems based on a set of predefined usability principles, called heuristics. (Nielsen, 1994)

The evaluators inspect the interface alone and after completing their evaluations, the results are aggregated. This method is important to ensure independent and unbiased evaluations from each evaluator. Each evaluator goes through the interface several times to inspect the various dialogue elements and compare them with a list of recognized usability principles. The results of the evaluation can be recorded either as written reports from each evaluator or by having the evaluators verbalize their comments to an observer. During the evaluation session, evaluators can be provided with hints on how to proceed in case they have problems using the interface. (Nielsen, 1994)

Overall, heuristic evaluation is a useful method for identifying usability problems in a user interface design, which can be attended to as part of an iterative design process.

However, it is important to note that heuristic evaluation is not a replacement for user testing, which provides a more comprehensive understanding of how real users interact with a product or system. (Nielsen, 1994)

The following are the 10 usability heuristics for user interface design proposed by Jakob Nielsen:

1) **Visibility of system status:** The interface should always keep users informed about what is going on through appropriate feedback within a reasonable amount of time.
2) **Match between system and the real world:** The interface should speak the language of the users, with words, phrases, and concepts familiar to them.
3) **User control and freedom:** The interface should provide users with a clear and easy way to undo or redo an action, exit from unwanted states, and navigate to where they want to go.
4) **Consistency and standards:** The interface should follow established conventions and standards for the task at hand, reducing the need for users to figure out how things work.
5) **Error prevention:** The interface should provide clear and effective error messages and prevent errors from occurring in the first place.
6) **Recognition rather than recall:** The interface should minimize the cognitive effort required from users by making objects, actions, and options visible and easy to find.
7) **Flexibility and efficiency of use:** The interface should cater to both novice and expert users, providing shortcuts, accelerators, and customization options.
8) **Aesthetic and minimalist design:** The interface should strive for simplicity and clarity, with only the essential elements displayed, and no unnecessary or irrelevant information.
9) **Help users recognize, diagnose, and recover from errors:** The v should provide clear and easy-to-understand error messages and help users recover from mistakes.
10) **Help and documentation:** The interface should provide clear and concise documentation and help resources, easily accessible from the UI.

Severity of usability problems:

“0 = I don't agree that this is a usability problem at all

1 = Cosmetic problem only: need not be fixed unless extra time is available on project

2 = Minor usability problem: fixing this should be given low priority

3 = Major usability problem: important to fix, so should be given high priority

4 = Usability catastrophe: imperative to fix this before product can be released” (Nielsen, 1994)

3.4.6.1 Heuristic markup

Heuristic markup is a method that is grounded in the principles of heuristic evaluation. The heuristic markup approach involves documenting the experience of a user as they interact with a product, with a focus on identifying deviations from recognized usability standards. Unlike heuristic evaluation, heuristic markup relies heavily on the evaluator's subjective reactions and responses to the product. Through the process of heuristic markup, one can systematically audit a product to assess its quality and identify opportunities for improvement. This approach is particularly useful in the design process, as it ensures that new designs conform to established usability principles. Moreover, the practice of heuristic markup allows evaluators to transcend the limits of familiarity and gain deeper insights into the product experience. (Buley, 2013)

3.5 Accessibility

Accessibility is the design of products, devices, services, or environments for people with cognitive, sensory, or motor impairments. Users with disabilities are often underserved by technological devices. It is impossible to know all the ways in which a user interacts with a product, which is why it is important to include people with disabilities in research. (Cooper, и др., 2014)

3.5.1 Accessibility Guidelines

- **Leverage OS accessibility tools and guidelines** – The future product should have structure to support assistive technologies such as VoiceOver and TalkBack and must comply with user interface guidelines for accessibility.
- **Don’t override user-selected system settings** – The product should not replace system-level settings that support accessibility options for interface attributes,

such as color schemes, font sizes, and typefaces. It should take into account any system-level accessibility settings for input methods and devices.

- **Enable standard keyboard access methods** – Keyboard accelerators, mnemonics, and a rational tab navigation scheme should be used for desktop applications. The user should be able to navigate through all content areas using the Tab key. The arrow keys should allow the user to navigate through the list, table, and menu contents. The Enter key should activate the buttons and toggles.
- **Incorporate display options for those with limited vision** – The product settings should support a high-contrast (at least 80 percent) display option using black text on a white background, typeface magnification, an option to display information for colorblind people, and an option to minimize motion and animation.
- **Provide visual-only and audible-only output** – The product should have access to audio interfaces provided by screen readers and accessibility services for vision-impaired users. Products should also support redundant visual and audio feedback for users with hearing impairments.
- **Don't flash, flicker, or blink visual elements** – Flashing and blinking at a rate of more than twice a second (2 Hz) may confuse people with visual impairments. They may also be the cause of seizures in people with epilepsy and other brain disorders.
- **Use simple, clear, brief language** – Use shorter and simpler texts in the interface.
- **Use response times that support all users** – Let users choose a longer response time, make the time-out period adjustable for users.
- **Keep layouts and task flows consistent** – Provide only a single navigation and action paradigm for cognitive, motor, or vision disabilities.
- **Provide text equivalents for visual elements** – Visual elements and controls should be marked with text so that screen readers can identify them. (Cooper, et al., 2014)

3.6 Design Principles

Design principles are generally accepted rules, assumptions, or guiding statements that define the relationships between design elements. (Unger, et al., 2012)

3.6.1 Unity

Unity measures how well design elements have an obvious association with each other to create a consolidated design idea. This design principle demonstrates unity in many ways: color, shape, and style. (Unger, et al., 2012)

3.6.2 Variety

Variety refers to the diversification of the elements of a design to break up the monotony and add a sense of freshness. The variety allows using different but similar design elements to keep users engaged. (Unger, et al., 2012)

3.6.3 Hierarchy

Hierarchy is the established order of design elements. This helps the user know what to focus on first and what actions to take. Things higher in the hierarchy are more visible and more likely to be highlighted to the user, while things lower in the hierarchy tend to be supportive and may seem less important. Hierarchy affects the user's attention when scanning a page. (Unger, et al., 2012)

Some of the factors determining the understanding of hierarchy are the location, color, and size of the action object and the tone and length of any text. As a general rule, objects that are larger, brighter, and have higher contrast against other objects on the page have more dominance, and short and powerful text will also draw attention. The arrangement of elements is essential for organizing information, which helps users find the information they need and highlight the design elements in order of importance. Focusing on the order of importance gives users exactly what they need without getting them frustrated in their experience. (Unger, et al., 2012)

3.6.4 Scale

It is used to draw attention to elements and help users find those elements more quickly. They also help users understand relative size. Use scale to make the most important elements in a design bigger than less important elements, which helps create emphasis and contrast. (Gordon, 2020)

3.6.5 Proportion

Proportion refers to the size relationships of its elements to each other, and to the outer dimensions of the overall design. Proportion helps make sure the size relationship between elements makes sense and that the elements on the screen are balanced against each other. (Unger, et al., 2012)

3.6.6 Consistency

In order for the design elements to be consistent, it is better to design one element once and use this design throughout the product. The best approach is to design each element, try it out in different contexts, and then refine the design as needed. Even though many design elements will be created in isolation from each other, they still need to work together. Good design is not just a collection of well-designed objects, but rather objects should form a system that functions as a coherent, consistent whole.

The consistency of design across different media creates a unified view of the brand identity among users. Branding consistency should be present at every level of product visual design, from navigation elements that appear on every screen to a meek button that only appears once. Inconsistent visual styles undermine the clarity of the corporate image and leave the audience with the impression that this company has not yet been able to identify itself. (Garrett, 2011)

3.6.7 Color

3.6.7.1 Color Theory

Color theory is the basis that informs the use of color in design, guides the selection of color palettes, and contributes to the effective transmission of design ideas both on an aesthetic and psychological level. (Hannah, 2021)

Color categories:

- Primary (red, blue, yellow colors).
- Secondary (combination of any two of the three primary colors: orange, purple, green).
- Tertiary (combination of a primary color with a secondary color: magenta, vermillion, violet, teal, amber, chartreuse) (Hannah, 2021).

Color schemes:

- Monochromatic – one base color and any number of tints or shades of that color.

- Analogous – colors that are adjacent to each other on the color wheel.
- Complementary – colors are opposite to each other on the color wheel.
- Split complementary – two colors adjacent to the base color's complement.
- Triadic – the color wheel is divided into thirds so that all the three colors are equally spaced.
- Tetradic (double-complementary) – combination of any complementary color scheme with another complementary color scheme. (Beaird, et al., 2020)

3.6.8 Grids

Grids refer to a system of intersecting parallel lines, both horizontal and vertical, which subdivide the display into a series of columns and rows. They facilitate comprehension of the regularity, organization, and dimensions of a webpage and guarantee that its layout aligns with the screen's limits.(Cooper, et al., 2014)

The use of grids in the design provides several advantages:

- Usability – Because grids attempt to arrange the positioning of elements, users can quickly find out where to find key interface elements. A well-designed grid greatly improves the screen's readability.
- Aesthetic appeal – A carefully considered grid and the choice of appropriate relationships between different areas of the screen can create a sense of order in the design that feels convenient for users.
- Efficiency – Standardization of layouts reduces the amount of labor for creating high-quality visual interfaces. (Cooper, et al., 2014)

3.6.9 White Space

Maximizing spatial utilization is a crucial means of enhancing the visual appeal and legibility of designs. White space denotes the area surrounding an object in an image. Specifically, it refers to the gaps between design elements or unoccupied space in a layout. (Beaird, et al., 2020)

Common methods of using white space effectively:

- **Line spacing** is the vertical distance between two blocks of text. Introducing negative space between sentences in a paragraph prevents letters from colliding and facilitates content readability.

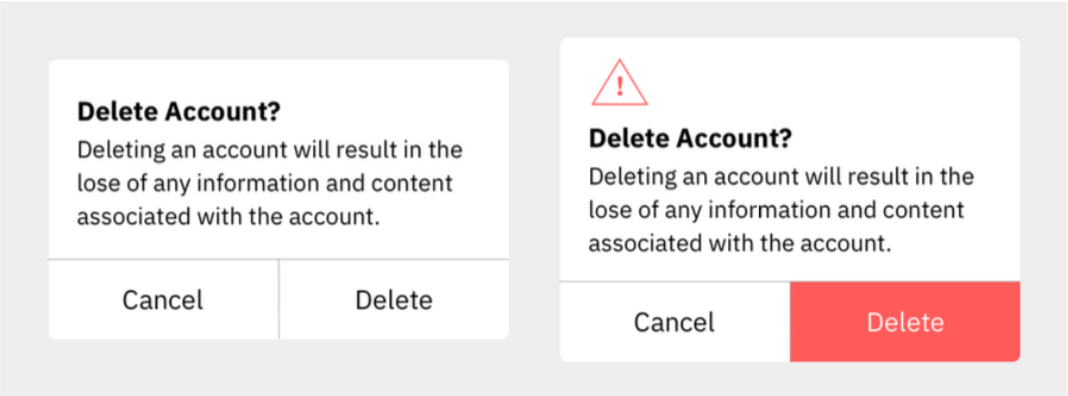
- **Padding** is the negative space surrounding design elements or between the border and the content. By providing objects with ample space, padding enables them to coexist within a design while preventing visual clutter.
- **Margins** is the space outside the design's border.

