UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

AN INSIGHT INTO AI-DRIVEN WEBSITE DESIGN: THE IMPACT ON USER EXPERIENCE

Ljubljana, December of 2025 IGOR MARTINOVIKJ

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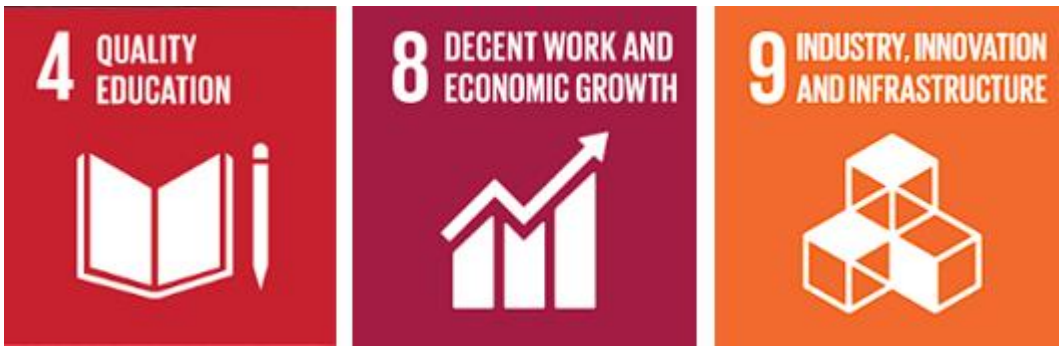
ABSTRACT

The thesis aims to present and explain the connections between artificial intelligence (AI), website design, and user experience (UX). Specifically, its purpose is to help companies recognize the benefits of integrating AI into website development. My approach to addressing this purpose involved a comprehensive analysis of published, proven literature and empirical data, offering a clear view of UX concepts and their vital role in e-commerce success, as well as the evolution of AI tools in website design. Additionally, data from a survey of participants highlights how AI-driven website design compares to human-driven design in terms of UX. The research was systematically conducted, evaluating four websites across two industries—fashion and travel. In the fashion industry, Evolve Clothing was selected as an AI-generated website, while Nour Hammour was chosen as a human-created site. For the travel industry, Islango represented an AI-generated website, contrasted with Cain Travel, which was developed by humans. Participants evaluated these websites on multiple UX dimensions using a standardized 5-point Likert scale. To deepen the analysis, participants also answered open-ended questions. The collected data was carefully analyzed, revealing valuable insights into the topic. This thesis enhances understanding of AI tools in website design and their comparison to human expertise, shedding light on the ongoing discussion about AI's potential to replace humans. Ultimately, it offers guidance for future research on this increasingly important subject.

KEY WORDS: artificial intelligence, website design, user experience, comparative analysis.

SUSTAINABLE DEVELOPMENT GOALS



POVZETEK

Moje magistrsko delo predstavi in razloži povezave med umetno inteligenco (angl. Artificial intelligence - AI), oblikovanjem spletnih strani in uporabniško izkušnjo (angl. User experience - UX). Konkretno je namen magistrskega dela pomagati podjetjem razumeti koristi, ki lahko izhajajo iz uporabe AI pri razvoju spletnega mesta. Magistrsko delo zajema analizo številnih objavljenih znanstvenih prispevkov v literaturi in empiričnih ugotovitev, s katerimi predstavim UX in njen pomen pri zagotavljanju uspeha e-trgovine. Podrobno analiziramorodja AI, ki se uporabljajo pri oblikovanju spletnih strani Podatki, zbrani z izvedeno raziskavo o številnih udeležencih, osvetljujejo, kako se oblikovanje spletnega mesta, ki ga poganja AI, primerja s človeškim razvojem, predvsem v smislu UX. Raziskava je bila izvedena na podlagi analize štirih spletnih mest v dveh različnih panogah - modni in potovalni dejavnosti. V vsaki izmed panog je bila izbrana ena spletna stran, ki je bila popolnoma ustvarjena z orodji AI ter ena spletna stran, ki ni bila ustvarjena z orodji AI. Podatke o tem, kako uporabniki percepirajo vse štiri obravnavane spletne strani, sem zbral s pomočjo ankete. Zbrane podatke sem nato analiziral in podal temeljnje ugotovitve raziskave, ki jih v diskusiji tudi primerjam z ugotovitvami iz literature.

KLJUČNE BESEDE: umetna inteligenca, oblikovanje spletnih strani, uporabniška izkušnja, primerjalna analiza

CILJI TRAJNOSTNEGA RAZVOJA

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LIST OF ABBREVIATIONS

AI – Artificial Intelligence

CAD – Computer-Assisted Design

CNN – Convolutional Neural Network

CPU – Central Processing Unit

CRM – Customer Relationship Management

CSS – Cascading Style Sheets

DDPD – Data-Driven Persona Development

DST – Digital Storytelling

FOSS – Free and Open-Source Software

GD – Generative Design

GPU – Graphics Processing Unit

IPA – Importance Performance Analysis

ISO – International Organization for Standardization

KE – Kansei Engineering

LLM – Large Language Model

LSTM – Long Short-Term Memory

ML – Machine Learning

NLP – Natural Language Processing

NLTK – Natural Language Toolkit

RWD – Responsive Web Design

SEM – Structural Equation Modeling

SEO – Search Engine Optimization

SNARC – Stochastic Neural Analog Reinforcement Calculator

STRIPS – Stanford Research Institute Problem Solver

TAM – Technology Acceptance Model

UCD – User-Centered Design

UI – User Interface

UX – User Experience

VADER – Valence Aware Dictionary and Sentiment Reasoner

VS – Visual Studio

1 INTRODUCTION

User Experience (UX) is a multidimensional concept that ranges from product and service usability to the user's responses, perceptions, and emotional triggers during interactions with a specific product, service, or system (Zarour & Alharbi, 2017). This view on UX highlights it as a rather complex notion that goes beyond mere usability and encompasses product and service engagement. As a result, it is viewed as a continuously evolving field shaped by technological advancements, user expectations, and the growing importance of artificial intelligence (AI). The term "User Experience" was first mentioned in 1993 by Don Norman during his time at Apple. He pointed out that UX goes beyond simple functionality, as it includes comprehensive assessments of how users interact with Apple's products. Norman consistently stressed the significance of considering effectiveness, efficiency, accessibility, and aesthetics to achieve a satisfactory UX (Nielsen & Nielsen Norman Group, 2017). Additionally, UX has been defined by the International Organization for Standardization as "A person's perceptions and responses that result from the use or anticipated use of a product, system, or service." (ISO 9241-210, 2010).

Between the initial mentioning of UX and its definition, efforts were also made to develop frameworks that assess what constitutes proper UX. A prominent framework for evaluating UX was introduced by Peter Morville (2004), known as the UX Honeycomb. This model outlines seven key elements that are vital to creating a positive UX: usefulness, usability, desirability, findability, accessibility, credibility, and value (Morville, 2004). The study expands on this framework, with a notable focus on "first impressions" and their impact on overall experiences, emphasizing the visual aspect of design as a dominant feature that significantly influences how users perceive and interact with products and interfaces. Studies consistently confirm that individuals quickly judge digital interfaces based on aesthetic qualities, affecting their perceptions of trustworthiness, usability, engagement, and overall satisfaction (Xu & Schrier, 2019; Wu et al., 2017).

Today's intense rivalry, large pool of experts, and advanced technology drive many products toward continuous improvements that make them more useful, engaging, valuable, longer-lasting, functional, and desirable. However, meeting the aspect of appeal is primarily influenced by aesthetics and design alone, making it a significant challenge and a crucial step in UX before any other factor comes into play (Costa, 2020). While usability emphasizes function, efficiency, and the practical use of a product, visual appeal leaves lasting impressions on users and fosters a willingness to interact. Furthermore, the initial impact and emotional bond established through brand identity are sparked by an aesthetically pleasing design that elicits specific positive feelings in users. This is essential for maintaining interest and ensuring users stay engaged; it not only attracts them but also encourages their continued participation.

The rise of AI-powered design has led to the development of automated tools such as Wix Artificial Design Intelligence (ADI), Hostinger AI website builder, and Adobe Sensei, which have transformed how websites are created and optimized. These AI systems analyze user behavior, preferences, and design trends to generate layouts, elements, content, and functioning code tailored to specific goals (Pandey, 2023). While AI enhances efficiency and personalization in design, the debate about whether it can replicate, compete with, or even fully replace human creativity, emotional intelligence, and aesthetic intuition continues. This steady progress in AI-driven business activities highlights the importance of critically evaluating their impact on UX, as AI has now become an important part of design systems and websites presented to users.

The purpose of this master's thesis is to better understand the benefits of using AI in website development, focusing on UX through testing real website examples. Therefore, the research investigates how AI affects website design and influences user interactions and perceptions. It compares AI-based designs with traditional, human-created ones, using various examples, and including extensive survey-based research to gather data. As AI tools continue to find their purpose in the digital world and beyond, businesses and managers need to understand, evaluate, and decide whether AI provides an improved or less desirable UX compared to traditional "handcrafted" designs. The current study presents findings based on user feedback, comparing key aspects such as usability, visual appeal, overall satisfaction, and other criteria derived from established UX frameworks in the literature.

The goals to be achieved by the current master's thesis are as follows:

- Presentation of UX definitions, concepts, and their significance in commercial website design

This goal is achieved by explaining UX principles and analyzing their importance for website success. This includes highlighting how UX influences engagement, conversion rates, and customer satisfaction, along with describing various techniques and approaches that demonstrate the entire process.

- Analyzing and examining AI tools used for website design

This goal is achieved by identifying leading AI web generation tools and their core functionalities. This also involved evaluating AI's ability to automate design processes, including layout generation, color schemes, typography, and personalization.

- Preparation of Website samples for Comparative testing

This goal is achieved by selecting website samples that are human-designed and tested, as well as AI-generated or AI-assisted. The AI-generated designs were chosen to represent realistic industries and organizations, ensuring a fair and relevant comparison.

- Analyzing participant feedback on ease of use, visual appeal, responsiveness, trustworthiness, and general feel.

This goal is achieved by examining trends in user preferences between AI-generated and human-designed websites, along with suggestions and predictions for AI-enhanced website development. This assesses whether AI should act as a primary tool, a supplementary resource for human expertise, or be ignored entirely in specific cases.

- Providing predictions on how AI will develop in web design and its potential role in shaping digital experiences.

By pursuing these goals, this research contributes to ongoing discussions about AI's role in today's industries. The findings help businesses, designers, and developers make informed choices about integrating such technology into their website creation process while keeping UX as a central focus of their design innovation.

The current master's thesis explores the impact of various techniques and methods used in website design and their influence on UX. Specifically, it emphasizes UX, website development, and AI tools employed in the website creation process. Industries are increasingly adopting AI for different business activities, but most often, AI is used to streamline routine or repetitive tasks. One such task, in today's internet-dependent business environment, is website creation. Therefore, a comparative analysis was conducted between websites developed by human effort, knowledge, and experience, and those generated by AI capabilities. The study gathered and analyzed information relevant to future decision-making processes for companies aiming to establish an online presence. To address all relevant topics, I first defined and elaborated on what UX, website design, and AI are.

Through survey research with 48 participants, I collected valuable data on how users perceive different website designs. The participants evaluated a variety of websites without knowing whether they were created by AI or humans. This blind testing reduced potential bias and encouraged more neutral assessments of their experience. The feedback provided insights into user preferences, possible limitations, and ways to better understand AI's role in website design. To achieve a balanced view, the survey included both closed and open-ended questions, focusing on user impressions, perceived usability, and visual appeal. This approach offered a complete picture of user perceptions, capturing both measurable responses and detailed feedback on reactions to AI-generated and human-created websites.

To improve the analysis, sentiment analysis using Natural Language Processing (NLP) is applied to user feedback collected from the survey's open-ended questions. This technique processes and categorizes text responses to identify positive, negative, or neutral sentiments about the websites' design and UX. By using NLP, subtle emotional responses and preferences can be extracted at scale, providing deeper insights into how AI-generated websites are perceived compared to human-designed ones.

By combining methodologies such as survey research and sentiment analysis, this study provides a comprehensive evaluation of AI's role in website design. Integrating both qualitative and quantitative methods enhances the reliability of the findings, paving the way for data-driven conclusions about the effectiveness of AI-generated website UXs. The structure of this thesis follows a logical order and aims to develop a holistic understanding of the relationships between website design, UX, and AI. In the first chapter, I discuss foundational concepts of website design, including definitions, components, processes, and the importance of creating quality online interactions, impressions, and perceptions. Next, I will elaborate on different design methodologies, analytical techniques, and key factors involved in optimizing website development. The second chapter focuses on UX by establishing theoretical and practical insights, principles, and challenges, while also presenting frameworks and tools used for enhancing UX. Moving forward, in the third chapter, I connect the areas of website design and UX, highlighting how various elements directly influence user perceptions and interactions. In the fourth chapter, the focus shifts to AI, starting with its history and progressing to its current relevance in competitive markets and emerging applications in website design. Finally, the empirical section presents a survey-based study of user feedback comparing AI-generated and human-designed websites, offering insights into AI's potential and limitations in creating meaningful digital experiences. Through this approach, I aim to provide a well-rounded, research-based perspective on AI's role in shaping digital experiences.

