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Application of AI in the User Interface Design Process

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Abstract

Aim: The objective of the article is to analyse the impact of artificial intelligence (AI) on the quality, efficiency and cost of user interface (UI) design through a systematic literature review. Notwithstanding the burgeoning interest in AI across diverse disciplines, there persists a dearth of systematised research addressing its tangible impact on UI design. The article aims to identify and analyse key aspects of this impact based on available academic publications and industry reports.

Methodology: The study is based on a systematic literature review, including academic publications and industry reports from 2018-2024. The analysis considers the use of AI in UI design, process automation, impact on interface quality and usability, and implementation costs. Key sources include Google Scholar, ResearchGate, IEEE Xplore and Forrester and Gartner reports. It should be noted that the study is limited to the analysis of available literature in Polish and English, which is one of the limitations of the presented review.

Results: The analysis of the literature indicates that AI contributes to the quality of user interfaces by reducing errors, analysing usage patterns and potentially automatically adapting UIs to user preferences. AI tools, such as generative design models, can speed up the UI development process and automate repetitive tasks. The results of the review also suggest that while AI has the potential to reduce design costs, it requires investment in tools and training of professionals, and its impact on costs is not clear at the current stage of technology development.

Implications and recommendations: The results of the literature review suggest that the use of AI in UI design can increase design efficiency and potentially improve product quality. Companies should consider both the potential benefits and challenges of implementing AI, such as ethical issues and the need for ongoing competence development. Further empirical research into the actual impact of AI on designers' creativity and long-term financial efficiency is recommended.

Originality/value: The article provides a structured analysis of the use of AI in UI design based on a literature review, filling an existing research gap by synthesising current trends and potential future directions of AI technology in the context of user interfaces. The conclusions of the review may be of value to both researchers and practitioners in the UX/UI industry seeking up-to-date knowledge on the application of AI in the field.

Keywords: artificial intelligence, user interface, UX/UI, automation, generative AI

1. Introduction

All elements of the world that were not created by nature were designed by man (Norman, 2018, p. 22). In this age of technological advances, more and more elements of the existing world need their own unique design. All designed solutions should focus on presenting this to the potential user in the best possible way, so that he or she is curious about it and at the same time understands all the functionalities presented. It is also undeniable that design is also responsible for the sales effectiveness of a product. A report by Forrester (2022) indicates that companies' investment in design can increase revenue by around 20-30%, and in response to a survey, 84% of the managers surveyed said that high-quality product design is the key to successful business. User interfaces (UI) are part of the field of design, clarifying the principles of aesthetics, intuitive customer experience or visual communication, which is of great importance for the comfort of the potential customer using the product. The most well-known industry using UI design, which is the focus of the article, is the thriving and one of the fastest growing industries – IT. As Chynał et al. (2018) note, the area of designing correct user interfaces is still a niche and often neglected part of product development, despite growing end-user expectations. Artificial intelligence (AI), which dates back to the early 1950s, where the term was first used at the Dartmouth conference, can help in this area (Boden, 2020, p. 30). Over many years, the development of AI progressed gradually, going through the first logic systems, where the most popular to this day is Logic Theorist,[1] or interactive interfaces, an example of which is the ELIZA programme.[2] All these experiences were the foundations of today's more perfect generative AI. A particular leap in global popularity occurred in November 2022, when Chat GPT was made available to the public, and by August 2023, it had already surpassed one of the most popular browsers, Bing, to become the most popular chatbot in the world reaching as many as 140 million visitors by the end of 2024. In the context of user interface design, artificial intelligence can be used to improve the quality of design, as well as to speed up all the processes involved and reduce their costs. Given the rapid development of AI and upcoming trends, research gaps can still be seen that include comprehensive analyses of the impact of artificial intelligence on interface design processes. Currently, most of the available research misses the broader context of AI's impact on the feel and quality of human-computer interaction (HCI), which would summarise current solutions and provide direction for further development.