3.6.10 Psychology principles that influence design

3.6.10.1 Von Restorff effect

The Von Restorff effect asserts that among several identical objects, the one that deviates from the norm is more likely to be retained in memory. This phenomenon is relevant when designing elements such as buttons, text links, price tables, and subscription plans. The effect can be harnessed to attract users' attention by distinguishing design elements and avoiding inadvertent user actions. The image below illustrates two variations of a confirmation modal. The left modal may cause users to take the wrong action as the delete button lacks emphasis. Conversely, the right modal uses visual contrast to highlight the most important button, preventing unintended actions by users. (Yablonski, 2020)

Figure 3An example of the von Restorff effect (Yablonski, 2020)



3.6.10.2 Jakob’s Law

People use knowledge from past experiences when interacting with something new. So users expect the site to work the same as the other sites they already know. Jakob's law takes into account the knowledge of users' previous experience to design solutions that are familiar to users. (Yablonski, 2020)

3.6.10.3 Hick’s Law

Hick’s law states that the time required to make a decision increases with the number and complexity of options available. Applying Hick's law ensures a better user experience by providing the right choice at the right time, rather than constantly providing all possible options. It is important to minimize opportunities for users and simplify the interface to avoid overwhelming users. Every user has a goal to achieve when interacting with the site, and the less people have to think about what they need to do to achieve their goal, the more likely they will achieve it. (Yablonski, 2020)

3.6.10.4 Fitt’s Law

It states that the time it takes for a user to engage with an object is relative to its size and the distance to it. Three key points can be deduced from Fitts ' law:

- Touch targets should be large enough so that users can easily distinguish them and accurately select them. When the touch targets are too small, users need more time to engage them.
- There should be enough space between the touch targets. If the distance between the elements is too small, the probability of errors touching the target increases.
- Touch targets should be placed in interface areas that make them easily reached. Placing touch targets in hard-to-reach areas of the screen will make it more difficult to select them. (Yablonski, 2020)

3.6.10.5 Aesthetic-Usability effect

The aesthetic usability effect states that an aesthetically pleasing design evokes a positive response in people's brains, enhances cognitive abilities, increases the perception of usability, and makes users believe that the design really works better. Users believe that the design works better, and are more likely to overlook minor usability issues. But in fact, it can conceal usability issues and prevent problems from being detected during usability testing. (Yablonski, 2020)

3.6.11 Gestalt Principles

Gestalt principles describe how people group similar elements, recognize patterns and simplify complex images when perceiving the world. The human brain tries to organize information by subconsciously combining parts into a cohesive whole. Applying Gestalt

Principles in the mockups helps to create a user-friendly design based on psychology and human behavior. (Gordon, 2020)

- **Similarity:** elements that look similar in some way are perceived to have the same function, while elements that seem dissimilar are perceived as belonging to separate groups. (Harley, 2020)
- **Proximity:** elements in close proximity to each other are perceived to be more closely related than those spaced further apart. (Harley, 2020)
- **Common region:** elements located within the same area are perceived to be grouped together and assumed that they have some common characteristics or functions. (Harley, 2020)
- **Closure:** states that when people look at an incomplete object, they subconsciously complete the image to see a whole, completed object. (Joyce, 2021)
- **Continuity:** elements that are arranged in a line or on a curve appear to be more related than elements not on the line or curve. (Bradley, 2014)
- **Symmetry and order:** elements are more visually pleasing when the parts of an object are balanced or are mirror images of each other. (Bradley, 2014)
- **Figure-ground:** elements are either in the foreground or in the background, they either stand out in front or recede into the background. (Hensley, 2016)

3.6.12 Visual design elements

- Hue – Color is best used carefully to convey the importance of the interface. A hue belongs to a family of colors (red, green, or blue). To create an effective visual system, a limited number of hues should be used. Hue is also tricky because color blindness is common in the general population and there are many types of color blindness. (Cooper, et al., 2014)
- Saturation – Refers to the intensity and richness of color. Highly saturated colors attract the user's attention when there is a strong contrast. (Cooper, et al., 2014)
- Orientation – Refers to the arrangement or layout of design elements, which is often tailored to the specific platform or device for which it is intended. Desktop computers typically utilize a horizontal orientation, while mobile phones and tablets provide the option for users to switch between vertical and horizontal orientations. "*Orientation can be difficult to perceive with some shapes or at*

small sizes, though, so it's best used as a secondary communication vector." (Cooper, et al., 2014)

- Size – The size of the element depends on other elements and factors affecting the design. Large items attract users' attention more, especially when they are much larger than similar elements around them. People automatically arrange objects in terms of their size and tend to assign relative values to these differences. A sufficient difference in size is also enough to quickly attract attention. (Cooper, et al., 2014)
- Shape – Defined as lines around a self-contained space that includes length and width. This is the main way to find out what an object is. This is not the best contrast property when the goal is to attract the user's attention. (Cooper, et al., 2014)

3.7 E-commerce UX Design

3.7.1 What is e-commerce?

E-commerce (short for Electronic Commerce) is an entrepreneurial activity involving the buying and selling of goods or services over the internet. E-commerce transactions can be carried out using a variety of electronic devices such as computers, tablets, smartphones, and other smart devices. This form of commerce enables the management of data, sales channels, advertising, and presentation of goods and services to be performed in novel ways. Additionally, e-commerce transactions facilitate payments, shipping, and refunds for goods and services sold. (Bloomenthal, 2022)

3.7.2 E-commerce design

A lot of new e-commerce businesses enter the market every year and it includes online clothes retail stores. Nowadays, entrepreneurs depend on online sales more than on offline, many businesses operate only online. Hence, it should be concluded that any kind of e-commerce business relies on its website or application. The UX design is a primary tool of company's success. The UX and UI design are evolving over time, and it is significant for a business to keep up with the times because it directly affects the income and potential growth.

When websites first appeared, people didn't really know how they should use them. Web designers sold business owners just a beautiful design that would satisfy the customer,

but there was a little strategy in this design. Because of this, most websites looked amazing, but there was no process behind the website. The strategy was just to hope that users would browse the site, find something they liked, and then come back to buy something. (Brunson, 2020)

Businesses are created by people for people. If people did not have needs and desires, businesses would not exist. Similarly, if no one could or would not satisfy the people's needs and wants, enterprises could not work. It is essential to understand how a person perceives information, how they make decisions, and what they do or do not do if there is a goal to create a successful business enterprise. Having a clear understanding of how the human mind works will help find the best ways to get things done efficiently and effectively. (Kaufman, 2020)

E-commerce design should follow the principles and methods of UX design outlined earlier in this dissertation. When designing an e-commerce site, it is always taken into account who will use the site and what they will use it for. Therefore, techniques such as user personas, user journeys, information architecture, prototypes, and other UX methods are suitable here. (Benyon, 2019)

When developing an e-commerce website or mobile application, the following aspects should be considered:

- Ease of operation,
- Strong branding,
- User data security,
- Effective use of visual elements,
- Visual representation of data through menus, catalogs, etc,
- The user's ability to leave reviews of goods and services,
- Easily available general and contact information,
- Design that supports the offer, and does not overshadow it. (Yalanska, 2021)

4 Practical Part

4.1 Practical Part description

The main goal of this part is to design fully working high-fidelity prototype of an online store. The prototype must correspond all UX design principles and standards and has to be as close as possible to the real online store. The process of this part is based on the previous research in the literature review section. Among all UX design techniques were selected the most relevant to this particular work.

The main aim is to create an applicable process of creating a website for an e-commerce store. Before starting to work on this part it should be mentioned that the design process usually follows some requirements from a client. To make the whole work more specific, several requirements from a client point of view were created. As the design method might differ from one client to another for various reasons, this thesis shows one possible way of creating an online store design with definite inputs.

The online store industry was selected based on the author's personal preferences. The design principle presented in this work is intended to be applicable not only to small online clothing retail stores but also to other e-commerce industries with online stores.

To create a high-fidelity prototype, certain requirements must be set. The requirements are:

- The design should be tailored for a small business with a limited budget.
- The business specializes in retailing clothing and footwear.
- Target audience is young adults who are interested in fashion and trends.
- The design should be visually appealing and well-designed, with a consistent layout and color scheme throughout the website.

This thesis follows the particular UX design phases to create a complete online store design:

1. User Research (survey, competitor analysis, personas),
2. Ideate (sitemaps, information architecture, user flow),
3. Design (wireframes, low-fidelity prototype),
4. Testing,
5. Design (high-fidelity prototype),
6. Testing,

7. Evaluation.

4.1.1 Figma

To realize all the planned work, the Figma application is selected. Figma is a cloud-based graphic and web design application that allows users to collaborate in real-time on various design projects. It provides a range of features for UX/UI designers, product designers, and graphic designers. Figma allows users to create both visually appealing and functional design using such tools as vector networks, frames, and components. The application also supports responsive design that adjusts the design to different screen sizes and resolutions. And the most important thing, Figma makes possible to create interactive prototypes for web and mobile applications.

4.2 User Research

4.2.1 Survey

In User Experience design, a survey is a research method used to gather data and insights about a particular group of users to gain a deeper understanding of the target audience, and to process this information to informed design decisions.

The online survey was created and included both open-ended and closed-ended questions, with the latter allowing for more structured data collection and analysis. As the concept of the online store was a clothing brand for young adults, the survey was spread among people between the age of 18–35-year-old. The data represented below is the outcome of the survey.

Table 1 Participants age ratio

What's your age range?	
18-26	62.5%
27-35	37.5%

Source: author's research

The age ratio is based on target users' group which is young adults. This demographic typically includes individuals between the ages of 18 and 35. Young adults are major participants in e-commerce industry, with many of them turning to online shopping for convenience and a wider selection of products. They are are active internet and social media users, and online shopping plays a significant role in their purchasing habits.

Table 2 Gender distribution among survey participants

What is your gender?	
Female	66.7 %
Male	25%
Non-binary	4.2%
Prefer not to say	4.2%

Source: author's research

Table 3 Participants' employment status

What's your current employment status?	
Employed full-time	62.5%
Self-employed	16.7%
Student	8.3%
Unemployed	8.3%
Employed part-time	4.2%

Source: author's research

Table 4 Participants' monthly income

What is your monthly income?	
$1000-$2000	37.5%
$1000 or less	29.2%
$2000-$3000	16.7%
$3000 or more	8.3%
I prefer not to say	8.3%

Source: author's research

Table 5 What type of device participants use the most when shopping online

What type of device do you use most when shopping online?	
Smartphone	66.7%
PC/Laptop	25%
Tablet	8.3%

Source: author's research

Table 6 What type of operating system participants are using on their phone

What type of operating system are you using on your phone?	
IOS	66.7%
Android	33.3%

Source: author's research

Table 7 What type of operating system participants are using on their computers

What type of operating system are you using on your computer?	
Windows	54.2%
Mac	33.3%
Linux	12.5%

Source: author's research

Table 8 Do participants prefer online or offline shopping

Do you prefer online or offline shopping?	
Online	75%
Offline	25%

Source: author's research

Table 9 How often participants shop online

How often do you shop online?	
Occasionally (once a month)	33.3%
Regularly (once a week)	33.3%
Rarely (less than once a month)	29.2%
Never	4.2%

Source: author's research

Table 10 How often participants shop for clothes online

How often do you shop for clothes online?	
Occasionally (once a month)	45.8%
Rarely (less than once a month)	41.7%
Never	8.3%
Regularly (once a week)	4.2%

Source: author's research

Table 11 What factors most influence participants‘ decision to make a purchase from an online store (multiple answer question)

What factors most influence your decision to make a purchase from an online store?	
Selection of styles and sizes	70.8%
Price	62.5%
Quality of the clothing	45.8%
Shipping and return policies	45.8%
Sales and promotions	37.5%
Convenience of the website or app	33.3%

Source: author’s research

Table 12 Would participants use the app or the mobile version of the site

If an online store has an app, would you use the app or the mobile version of the site?	
App	70.8%
Mobile version	29.2%

Source: author’s research

Table 13 For what reasons participants usually leave the site without completing the order (multiple answer question)

For what reasons do you usually leave the site without completing the order?	
Unclear or incomplete product information	54.2%
High delivery prices	50%
High prices	50%
Difficult navigation	45.8%
Lack of trust (do not trust the website or the company)	45.8%
Distractions or interruptions (pop-ups or ads)	37.5%
Slow loading times	37.5%
Lack of payment options	33.3%

Source: author’s research

Table 14 Do participants think it is important that the design of the site is visually pleasing, aesthetic

Do you think it is important that the design of the site is visually pleasing, aesthetic?	
Yes	100%
No	0%

Source: author’s research

Some of the open-ended questions and respondents' answers are represented below.

- **What are your favorite online clothes shops?**

People named those brands: Zalando, Asos, Arket, About you, NA-KD, Mango, Zara, Ganni, COS, Uniqlo, Farfetch, Matches Fashion, H&M and etc. The absolute leaders in popularity are Zalando and Asos.

- **Could you please name the online stores that you visually like?**

People named those brands: Farfetch, Acne Studios, Zara, Mango, Stradivarius, Asos, Zalando, Arket, Zara Home. Most respondents highlighted again Zalando and Asos brands, but also Zara and Mango showed up often. "Actually, almost all of the shops are visually nice" mentioned one respondent.

- **What brings you the most pleasure from online shopping?**

Participants mentioned: silence and peace, rare items, interface, number of products and prices, when everything turns out great, variety of brands, fast delivery, return options, coupons, time efficiency, convenience, unlimited options, unpacking the delivered product, pick up points nearby, sitting at home.

- **Is there anything else you'd like to tell me about your shopping for clothes online?** This question was asked at the end of the survey in case some participants wanted to share more information that wasn't asked in previous questions.

Most participants left this question unanswered but some of them left interesting comments:
"So far, online shopping has been very pleasant. On very rare occasions I've had bad experience, usually it was not the shop's mistake."
"I want an app to know my size, and I want AI to offer me new looks composed of clothes I already have with clothes I can by for cheap this week/month. Moreover, I want an app to know occasion, weather condition of location I'll be next week so it'll keep me updated on my best looks. Also, new socks every two weeks. Ships upon subscription."
"I like buying stuff online because I can discover new brands and buy things I do not have in my country".
"Videos are good presentation too"
"I prefer online shopping over offline, but when I'm in the mood to touch clothes and try them on – I go shopping offline"
"I get some kind of satisfaction supporting small businesses and unique brands that I may not have been able to find otherwise".

4.2.2 Survey analysis and research insights

83.5% of participants are employed and 62.5% of them have income more than $1000. 25% of participants have monthly income more than $2000.

66.7% of participants use smartphones most for shopping online. And 66.7% of respondents use IOS operating system on their smartphones.

45% of participants shop for clothes occasionally (minimum once a month) and 41.7% of participants do it less than once a month.