2 WEBSITE AND DESIGN

Following standard professional practice, websites serve as a crucial touchpoint where businesses, organizations, and users often first connect. Therefore, designing a website is a multidisciplinary field that combines aesthetics, technology, human talent, functionality, and UX into one. It incorporates principles that create engaging, user-friendly, and beneficial interactions for all involved parties (Jongmans et al., 2022).

As businesses rely more on online presence for branding, marketing, and customer appeal, the importance of a well-designed, attention-grabbing website has grown significantly. Not only does a website's design influence user perception and interaction, but it ultimately drives business success. Studies suggested that first impressions of a website are formed within the initial seconds, and only later did factors of functional quality play a role in determining credibility, relevancy, and trustworthiness (Lindgaard et al., 2006).

This chapter explores the fundamentals of what it means to design a website, including definitions, procedures, and methods for its creation. It also examines various design techniques and factors that contribute to a high-grade UX. By understanding the key components of websites and design itself, a foundation is set for analyzing AI's role in enhancing website creation and its impact on UX.

2.1 Definition of website design

Website design is broadly defined as the process of creating and arranging content intended for online use, with the goal of providing visually appealing and functionally strong experiences (Garrett, 2011). It specifically includes disciplines such as visual graphic design, user interface design (UI), UX design, and web programming. Each area has the purpose of delivering an impactful and valuable digital presence. This means websites focus not only on aesthetics but also on usability, navigational flow, responsiveness, and interactive elements, benefiting both customers and organizational goals. Additionally, the rising demand for mobile-friendly websites highlights the importance of proper cross-device integration of the same trust, perception, and engagement challenges (Krug, 2014).

Considering perspectives on visuals of website design and their significant influences on UX, and their overall website evaluation, alongside usability and practicality, serves as an overall recipe for positive ratings. In essence, designers and developers are encouraged to cultivate initiatives in the process of website design that evoke positive reactions, engagement, and deep user satisfaction with a company's digital presence. By bringing together these characteristics, websites can build a path toward clear communication of brand values, precise content delivery, and inviting browsing experiences – all of which benefit customer conversion rates (Jongmans et al., 2022).

The importance of website design becomes even more evident when considering its influence on user impressions and customer engagement patterns. Given that website users frequently make assessments of a website's reliability, credibility, trustworthiness, and professional status within seconds of landing eyes on it. This phenomenon emphasizes the significance of design elements such as color schemes, typography, symmetrical layouts, and consistent branding as they collectively influence how quickly users find desired information and how positively they perceive a website (Fogg et al., 2003). As competition grows and intensifies in practically every digital sector, organizations continue to invest in comprehensive, user-centered website designs that serve as key differentiation points and build sustained user loyalty. Furthermore, this differentiation point has become one of the main elements of competitive advantages in today's business organizations (Park & Gretzel, 2007).

2.2 Website design process

The process of designing a website involves much more than just coding, wireframing, or adding social media buttons. Good website design has the purpose of delivering engaging, informative, and entertaining experiences to end users, guiding them through a sales funnel. In his article, Meazey (2020) outlines seven steps for achieving balance in the process of website design:

1. Goal identification: What does the website aim to accomplish? Designers consult with stakeholders to define the primary purpose, target audience, and desired outcome.
2. Scope definition: Once goals are placed, project boundaries are set by deciding what features and pages are needed and on what timeline. This prevents "scope creep", where new requests surface during development without added time or resources.
3. Sitemap and Wireframe creation: A sitemap shows how content and pages connect, serving as a blueprint for the entire website. While wireframes show how elements like navigation menus might be arranged, they help designers pinpoint early usability issues.
4. Content creation: The backbone of a successful website is focusing on search engine optimization (SEO) along with engaging writing. This phase ensures that the text is well-structured around the product or service while maintaining easy navigation.
5. Visual elements: "Look and feel" of a website, achieved by strategically placed images and color palettes, typography, and brand elements for high-quality visuals conveying professionalism and trust.
6. Testing: Before the website is made public, designers test the site across multiple devices and browsers, checking for bugs, glitches, and overall UX. This step may also involve automated tools to detect problems like slow performance or SEO issues.
7. Launch: Designers schedule a launch timeline and consider communication strategies before releasing the website to its end users. Real-world user feedback often uncovers areas for improvement, so maintenance and updates become an ongoing responsibility.

Ultimately, the web design process highlights the inherently iterative nature of website creation. Further testing, content optimization, and careful attention to aesthetics are necessary to ensure the website's ongoing success even after the launch, spreading the brand's message for future customers (Meazey, 2020).

2.3 Methods for website design

The following section consists of literature research and understanding of various website design methodologies. Different methodologies mean various strategies and practices used to tailor the best case-specific UXs, improvements in functionality, and revision of workflows overall. By illustrating some prominent website design methods and highlighting how they complement and enrich the foundations of web design, I made a connection between what I previously described and what follows in this thesis.

Depending on the purpose the website will serve, there are different methods for taking on the task of website creation. Each method represents a clear-cut map for navigating actions from beginning to end. Selecting an appropriate method is important for effectively translating the structured phase initiatives of website design. There are several methodologies, one of which is widely used and recognized as the User-Centered Design (UCD). A prominent method focusing on designing, testing, and improving with real users being involved at every step. This approach incorporates extensive use of researched data

and iterative feedback from actual users in the process of website design. Techniques such as user personas and usability testing further allow for alignment of needs and expectations. One such example is the case of a transportation company that uses the Kansei Engineering (KE) UCD method. Kansei is derived from a Japanese term meaning sensitivity, feeling, or emotion. This engineering method proved very useful in designing a website for this industry by applying KE to the redesign of a transportation company's website; they effectively aligned visual and interactive elements with user emotions, improving overall satisfaction and usability. (Akram et al., 2024)

Responsive Web Design (RWD) is another method proven in many practical scenarios. This method employs flexible grids, scalable images, and Cascading Style Sheets (CSS) media queries (which are short snippets of code used in RWD websites that act on the grids and images, adapting them based on characteristics, trying to ensure proper content display across different devices). Eye-tracking technologies also enrich the design process by providing empirical insights into user behavior. Research by Veeravalli (2023) illustrates how gaze analysis can guide the strategic placement of content, significantly improving website navigation and user intuitiveness.

Furthermore, Agile Web Design methods exist and take on the approach of iterative, incremental development cycles, which facilitate continuous improvements based on constant feedback. This approach enables flexibility and responsiveness through the design process, adapting quickly to evolving project requirements. The method is especially important for websites that require regular update features, quick bug fixes, and rapid responses to demands. There are different versions of the Agile method (like Scrum), and they are chosen based on user feedback and security requirements. (Maleki & Ramsin, 2017).

2.4 Techniques of website design analysis

Analyzing the design and functionality is valuable for further improvements and creating a well-rounded website. The standard approach to website analysis usually includes actions like running SEO audits, testing website speed, conducting competitor analysis, and examining website traffic, all of which establish a good baseline. However, gaining a deeper understanding of visitors, users, and customers provides the key insights needed to optimize the website and encourage more interaction, leading to conversions. To achieve this, leverage your users for comprehensive insights into website development. User-driven analysis reveals motivations, frustrations, and experiences through tools like heatmaps, session replays, feedback widgets, user surveys, and interviews. Behavior analytics, psychographics, market research, usability testing, and targeted user feedback offer actionable insights to improve UX, conversion rates, and overall website performance (Contentsquare, 2024).

A noteworthy case study is one by Wijaya et al. (2021), where websites are analyzed in a structured approach, combining three detailed techniques: WebQual 4.0, Importance Performance Analysis (IPA), and Structural Equation Modeling (SEM). WebQual 4.0

specifically is about evaluating website quality based on direct user perceptions, focusing on three important dimensions:

- Usability, assessing how user-friendly the website is, including aspects like ease of navigation, interaction clarity, and appealing design.
- Information quality, which examines whether the content provided is accurate, relevant, timely, and understandable
- Service Interaction, focusing on the user's sense of security, trust, and reliability, resulting in good communication and conducting transactions with the website.

IPA complements WebQual by visualizing users' perceptions against their expectations on a practical two-dimensional grid, helping identify specific website attributes that need immediate improvement or should be consistently maintained. This analysis enables managers to pinpoint which website features users value the most and whether their current implementations meet expectations. Lastly, SEM provides depth by statistically confirming relationships between these dimensions and their influence on customer satisfaction and loyalty. By combining these methods, managers gain a framework that supports creating a lasting positive UX and long-term customer loyalty. Here, SEM serves only as a statistical method to build latent constructs from the survey items and test the paths among them. (Wijaya et al., 2021).

2.5 Website design factors influencing user experience

Several factors influence UX in e-commerce: usability, usefulness, desirability, accessibility, security, findability, and functionality. Recognizing and integrating these factors is essential for creating digital websites that deliver satisfying interactions, thereby improving overall UX and maintaining ongoing engagement (Qubstudio, 2022).

Qubstudio (2024, figs. 1–6) study explores how various design elements influence user acceptance of interactive websites: Interface Simplicity, Navigational Usability, Content Readability, Interactive Feedback, Personalized Experience, and Aesthetic Pleasure. The study then uses the Technology Acceptance Model (TAM) to frame perceived ease of use, perceived usefulness, attitude, and behavioral intention to use, while SEM only served as a statistical method to test the relationships among these constructs. In this design, the six elements are treated as predictors of perceived ease of use and perceived usefulness. Those perceptions then shape attitude and, in turn, intention to use or return. Researchers selected five popular interactive platforms (Behance, Dribbble, Awards, SiteInspire, and Pttrns) and collected survey data from people who visited these websites, then analyzed the results using SEM and semi-structured interviews. It showed that a clean, organized interface (Interface Simplicity) and easy-to-read content (Content Readability) greatly increased both perceived ease of use and perceived usefulness; in other words, users felt more comfortable navigating

these websites and viewed them as more valuable when their layouts were simple and well-structured.

Similarly, visually pleasing designs (Aesthetic Pleasure) had a large, favorable effect, as many participants associated high-quality aesthetics with professionalism and trustworthiness. However, advanced navigation features (Navigational Usability) did not always help. Often, complicated layouts or hidden menus made the website feel more troublesome, which reduced perceived value. Likewise, interactive feedback (such as pop-up messages or loading animations) often mattered less than anticipated delays or inconsistencies in these cues tended to annoy users rather than comfort them. Meanwhile, personalization capabilities could backfire when poorly targeted or overly complicated, making users feel overwhelmed by additional customization options or irrelevant recommendations, and therefore compromising both ease of use and usefulness. In this study, the classic link from perceived ease of use to perceived usefulness did not hold consistently, suggesting that users might judge a website's practical value more on how it achieves their immediate goals than on how simple it seems to run. The typical TAM relationships remained robust overall: perceived usefulness affected attitudes and intentions, and positive attitudes encouraged future use. Deeper insight was revealed by the interview responses: although more seasoned or registered users complained about distracting personalization and peculiar navigation that slowed them down, casual visitors praised simple designs and elegant typography. In summary, the study emphasizes that although users value simple, aesthetically pleasing experiences, designers must carefully balance usability, personalization, and aesthetics to avoid adding features that unintentionally detract from the very UX they are intended to improve (Lun et al., 2024).

2.6 Main advantages of having a well-designed website

A website is regarded as one of the most valuable things a company can have for its online presence. In today's digital media age, an online presence is essential for promoting a company's products and services. Well-designed and executed websites offer a competitive advantage by increasing customer awareness, ensuring 24/7 availability, and facilitating communication. Constant visibility is one of the key benefits of maintaining an online presence through websites and other media, as it enables the exchange of information and networking opportunities. This not only helps build strong relationships with clients but also reaches out to similar businesses and vital talent pools that can benefit the organization. Achieving this involves creating an interactive interface with features that go beyond simple browsing and purchasing, such as feedback sections, contact options, and links to other media platforms, all of which are clearly visible to any interested visitor. For effective results, factors like page layout, graphics, colors, and both back-end and front-end functionality are crucial (Wadovick, 2011). Furthermore, professionally designed websites foster trust and satisfaction among users, as they offer interactive features, transparent customer reviews, and answers to common questions. Attractive websites with good

usability boost customer confidence in the brand, increasing the likelihood of purchases. A strong online brand presence and credibility also enhance engagement and retention, encouraging more outreach and repeated visits—ultimately providing a competitive edge (Flavian et al., 2009).

3 USER EXPERIENCE

Success on websites is determined by many factors and criteria, however one of the most important aspects that governs a website's outcome is UX. Most websites are constructed around the idea of creating better digital interactions through visual appeal, accessible information, and efficiency in meeting needs. Several factors that make a good website also align with what makes for excellent UX. Quality UX design aims to reduce friction and confusion by maximizing clarity, engagement, and satisfaction, all of which greatly affect brand perception and customer loyalty. This section will analyze fundamental UX theories in detail, explain how UX is defined in academic and industry literature, examine various techniques and design methods it uses, and discuss some of the advantages and disadvantages involved in creating strong, effective UX models. Finally, it will clarify how UX principles relate to the development of well-designed websites, highlighting how thoughtful UX strategies can transform a website from merely functional to truly engaging and impactful.