The main objective of this paper is to analyse, based on a systematic literature review, the impact of artificial intelligence on the quality, efficiency and cost of user interface design. Despite the growing interest in AI in various fields, there is still a lack of comprehensive summaries and analyses of the available research on its application and impact on the UI design process. Therefore, this paper attempts to answer the following research questions based on the literature analysis:

- **RQ1**: how does artificial intelligence affect the number of errors and the quality of user interfaces created?
- **RQ2**: according to the publications analysed, does artificial intelligence speed up the work of designers, especially in the context of automating repetitive tasks?
- **RQ3**: does the use of artificial intelligence help to reduce the cost of user interface design?

[1] The first automated programme, written in 1956 and recognised as the first artificial intelligence programme.

[2] A simulation created in 1966 by Joseph Weizenbaum that generated responses based on previous conversations conducted in the programme.

In section 2, the literature review is presented along with the identification of the research gap that was used to formulate the above questions. Section 3 discusses the methodology of the data collection necessary for the analysis in section 4. The article ends with conclusions and a discussion of the research findings.

2. Literature Review

2.1. Artificial Intelligence in User Interface Design

As part of the rapidly developing artificial intelligence, it is increasingly being combined with various areas that need to significantly reduce costs and speed up work. The results of the survey conducted by Bertão and Joo (2021) indicate that around 70% of UX/UI designers surveyed intend to use AI to speed up and automate their system design tasks, effectively allowing them to focus on more creative aspects of their work. According to Dam et al. (2019), artificial intelligence stands out for its potential to lead to increased productivity as well as efficiency in project delivery. Task automation, risk analysis support, or decision-making are just some of the many advantages that AI offers. Designing user interfaces is creative work that has to be based on many variables, such as the behaviour, ethnicity, age or limitations of the target group, for example. Working on huge data models is very difficult, time-consuming and costly. According to a recent study by Dell'Acqua et al. (2023), generative AI is able to improve performance by more than 40% and increase speed by more than 25%, which allows for more than 12% more tasks to be completed and significantly boosts overall productivity.

In the literature (up to 2024), one can find plenty of examples of the use of artificial intelligence in software supporting the work of user interface design. Some of the more popular platforms mentioned that utilise AI in this area include Canva, DALL-E, and MidJourney. With such tools, designers not only gain more creative possibilities, but also an easy, intuitive way to use applications. The market for applications that use artificial intelligence in the context of interface design is constantly growing. We can already see that leading companies such as Adobe and Google, which have a huge market share, are focusing on the new trend of using AI in apps. An example of an application coming from Adobe, is Figma AI which, thanks to the implementation of artificial intelligence, is easy and fast to design the user interface in different screen resolutions, which is very important in terms of the scalability of the designed application for different devices, from large screen resolutions to implementation on mobile devices. In addition, the app is integrated with all the supporting tools from Adobe, such as the Adobe Sensei platform, which, with the help of AI, can generate images that will delight potential customers, and its Adobe Firefly extension for converting generative text into images. Responding to the growing trend of using artificial intelligence is the Flutter Flow tool, originating from Google. It is such an innovative tool that it allows the user interface to be designed at the same time, along with the programming of all functionalities. In addition, the generated views and, at the same time, the entire application can be easily adapted to a given screen resolution or platform. Currently, Flutter Flow allows applications to be generated in iOS, Android, Windows and Linux environments. Google continues to develop the Flutter project, adding new AI functionality, the most recent example being the integration of Vertex AI for generative audio and video processing, which could facilitate the integration of virtual assistants into mobile devices.

2.2. Identification of a Research Gap

The rapidly expanding field of artificial intelligence implies an increasing amount of new research into its use. However, despite the growing knowledge base, there are still areas for deeper exploration. Currently, most of the available information on artificial intelligence in user interface design in academic publications (Schmidt et al., 2021; Stige et al., 2023; Sunitha et al., 2024) focuses mainly on

theoretical approaches to the topic, neglecting the broader context of the practical use of the available tools in design processes and their impact on the final user experience. Another important aspect is the lack of a comprehensive summary of existing developments and research to better understand the long-term directions of artificial intelligence in the context of user experience design. Based on a review of the available scientific literature, significant research gaps and areas for further analysis were identified, which form the basis for answering the key research questions (RQ1, RQ2, RQ3).