The most influential factor that affects participants' decision to make a purchase from an online clothes store – selection of styles and sizes (70.8%).

If an online store has an app, most people (70.8%) would use the app rather than mobile version of the site.

Among reasons for leaving the website without completing the order participants indicated: unclear or incomplete product description (54.2%), high delivery prices (50%), high prices (50%), difficult navigation (45.8%), lack of trust (45.5%).

All participants (100%) think that visually pleasing and aesthetic design is important for the website.

Most participants mentioned Asos, Zalando, Zara and Mango as their favourite brands for shopping, also the websites of these brands are considered as visually pleasing among many respondents. This information will be used for the further research in competitive analysis.

All online stores mentioned by participants are successful retail businesses, their websites follow modern web design trends and constantly improve their user experience. Many of them, in addition to the web version of the online store, also have an app. In the research was found that 70.8% of participants would use an app instead of the web version. It is applicable for an online store with a bigger budget and recognition, the mobile app development costs are more expensive than building a mobile website, especially for developing separate versions for different platforms, also an app requires ongoing maintenance and updates, which can be time-consuming and costly. This thesis considers the side of creation an online store design with minimal investment because many small businesses start with a limited budget and resources.

Based on findings that 66.7% of participants use smartphones when they shop online, this practical part is focused on mobile-first design approach that prioritizes designing for mobile devices before desktop screens.

4.3 Competitive analysis

The aim of this analysis is to understand the strengths and weaknesses of the user experience provided by direct and indirect competitors, and to identify opportunities for developing the future website. The gathered information can then be used to inform the design of the brand's website, and to make informed decisions about the features and functionality that should be included. By understanding what competitors are doing, it is possible to identify opportunities to differentiate the brand's design and provide a better user experience.

The competitive analysis contains the study of four direct competitors: Asos, Zalando, Zara and Mango. The study was conducted separately for the mobile and desktop versions of brand websites. The current applications of these online stores are not taken into account for analyzing mobile UX solutions.

When doing a UX competitive analysis, there are several key factors to consider in order to accurately evaluate the user experiences provided by different websites, these factors identified in detail in Chapter 3.2.15.

Rating system:

- Great – everything works great
- Good – there are opportunities for improvement
- Ok – could work better
- Poor – the feature is either missing or very poorly designed

Figure 4 Competitive analysis – mobile

	Asos	Zalando	Zara	Mango	Acne Studios
Navigation	Great	Great	Great	Great	Great
Search	Great	Good	Good	Ok	Great
Product pages	Great	Great	Great	Great	Great
Checkout process	Great	Good	Great	Good	Great
Load time	Great	Great	Great	Ok	Great
Accessibility	Good	Good	Great	Good	Good
User feedback	Good	Good	Good	Good	Good
Branding and Visual Design	Good	Good	Great	Great	Great
User flow	Great	Great	Great	Great	Great
Interaction Design	Great	Good	Ok	Good	Good

Source: author's analysis

During the competitive analysis some gaps were noticed among these five websites:

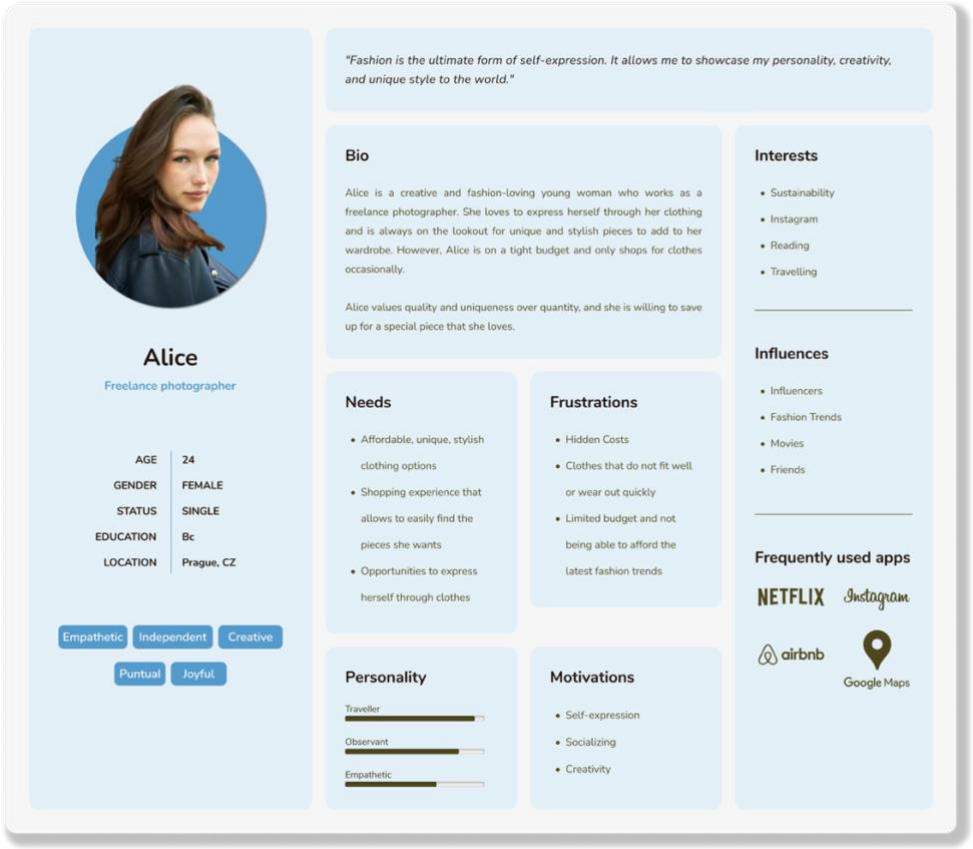
- Too small icons, sometimes it is hard to press the right icon.
- The scrolling process is not smooth.
- No option to change the language.
- No ‘delete product’ option in shopping bag.

In the future product, these flaws will be regarded.

4.4 User Personas

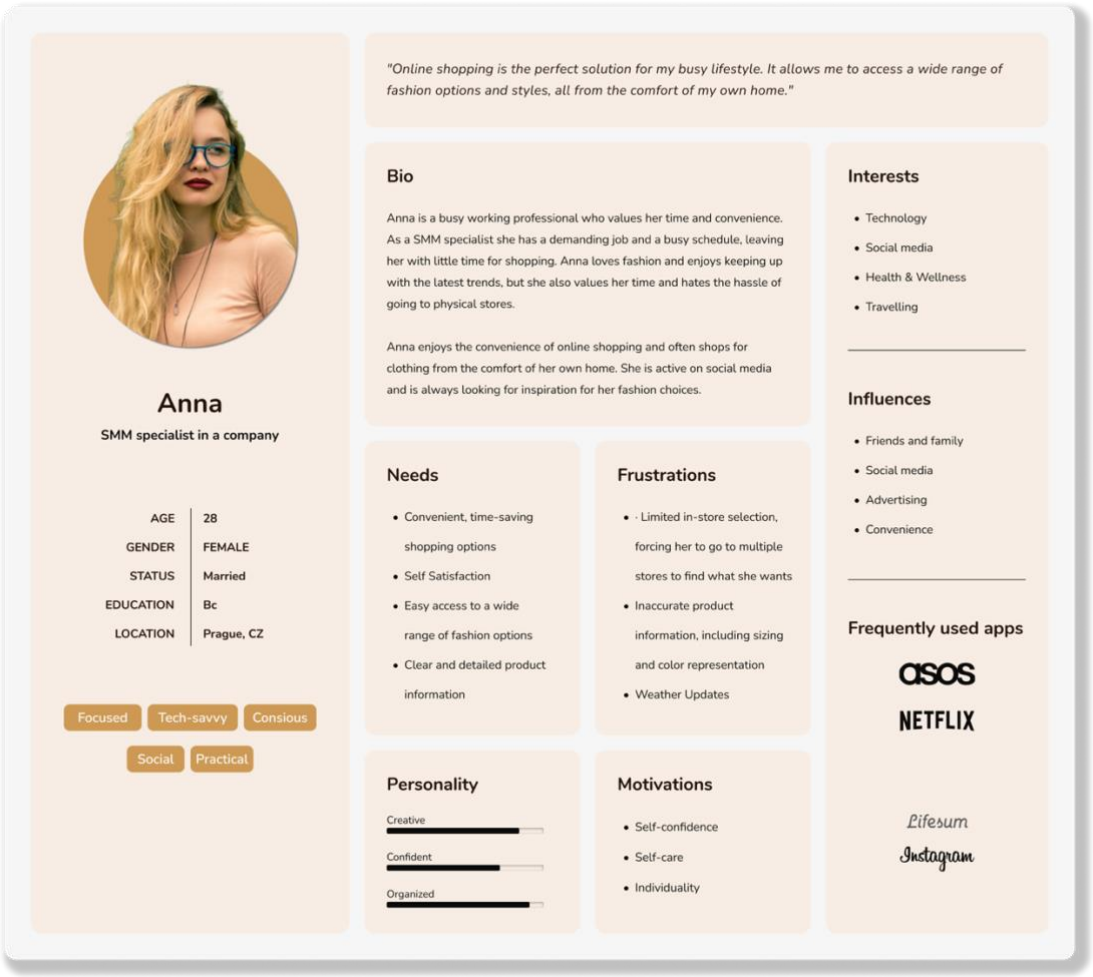
User personas are fictional characters that represent a product’s typical user base. The purpose of this method is to provide a deep understanding of the people who will be using the product. User personas help to make design decisions that are aligned with users’ needs and expectations, and to prioritize features and functionality based on what will be most valuable to the target audience. More details can be found in chapter 3.2.12.

Figure 5 Persona A



Source: author’s analysis

Figure 6 Persona B



Source: author's analysis

Persona A and Persona B are two primary personas. By understanding the needs and preferences of both Alice and Anna, the clothing store website can be designed to meet the needs of a broader target audience. Considering the unique perspectives and goals of different users, more holistic and user-friendly experience can be created.

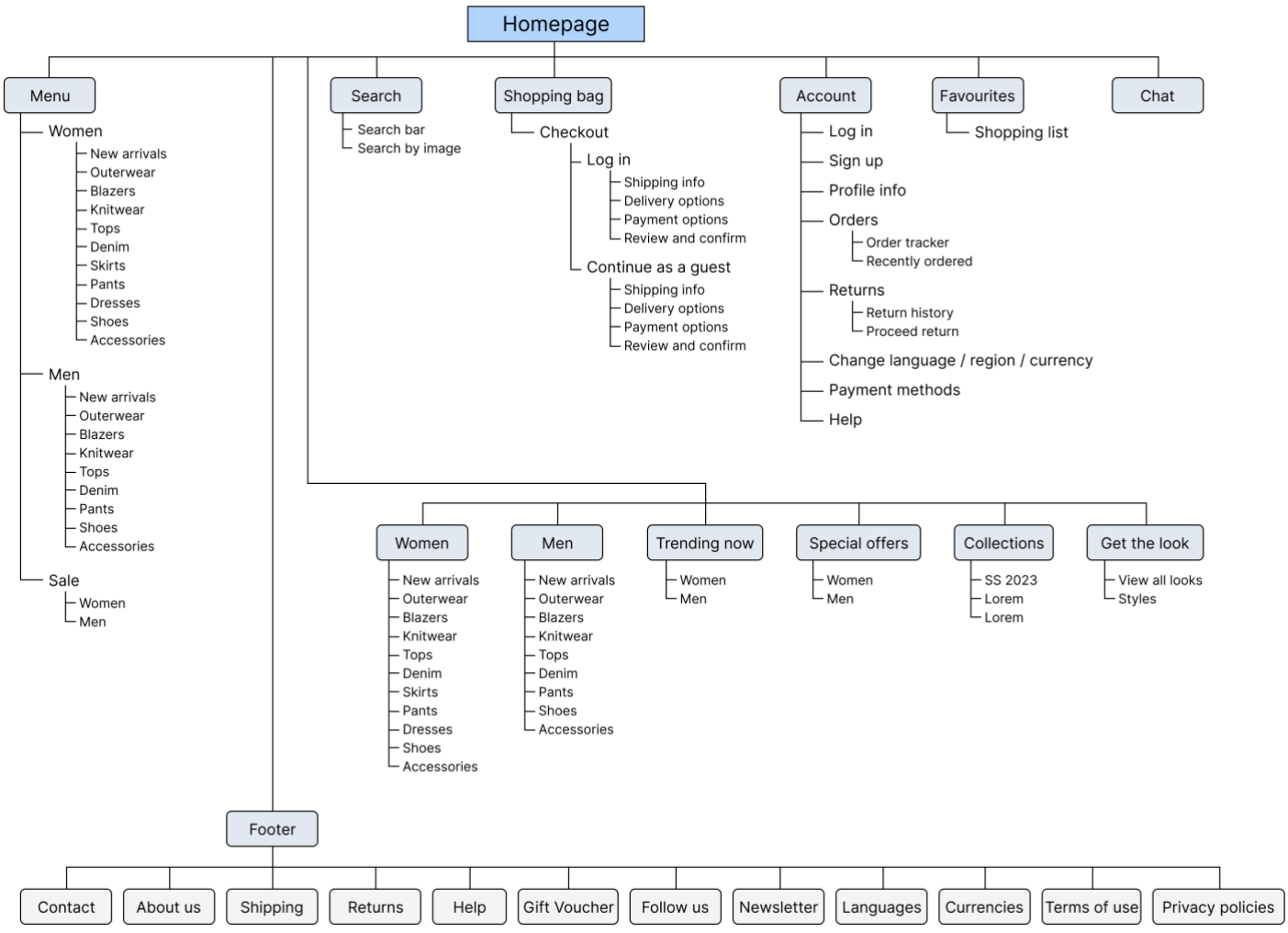
4.5 Information Architecture and User Flow

4.5.1 Information Architecture

The website structure follows the same structure as other websites do. Referring to Jacob's Law, users spend most of their time on different sites, so users expect to see the site's logic and appearance the same way as all other sites they already know. As for a clothing online store, it is crucial to include such webpages: homepage, product pages, shopping cart page, checkout page, look book page, about us page, contact us page.