3.1 Definition of user experience

Exploring UX across different disciplines has led to various definitions; however, the core elements that create a clear understanding remain consistent. A widely accepted definition in UX research and practice states that UX is a person's perception and response resulting from the use or expected use of a product, system, or service (Peruzzini et al., 2016). This definition emphasizes the subjective nature of UX, highlighting that UX is influenced by emotions, behavior, and expectations before, during, and after interacting with a company's system. Ultimately, it suggests that UX is not solely about usability but also about the "feel" customers experience when they interact with touchpoints.

A singular definition for UX is yet to be agreed upon; however, there exist ways to explain shared attributes with recurring definitions. According to Berni and Borgianni (2021), UX is a complex, interdisciplinary concept that can be understood through researching UX. It consists of two key focal points: Fundamental elements of interaction and typologies of experience. The fundamental elements include the user, which encompasses an individual's perceptions, expectations, needs, motives, and feelings. The system, referring to the product, service, or interface that the user is interacting with, and the context of use, which accounts for the physical, social, and time-related environment where the interaction takes place. Additionally, UX can be categorized into three main experience types: Ergonomic Experience, which is about usability, efficiency, and affordability; cognitive experience,

related to perceptions, aesthetics, and interpretation; and lastly emotional perception, which encompasses pleasure, hedonic values, and personal connections to the system (Brogia& Borgianni, 2021). This article reinforces the fact that UX is a holistic interaction between user and system within its given context, ultimately shaping engagement, perception, and satisfaction. Looking at a previous study by Hassenzahl (2008), UX is defined as a monetary, primarily evaluative feeling during the interaction with a product or service. This definition moves the focus from the product itself—its usability, features, and functions —to the user's emotions and subjective perception. UX is seen as a dynamic and time-dependent phenomenon, constantly changing based on current feelings rather than retrospective evaluations. The study highlights that UX is not just a new term for usability; instead, it must prioritize emotions, motives, and personal meaning in human-system interactions.

3.2 User experience principles

UX design is a process through which firms develop solutions to user-specific problems and promote a proactive approach to addressing issues. Creating effective UX involves many factors and considerations. As a result, researchers and practitioners have developed various implementation models based on different principles. Over the years, different industries and digital initiatives have influenced the framework and design principles, giving managers the freedom to make informed decisions and craft their own designs. Each framework ultimately provides guidance for structured design, evaluation, and management of UX. They serve as a foundation for making design choices, ensuring systems are intuitive, engaging, and aligned with human cognitive and emotional needs. By adhering to established UX principles, organizations can build a solid base for future improvements. These principles help reduce cognitive load and decrease the chances of user error. Consequently, this consistent design approach helps maintain workflows' momentum and reliability over time (Hartwig & Rein, 2020).

3.2.1 Core UX design principles

As Richardson et al. (2021) stated in the article on mobile application UX, based on Morville's UX Honeycomb Framework, the core UX principles are:

- Usability – the system must be easy to learn, efficient to use, and provide a streamlined interaction that minimizes cognitive load. This includes aspects like memorability, effectiveness, and delightfulness.
- Usefulness – the product should fulfill a clear purpose by addressing specific needs of its target audience. Usefulness is evaluated by whether the system provides practical and relevant content.
- Desirability – UX should provoke positive emotions and engagement through aesthetics, branding, and interactive elements. This principle covers visual appeal, emotional engagement, and interactive responsiveness.

- Findability – information and features should be easy to locate, and must be supported by a clear visual hierarchy, proper text formatting, search functionality, and intuitive navigation
- Accessibility – the design must be inclusive, ensuring usability for individuals of different abilities and disabilities. This means that the text must be readable, include alternative text for images, and support screen readers.
- Credibility – the product must appear trustworthy and reliable by providing transparent, high-quality information. Content needs to be accurate; sources should be transparent, and design elements must support credibility.
- Valuable – the overall UX should provide value to the user. This principle ensures that the product meets user expectations and improves satisfaction and retention.

3.2.2 Challenges in UX

In general, UX design faces several challenges that arise from the need to satisfy diverse user needs and contexts. One of the central challenges identified by an industrial case study involving UX designers and developers is time pressure, which often forces teams to deprioritize UX planning, evaluation, and testing in favor of rapid feature delivery, leading to superficial or neglected UX work. In situations under pressure of deadlines, oftentimes teams experience communication breakdowns, where the UX team struggles to align their design rationale with other teams, resulting in misunderstandings and a loss of design intent, followed by inconsistent implementations in the process. Another persistent challenge is the poor maintenance of UX artifacts and documentation, such as mockups or personas. As project stages evolve, these artifacts fall out of sync with development, making them less practical and more challenging to integrate into ongoing workflows. Despite initial integration efforts, such as upfront design and parallel workflows, the mutual adjustments between UX and development teams remain fragile, leading to breakdowns over time. Overall, organizational, process, and collaboration issues significantly hinder the delivery of high-quality UX systems, even in environments adopting agile methodologies. (Persson et al., 2022) Challenges are continuously discussed during the development of effective UX concepts across different scenarios, and they arise and change with time. Particularly interesting is the context of AI-driven design and the new AI automation initiatives in website design and UX approaches. Hartwig and Rein (2020) identified balancing automation and human control as one of the main challenges. When it comes to the design of complex systems, the authors believe that users should have control over AI decisions.

3.3 Theoretical foundations for UX enhancement

UX enhancements are grounded in theoretical models that provide structured approaches for improving user satisfaction. The foundational theories that guide UX enhancement initiatives include maturity models, process representations, and shared models or tools,

which create case-specific strategy implementations. By creating a multidimensional approach to UX improvement, organizations can evaluate, optimize, and design methodologies for UX enhancements. UX enhancement, as an initiative, dictates that managers must comprehend the organization's current UX maturity so they can identify strengths and weaknesses from which to further improve. Even in situations where the UX seems satisfactory, Pernice et al. (2024) emphasize the importance of assessing if the process can be further improved. The UX maturity model proposed by the authors was created for that exact purpose. It benefits organizations by providing a structured assessment of their current UX practices and guiding them through incremental improvements. It identifies key factors such as strategy, culture, process, and outcomes that must evolve together through the stages for an effective UX outcome. By progressing through the six maturity stages of Nielsen Norman Group's UX maturity model, organizations can systematically embed user-centered designs, ensure leadership support, allocate resources reasonably, and refine UX impact through measurable outcomes. Six stages of UX Maturity are the following (Pernice et al., 2024):

Stage 1: Absent (ignored, nonexistent, undiscovered)

Stage 2: Limited (uneven, haphazard, aspirational)

Stage 3: Emergent (functional, promising, inconsistent, inefficient)

Stage 4: Structured (partly systematic, variably effective)

Stage 5: Integrated (comprehensive, pervasive, universal)

Stage 6: User-Driven (beloved, reproducible, habitual)

This structured approach pushes organizations to prioritize UX when necessary, improve usability, and enhance overall satisfaction, since it reinforces all factors in unison instead of separating them.

Theoretical foundations show that frameworks for UX enhancement vary by the nature of the product or service, its characteristics, and customers. UX enhancement is rooted in several theoretical models that guide organizations to improve their practices. Zamir et al. (2025) propose a UX maturity model specifically for Free and Open-Source Software (FOSS), demonstrating how organizations can progress through enhancement strategies to the decentralized and community-driven nature of FOSS. The model adapts to Nielsen's maturity model by creating FOSS-specific constraints but following the previously defined framework. These models act as diagnostic tools and development roadmaps, making highly relevant contributions that go far beyond just their own organization.

Further significant studies were conducted on different UX enhancement tools, one of which is on Digital Storytelling (DST) and Information Visualization (InfoVis) in Museum

Exhibitions. Rosli and Kamaruddin (2020) highlight the role of narrative-driven and immersive experiences in fostering user engagement. DST combines narrative structures with multimedia elements, influencing emotional engagement, which Rosli and Kamaruddin argued as a key driver of UX enhancement in such scenarios. InfoVis, as a tool, allows for interactive elements in a museum setting, making data representation more intuitive and engaging. These tools are not just about usability but about creating emotional, immersive, and meaningful UX.

Dabouis et al. (2023) argue that small and medium-sized design agencies often have poorly structured UX design processes, which consequently lead to poor UX traceability and inconsistent quality. To address this, the study proposes that a graphical UX process representation be implemented to retrospectively map specified, imagined, and evaluated UX states within past design projects. A structured diagram that maps out the design process and UX-related decisions over time, allowing teams to compare projects, learn from past mistakes, and establish repeatable UX best practices. This makes UX enhancement more systematic and predictable.

3.4 Persona development technique

Persona development in UX is a user-centered design technique that helps teams create products tailored to real user needs by representing different segments of the target audience through fictional but research-based characters. Unlike traditional market segmentation, which is reliant on statistical data points, personas are created from field research, interviews, and behavioral insights, making them relatable representations of actual users rather than abstract metrics. This approach enables designers, developers, and marketers to understand their users better, ensuring that decisions are not made based on assumptions but rather real-world examples of behaviors, goals, and pain points. UX Personas typically include demographics, behavioral patterns, complaints, motivations, etc., providing a clear reference point throughout the design process. (Ritter & Winterbottom, 2017b, pp. 132–134) With the integration of personas into UX workflows, teams can align their strategies to prioritize usability, accessibility, and engagement, leading to user-friendly products. The technique is a multi-step, systematic method that starts with a hypothesis formulation, before moving on to behavioral variable identification, establishing key factors like usage frequency, features, and interaction patterns. After identifying all the previously mentioned, the process continues to group and clearly visualize user tendencies. Subsequently, the process involves synthesizing characteristics and user goals, creating a comprehensive user profile reflecting real emotions, motives, habits, and expectations. The technique also emphasizes performing a thorough check for redundancy and completeness to ensure accurate representations. This leads to expanding personas through detailed narratives, providing clarity on user attitudes and scenarios.

Lastly, the personas are segmented as primary or secondary based on their relevance and interaction with the system, directly influencing the creation of targeted use cases and corresponding prototypes. (Djamarullah & Kusuma, 2022) Following that structured approach, UX designers can produce defined, actionable personas that guide user-centered decisions. It is a constantly evolving technique that develops significantly with the emergence of Data-Driven decision-making. Specifically, DDPD emerged as a data-driven persona development method, a method leveraging computational algorithms and quantitative data such as web analytics and social media interactions to generate representative, accurate, and continuously updatable personas. Despite the number of advantages from using DDPD, there are challenges in keeping data from biasing, and creating shallow persona narratives due to overreliance on numeric data and inconsistent evaluation methods (Salminen et al., 2021).

3.4.1 Benefits of persona development for understanding users

Persona development serves as a powerful technique that can further evolve and benefit design decisions by aligning them with real user needs. Integrating personas into the design process is intuitive and effective in terms of user needs, recognizing experiences, behaviors, and goals. By developing fictional characters based on real data, designers can step outside their own perspectives and broaden their understanding of different people's requirements. This practice not only simplifies design processes but also ensures greater success, leading to a more user-centered UX (Dam & Siang, 2024). Personas primarily benefit UX by providing designers with deep insights into not only behavior but also limitations. Developing accurate personas through thorough user research ensures that design decisions consistently align with actual user needs, allowing the creation of highly valued UXs. By clearly defining user characteristics, personas foster empathy among team members, facilitate targeted communication, and guide usability testing, ultimately resulting in products that resonate with targeted audiences and deliver measurable improvements in user satisfaction and product performance (Kaplan, 2024).

3.4.2 AI contribution to persona development

Like in most cases, AI is capable of streamlining the process, saving time, and may allow teams to focus on more important aspects of the design process. AI automates and enhances the creation of user personas through various tools. Large Language Models like GPT 4.x and Text-to-Image Models like DALL·E, enable designers to quickly generate diverse personas from both spoken and written prompts, producing comprehensive profiles and corresponding images. This automation, if appropriately incorporated and supervised by human intellect and experience, can allow for rapid scalability and broader exploration of user segments. Additionally, AI-driven personalization leverages data and ML algorithms to create adaptive, responsive, and contextually relevant UX, moving beyond static personas to more dynamic ones. However, it is important to approach AI-generated personas critically,

as they may accidentally cause biases present in their training data, leading to stereotypical representations. Therefore, designers must remain involved in refining the data, the output of AI, and ensuring quality. By integrating AI capabilities with human oversight, the process of persona development can ultimately further evolve and develop novel approaches (Sattele & Carlos Ortiz, 2024).

3.5 Connecting website design and user experience

The relationship between website design and UX is a crucial area of interest for both scholars and practitioners. With the rapid growth of digital interactions, the connection lies in functional elements, engaging content, and aesthetic appearance. How a site is built significantly influences user impressions, feelings, and actions when they interact with websites on various devices and in different situations. It's essential for professionals to design a website that offers a responsive layout and tells the brand's story, guiding users to engaging but not overwhelming information. Proper design benefits both customers and companies because effective design means creating responsive and adaptable websites across any screen or device without compromising aesthetics (Edwards, 2024). This section closely examines the importance of website design in shaping UX, using evidence from both theoretical and empirical research.