3. Methodology

The methodology used in this paper is based on a systematic review of the literature. This method will present the collected data in a synthetic way in the field of artificial intelligence and user interface design. The review is based on identifying potential future trends, existing problems and the benefits of using generative artificial intelligence in the interface design. Table 1 presents the criteria for selecting the literature sources on which the review was based.

Table 1. Criteria for selection of literature sources

Data sources	Google Scholar, Research Gate, arXiv, DOAJ, IEEE Xplore, Forrester and Gartner Reports
Publication topics	Application of artificial intelligence in user interface design
Publication interval (years)	2018-2024
Language of publication	Polish, English
Type of publication	scientific articles, post-conference articles

Source: own elaboration.

The literature review followed a structured step-by-step process to facilitate the selection of potentially most valuable material. This process is illustrated in Figure 1.

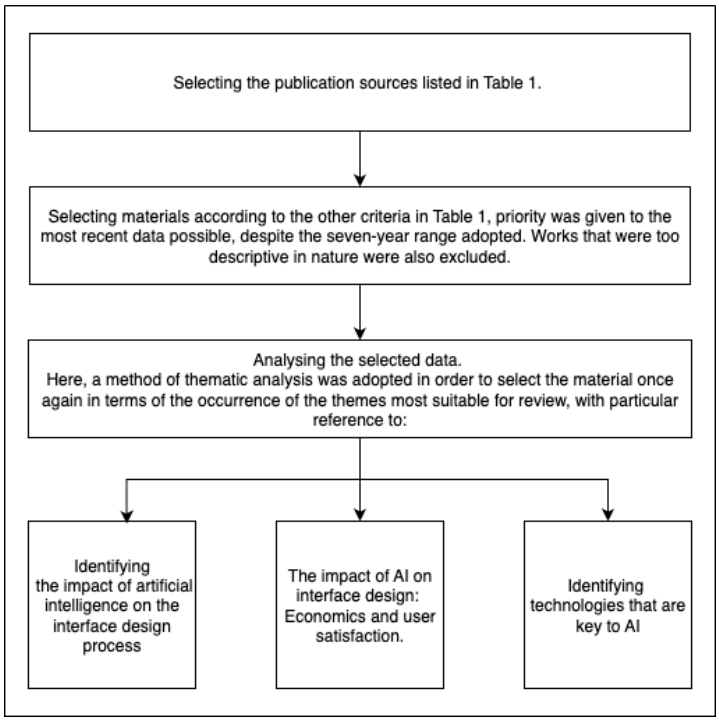

Fig. 1. Literature selection process

Source: own elaboration.

It is also worth noting that the selection criteria also have their limitations and drawbacks. Table 2 lists the most noticeable barriers that may weigh on material selection.

Table 2. Perceived barriers to material selection in the literature review

Barrier	Justification
Source	The most popular science sources have been selected. It is possible that valuable material has been omitted due to the failure to include other sources.
Language	The selection of materials included only publications in two languages, which closes the way to reaching materials that comply with the other criteria in Table 1.
Availability	It is possible to omit studies that have not yet been published.
Area	The thematic selection may have significantly reduced the materials, with particular attention paid to limiting scientific publications that are too generally thematic.

Source: own elaboration.

Despite the limitations that have arisen, which may affect the results of the study, it is worth noting that the systematic review still provides many valuable findings on which to build when conducting further studies. It is also a fact that it is not possible to conduct a literature review taking into account all the variables that occur, however, perhaps in the future artificial intelligence will be developed enough to automate part of the search and to speed up the review process through tools that will be integrated with it. Section 4 will present the results of the research conducted on the basis of the literature review, taking into account the research questions.