It is essential to adopt a realistic approach at this stage, recognizing that it is not feasible to meet all user demands. Various constraints, such as budgetary, temporal, technological, and human resource limitations, must be considered when creating the plan and determining the target areas. Thus, it is advisable to avoid excessive ambition and instead focus on addressing pressing concerns with the available Information Architecture (IA) capabilities. Any necessary adjustments to the IA can always be made in the future.

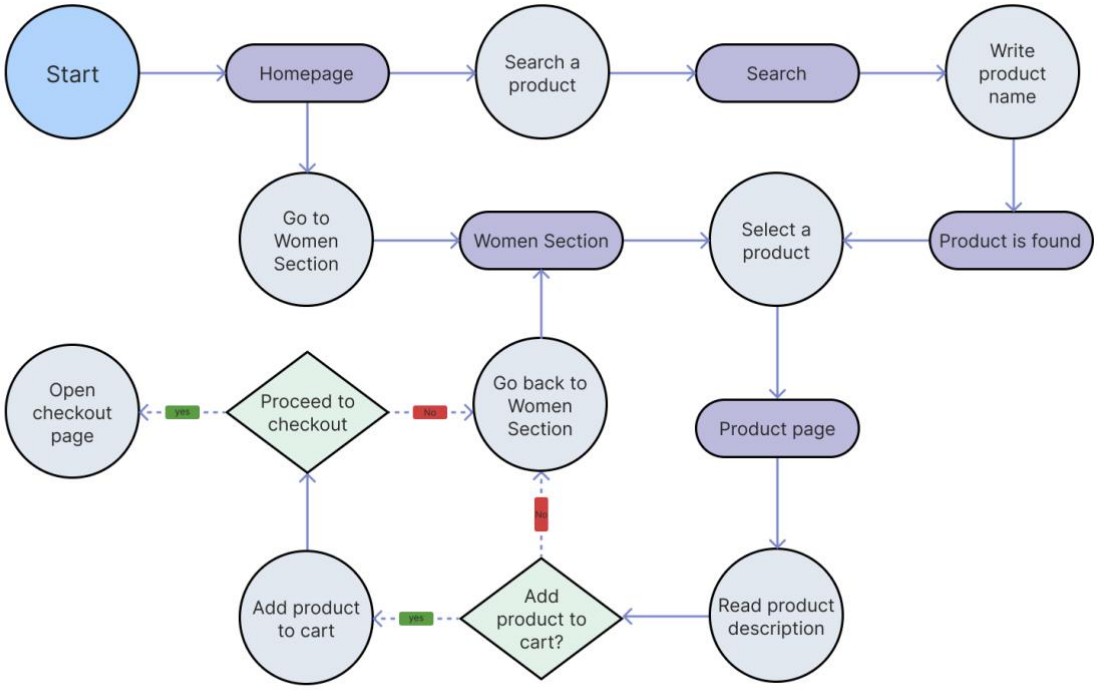
Figure 7 Information Architecture



Source: author's creation

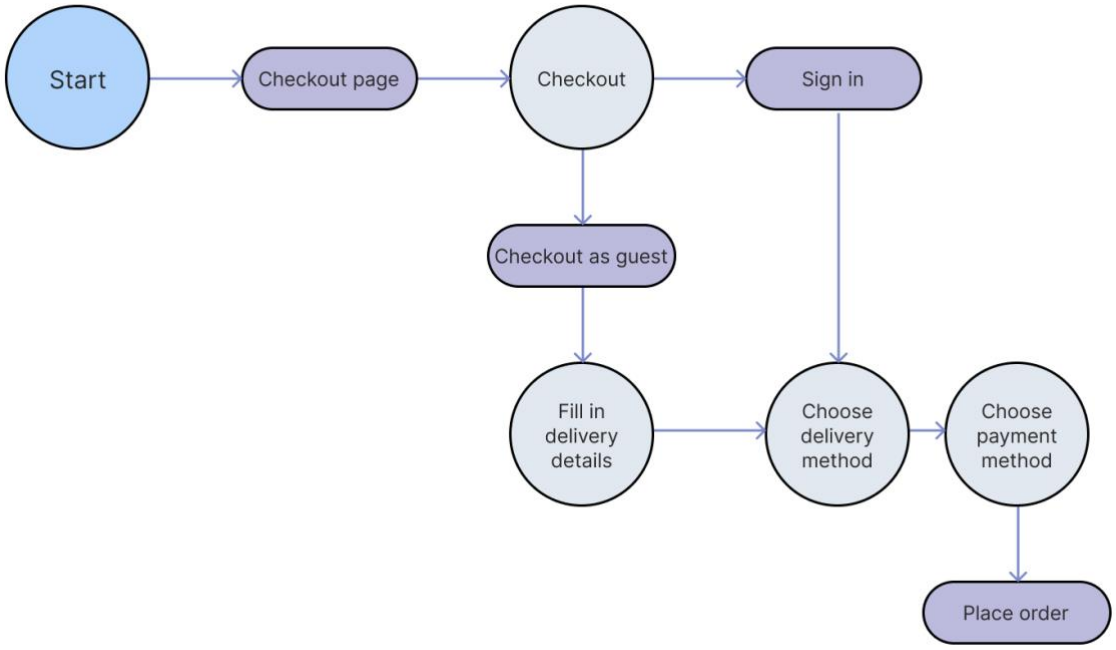
4.5.2 User flow

Figure 8 User flow 1



Source: author's creation

Figure 9 User flow 2



Source: author's creation

4.6 Low-fidelity prototype

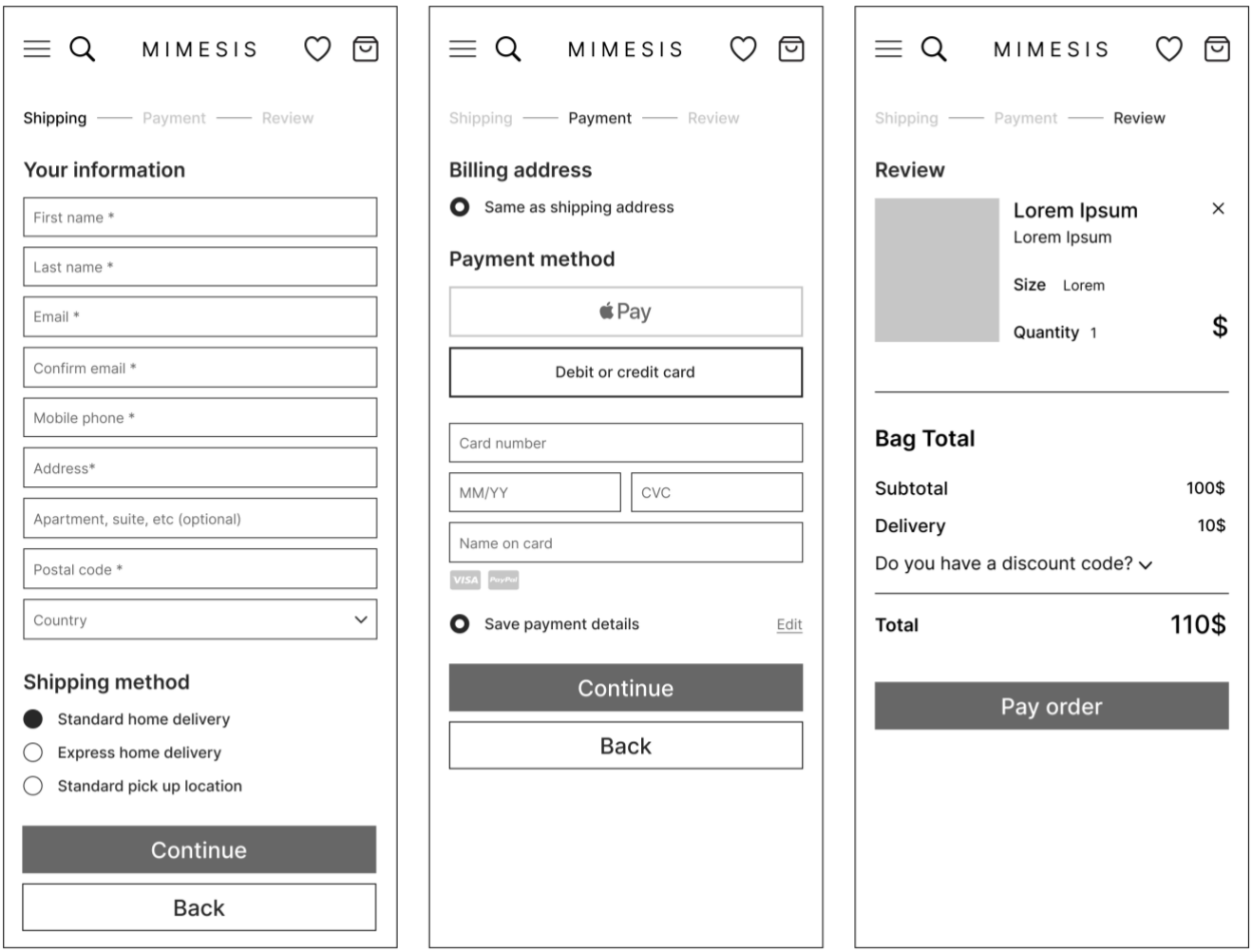
4.6.1 Wireframes creation

Wireframes are an essential component of UX design, used to visualize and communicate the layout and functionality of digital interfaces. The primary purpose of wireframes is to establish the basic structure and layout of the interface before the actual design process begins. This allows designers to focus on the functionality of the interface and how it will be used by the user. Wireframes provide an easy-to-understand visual representation of the site or application's information architecture, which is the organization and labeling of content and features.

Creating wireframes is the first step in designing the future website. Information architecture and user flow help guide the overall structure of the wireframes in a logical and intuitive way. The aim is to create simple but effective design that meet the needs of the target audience. First, the mobile version was created, and only after that the desktop version – to follow mobile-first principle.

Based on all the previously obtained information, the prototype of the online store was created. The Figma application was used as a tool for making this prototype. The prototype of the online store website was created according to a template on a size of 390x844, corresponding to the screen size of an iPhone 14. This particular screen size was selected based on empirical data gathered from a survey indicating that 66.7% of respondents utilize smartphones operating on the IOS platform. Consistent with the theoretical framework, the prototype was constructed exclusively using symbol and object representations and was created in grayscale to avoid excessive focus on intricate details.