3.5.1 Importance of website design to user experience

Visual aesthetics are not purely about good looks and appeal; it is also about creating an emotional connection with the user. Every part of the website, font, object size, color choice, shapes, resonates with users' perceptions, emotions, and behaviors on a deeper level (Edwards, 2024). A large portion of what influences a user's experience and how one evaluates and interacts with the brand and product is the design of a website. In the literature by Jongmans et al. (2022), website design is portrayed as the foundational element of UX, as it has a direct connection to user perception, navigation, and emotional response to the digitally conveyed message through a company's website appearance. This design is meant to streamline the interaction and search for one's relevant information, leading to satisfactory outcomes. That case study suggests that visual hierarchy, typography, spacing, and other visual elements are what primarily influence a positive response. These early perceptions are in many cases the reason for the willingness to explore further and potentially generate a profitable interaction between user and company. Even factors like intuitive navigation can cause a user to stay or leave the website. Thus, website design is not just a decorative layer but rather serves as a core functional component of UX. Furthermore, Bhanarkar et al. (2023) emphasize the RWD and its necessity for today's mobile-first approach to the digital industry. Their study confirms that websites optimized for different devices by using fluid grids, media queries, and adaptable visual components not only reduce navigation errors but also improve content accessibility. Users interacting with websites of high RWD develop

greater trust and respect for a brand, ultimately promoting long-term interactions with that digital platform.

3.5.2 Evidence supporting design as a contributing factor

Evidence supporting design as a contributing factor is demonstrated in a study that examined how visual design influences user interactions and experiences with websites. The research proposed a sequential approach to explaining how attractive design influences final outcomes in UX. The process is described as a "usability-to-pleasure" path, emphasizing that design goes beyond aesthetics and actively shapes both cognitive and emotional responses that are important for desirable user judgments. To test this, the authors conducted two experimental studies. The first experiment used a fictional website of a travel agency presented in two contrasting versions: one with balanced layouts, meticulously chosen colors, and artistic elements, and another with generic fonts, rigid grids, and poorly designed elements. Participants who engaged with the more attractive version reported higher usability, which translated to higher pleasure and, in turn, more favorable evaluations of the website. A second experiment replicated the approach using a real e-commerce website to ensure practical relevance. The findings once again confirmed that appealing design enhances usability, and that usability leads to pleasurable experiences, which ultimately trigger emotions that drive positive user evaluations and reuse intentions.

An important contribution of this research is the rejection of an alternative model in which pleasure stems from usability. Instead, the results showed that usability supported by good design is the foundation upon which pleasure arises, and only when usability leads to pleasurable experiences do users form stronger intentions to return or recommend the website. By confirming this relationship in both controlled and real-world settings, the authors presented robust evidence that visual design is a contributing factor to UX and a key determinant of how websites are ultimately judged (Jongmans et al., 2022).

Similar evidence comes from data gathered by a questionnaire created for a mobile app called "Daily Yoga". The research also examined how design influences UX and found that an aesthetically pleasing and personalized interface significantly increased user willingness to pay for the service and encouraged deliberate, continued use. Beyond financial intentions, the design also strengthened several other dimensions of favorable UX, such as higher perceived usefulness and intuitive navigation. These factors demonstrate that design choices do not merely shape first impressions but actively drive practical and emotional outcomes (Yu & Huang, 2020).

The final example, Bhanarkar et al. (2023), examined the design and development of responsive websites, focusing on techniques applied to enhance both technical performance and layout adaptability. Findings showed that responsive websites minimized the need for excessive horizontal scrolling, presented users with the intended design, and directly improved user comfort and overall satisfaction. The research involved analyzing user

interactions and feedback across different devices to assess how responsiveness influences UX. In this context, responsive websites are defined as those capable of maintaining their aesthetic design and content integrity across different screen sizes and devices. In contrast, non-responsive websites are characterized by limited adaptability. For instance, a desktop version of a website may operate effectively, but when accessed on a tablet, the same website may lose important aspects of design, functionality, or content accessibility. This reflects a growing challenge in website design, given the increasing dominance of mobile devices and the expanding variety of screen sizes that no longer conform to the traditional desktop standard. The study addressed these challenges by drawing on real-world development practices and investigating the implementation of responsive design techniques, including fluid grid layouts, adaptable images, media queries, and responsive navigation frameworks. (Bhanarkar et al., 2023).

4 ARTIFICIAL INTELLIGENCE

AI is a prominent technology and topic of discussion in our past and present technological accomplishments. AI is a technology designed to offer advanced capabilities that go beyond simple automation. It has the capability of making predictions, learning, generating creative content, performing complex calculations, and more. It is influential in daily life, business activities, competitive markets, strategic decisions, business insights, and operational efficiency. Its widespread use makes it important not only to understand its benefits but also to be aware of the risks involved. This section focuses on the origins of AI, its current applications, and future possibilities, aiming to portray a complete picture of AI.

4.1 History and origin of AI

The origins and evolution of AI reflect a complex journey shaped by theoretical insights, breakthroughs, and sociocultural influences. AI progressed through important phases, often punctuated by alternating cycles of optimism and skepticism. Interestingly, humans have dreamed of machines performing automated tasks since the 1900s, and some might argue that even pre-20th-century scholars discussed and tested inventions closely resembling the concept of AI. However, inventions similar to today's AI were created by Spanish engineer Leonardo Torres in 1914, who demonstrated excellent knowledge of electromagnetics and designed a fully automated chess game. Once set up, the machine required no human intervention to play and could even checkmate human opponents in certain scenarios. (Mucci, 2024).

The first significant progress in AI can be traced back to 1943 with the written work of Warren McCulloch and Walter Pitts titled “A Logical Calculus of the Ideas Immanent in Nervous Activity. " For the first time, there was a discussion about understanding the brain as a computing system, introducing the concept of artificial neural networks. Modern AI systems heavily rely on this idea, especially in inspiring neural networks and deep learning.

The term AI originated in a workshop proposal organized by John McCarthy of Dartmouth College and Marvin Minsky of Harvard University in 1955, submitting a research project proposal titled "A proposal for Dartmouth Summer Research Project on Artificial Intelligence". This is widely considered as the official origin of the developing field of AI. In 1958, John McCarthy created the first programming language, which was used in AI research, following the logic of mathematics and algorithms he developed with the purpose of handling symbolic information.

During the 60s, systems such as ELIZA, created by Joseph Weizenbaum, were capable of mimicking human conversation by responding to typed input of natural language. ELIZA was a chatbot that served psychotherapy and worked on pre-set rules for word matching. It did not exactly understand any meaning, but it did demonstrate a most impressive performance of rephrasing. Early robotics and neural network challenges began with the first mobile robot capable of reasoning its own actions, planning, and problem-solving. The SRI – Stanford Research Institute significantly contributed to robotics invention and early NLP of Shakey the robot. Shakey could perform simple tasks by using cameras and sensors to perceive its environment and convert commands into logical steps using symbolic AI and Stanford's very own problem-solving algorithm, STRIPS (Stanford Research Institute Problem Solver). Symbolic AI consisted of hand-coded rules, logic, and symbols and meant using IF-THEN rules, logic trees, and knowledge graphs to program the whole logic manually (Kuipers et al., 2017). Next advancements began with the works of Geoffrey Hinton and Ronald Williams on the introduction of the backpropagation algorithm and its use in AI. Backpropagation is a form of propagation that basically makes a guess (output) and then goes backwards, checking how wrong the guess was (error), then adjusting the weights a little to do better next time. However, for that period, its utility could only be proven on a small scale, due to the limiting factor of hardware technology at that time (Mucci, 2024).

In 1989, Yann LeCun successfully applied backpropagation (short for backward propagation of errors) to convolutional neural networks (CNNs) for handwritten digit recognition, demonstrating neural networks' practical value. CNN networks break images into small pieces and look for patterns, stacking these patterns to recognize bigger things, and are good at things like facial recognition. In the 1990s, a large tech company called International Business Machines (IBM) created the Deep Blue system that successfully defeated chess champion Garry Kasparov in 1997, showcasing early AI abilities of surpassing human performance. In the same period, Long Short-term Memory (LSTM) networks, introduced by Hochreiter and Schmidhuber, addressed limitations in sequential learning and became instrumental in processing time-series and language data. 1995 is a year marked by the first ever developed chatbot called A.L.I.C.E. by Richard Wallace. The name stood for Artificial Linguistic Internet Computer Entity, and it was built on the foundation laid by Joseph Weizenbaum's ELIZA program. In the early 00s, projects like Cynthia Breazeal's Kismet explored human-robot emotional interaction, while Andrew Ng and colleagues demonstrated the efficiency of graphics processing units (GPUs) for large-scale deep learning. Fei-Fei Li's

ImageNet project in 2007 further provided the critical infrastructure for training large-scale visual recognition systems (Mucci, 2024).

Before 2010, the scalability of these CNN networks was doubted by many, and in some ways, researchers in the field began abandoning them. However, from 2010 onwards, we began to see different transformative progressions in the field of AI, driven mainly by the concept of deep learning. Breakthroughs such as AlexNet (2012) developed by the University of Toronto revolutionized the concept of deep learning. Two students, Alex Krizhevsky and Ilya Sutskever, alongside their professor and mentor Geoffrey Hinton, started training neural networks on vast amounts of data using GPUs instead of central processing units (CPUs). This shift enabled their model to train up to 30 times faster, allowing for deeper architecture and unlocking the potential for higher performance and larger-scale models. In the year 2016, models were set to further improve by mastering the task of strategic thinking in the old East Asian game of Go. Google's AI research lab, known as DeepMind, created a hybrid AI system, named AlphaGo, which became the first computer program to defeat a world champion in Go, Lee Sedol. In the game, played on a 19x19 grid, players take turns placing black or white stones to claim territory. AlphaGo is considered a "hybrid" AI system because it employed a combination of deep neural networks and reinforcement learning, enabling it to learn optimal strategies through self-play and experience. This marked success for the future of AI, demonstrating that it can master complex strategic reasoning. Before these developments, AI had already begun to exhibit capabilities in understanding human language. (Mucci, 2024).

However, going back to the year 2010, we must acknowledge the company Apple for introducing a revolutionary concept in the field of AI. Particularly, their creation of Siri, a voice-activated virtual assistant embedded in their iPhone devices. Siri utilized voice recognition and NLP to understand tasks and answer questions. Although limited in scope at the time, it represented the integration of AI into consumer technology. Another milestone in the evolution of AI occurred when researchers at Google and OpenAI conducted experiments in unsupervised learning-a form of machine learning (ML) where models learn patterns directly from data without explicit labels. In one notable experiment, a neural network trained on YouTube video frames learned to identify the concept of a cat without ever being told what a cat is. This phenomenon highlighted AI's ability to extract meaningful representations from raw, unlabeled data, which is a fundamental capability for building flexible and autonomous systems.

In the recent 2020s, OpenAI released GPT-3 (generative Pre-trained Transformer 3), a large language model (LLM) containing 175 billion parameters. GPT-3 demonstrated the ability to perform tasks such as translating, summarizing, and code generation with minimal task-specific training, a property known as few-shot learning. The model's capacity to generate logical and contextually appropriate text, based on written prompts, has had profound implications for fields ranging from education to software development. In the same year, Google's DeepMind Lab showcased AlphaFold 2, an AI system capable of predicting three-

dimensional structures of proteins form their amino acid sequences with high accuracy. This solved a long-standing problem in computational biology and opened new opportunities for drug discovery, medical research, and biomedical innovations.

From the year 2021 to the present day, other AI initiatives revolve around perfecting LLM models such as the GPT model and expanding their capabilities for the purpose of wide-range human use. The end goal is to help humans learn faster and work smarter, all while providing an increasingly natural interactive feel. Apart from text generation, OpenAI's DALLE, introduced in 2021 and followed by later versions, enabled the generation of highly realistic images from natural language descriptions (textual prompts). In 2024, OpenAI even introduced Sora, a model that extended generative AI into the realm of video creation from textual prompts, opening new possibilities in visual media and content generation (Mucci, 2024). Moreover, LLM models are now updated and enhanced in ways that allow them to function as multi-modal systems. Multi-Modal LLMs mean that they are capable of understanding and working with more than one type of input or output, not just text. By combining text, image, or even audio, examples like GPT-4o show great sophistication and usefulness. Aside from wide personal utility, LLMs find their purpose in many enterprise and business settings. The well-established tech company IBM works on pre-trained LLM models called Granite models, which are like the models of GPT and Claude, that focus on enterprise and business-specific use cases. They are designed to be smaller, efficient, secure, and customizable. Also, part of this broader industry trend is Apple's intelligence platform, focusing on efficient multi-modal privacy-centric models (Stryker, 2024).