4. Research Results

The results of the research refer to the thematic analysis of the literature carried out, which explored the links between artificial intelligence and user interface design. The analysis of previous research has structured the knowledge on the topic and verified the three research questions posed (RQ1, RQ2, RQ3) in section 1. The valuable information that was obtained during the analysis presented how artificial intelligence can be used to automate tasks, support design processes, or reduce the cost of producing a design, which can prove to be the key to success for many companies looking to reduce costs, decrease production time, or keep up with contemporary trends. The current review focuses on the use of artificial intelligence in user interface design, however, it also presents tangible benefits for other industries. Sections 4.1, 4.2 and 4.3 present the key answers to the questions posed, along with real-life examples of the use of artificial intelligence in user interface design companies.

4.1. (RQ1) How Does Artificial Intelligence Affect the Number of Errors and the Quality of User Interfaces Created?

The analysis conducted confirms that artificial intelligence contributes significantly to improving the quality of the created user interfaces, as well as to reducing the number of generated errors. Nevertheless, it also comes with some challenges and limitations. Table 3 shows the most important summary of the answers to the research question on the impact of artificial intelligence on the quality of user interfaces and the number of errors made.

In summary, artificial intelligence is well and truly able to improve the quality of user interfaces as well as to reduce the number of errors that arise and even to respond to communication from users, supporting a solution dedicated to even the smallest audiences. However, it is also worth noting that there are limitations associated with it. Concerns such as the high costs of implementing artificial intelligence, maintaining data security or integrating it with the systems in use (Ormaza Cevallos et al., 2024) can lead to legitimate doubts from both business and customers.

Table 3. Summary of responses to question RQ1

Aspect	Description
AI tools in UI design	Artificial intelligence offers a range of tools for predicting and solving problems in user interface design. The most popular approach is deep learning to reduce errors and tailor the interface to a specific user group (Li et al., 2024; Yang et al., 2020).
Improving usability and user experience	AI contributes to improving the usability of human-computer interaction and user experience. An example is the Bing search engine, where AI has improved user experience and personalisation of search results, introducing features such as split-screen layouts and automatic field prompting (Peischel, 2024). In 2023, Microsoft invested $13 million in OpenAI, highlighting the huge potential of this technology.
Analysis of large data sets	AI analyses big data models, which is helpful in exploring user experience metrics. This helps reduce the barrier to entry in the digital world and enables the creation of more intuitive interfaces. AI systems also support the analysis of user feedback, which allows designs to be effectively tailored to the requirements of narrow social groups (Kim et al., 2020; Li et al., 2024).

Source: own elaboration.

4.2. (RQ2) According to the Publications Analysed, Does Artificial Intelligence Speed up the Work of Designers, Especially in the Context of Automating Repetitive Tasks?

The analysis of literature indicates that artificial intelligence significantly speeds up the process of producing user interfaces, and that the automation of systematic tasks results in shorter design times. However, as with the previous questions, there are also some limitations and challenges that need to be addressed. Table 4 shows the synthesised knowledge for answering the research question on the impact of artificial intelligence on user interface production time and process automation.

Table 4. Summary of responses to question RQ2

Aspect	Description
Automate work and increase available time	AI-enabled tools such as machine learning (ML) and deep learning (DL) algorithms are effectively used to automate work, resulting in more available time for more creative and imaginative tasks (Bagnato, 2023).
Generation of interfaces and application code	AI, through implementation in programming support tools, is able not only to design user interfaces, but also to generate initial application code. This saves time for both designers and developers (Jadhav & Gholve, 2024).
Rapid response to user feedback	In the interface design process, AI, with its long-term memory (LSTM) and generative overlay networks (GANs), enables rapid response and prototyping of interfaces using the original data models (Choudhury, 2022).
Improved personalisation of designs	AI integrated with the tools used by interface designers offers new design variations and enhancements that can provide information about consumers and allow for better personalisation at an early stage (Adeleye, 2024).
Analysis of potential problems in projects	Advanced AI algorithms can analyse the design for inaccuracies in requirements and potential problems, providing valuable information at an early stage of the project (Dzhusupova et al., 2023).

Source: own elaboration.