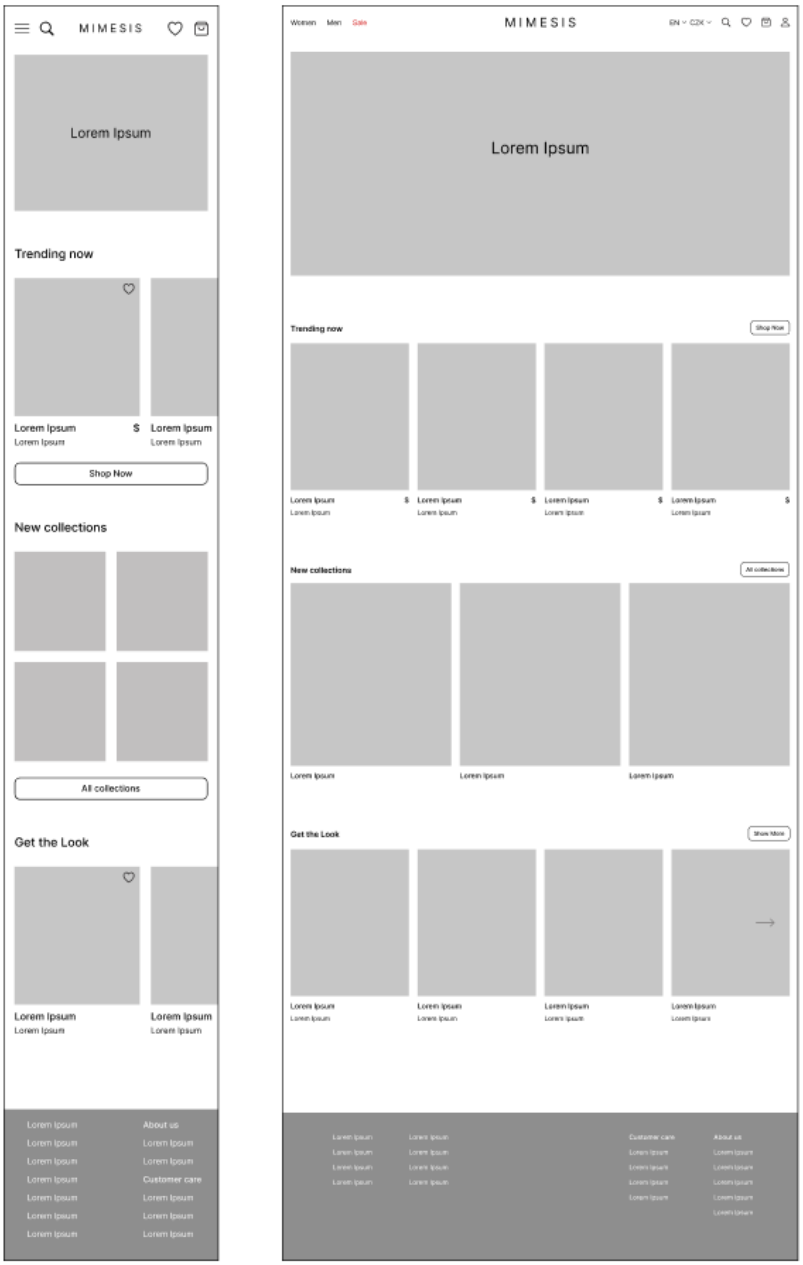
Figure 10 Wireframes – Checkout process (mobile)



Source: author's creation

For a visual example of the work done, the wireframe above illustrates the checkout process from User Flow 2. The user is given the opportunity to make a purchase in three stages, by going through Shipping, Payment and Review, filling all the required information.

Figure 11 Wireframes – Homepage (mobile and desktop)



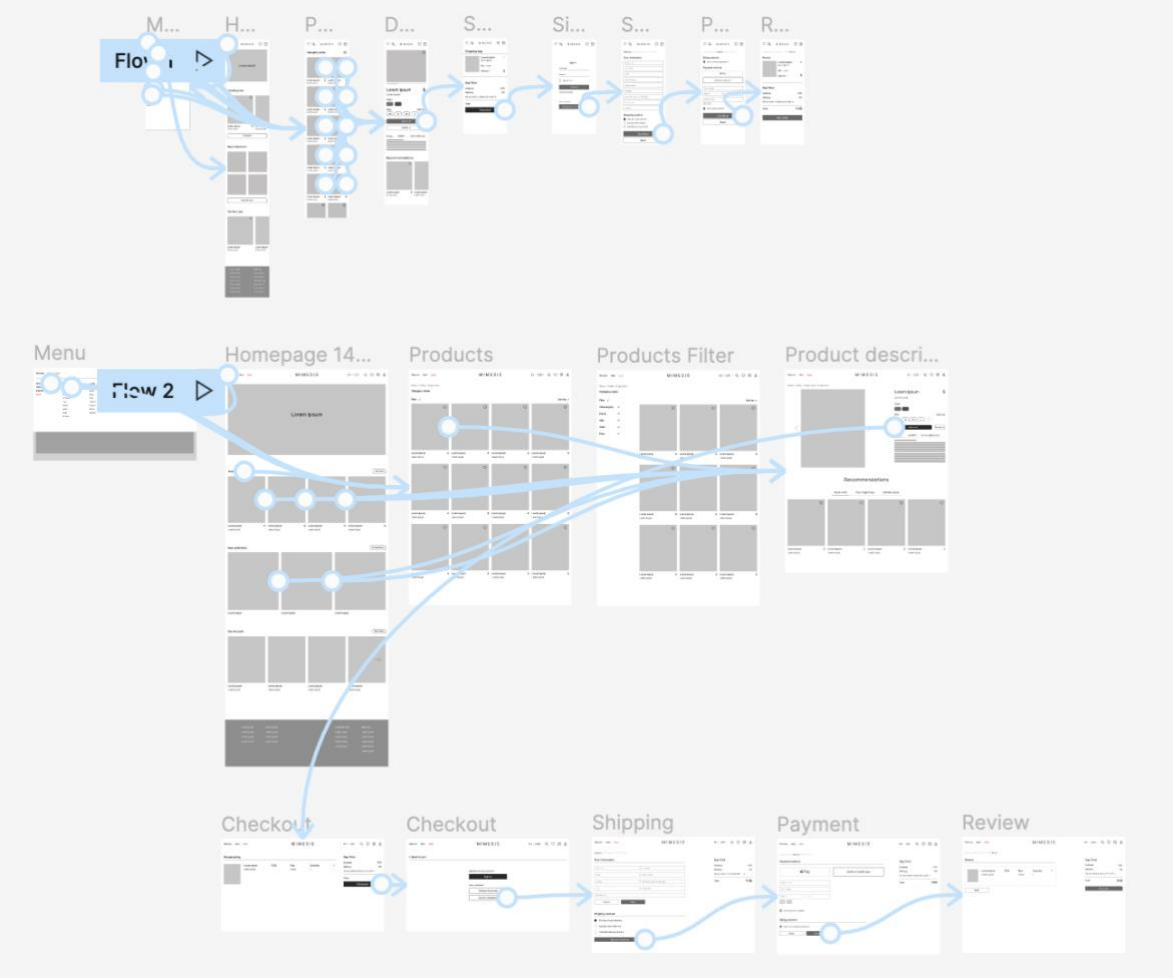
Source: author's creation

The goal of a low-fidelity prototype is to quickly explore different design concepts and test them with users, without investing too much time or resources in the development of a more refined and detailed prototype. To gather feedback and make necessary changes before committing to more time-consuming and costly aspects of the design process.

Since the Figma program offers the possibility of creating various actions and each screen and all screens are interconnected, respondents can go through the entire prototype of

the application, click through individual screens, and familiarize themselves with the application.

Figure 12 Figma ptototype interactions



Source: author's creation

4.6.2 Unmoderated Usability study

Usability studies are carried out to assess user-product interactions across various platforms such as products, websites, and applications. The primary objective of such studies is to enhance user experience, resulting in increased efficacy, efficiency, and satisfaction. As this a low-fidelity prototype testing for a small brand with limited budget, the overall study is shortened (with no iterations) for resource saving purposes. The main focus will be on a high-fidelity prototype usability study because for users it is easier to perceive the completed colorful website with images and all features than a limited low-fidelity prototype.

Research goals: The purpose of the usability study was to evaluate the user experience and to identify any pain points or areas of confusion in the website's navigation of the store website. The study included a total of 5 participants who were asked to complete a series of tasks via Figma prototype (the link to the interactive prototype were provided).

Research questions:

How long does it take customers to find a specific product they need?

How long does it take a user to place an order?

Are there parts of the user flow where users get stuck?

Do users think this online store is easy or difficult to use?

Are there more features that users would like to see included in the app?

Participants:

- 3 participants who shop for clothes from time to time
- 2 participants who like online shopping
- 4 females, 1 male, aged 18 to 35 years old

Test scenarios:

Scenario 1: Searching for a Product

Task 1: Find a product. Add it to your cart.

Scenario 2: Checking Out

Task 2: Start the checkout process by clicking on the shopping bag. Complete the checkout process.

Results: Overall, users found the website to be easy to use and intuitive. However, some participants expressed frustration with the limited ability of a rough and basic low-fidelity prototype. Participants found the checkout process to be relatively easy, with clear instructions and minimal barriers to completion. However, a few users expressed confusion about shipping options and additional fees. Some users missed choosing a size from a dropdown menu before adding a product to the shopping bag.

Based on the results of the study, a high-fidelity prototype was created.

4.7 High-fidelity prototype

4.7.1 UI design

When designing a UI for a clothing brand online store, it is crucial to strike a balance between aesthetics, functionality, and usability. In-depth descriptions of applying UI design principles can be found in relevant literature reviews. The primary aim of the design should

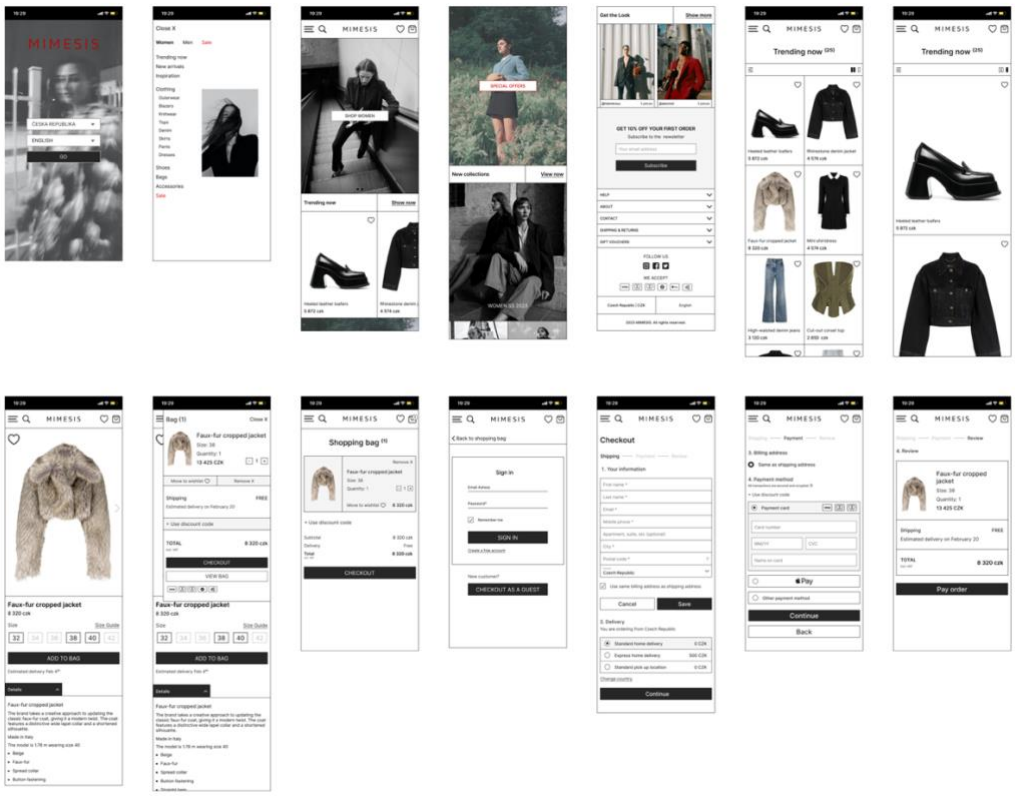
be to showcase the products, utilizing high-quality images and detailed descriptions to facilitate browsing and purchasing by users. To attract and retain user attention, highlighting new arrivals, sales, and popular items is necessary. Navigation must be simple and intuitive, facilitating ease of finding items by users. Clear categories and subcategories can aid in organizing products, and a search bar should be provided for users who prefer to search by keyword. Consistency in branding elements such as the logo, typography, and color palette throughout the website is essential. The aim is to make a successful UI design by following these guidelines and making the design visually appealing, modern and easy to use.

Product images used in this high-fidelity prototype are from farfetch.com. The use of these images is for scientific purposes only.

4.7.2 Mobile version

As already done with the low-fidelity prototype, the mobile first approach is also applied to the high-fidelity prototype. The image below shows the screens of the online clothing store if the user navigates from start to finish, where the start is the first page when the site opens and the end is where the user makes a purchase.