4.2 Use of AI in today's competitive market

In today's competitive marketplace, AI has become a key tool for transformation, fundamentally reshaping business operations, marketing efforts, strategies, and decision-making processes. Academic research over recent years consistently shows that integrating AI tools gives companies a strategic edge through improved automation, data-driven insights, and personalized customer experiences. Domini et al. (2022) highlight that AI should be viewed as a combination of machine translation, chatbots, deep learning, and neural networks, rather than just a single technology. As a transformative force, AI can provide a competitive advantage by enabling companies to automate routine tasks, make decisions based on data, and personalize customer interactions. Each AI capability plays a role in enhancing process performance, which the study categorizes into three areas based on value: Automation, Information, and Transformation.

Haleem et al. (2022) examine AI's role specifically in marketing, identifying numerous applications that enhance a firm's ability to attract and retain customers in a crowded marketplace. AI enables marketers to design tailored advertising campaigns, predict consumer preferences, and implement dynamic pricing strategies. Furthermore, key marketing activities such as email personalization, real-time content recommendation,

customer segmenting, and campaign optimization are now being enhanced by AI capabilities and machine learning. The authors also note that AI's use increases interaction with consumers in highly individualized ways, elevating brand engagement and return on investments.

Wang (2024) argues that AI facilitates strategic business decisions that influence market competitiveness. He emphasizes the importance of predictive analytics powered by AI, which is particularly useful for forecasting market trends, optimizing supply chains, and reducing operational risks. Furthermore, AI enhances customer relationship management (CRM) through real-time personalization and chatbot communications. Additionally, AI-driven simulation seems to have accelerated product development cycles, enabling faster time-to-market and agile responses to competitor actions. Lastly, Hassani and Mosconi (2022) showed how AI-powered competitive intelligence is capable of transforming a market analysis by leveraging NLP and ML algorithms for gathering and interpretation of unstructured data. AI's proven capabilities for real-time data interpretation of social media posts, competitor websites, and online reviews help organizations identify trends, monitor customer sentiment, and anticipate competitor actions.

4.3 AI-driven design tools

The wide integration of AI technology into processes of design has gone from theoretical discussions to practical implementation quite rapidly. Across numerous disciplines and different industries like architecture, mass production, product development, and urban planning, AI-driven design tools have emerged as powerful instruments for increasing creativity, enhancing performance evaluation, and encouraging human-AI collaboration. In the context of urban planning, InFraRed leverages deep learning to provide performance feedback during design processes, allowing designers to explore complex design spaces efficiently. This AI-driven platform addresses traditional challenges of time and expertise by replacing computationally expensive simulations with surrogate models-trained neural networks that offer rapid predictions with acceptable accuracy. Importantly, InFraRed emphasizes design exploration over optimization, encouraging open-ended, performance-driven experimentation with large-scale urban environments (Galanos & Chronis, 2022).

Utilizing AI, users constantly seek to automate and enhance the process of design, especially when it comes to spatial and urban contexts. Most recent advancements in ML have increased AI capabilities for generative tasks, such as shape grammar and configurational modeling. To clarify, shape grammar is a computational design method that follows rules (similar to grammatical rules in languages) to create and modify geometric shapes for complex designs. Improving this method is crucial for ensuring design coherency and editability. Additionally, configurational modeling is simply a method for AI to understand spatial arrangements and relationships by learning patterns of good configurations from already existing plans. By improving, testing, and running these methods, AI can reach far

beyond architectural design and translate to improving generative design (GD) for other contexts. Moreover, current capabilities stretch personalized design and predictive analytics, making AI an instrument that can mirror or extend human creativity and skill. Latest tools, including consumer available platforms like ChatGPT, that can assist with layout, compositions, and design ideation, demonstrating human-like dialogue and insight (Batty, 2024).

The most recent contribution by Lee et al., (2025) provides a systematic analysis of AI support systems in human-centered design, using the Double Diamond model to map AI contributions across the design process. Double Diamond is a step-by-step guide designers use for solving problems by drawing two diamond shapes, one that represents the understanding of a problem and the second for creating the solution. This chosen shape is deliberate and represents a wide range of ideas before narrowing down to one, naturally depicting the process of thinking. By following this model of problem discovery, definition of the problem, development of ideas, and finally delivering solutions, they were able to identify gaps in how AI is used in design. Their study found that most AI design tools are more effective at delivering solutions than at identifying the problems themselves. To support this claim, the authors conducted literature reviews and analyzed case studies involving ChatGPT and robotic systems. From these, the authors identified a range of AI functions, including idea generation, user modeling, feedback analysis, prototyping, and inspiration sourcing. Their findings support the notion that AI tools can expand the creative capacity of designers, particularly when used to automate repetitive tasks. AI systems are, in fact, aligned with human workflows and could become even more sophisticated through constant improvements, utility, and refinement for the sake of design (Lee et al., 2024).

4.4 AI and website design

Integrating AI into web development and design presents a significant advancement in the goals of dynamic, user-centered digital environments. Traditional websites, often static and generic, are increasingly replaced by intelligent platforms that respond to user behavior, customize preferences, reduce costs, boost efficiency, and facilitate streamlined utilization. As AI technologies continue to progress, their application can be seen as beneficial for many of these goals. Recent academic studies underscore that AI's contribution to web development goes beyond just code creation and automation. From chatbots providing continuous user support to recommendation engines for content delivery, AI-powered or AI-supported design is becoming more prevalent throughout the web development process. Additionally, user-focused personalization has become a key strategy for increasing engagement and satisfaction by utilizing AI and ML. Adaptive systems are now capable of analyzing user behavior, preferences, and real-time contextual signals to customize content, layout, and features to individual needs (Rahaman et al., 2023). This approach moves beyond one-size-fits-all design to offer a dynamic experience that evolves with the user, improving retention. Techniques like user profiling, collaborative filtering, and context-aware

adaptation help systems deliver high-quality recommendations and interfaces that respond to factors like time zone, location, or device type. Despite these advantages, we must also acknowledge the increased challenges related to privacy and data security and promote ethical AI-enhanced websites that maintain trust and transparency.

4.4.1 AI contribution to website design

Website design, in its traditional sense, is reliant on manually intensive development processes of whole teams, and their competence in translating visual concepts into functional code using programming languages such as HTML, CSS, and JavaScript. AI can be a tool, a transformative integration in the modern web design processes, if used appropriately. The introduction of AI is meant to mitigate the downsides of traditional approaches to designing a website, save time, allow greater focus on creativity, and minimize errors. Particularly through ML, deep learning, and NLP, AI automates key tasks in design and development workflows. One of the most notable contributions of AI is code generation, capitalizing on the capabilities of processing written text prompts and sketches, directly generating code. Technologies like Pix2Code, Sketch2Code, and related neural network-based models have shown that AI can replicate design intent from static images, generating functioning front-end components with a high degree of accuracy (Muthazhagu & B, 2024). Beyond visuals, AI incorporation has the possibility of enhancing UX through personalization. ML algorithms analyze user behavior – such as browsing history, click patterns, and interaction sequences – to deliver customized content. An increased level of personalization increases user engagement by dynamically adjusting web interfaces to individual preferences. Furthermore, NLP powers chatbots and virtual assistants, allowing websites to have 24/7 attention towards users. These tools answer questions, provide guidance, and simulate human-like responses, thereby reducing dependency on customer service agents. AI is also beneficial in the creation of SEO-optimized product descriptions, blog posts, and streamlining the content pipeline for digital platforms (Upadhyaya, 2024).

4.4.2 AI tools for automating and enhancing design

According to Ghorbani (2024), AI tools have greatly automated and transformed design activities, significantly enhancing efficiency and creative outcomes. AI-driven tools, notably those integrated within Adobe Creative Cloud, offer substantial assistance to designers through the automation of repetitive and cognitively demanding tasks. Adobe's primary AI engine, Adobe Sensei, enhances website design workflows by providing intelligent automation capabilities such as responsive layout generation, automated content-aware image editing, and efficient prototyping through tools like Adobe XD and Photoshop. Within Adobe XD, Designers can prototype website interfaces by using responsive resizing features, repeat grid automation for quick duplication of UI components, and adaptive layout adjustments.

Furthermore, AI tools have been incorporated as website builders, utilizing automation design and development tasks, allowing website creators to focus entirely on customization. Among leading AI website builders are Wix, Jimdo, Bookmark, and Zyro. Wix ADI (Artificial Design Intelligence) simplifies website creation by asking users a series of questions about their purpose, design preferences, and required features. Based on these responses, Wix ADI automatically generates a website with relevant content and images. Users can later customize the website with a straightforward drag-and-drop editor (Guinness, 2024). All the AI platforms mentioned utilize the same approach towards dealing with the task of website design automation. Leveraging AI to simplify and expedite the website creation process and content generation tasks, they make it feasible for individuals and small businesses to establish an online presence without the expense of technical skills. This approach highly accelerates the design process and aligns with the creator's vision. However, whether it meets end-UX criteria is a different, yet equally important, question we discuss in this work.

When it comes to other specific AI tools enhancing design processes, Autodesk is a software company widely known for creating such tools in engineering, architecture, construction, various manufacturing industries, etc. One of their flagship products, Fusion 360, is a cloud-based computer-assisted design (CAD) software platform that combines different stages of the product development process, like modeling, simulation, manufacturing, and collaboration, all in a single environment. Within Fusion 360, Autodesk introduced an advanced feature known as "generative design". GD utilizes AI algorithms, aiding designers and engineers in developing optimized solutions for structural and mechanical design problems. The main advantage of GD is that it can automatically generate numerous different design options based on specific criteria set by the user, such as weight minimization or stiffness maximization, while considering various manufacturing methods like additive manufacturing (3D printing) or milling. The user-specified component uses cloud computing resources to run simulations and run tests on multiple designs simultaneously, greatly benefiting the process of design itself. Even though GD significantly streamlines and enhances the design exploration process, the generated designs often require minor refinements and post-processing for optimal performance and practical manufacturing. Thus, Autodesk's Fusion 360 and its integrated GD significantly improve design workflows, allowing designers to efficiently create innovative components, which would be impossible with traditional design methods alone (Buonamici et al., 2021).

4.4.3 AI-based psychology design and recommendations

As digital interfaces become increasingly central to everyday life, designers are recognizing more that user reactions are influenced not only by functionality but also by psychological responses to visual elements such as color and shape. A recent case study by Nissen et al. (2024) explored this topic by combining evolutionary psychology with neuroimaging technology to understand how website users subconsciously respond to specific design

features. The researchers conducted a lab-based experiment using functional near-infrared spectroscopy, a brain-scanning method that detects neural activity by measuring blood flow in the prefrontal cortex. Participants viewed websites designed in three color conditions (blue, red, and black-and-white) and with two button shapes (sharp and round), while their brain activity and self-reported feelings were recorded. Blue color-themed websites reduced cognitive load and increased trust and pleasure, while red designs elicited stronger neural activation and higher arousal. Rounded buttons activated reward-related areas in the brain, indicating a subconscious preference for these over sharp-edged buttons. To be effective, AI-based design systems should integrate such funding into their algorithms, prioritizing psychologically beneficial characteristics to enhance user approachability and satisfaction.

4.4.4 Instances of successful use of AI suggested design

AI has progressively shown its capabilities of generating effective and innovative design solutions across various industries, with real-world applications demonstrating success regarding aesthetics and functional improvements. In architecture, Zaha Hadid Architects successfully implemented custom AI software to automate early-stage and mid-stage design tasks, resulting in significant productivity gains in some phases of the project development. This allowed designers to generate visually complex structures faster, enhancing the firm's competitive edge while maintaining their distinct style (Ackerman, 2025). In the automotive industry, Lukas Czinger used AI alongside 3D printing to engineer the Czinger 21C hypercar, optimizing the vehicle's design for weight, aerodynamics, and performance through AI-informed structural analysis. The car has since proven significant performance feats in engineering (Booth & Johnson, 2024). In the fashion industry, designer Lulu Li collaborated with Moncler to bring AI-generated concepts to life in actual collections. The AI contributed novel garment ideas that human designers interpreted and refined into high-fashion pieces, blending computational creativity and craftsmanship.

Lastly, a compelling and creative example of AI-assisted design is found in the interactive art installation "Visions of Destruction" by Guljajeva et al. (2024), which uses AI to illustrate how human actions can harm the environment—visually and in real time. The installation begins with a beautiful, untouched digital landscape displayed on a screen. As viewers look at the screen, an eye-tracking system detects exactly where they are focusing their attention. That gaze data is then fed into an AI model called Stable Diffusion, which has been trained to modify images. Using a technique called inpainting, the AI transforms parts of the image that the viewer is focusing on, gradually turning them into scenes of environmental damage such as urbanization, pollution, and deforestation. In simple terms, the more someone looks at a part of nature, the more the piece starts to "break down" and turn into a man-made or ruined environment. This clever interaction is meant to symbolize how even our smallest actions can have real consequences for the world. What is even more thoughtful is that if no one interacts with the screen for a while, the AI slowly rebuilds the scene back to its natural form, suggesting that recovery is possible when human pressure is removed.

5 EMPIRICAL RESEARCH

To assess the impact of AI-generated, as opposed to human-created, websites on UX, this empirical research section of the current thesis represents a comparative study involving four live websites. Through user testing and a carefully constructed survey, the research captures participant feedback across multiple UX dimensions, which were derived from previously validated frameworks such as WebQual 4.0 and the UX Honeycomb. These dimensions include usability, visual appeal, trust, personalization, and responsiveness. The findings aim to uncover meaningful insights into the strengths and limitations of AI-driven design compared to traditional, human-made websites. Additionally, this empirical study could serve as an example for future analysis in various fields where AI and human talent cross paths.