In summary, the results of the analysis answer affirmatively to the question posed that artificial intelligence significantly speeds up the work of interface designers and other professions. In many cases, automation and increased productivity are associated with improved solution quality, as the time saved can be used for more creative, less error-prone work aimed at delivering greater product value and further development. However, the challenges and potential problems arising from task automation must also be considered. Artificial intelligence is still at an early stage in its development, but it is already raising questions and concerns, especially in the context of its use in computer-human

interactions in the interface design process. The integration of artificial intelligence into designers' tools also implies the need to establish new ethical rules, improve professional skills and identify potential risks, including those related to security (Vasiliu, 2024).

4.3. (RQ3) Does the Use of Artificial Intelligence Help to Reduce the Cost of User Interface Design?

Artificial intelligence significantly impacts the cost of user interface design development. Assisting designers by automating and optimising various design stages in many cases shortens the release cycle. Nevertheless, at this stage, it is not possible to conclude unequivocally that AI significantly reduces development costs. The full analysis takes into account both the process of designing the solutions and the handling of the tools by skilled personnel, as well as the sheer cost of implementing these solutions. Table 5 summarises the conclusions of the thematic analysis, which is also an inconclusive answer to the question.

Table 5. Summary of responses to question RQ3

Aspect	Description
Transforming prototypes into finished code	Artificial intelligence integrated into interface design tools can transform a mock-up prototype into finished code, significantly speeding up development work and reducing the cost of producing a given interface (Dave et al., 2021).
Identification of dependencies and problems in projects	Thanks to their deep learning capabilities, artificial intelligence algorithms can identify any dependencies and problems arising from ill-conceived design at the outset, reducing the cost of potential redesign (Stige et al., 2023).
Scalability of projects	Artificial intelligence-supported tools support the scalability processes of interface design. Artificial intelligence, through deep learning algorithms, produces increasingly creative solutions over time, reducing the cost of user-centred design (Verganti et al., 2020).

Source: own elaboration.

Generalising the above, it is noticeable that artificial intelligence has a significant impact on the cost of producing a project. On the one hand, collecting all its advantages, we can succumb to the statement that it is an ideal tool that minimises costs. On the other hand, other aspects affecting the integration of artificial intelligence in tools are also noteworthy. The first noticeable fact is the price of the available tools, which can become unprofitable in the case of small companies; it is worth adding that the tool itself will not be sufficient to build the interface design, and skilled personnel are also needed, which leads to the assumption that the average cost of training employees can be high. Most importantly, however, nowadays artificial intelligence is not yet that accurate, so despite the use of the right tools, the manual work of designers will not be completely eliminated. The perspective is important. Each situation requires individual decisions to meet the needs of the project. Looking at it objectively, however, there is a great opportunity in reducing costs using artificial technology, especially in the long term, where the profit will outweigh the costs.

5. Discussion and Conclusions

The results of the research clearly show that artificial intelligence has a positive impact on improving the quality of user interfaces, including scalability, accessibility and intuitiveness. Deep learning, or machine learning algorithms, allow designers to accurately design interfaces for specific user groups, as well as quickly incorporate corrections and suggestions for improvement. All of this leads to friendly, seamless user interaction with the designed interfaces, reducing the barrier created between the digital world and the real world (Li et al., 2024). In addition, all automation tools that use artificial intelligence contribute significantly to helping designers focus on the most valuable work they need to

do (Yang et al., 2020). Despite the fact that implementing artificial intelligence is not always cost-effective, it should be seen as an investment for the future. Every day, new tools are being developed that are more efficient or tailored to the needs of customers. The assistance offered by artificial intelligence is the help that evolves into an autonomous virtual designer. However, it is important to be aware of the risks that exist when using AI. Currently, the solutions offered by AI must be checked very carefully because they may contain problems such as bias, accuracy, schematism or providing false data (Bagnato, 2023).

While answering the research questions, research gaps requiring further research were also identified. Below are some questions on which further research can focus.

- It is important to consider how AI tools, affect the creativity of designers. Does it only come to support and accelerate the design process, or does it obliterate the character of the design?
- Has there been a positive impact on financial performance as a result of the implementation of artificial intelligence, over a larger period?
- What impact does artificial intelligence have on legal breaches or ethical problems? How can this be prevented?