Figure 13 Mobile version design pages

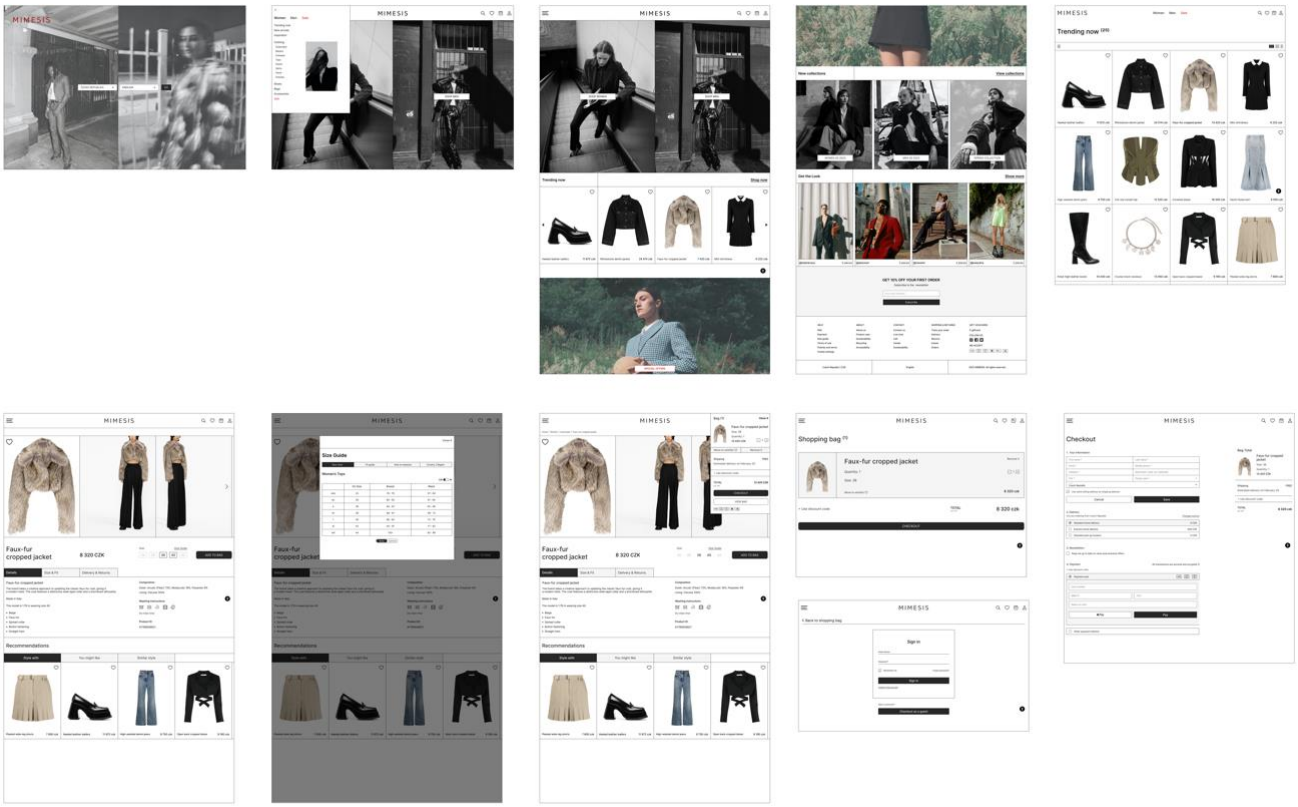


Source: author's creation

4.7.3 Desktop version

Before commencing the design process for the desktop version of a website, it is paramount to meticulously evaluate the design of the mobile version and ascertain which features must be retained to maintain consistency across all versions of the website. It is also imperative to consider various factors such as screen size, the number of columns, and the placement of navigation elements. Given the larger screen real estate afforded by desktop screens, designers can leverage larger fonts, images, and icons to enhance user experience. Additionally, some features can be incorporated extra on the desktop version that may not be feasible on the mobile version. Navigation design varies significantly between mobile and desktop versions of a website, the navigation should be adjusted to cater to the larger desktop screen size. Implementation of drop-down menus or a sidebar menu can ease users' browsing experience. The desktop version of the website should be responsive and adapt to different screen sizes. This is crucial since users can access the website using diverse devices with varying screen sizes.

Figure 14 Desktop version design pages

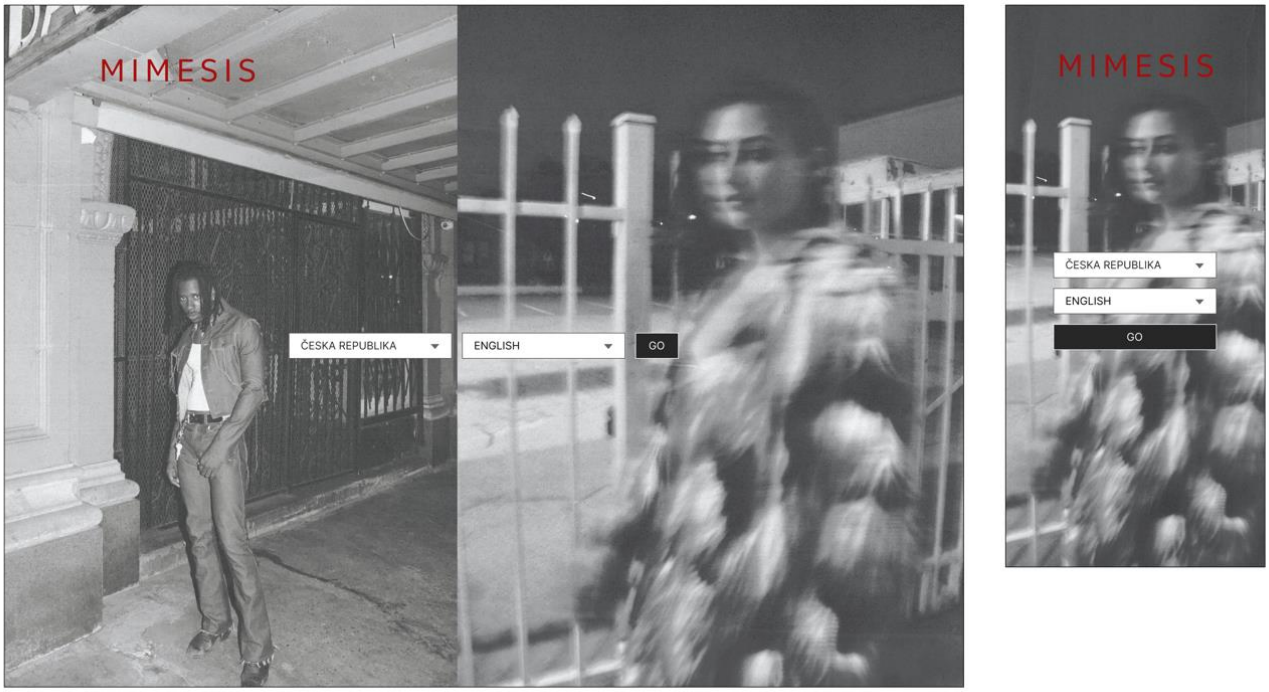


Source: author’s creation

4.7.4 Mockups and features

1. Country and language selection when entering the site. During the study, it was found that on some websites there is no option to change the language. Not all people living in the country speak the local language, it is very essential to enable this feature.

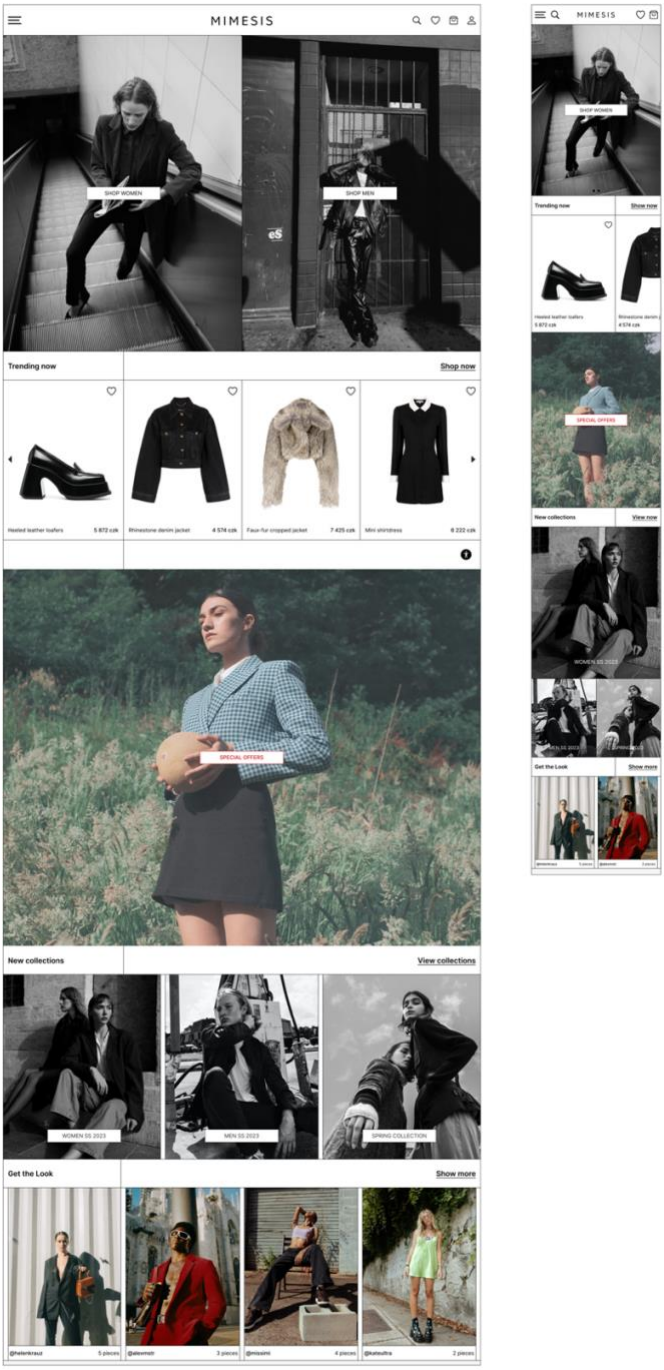
Figure 15 First page – Country / Language selection – Desktop and Mobile versions



Source: author's creation

2. Homepage. The homepage of the website contains several beneficial features such as the "trending now" section that displays the most sought-after products, links to new collections, special prices, and discounted items. Furthermore, at the lower section of the homepage, the "get the look" section is available, providing users with the opportunity to select the look of their choice and view the corresponding marked products.

Figure 16 Homepage – Desktop and Mobile versions

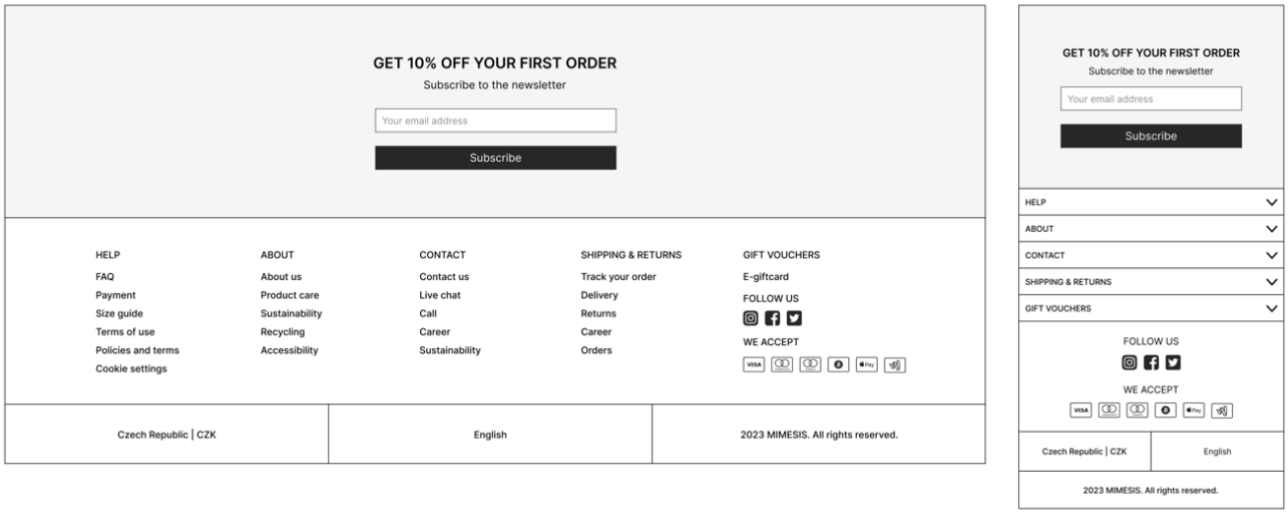


Source: author’s creation

3. Footer. The footer section of the website incorporates a newsletter subscription feature that offers a 10% discount to new users. It is worth noting that this feature is frequently presented as a pop-up window across various websites. However, pop-ups can impede the user's browsing experience and can be perceived as intrusive, resulting in a negative user experience. They can also pose challenges to users attempting to close them,