5.1 Methodology and research technique

The selection of websites was made across two distinct industries: travel and fashion. Each pair includes one AI-generated website, built using the Wix platform, and one human-created website developed by a professional agency, Islango and Cain for travel, and Evolve Clothing and Nour Hammour for fashion. This pairing was a deliberate methodological choice to improve focus and increase the validity and reliability of this empirical research. By controlling industry-specific expectations and functionality, this approach helps ensure that user evaluations primarily reflect UX and minimize distracting factors. Variations in content and purpose could interfere with comparability; therefore, this was one way to isolate the effects and determine whether AI or a human created the website.

A total of 48 participants took part in the study by visiting all four websites, interacting with them, and then immediately answering a structured online survey. Each participant was selected from my personal contacts whom I knew to be responsive and reliable, and ensured a mix of ages and backgrounds. They were not previously made aware of which website was AI-generated or human-created, minimizing bias. The survey was based on validated UX frameworks, including Morville's UX Honeycomb (Morville, 2004) and WebQual 4.0 (Wijaya et al., 2021). It included various question types, such as Likert-scale, ranking, comparative, and open-ended questions. In addition to quantitative analysis, participants' qualitative feedback was analyzed using NLP-based sentiment analysis to reveal deeper emotional and perceptual insights.

5.2 Preparation for the research method and survey implementation

Each website's origin is credited through Wix attributions, included in Appendices 1 and 2. Specifically, the Cain travel website was built by the agency Blennd, which published a case study detailing the design system and development process (Blennd, 2024). For the second human-made website, Nour Hammour, the creation process is thoroughly explained on the

development agency's website (Commerce-UI, n.d.). Additionally, Nour Hammour's website credits both the development agency and digital designer Ania and Lucie in a footer section labeled "Credits" (Nour Hammour, n.d.).

In contrast, Islango, one of the AI-generated websites, was built using Wix's ADI (Artificial Design Intelligence) builder, which automatically creates layouts and content without any visible involvement from a design agency or credited designer. Similarly, Evolve Clothing was also developed through the Wix platform using AI-driven design features, and no human developers or designers are credited in its creation. Both websites, therefore, lack explicit human design attributions, further supporting their classification as AI-generated (see Appendix 1).

The survey was conducted using Google Forms, and participants were provided with a brief introduction, instructing them to interact with each website for at least two minutes before proceeding to the next. To maintain participant engagement and ensure the survey's successful completion, I chose Likert-scale questions with a 5-point scale, along with a closing section of open-ended questions in case a deeper understanding could be gained through sentiment analysis. The survey questionnaire is shown in Appendix 3.

At first glance, the gathered raw, unrefined data collected from the response section of Google Forms might provide some insight; however, it is not reliable to draw conclusions based solely on initial impressions. To ensure accuracy and meaningful interpretations, a systematic approach was used to organize and examine the data in Excel spreadsheets. Excel's built-in features were sufficient for the analysis of the quantitative data gathered. To be more specific, I was able to transform the data, arrange it properly, standardize columns, ensure structure consistency, and finally perform basic descriptive statistics such as calculating mean values, standard deviations, and create graphical representations of the results. Moving forward, I used Microsoft's Visual Studio (VS) Code and Python for the survey's qualitative component, which included answers from open-ended questions. More precisely, I utilized NLP techniques using Python within VS with the intention of transforming subjective, open-ended responses into quantifiable data from which I could extract meaning.

Using Python with the pandas and Natural Language Toolkit (NLTK) libraries, I was able to load the data and automatically identify every column containing open-ended responses. Pandas is a Python library for data analysis that simplifies loading, cleaning, organizing, and working with structured data. It allowed me to load an entire spreadsheet into a single DataFrame object, enabling me to filter, sort, edit, and analyze the data with just a few commands. Meanwhile, NLTK is a Python library that facilitates the processing and analysis of human language data. It provides tools for text processing and analysis, including evaluating the emotional tone of responses by assigning sentiment scores and categories (Positive, Neutral, Negative). For this purpose, I used the Valence Aware Dictionary and Sentiment Reasoner (VADER), which is part of the NLTK library. VADER is a widely used,

validated, rule-based model specifically designed for analyzing social text data. For each participant's response, VADER generated a numerical compound sentiment score from -1 (most negative) to +1 (most positive), with 0 indicating neutrality. To convert these scores into labels, rules were set so that scores greater than or equal to +0.05 are considered positive; scores less than or equal to -0.05 are classified as negative; and scores in between are regarded as neutral.

To preserve the original responses along with their calculated versions, I made sure to save all files separately. This allows for straightforward comparison across responses while ensuring transparency and the ability to replicate the results. Lastly, I generated summary statistics for each question by counting the total number of positive, negative, or neutral responses and calculating the average sentiment score.

5.3 Key findings and analysis of gathered data

After preparing everything and organizing for analysis, I examined all participant responses in detail. The goal was to understand participant perceptions of UX across four different websites, comparing human-designed and AI-generated examples from the fashion and travel sectors. After thoroughly analyzing the data, the following results and insights emerged.

The first part of my analysis used Likert-scale ratings, which I see as an important source of quantitative insight because they directly show participant perceptions across key UX areas like usability, visual appeal, trust, and responsiveness. Responses for each website and dimension were analyzed with descriptive statistics, including mean ratings and standard deviations. These statistics summarize both the central tendency (mean) and the variability in responses (standard deviation), providing an understanding of not only average participant sentiment but also how consistent their evaluations are. For example, a higher mean score suggests that participants generally rate that dimension more positively, and vice versa. The standard deviation indicates the level of agreement among respondents; a lower standard deviation implies less variability and more uniform opinions about that specific question. Using Excel's functions, I calculated these metrics for each website and dimension separately.

The results revealed noticeable differences in perceived UX quality, highlighting the subjective nature of the analysis. Evolve Clothing consistently received slightly higher average scores across categories, especially in visual appeal and responsiveness. Conversely, Nour Hammour generally received lower scores, indicating less favorable perceptions. Although the differences were small, they were still present and were visually represented using charts to facilitate comparison. Interestingly, in this case, Evolve Clothing, as the AI-generated website, scored higher in Navigation and Layout by 0.50. The overall mean difference between the fashion and clothing websites was 0.22 in favor of AI. Islango and Cain Travel often held intermediate positions; in some categories, Islango showed a slight

edge, while in others, it did not. An important point is that users were more engaged with Islango, with a mean difference of 0.44. At the same time, Cain Travel excelled in the dimension of functionality (smoothness), with the same value score. When it comes to the total mean score, it equaled 0.08, which is arguably a negligible amount, leading to the conclusion that the overall UX perception was nearly identical. This comparison indicates that AI-generated design (Islango) may excel in user engagement but may fall short in certain areas like credibility and functionality. These subtle differences, shown in Figure 2, suggest that neither design approach is categorically superior; they offer distinct strengths across different dimensions.

This quantification revealed relative performance and unraveled the advantages or disadvantages of AI-generated design for each UX dimension, ensuring that subtle patterns were not lost in averages alone. The columns containing the differences in scores based on user feedback serve as a good representation for these nuanced comparisons. (See figures 1 and 2)

Table 1: Comparative UX Ratings Across Dimensions: Evolve Clothing (AI) vs Nour Hammour (Human)

54		Evolve Clothing (AI)	Nour Hammour (Human)	Differences (AI vs Human)
55	Navigation	4.31	3.81	0.50
56	Layout and Structure	4.31	3.77	0.54
57	Visual appeal	4.13	3.96	0.17
58	Brand representation	4.33	4.25	0.08
59	Trust and security	3.98	4.00	-0.02
60	Credibility and Professionalism	4.13	4.23	-0.10
61	Engagement	3.92	3.81	0.10
62	Functionality: Smoothness	4.31	4.00	0.31
63	Functionality: Speed	4.15	4.10	0.04
64	Functional effectiveness	4.19	3.92	0.27
65	Return Intent	3.85	3.33	0.52
66	**Totals:**	**4.15**	**3.93**	**0.22**

Source: own work.

Table 2: Comparative UX Ratings Across Dimensions: Islango (AI) vs Cain Travel (Human)

58		Islango (AI)	Cain travel (Human)	Differences (AI vs Human)
59	Navigation	4.23	4.06	0.17
60	Layout and Structure	4.27	3.96	0.31
61	Visual appeal	3.94	3.85	0.08
62	Brand representation	4.00	3.75	0.25
63	Trust and security	3.67	3.85	-0.19
64	Credibility and Professionalism	3.79	3.94	-0.15
65	Engagement	3.92	3.48	0.44
66	Functionality: Smoothness	3.77	4.21	-0.44
67	Functionality: Speed	3.85	4.15	-0.29
68	Functional effectiveness	4.06	3.85	0.21
69	Return Intent	3.46	3.02	0.44
70	**Totals:**	**3.91**	**3.83**	**0.08**

Source: own work.

Moving forward, in addition to the Likert rating questions, participants were asked to choose which website they felt had the "best overall feel" (UX) and which had the "worst." Although it is a simple question, it reinforces the Likert findings by confirming Evolve Clothing's overall favorable perception. Analysis of these categorical questions was done by inputting participant selections into a straightforward frequency count table. The table showing "Best count" indicates that Evolve Clothing received the highest number of "best overall UX" votes, clearly making it the most favored website. Nour Hammour and Cain Travel received significantly fewer positive votes, reflecting lower participant preference. The "worst" count table revealed Nour Hammour was most frequently identified as having the worst overall feel among the four, while Evolve Clothing has the fewest negative votes. This count-based method is valid and effective for analyzing participant rankings because it directly reflects overall preferences in categorical terms. (see figure 3)

Table 3: Participant Selections of Best and Worst Overall UX per Website

Site	Best Count	Worst Count
Nour Hammour	12	19
Evolve Clothing	17	4
Cain Travel	10	15
Islango	9	10
Total	**48**	**48**

Source: own work.

Beyond the closed-ended questions, I included open-ended feedback in the survey for each website, allowing participants to freely share what they saw as positive or negative observations. I then conducted a sentiment analysis on the participants' actual free-text feedback about each website. Using Python with the pandas and NLTK libraries in VS Code, I utilized NLP technology through the sentiment analysis module VADER. Results from this analysis showed that participants favored the AI-generated websites, especially Evolve Clothing. The highest sentiment average score was for Evolve Clothing (AI), at +0.35 out of +1, with 33 positive mentions. Islango (AI) had the second-highest score, averaging +0.23 with 23 positive responses. Nour Hammour (human) had a lower average of +0.19 with 23 positive responses, and Cain Travel (human) had the lowest average at +0.15 with 18 positive mentions. These findings suggest some correlation with previous results, indicating users slightly preferred the AI-generated websites over the human-created ones. Additionally, all responses and scores were preserved to ensure transparency and reproducibility.

To further elaborate on the sentiment analysis, it is important to note that, unlike simple positive counts, this continuous metric reflects the overall emotional intensity of all responses. The summary scores represent the combined meaning of all individual VADER scores, which range from -1 to +1. Additionally, responses are considered to have different emotional intensities, such as strongly positive, mildly positive, neutral, mildly negative, and strongly negative – that is where the NLP capabilities were most useful. As a result, two websites may have the same number of positively labeled responses but different average scores if one received stronger positive wording or possibly negative responses with lower intensity. In this example, while Nour Hammour and Islandgo both have 23 positive responses, Islandgo's higher sentiment average score indicates its positive responses were generally stronger and had fewer negatives. (see figure 4)

Table 4: Summary of Sentiment Analysis Results Across Websites

Sentiment Summary table					
Website	**Positive**	**Neutral**	**Negative**	**NA / Blank**	**Avg_Score**
Cain Travel website:	18	763	12	0	0.1565
Islango website:	23	765	5	0	0.23185625
Nour Hammour website:	23	759	11	0	0.19049167
Evolve Clothing website:	33	755	5	0	0.34972708

Source: own work.

Lastly, participants were asked to share their suspicions about AI-generated websites in the final open-ended question. Of 45 valid responses, 28 expressed some level of suspicion of AI use, but interestingly, most of that suspicion was directed toward the human-created website Cain Travel. The analysis was done manually by reading and categorizing each comment individually. Two responses stood out to me: one where the participant showed no

obvious suspicion of any website, but if they had to choose, they would pick Cain Travel as most likely; and another where they mentioned Nour Hammour as the most likely because of the simulations, linking capabilities, and complex design attributed to AI.

This combination of quantitative and qualitative analysis provides complementary evidence. While Likert-scale ratings revealed subtle patterns in participants' UX perceptions across all dimensions, sentiment analysis of open-ended responses provided a deeper understanding of their subjective experiences, confirming overall trends and revealing differences between AI-generated and human-created websites.

6 DISCUSSION

This final section of the current thesis reflects on the main findings in relation to its purpose and goals, exploring their broader significance, practical applications, limitations, and directions for future research.