The literature review carried out helped to answer the research questions regarding the impact of artificial intelligence on the quality of user interfaces, the efficiency of design processes and the cost of producing them. The analysis showed that artificial intelligence can significantly improve the quality of interfaces and speed up design processes, which can lead to cost reductions, provided several key factors are taken into account. Firstly, it is important to bear in mind that the introduction of AI does not mean a complete replacement of human labour. AI tools should serve as a support to designers, not as a stand-alone solution. Secondly, artificial intelligence is not the only driver of financial success – while it can support it, a key role is played by managers, who must skilfully integrate these technologies into organisational processes. Finally, decisions regarding the use of AI should not be made solely on the basis of trends but should be based on sound analysis and tailored to the individual needs of the company. In conclusion – the analysis carried out provided important information to better understand the potential and limitations of artificial intelligence in user interface design.

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Zastosowanie AI w procesie projektowania interfejsu użytkownika

Streszczenie

Cel: Celem tego artykułu jest analiza wpływu sztucznej inteligencji (AI) na jakość, efektywność i koszty projektowania interfejsów użytkownika (UI) poprzez systematyczny przegląd literatury. Pomimo rosnącego zainteresowania AI w różnych dziedzinach brakuje usystematyzowanych badań dotyczących jej rzeczywistego wpływu na projektowanie UI. Niniejszy artykuł ma na celu zidentyfikowanie i przeanalizowanie kluczowych aspektów tego wpływu na podstawie dostępnych publikacji naukowych i raportów branżowych.

Metodyka: Przeprowadzone badanie opiera się na systematycznym przeglądzie literatury, obejmującym publikacje naukowe i raporty branżowe z lat 2018-2024. Analiza uwzględnia zastosowanie AI w projektowaniu UI, automatyzację procesów, wpływ na jakość i użyteczność interfejsów oraz koszty wdrożenia. Kluczowe źródła obejmują Google Scholar, ResearchGate, IEEE Xplore oraz raporty Forrester i Gartner. Należy zaznaczyć, że badanie ogranicza się do analizy dostępnej literatury w języku polskim i angielskim, co stanowi jedno z ograniczeń prezentowanego przeglądu.

Wyniki: Analiza literatury wskazuje, że AI przyczynia się do poprawy jakości interfejsów użytkownika poprzez redukcję błędów, analizę wzorców użytkowania i potencjalne automatyczne dostosowanie UI do preferencji użytkowników. Narzędzia AI, takie jak generatywne modele projektowe, mogą przyspieszać proces tworzenia UI oraz automatyzować powtarzalne zadania. Wyniki przeglądu sugerują również, że choć AI ma potencjał do obniżenia kosztów projektowania, wymaga inwestycji w narzędzia i szkolenie specjalistów, a jej wpływ na koszty nie jest jednoznaczny na obecnym etapie rozwoju technologii.

Implikacje i rekomendacje: Wyniki przeglądu literatury sugerują, że wykorzystanie AI w projektowaniu UI może zwiększyć wydajność projektowania i poprawić jakość produktów. Firmy powinny rozważyć zarówno potencjalne korzyści, jak i wyzwania związane z implementacją AI, takie jak kwestie etyczne i konieczność ciągłego rozwoju kompetencji. Rekomenduje się dalsze badania empiryczne nad rzeczywistym wpływem AI na kreatywność projektantów oraz długoterminową efektywność finansową.

Oryginalność/wartość: Artykuł dostarcza usystematyzowanej analizy wykorzystania AI w projektowaniu UI na podstawie przeglądu literatury, wypełniając istniejącą lukę badawczą przez syntetyczne przedstawienie obecnych trendów i potencjalnych przyszłych kierunków rozwoju technologii AI w kontekście interfejsów użytkownika. Wnioski z przeglądu mogą być wartościowe zarówno dla badaczy, jak i dla praktyków z branży UX/UI, poszukujących aktualnej wiedzy na temat zastosowania AI w tej dziedzinie.

Słowa kluczowe: sztuczna inteligencja, interfejs użytkownika, UX/UI, automatyzacja, generatywne AI