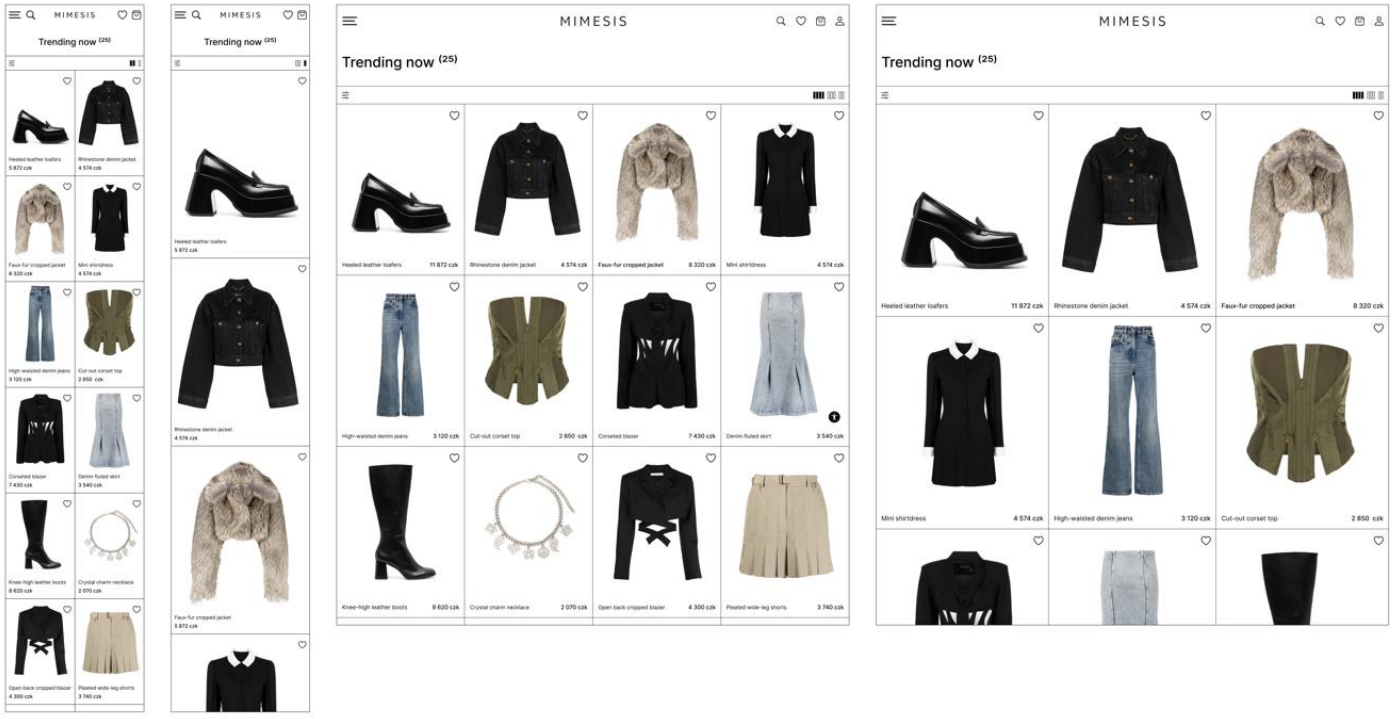
particularly when accessed via mobile devices, leading to usability issues. The footer section contains important navigation elements, where users can easily find what they're looking for, even if they don't initially find it in the main navigation menu. Users can change the language and country at any time at the very bottom of the page.

Figure 17 Footer – Desktop and Mobile versions



Source: author's creation

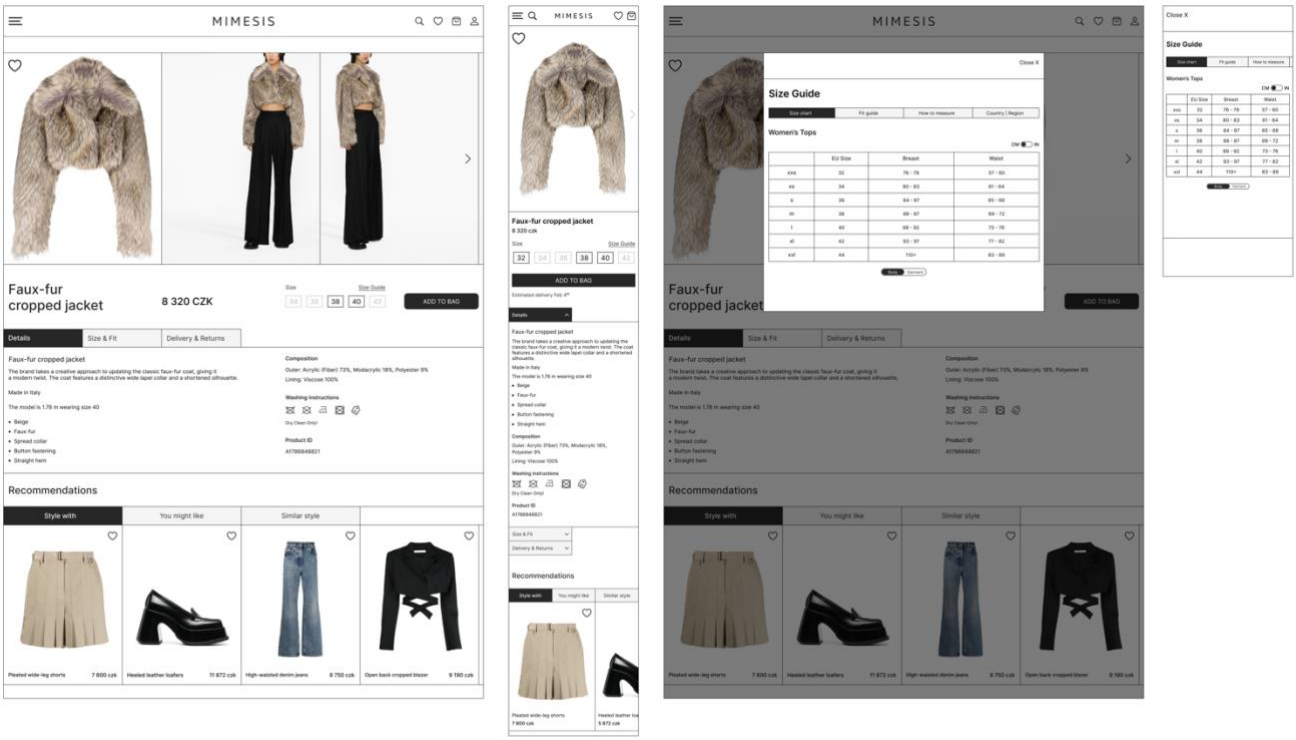
Figure 18 Category page – Desktop and Mobile versions



Source: author's creation

4. View options. Using different view options on a website ensures that all users have access to the content by customizing it as they prefer. Mobile version has two different options of view – where the screen displays one or two products, the desktop version has three options – displays four, three and two products.
5. Product page. Product page contains different essential features. A high-quality product image is one of the most important features of a product page. It is large, clear, and shows the product from multiple angles. The product title and description, presented in a concise and lucid manner, provide essential information about the product's characteristics and functionalities. The presence of a conspicuous "Add to cart" button expedites the process of adding the product to the user's cart. A detailed size chart will help users make the right choice of size.

Figure 19 Product page – Size Guide – Mobile and Desktop versions

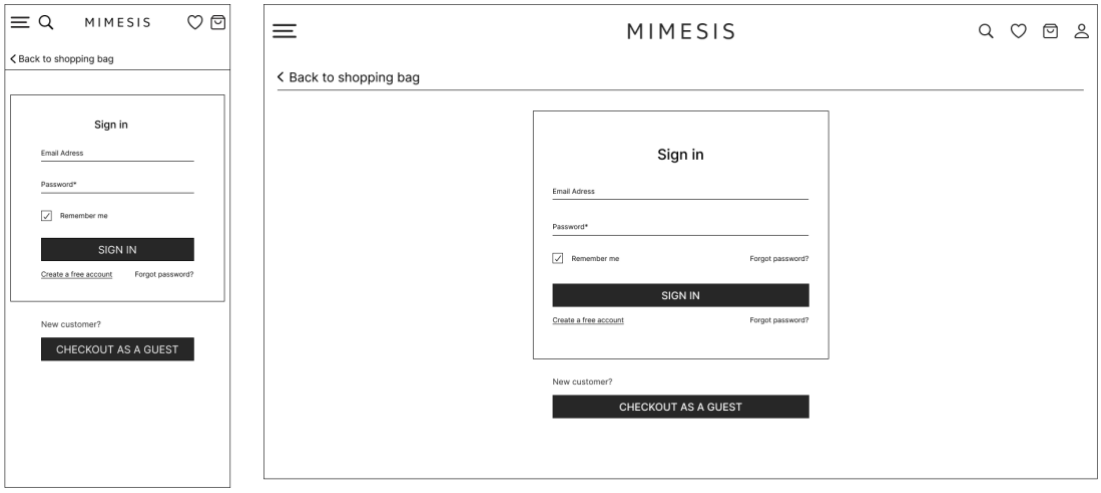


Source: author’s creation

The product page has several features at the bottom, including the "Recommendations" suggesting related products on the product page. This feature aims to stimulate users to explore other products on the website. Further, the "Style with" feature recommends products that complement the given product on the page. Alongside this, the "You might like" feature suggests products based on the user's preferences, whereas the "Similar style" feature recommends products similar to the product displayed on the page.

6. Quick checkout as a guest. The quick checkout feature is a payment method that enhances customer convenience and facilitates rapid and effortless completion of purchases, thereby optimizing the process's efficiency and user-friendliness. This feature simplifies the checkout process, requiring only a few clicks for users to conclude their transactions.

Figure 20 Sign in page – Desktop and Mobile versions



Source: author's creation

4.7.5 Usability study and design evaluation

After creating a high-fidelity prototype, a usability study is conducted to evaluate the design's effectiveness and efficiency. The study entails the recruitment of participants who represent the design's target audience. These participants are instructed to perform a set of tasks using the prototype, while their actions and feedback are recorded and analyzed.

Objectives of a usability study:

- To evaluate the overall user experience of the website, including ease of use, navigation, and visual appeal.
- To identify any pain points or areas of confusion in the website's navigation, product search, and checkout process.
- To gather feedback from users on their experience with the website, including likes and dislikes, and suggestions for improvement.
- To identify opportunities to improve customer satisfaction and enhance user experience.

Heuristic evaluation is also conducted during the study to assess the design's adherence to established usability principles. Heuristic evaluation should ideally be undertaken by a group of experts in usability and design, but it is not always possible due to resource limitations. In this thesis, the assessment is made by the author. This method described in chapter 3.4.6.

Furthermore, usability metrics are employed to assess the effectiveness and efficiency of the design. These metrics included: task success rate, user error rate, conversion rate, and system usability scale. More detailed these metrics described in chapter 3.4.3.

In conclusion, the conduction of a comprehensive usability study that integrates both heuristic evaluation and usability metrics is fundamental in ensuring that a high-fidelity prototype is optimized for usability, intuitiveness, and user satisfaction in accordance with the intended audience.

5 Results and Discussion

5.1 Usability study

5.1.1 Unmoderated usability study

Participants complete the study on their own time, without a moderator present. Participants have a link to the prototype in Figma, they are given instructions and tasks to complete. Participants explained that not all products can open and not all features work. Participants are asked to provide feedback and answer open-ended questions. The usability study conducted both for mobile and desktop versions of the website. First, users go through mobile scenarios, then they go through desktop scenarios, after that they answer questions and share their impressions.

Usability study questions:

1) What is your overall impression of the website's design and layout?
2) Were you able to easily find the clothing items you were looking for? If not, what challenges did you face?
3) Were you able to successfully complete a purchase on the website? If not, what challenges did you face?
4) What did you think of the website's checkout process? Was it clear and easy to follow?
5) Was the website's menu structure clear and intuitive?
6) Did you find the website's sizing information helpful in selecting the right size?
7) What improvements would you suggest for the website to enhance the user experience?

Participants:

The number of participants in a usability study should be based on a balance between the study's goals, available resources, and the time and effort required to recruit and conduct tests with participants.

- 3 participants who shop for clothes from time to time.
- 3 participants who like online shopping.
- 4 females, 2 males, aged 18 to 35 years old.

Location: Prague, Czech Republic

Length: 30 minutes

Test scenarios:

Scenario 1: Searching for a product.

Task 1: Find the faux fur cropped jacket from a homepage, add it to your bag in a size 38.

Scenario 2: Changing the view.

Task 2: Open the menu and choose “Trending now” or “New arrivals” category. Change the view option. Scroll down and up.

Scenario 3: Browsing categories.

Task 3: Browse the “Trending now” category and choose the product you like. Swipe the photos, view the details of the product, use size chart, and add the product to your bag in available size.

Scenario 4: Checking out.

Task 4: Start the checkout process by clicking on the shopping bag icon. Complete the checkout.

Scenario 5: Finding any product.

Task 5: Browse the website wherever you like, add any product to your bag. Complete the checkout.

5.2 Research results

5.2.1 Participants’ answers to usability study questions

Usability study questions provide researchers with valuable information about users' experiences with a website. By participating in a usability study, users have the opportunity to share their insights and opinions about the design, navigation, functionality, and other key aspects of the website or product. User feedback is critical to identifying usability issues and areas for improvement.

Usability study questions are designed to elicit data about users' experiences, and this data is analysed to make informed decisions about how to improve the design and functionality. Without user feedback, it would be challenging to identify these issues and make the necessary improvements to ensure that the website is usable and meets the needs of its intended audience.

Summary of the participants' answers (details can be found in the Appendix):

Participant 1:

- Positive feedback on website design and navigation.

- Clear and easy checkout process but confusing confirmation page.
- Helpful sizing information.

Participant 2:

- Positive feedback on website design and navigation.
- Easy finding of clothing items and successful checkout.
- Helpful sizing information.

Participant 3:

- Positive feedback on website design.
- Difficulty finding specific clothing item and search bar issues.
- Successful purchase with straightforward checkout process.

Participant 4:

- Positive feedback on website design and navigation.
- Clear and easy checkout process.
- Helpful sizing information.

Participant 5:

- Positive feedback on website design and navigation.
- Easy finding of clothing items.
- Clear and easy checkout process.
- Helpful sizing information.

Participant 6:

- Positive feedback on website design and navigation.
- Easy finding of clothing items.
- Clear and easy checkout process.
- Helpful sizing information.