The comparative analysis of AI-generated, as opposed to human-created, websites revealed meaningful insights. Previously established dimensions of UX were evaluated through quantitative Likert-scale ratings, showing minor but meaningful differences between AI and human design. AI's current level of proficiency and importance are continuously assessed to enhance its applicability across various domains. This study contributes to understanding AI in website design and its impact on UX through specific dimensions such as navigation, aesthetics, trust, and functionality. The case study examined two categories of websites representing popular industries among users: fashion and travel. The four websites are real-world, live examples of different technologies, budgets, design methods, and approaches to launching and maintaining sites. The most recently launched AI-designed website, Evolve Clothing, achieved the highest overall scores in UX dimensions like navigation and appeal, suggesting that AI can produce polished and functional websites. Although the differences were slight, they were noticeable and significant enough for participants to perceive greater engagement and ease of use. Conversely, Nour Hammour highlighted potential limitations of human design in meeting user expectations. Despite the company's investment in a specialized Commerce-UI development team and renowned digital designers Anita and Lucie, participant feedback indicated that its performance did not surpass that of Evolve Clothing.

To complement the quantitative findings, the qualitative component provided additional depth to the overall insights. Using NLP-based sentiment analysis, the study offered objective, measurable interpretations of open-ended user feedback. The results showed higher average sentiment scores and more positive responses for the AI-generated websites. This indicates that participants' unstructured comments generally expressed a more favorable tone toward AI-generated websites, undeniably reinforcing the quantitative results. However, it is also important to note that there were significant numbers of neutral responses and notable negative responses across all websites. This suggests that neither AI nor human

design was universally preferred. Additionally, I included a final open-ended question asking participants if they suspected any of the websites to be AI-generated. Interestingly, the most frequently suspected website was Cain Travel, which was actually created through human effort. This leads me to conclude that highly polished and generic layouts tend to create a perception of AI-generation.

6.1 Comparison of findings with literature

The empirical findings from the survey indicate that AI-generated websites, such as Evolve Clothing and Islango, can indeed outperform or at least match their human-created counterparts across key UX areas, including visual appeal, navigation, and overall user sentiment. These results align with existing research, which highlights the increasing sophistication and practical use of AI in website design. Jongmans et al. (2022) argued that visual aesthetics directly influence usability and emotional responses, forming what they call the "usability-to-pleasure" pathway that enhances user perceptions. My results confirm this relationship, especially with Evolve Clothing, which received the highest Likert-scale ratings for layout and appeal and was most often mentioned as offering the best overall UX. Additionally, I applied NLP to open-ended participant feedback, finding that AI-generated websites produced higher sentiment scores, with Evolve Clothing showing the most positive emotional tone among the four sites. While this analytical approach contributed methodologically by quantifying qualitative responses through sentiment scoring, its scope was limited by the relatively small corpus of data. Nonetheless, it reinforced and expanded findings from studies that have focused exclusively on UX dimensions of visual appeal.

Moreover, this study offers insights that extend beyond current academic agreements. Lun et al. (2024) emphasized that clean interface design, readability, and aesthetic appeal significantly influence perceived trust and the development of emotional connections with a brand. However, an additional factor that shapes user perceptions is the suspicion that a website may be AI-generated, which can decrease users' willingness to form genuine emotional bonds with the brand's story. In some cases, the distinction between AI-generated and human-created content becomes blurred due to prevailing biases about what AI-generated content looks like. For example, Cain Travel, a human-designed website, was most often suspected of being AI-originated. This likely stemmed from its highly polished yet impersonal and bland design. This observation supports the arguments of Ghorbani (2024) and Upadhyaya (2024), who state that AI often produces clean but bland and homogeneous visual outputs for website creation. They suggest this is caused by "over-automation" from the constant, uniform use of highly precise tools for layout generation. In contexts involving trust, uniqueness, and brand storytelling, creating emotional authenticity may require more than just visual refinements. It might be necessary to deliberately make human-centered choices that counterbalance AI's algorithmic precision. Therefore, the study not only confirms previous claims about the benefits of AI in web design but also highlights new

considerations related to perception, distinctiveness, and the unintended effects of over-automation.

6.2 Limitations and outlook for further research

Although this study provides valuable insights into the impact of AI-generated versus human-created websites on UX, several limitations should be recognized. First, the sample size of 48 participants can only be sufficient for basic comparative analysis and may not fully represent the diversity of internet users in terms of digital literacy, culture, or age. Expanding demographic sampling in future research could uncover more detailed differences in perceptions and interaction patterns, especially across generational or cultural groups. However, this expansion can be technically and logistically challenging and may require larger teams, which would increase costs. Additionally, the research design includes only two industries (fashion and travel), restricting the applicability of the findings to other important sectors where user expectations, content complexity, and trust requirements can vary widely. Future studies should include a broader range of industries, particularly those where UX is a key factor in success.

Additionally, the current study relied on a one-time, cross-sectional survey approach. While the method is effective for capturing immediate reactions and comparisons, it does not account for long-term feelings, engagement, changes in behavior, and usefulness over time. Researchers with greater technical capabilities should consider the factor of repeated exposure to interfaces and include users' evolving perceptions. Another limitation is the limited transparency surrounding AI tools themselves. Specifically, Wix, as a platform, does not provide detailed information about its underlying design algorithms or the degree of human intervention in its design system. As such, it remains challenging to isolate whether participant responses were influenced purely by AI design choices or by preset templates and constraints set by humans. Future research could consider using custom-built AI-generated websites or collaborating with developers to ensure complete control over the design process.

Finally, applying sentiment analysis provided valuable insights into participant attitudes; however, its scope was limited by the small number of open-ended responses. In the future, there could be the added benefit of incorporating more advanced NLP techniques with a larger volume of responses and richer qualitative feedback, yielding deeper interpretive results. Additionally, enhancing sentiment analysis with biometric data (e.g., eye tracking, time-on-task, click patterns, etc.) could give an even more comprehensive view of UX and emotional engagement.

7 CONCLUSION

In conclusion, this research has practical implications for design practice, AI tools, and their current strengths and weaknesses. The sample of participants was moderate in size, and the

websites selected focused on commonly encountered industries; they do not represent outcomes for other sectors or specific examples but contribute to overall perception. Additionally, it confirms that AI-driven design can sometimes produce competitive UX results. It supports the idea that AI design tools are rapidly maturing and capable of creating high-quality, user-friendly, and aesthetically appealing websites that compete with traditional design methods. At the same time, the mixed results in some areas and sectors underscore how human expertise remains crucial in interpreting complex, domain-specific needs and adding emotional nuance that automation alone still cannot provide. Companies should view AI tools as powerful assistants rather than complete replacements, advocating for a hybrid approach that enhances both speed and creativity for better outcomes. Despite these valuable insights, the study has limitations. The sample included 48 participants, and this may have been influenced by industry context and brand familiarity, which could introduce subjectivity and affect human judgments that are not directly observable.

Future research could expand participant samples, test across more industries, and explore evolving AI design tools beyond Wix, as was the case in the current study. Incorporating observational user testing, eye tracking, and other advanced methods could yield more detailed data on user responses to AI versus human design. Overall, this study provided empirical evidence to the ongoing discussion of AI's role in human activities, particularly in the case of website design. It showed that AI can play a significant role in creating designs that meet or even surpass human-designed alternatives in key UX areas, while also emphasizing the ongoing need for human oversight. As AI design tools improve, it is crucial to understand how best to integrate them with human talent to deliver exceptional, user-centered digital experiences.