5.2.2 Usability study findings

Participants found the design and layout of the website to be visually appealing and generally easy to navigate. User frustration with interaction was only due to the limitations of the prototype, such as looking for a product using search bar, as it is not possible to implement all the actual features of the real site in the prototype. Some participants had technical issues with the Figma prototype, not all product images were displayed in high

quality, not all interactions were touch-based when they should have been. Technical problems did not occur for all participants, for four of them everything worked smoothly.

Positive findings:

- The website has a modern and visually appealing design.
- Checkout process was relatively clear and easy to follow.
- The navigation menu is clear and intuitive, making it easy to find items.
- The website's color scheme is pleasing.
- Participants appreciate the availability of different payment options such as Apple Pay.
- Participants appreciated the option to checkout as a guest.

Recommendations considered for future improvements:

- Make the confirmation page clearer to indicate whether the order has gone through or not.
- Make the search bar functional.
- Include all categories from homepage to the menu.
- Add an option for the sticky menu on top while scrolling.
- Duplicate the price of the product next to the payment button.
- Add customers‘reviews.
- Highlight important information, such as delivery dates, during checkout.
- Provide more information about the fit of the clothing.
- Consider adding a chatbot to assist customers with questions or concerns.
- Make the icons in the navigation menu smaller.
- Make the homepage more gender-neutral to appeal to a wider audience.
- Provide a "recently viewed" section on the website to facilitate finding products that were looked at earlier.
- Ensure all images of the clothing items are of high quality.

Usability study provides a summary of the findings and recommendations for improving the user experience. By analyzing the data collected during the study, it may be said that the online store high-fidelity prototype has its strengths and weaknesses.

The results of the study are clearly presented, key issues are highlighted and recommendations for improvement are given. The usability study findings based on objective data and provided actionable insights that can be used to improve the prototype

and future website. It is essential to have a clear understanding of the findings and recommendations from a usability study to prioritize future development efforts and to ensure the product meets the needs of its users.

5.3 Evaluation of results

5.3.1 Heuristic evaluation

Performer: author

Action: comparing usability to predefined heuristics from chapter 3.4.6.

Date: 13.3.2023

Website: Mimesis online clothing store high-fidelity prototype

Severity:

0 = I don’t agree that this is a usability problem at all

1 = Cosmetic problem only: need not be fixed unless extra time is available on project

2 = Minor usability problem: fixing this should be given low priority

3 = Major usability problem: important to fix, so should be given high priority

4 = Usability catastrophe: imperative to fix this before product can be release

Table 15 Heuristic evaluation

Heuristics	**Issue**	**Severity**
Visibility of system status	The payment confirmation page should clearly indicate whether the order has gone through or not. A message or notification should be displayed to the user, indicating that their order has been successfully placed.	3
Match between system and the real world	The prototype was found to have a reasonable match between the system and the real world, with language and terminology that is familiar to users in the context of online shopping.	0
User control and freedom	There were some areas where the user control and freedom could be improved, such as in the checkout process, where it was not able to edit shipping after placing an order. A "recently viewed" section also gives users more control	2

	over their browsing experience and allow them to quickly find products they have previously viewed.	
Consistency and standards	The consistency could be improved, such as in the layout of product pages, which varied between categories.	1
Error prevention	It is important to provide adequate error prevention and recovery features, such as confirmation prompts for irreversible actions, validation checks, ensure that the search bar is functional.	3
Recognition rather than recall	The prototype was found to prioritize recognition over recall, by providing users with clear and easily accessible information and options throughout the system.	0
Flexibility and efficiency of use	The prototype was found to provide flexibility and efficiency of use by offering different levels of interaction, however, the user profile settings could be improved to provide more customization options.	1
Aesthetic and minimalist design	The prototype was found to have an attractive and minimalist design, however more gender-neutral homepage could appeal a wider audience, also important to make sure that all product photos are in high quality.	1
Help and documentation	The prototype was found to provide helpful documentation and guidance for users.	0
Help users recognize, diagnose, and recover from errors	The prototype was not found to provide the error messages, making it difficult to recognize when an error could occur. This happened due to high-fidelity prototype limitations but must be fixed and tested before release.	4

Source: author's analysis

5.3.2 UX metrics Results

- **Task success rate**

Participant 1: Completed 4 out of 5 tasks correctly (80% success rate)

Participant 2: Completed 5 out of 5 tasks correctly (100% success rate)

Participant 3: Completed 4 out of 5 tasks correctly (80% success rate)

Participant 4: Completed 5 out of 5 tasks correctly (100% success rate)

Participant 5: Completed 5 out of 5 tasks correctly (100% success rate)

Participant 6: Completed 5 out of 5 tasks correctly (100% success rate)

Average Task Success Rate: 90%

Majority of participants were successful in completing the tasks, with four out of six participants achieving a 100% success rate. The average task success rate across all participants is 90%, which is a high result. These results suggest that the prototype is generally effective and easy to use, however, there were some instances where participants were not able to complete all tasks correctly, which could indicate areas for improvement in the prototype design or user testing process.

- **User error rate**

Participant 1: 29.17%

Participant 2: 8.33%

Participant 3: 31.25%

Participant 4: 12.5%

Participant 5: 16.67%

Participant 6: 6.25%

Average User Error Rate: 18.75%

The user error rates vary among the participants, with some having a relatively low error rate (such as Participant 2 with 8.33%) and others having a higher error rate (such as Participant 3 with 31.25%). The average user error rate across all participants is 18.23%, which suggests that there are some areas of the prototype that may be causing confusion or difficulty for users. These results may help identify specific areas of the prototype that need improvement to reduce the overall user error rate and improve usability.

- **Conversion rate**

Participant 1: Converted on 4 out of 5 tasks (80% conversion rate)

Participant 2: Converted on 5 out of 5 tasks (100% conversion rate)

Participant 3: Converted on 3 out of 5 tasks (60% conversion rate)

Participant 4: Converted on 4 out of 5 tasks (80% conversion rate)

Participant 5: Converted on 5 out of 5 tasks (100% conversion rate)

Participant 6: Converted on 5 out of 5 tasks (100% conversion rate)

Average Conversion Rate: 90%

Three of the six participants achieved a perfect conversion rate of 100%. The average conversion rate is 90%. This means the prototype meets the needs of users, resulting in a higher likelihood of completing the desired conversion goals.

- **System Usability Scale** (SUS)

Participant 1: Scored 87 (Excellent)

Participant 2: Scored 90 (Excellent)

Participant 3: Scored 76 (Above Average)

Participant 4: Scored 83 (Excellent)

Participant 5: Scored 89 (Excellent)

Participant 6: Scored 80 (Excellent)

Average SUS Score: 84.2 (Excellent)

The participants rated the prototype on the SUS questionnaire, with all participants achieving an above-average score and four out of six participants receiving an excellent score. The average SUS score is now 84.2, which is considered excellent. This suggests that the prototype is highly usable and meets the needs and expectations of users.

Based on the obtained UX metrics data, the results suggest that the system is generally effective and usable. However, the results also reveal some issues among participants. Further analysis may be required to investigate the underlying factors contributing to these issues, and to develop evidence-based recommendations to address any identified issues and enhance the overall user experience.

6 Conclusion

This diploma thesis focused on studying and investigating the application of User Experience Design principles to an online store. The theoretical part comprehensively covered several UX techniques and methods, such as User-Centred Design and Design Thinking, User Research, Prototyping, Design Testing, Accessibility, E-commerce UX Design, and embraced different Design Principles.

The partial objectives of the thesis were accomplished. The main methods, rules, and tools for UX, usability, and UX design were characterized, providing an overview of the most relevant techniques used in this area. A high-fidelity prototype for an online store was designed based on pre-defined requirements, conducted user research, and low-fidelity prototype testing. Appropriate methods for testing the high-fidelity prototype were identified, and the testing was conducted, obtaining valuable feedback from users. Finally, the results were evaluated, providing insights and recommendations for enhancing the UX design of the online store prototype.

The main objective of the thesis was to design and evaluate a high-fidelity prototype using selected user experience methods, and this objective was performed. The application of UX methods throughout the design process facilitated the creation of an online store that adequately meets users' needs and preferences, thereby providing a positive user experience. The evaluation of the prototype furnished valuable feedback and insights into the usability of the online store, leading to recommendations for further improvements.

The findings of this thesis underscore the crucial role of applying user experience methods in the design of an online store. Online store UX must continually be enhanced and revised based on user feedback. The methods, rules, and tools for UX, usability, and UX design described in this thesis can serve as a guide for designers and small business owners to create efficient and user-friendly e-commerce platforms.

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9 List of pictures, tables, graphs and abbreviations

9.1 List of pictures

9.2 List of tables

9.3 List of abbreviations

UX – User Experience

UCD – User-Centred Design

SME – Subject-Matter expert

E-commerce – Electronic commerce

IA – Information Architecture

Lo-fi prototype – Low-fidelity prototype

Hi-fi prototype – High-fidelity prototype

KPIs – Key Performance Indicators

SUS – System Usability Scale

NPS – Net Performance Score

Appendix

Participants' answers to usability study questions

Participant 1:

1) I think the website's design and layout is modern and visually appealing, understandable navigation in the menu.
2) No problem finding items.
3) Yes, I was able to successfully complete a purchase on the website. However, the confirmation page was a bit confusing, and it wasn't clear whether my order had gone through or not.
4) I thought the checkout process was clear and easy to follow. I liked that there were different payment options available, such as Apple Pay.
5) The website's menu structure was clear and intuitive, and it was easy to find the categories I was looking for, but I also want to see what's on the main page is also in the menu.
6) Yes, I found the website's sizing information to be very helpful.
7) I want what is on the main page, also have on the menu. Also, with scrolling, I would like to have an option for the sticky menu on top. The search bar didn't work, when I wanted to search for a product. And perhaps the icons in the navigation menu are a bit large.

Participant 2:

1) It's a comfortable website for using. It's very easy to understand how everything work there. I found the color scheme to be pleasing, and the layout was easy to navigate, but some product images were not in a high-quality.
2) Yes, it was easy.
3) Yes, I was able to successfully complete a purchase.
4) Overall, I thought the checkout process was clear and easy to follow. However, I would like to see how much I pay for the product somewhere near to the pay button.
5) Yes, it was clear and intuitive.
6) Yes, I did find the website's sizing information helpful in selecting the right size.

7) I think it’s understandable, good-looking, and practical website. One improvement I would suggest for the website is to have reviews from other customers.

Participant 3:

1) I thought the website's design was visually appealing.
2) It was difficult for me to find specific clothing item I was looking for. The search bar didn't seem working, not all categories were working.
3) Yes, I was able to complete a purchase but sometimes I had to tap several times to open the page. Anyway, the checkout process was straightforward and easy to follow.
4) The checkout process was straightforward, I really liked that I could checkout as a guest.
5) The website's menu structure was clear and intuitive.
6) Yes, I found the website's sizing information to be helpful.
7) Maybe it would be helpful if there were more customer reviews available for each item, so I could get a better sense of its quality and fit.

Participant 4:

1) The website's design and layout were very sleek and modern.
2) Yes, I was able to find the clothing items I wanted without too much trouble.
3) Yes, I was able to successfully complete my purchase without any major challenges. The checkout process was straightforward and easy to understand.
4) The checkout process was clear and easy to follow. I would highlight important information, delivery dates.
5) The website's menu structure was very easy to understand.
6) I found the sizing information to be helpful. While the website provided measurements for each size, I would also have appreciated more information about the fit of the clothing.
7) Everything is cool, maybe it would be useful if the website had a chatbot to assist customers who have questions or concerns.

Participant 5:

1) Overall, I found the website's design and layout to be visually appealing and easy to navigate, maybe the mobile version has slightly big icons in the navigation bar.
2) Yes, I was able to find the clothing items I was looking for with relative ease. However, I did notice that the search bar was not working.
3) Yes, I was able to successfully complete a purchase on the website.
4) I thought the website's checkout process was fairly clear and easy to follow.
5) Yes, I found the website's menu structure to be clear and intuitive.
6) Yes, I found the website's sizing information to be helpful.
7) One improvement that I would offer for a website is to make a home page more gender-neutral, at the moment it seems that it is only a website of women's clothing.

Participant 6:

1) My overall impression of the website's design and layout was positive. The website had a clean and modern look, and I found it easy to navigate. But some images of the clothing items were blurry, but maybe it wasn't meant to be like that.
2) I managed to find most of the clothing items I was looking for, but I noticed that when changing the view to one product on the page, you swipe to the very bottom, there is no beige skirt, and when you change the view to two products on the page, this skirt is.
3) Yes, I was able to complete a purchase.
4) Yes, it was pretty easy to follow.
5) In general, the structure of the website menu was simple and understandable. Nevertheless, I did find myself clicking back and forth between pages to find specific items, which could be frustrating.
6) The sizing information was helpful.
7) One of the improvements that I would suggest is to add the “recently viewed” section to the website. This would facilitate the search for products that I looked at earlier and, perhaps, want to buy later.