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APPENDICES

Appendix 1: Screenshots of Website Attribution

Figure 5 A

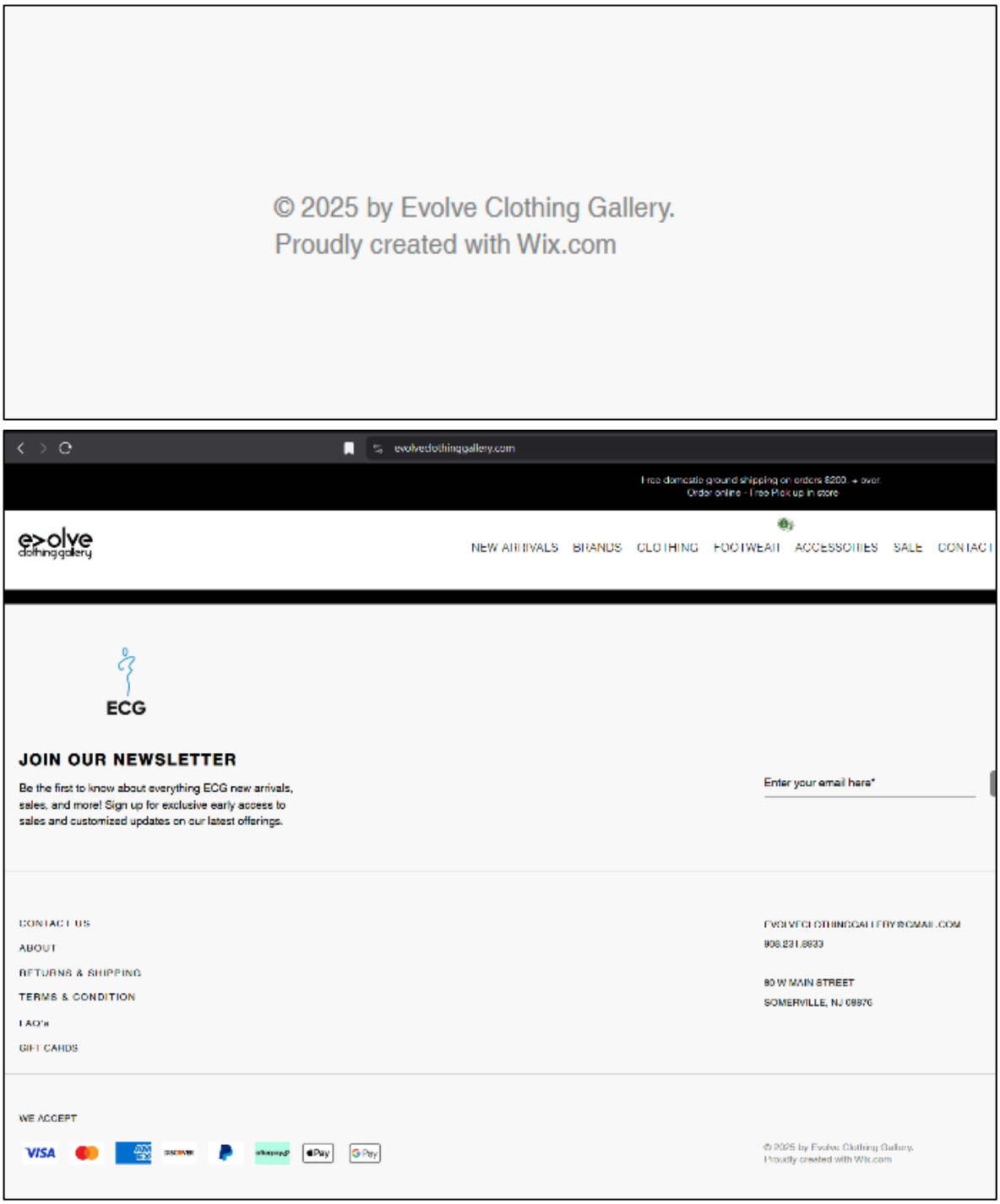


Figure 6 A

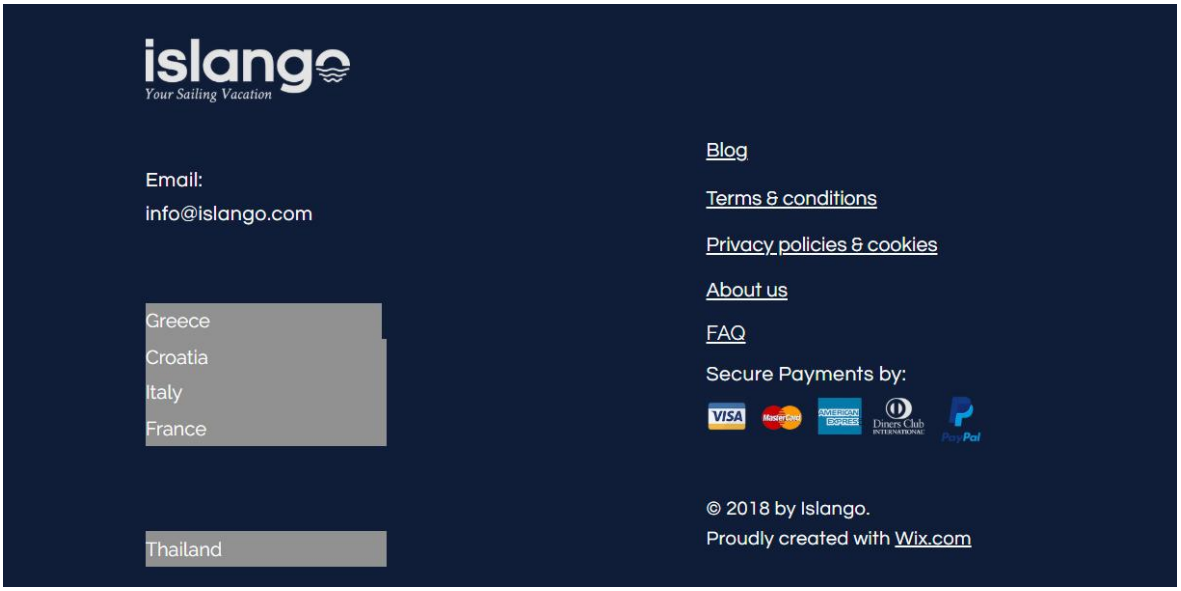
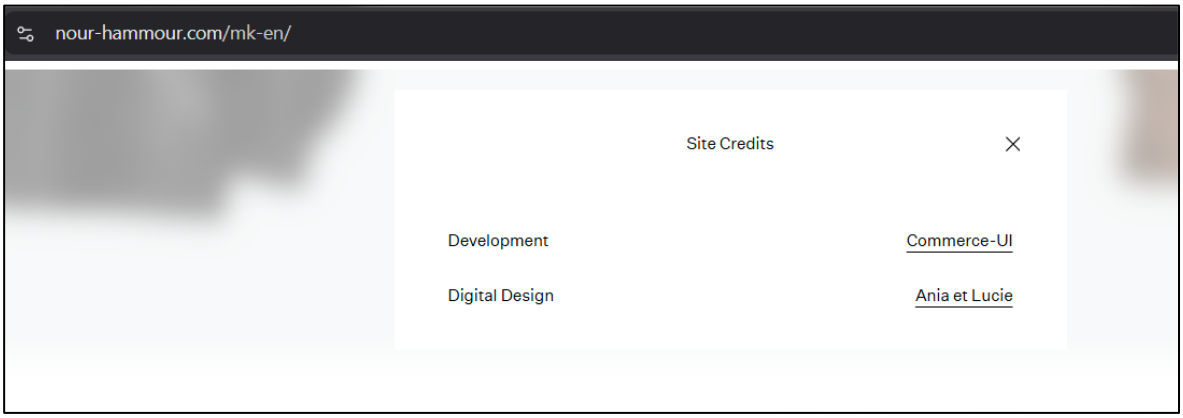


Figure 7 A



Appendix 2: Case Study Excerpts and links

Cain Travel: Blennd. (2024, January 19). Case study: Cain Travel Agency Web Development | Blennd. https://blennd.com/work/cain-travel-agency-website-development/

Nour Hammour: https://commerce-ui.com/work/nour-hammour-hydrogen-shopify
https://aniaetlucie.com/projects/nour-hammour

Appendix 3: Questionnaire

Website Experience Survey

Hello! My name is Igor Martinović, and I am a Master's student in Business Informatics at the University of Ljubljana.

This survey is part of my thesis research and aims to better understand how users perceive and interact with different types of websites.

Your responses are anonymous and will be used solely for academic purposes. Thank you for your time and contribution!

You will be interacting with four different websites. Please spend at least 2 minutes exploring each website thoroughly. Try to complete tasks you would normally perform, such as finding specific information, navigating menus, reading content, or making hypothetical purchases. The websites you will be interacting with are:

1. https://www.evolveclothinggallery.com/
2. https://nour-hammour.com/mk-en/
3. https://caintravel.com/
4. https://www.islango.com/

After interacting with each website, answer the following questions thoughtfully and honestly.

* Indicates required question

Participant Context

1. Which device are you using for this survey? *

Mark only one oval.

- ◯ Desktop/Laptop
- ◯ Tablet
- ◯ Smartphone

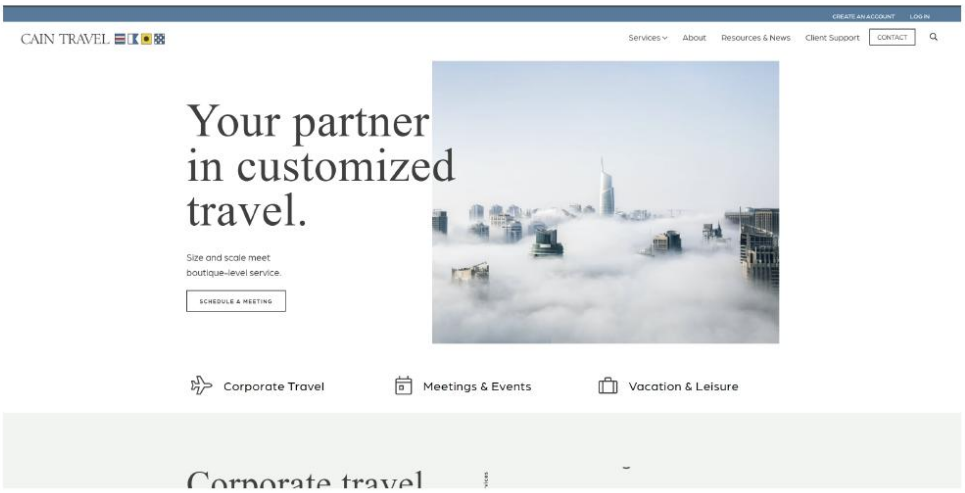
2. How confident are you in general in using websites? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very confident

Cain Travel

Answer the following questions on a scale of 1-5;



3. How easy was it to navigate the website of Cain Travel? *

Mark only one oval.

	1	2	3	4	5	
Diff	◯	◯	◯	◯	◯	Very easy

4. How intuitive was the layout and structure? *

Mark only one oval.

	1	2	3	4	5	
I cc	◯	◯	◯	◯	◯	Very intuitive

5. How visually appealing was the design of Cain's website? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Excellent

6. How well did the visual elements represent the brand of Cain travel? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Excellent

7. How secure and trustworthy did the website feel? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very secure and trustworthy

8. How credible and professional did the content appear? *

Mark only one oval.

	1	2	3	4	5	
Not credible	◯	◯	◯	◯	◯	Very credible and professional

9. How engaged did you feel while interacting with the website? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very engaged

10. How smoothly did the website function? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very smooth

11. How quickly did the website respond to your actions? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Very Fast

12. How effective was the website in helping you find what you were looking for? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very effective

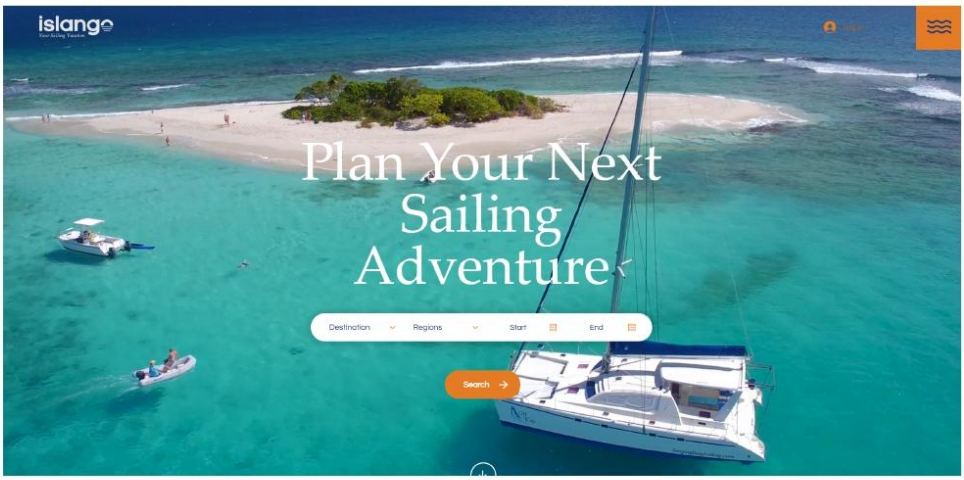
13. How likely are you to use the website again? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very likely

Islango

Answer the following questions on a scale of 1-5;



14. How easy was it to navigate the website of Islango? *

Mark only one oval.

	1	2	3	4	5	
Diff	◯	◯	◯	◯	◯	Very easy

15. How intuitive was the layout and structure? *

Mark only one oval.

	1	2	3	4	5	
I cc	◯	◯	◯	◯	◯	Very intuitive

16. How visually appealing was the design of Islango's website? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Excellent

17. How well did the visual elements represent the brand of Islango? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Excellent

18. How secure and trustworthy did the website feel? *

Mark only one oval.

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Very secure and trustworthy

19. How credible and professional did the content appear? *

Mark only one oval.

	1	2	3	4	5	
Not credible	◯	◯	◯	◯	◯	Very credible and professional

20. How engaged did you feel while interacting with the website? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very engaged

21. How smoothly did the website function? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very smooth

22. How quickly did the website respond to your actions? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Very fast

23. How effective was the website in helping you find what you were looking for? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very effective

24. How likely are you to use the website again? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very likely

Nour Hammour

Answer the following questions on a scale of 1-5;

25. How easy was it to navigate the website of Nour Hammour? *

Mark only one oval.

	1	2	3	4	5	
Diff	◯	◯	◯	◯	◯	Very easy

26. How intuitive was the layout and structure? *

Mark only one oval.

	1	2	3	4	5	
I cc	◯	◯	◯	◯	◯	Very intuitive

27. How visually appealing was the design of Nour Hammour's website?

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Excellent

28. How well did the visual elements represent the brand of Nour Hammour? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Excellent

29. How secure and trustworthy did the website feel? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very secure and trustworthy

30. How credible and professional did the content appear? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very credible and professional

31. How engaged did you feel while interacting with the website? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very engaged

32. How smoothly did the website function? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very smooth

33. How quickly did the website respond to your actions? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Very fast

34. How effective was the website in helping you find what you were looking for? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very effective

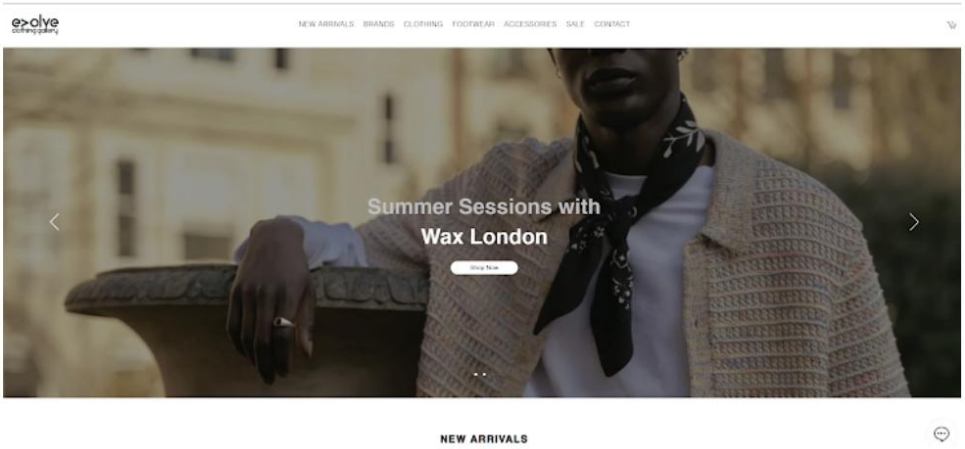
35. How likely are you to use the website again? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very likely

Evolve Clothing Gallery

Answer the following questions on a scale of 1-5;



36. How easy was it to navigate the website of Evolve Clothing? *

Mark only one oval.

	1	2	3	4	5	
Diff	◯	◯	◯	◯	◯	Very easy

37. How intuitive was the layout and structure? *

Mark only one oval.

	1	2	3	4	5	
I cc	◯	◯	◯	◯	◯	Very intuitive

38. How visually appealing was the design of Evolve Clothing's website?

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Excellent

39. How well did the visual elements represent the brand of Evolve Clothing? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Excellent

40. How secure and trustworthy did the website feel? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very secure and trustworthy

41. How credible and professional did the content appear? *

Mark only one oval.

	1	2	3	4	5	
Not credible	◯	◯	◯	◯	◯	Very credible and professional

42. How engaged did you feel while interacting with the website? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very engaged

43. How smoothly did the website function? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very smooth

44. How quickly did the website respond to your actions? *

Mark only one oval.

	1	2	3	4	5	
Ver	◯	◯	◯	◯	◯	Very fast

45. How effective was the website in helping you find what you were looking for? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very effective

46. How likely are you to use the website again? *

Mark only one oval.

	1	2	3	4	5	
Not	◯	◯	◯	◯	◯	Very likely

Multiple choice questions

47. Which of the four websites provided the best overall user experience (e.g., design, ease of use, trust, and engagement)? *

Mark only one oval.

- ◯ Cain Travel
- ◯ Islango
- ◯ Nour Hammour
- ◯ Evolve Clothing

48. Which website had the worst feel out of the four? *

Mark only one oval.

- ◯ Cain Travel
- ◯ Islango
- ◯ Nour Hammour
- ◯ Evolve Clothing

Open ended questions

Please describe in short sentences what stood out to you in a positive or negative way for each of the websites below:

49. Cain Travel website: *

_____

50. Islango website: *

_____

51. Nour Hammour website: *

_____

52. Evolve Clothing website: *

_____

53. Do you believe any of these websites were created using AI? *
If yes, which one(s) and why?

Thank you for participating! Your input is highly appreciated and will contribute to my research as part of my master's thesis.