IMPACT OF AI ON UI/UX DESIGN AND RESEARCH: LEVERAGING PROCESSES AND SHAPING THE FUTURE OF USER EXPERIENCE

Maya Stoeva

Abstract. *The rapid evolution of artificial intelligence (AI) is profoundly reshaping the domain of user interface and user experience (UI/UX) design as well as the accompanying research practices. This paper investigates how AI-powered methods and tools are redefining the ways designers conceptualize, develop, and evaluate user experiences. Through an analysis of the current state of UI/UX design and its growing integration with technologies such as generative models, predictive analytics, and automated usability testing, the study reveals the emerging opportunities and challenges within this evolving discipline. It emphasizes how AI enhances designers' capabilities across key stages of the process – ideation, prototyping, user research, and assessment – by supporting more data-driven and adaptive decision-making. Additionally, the paper considers the ethical, creative, and methodological dimensions of human-AI collaboration in design. Finally, it outlines possible directions for future UI/UX research, emphasizing the importance of interdisciplinary approaches that align technological innovation with the core values of human-centered design.*

Key words: Artificial Intelligence (AI), UI/UX Design, Agent–Computer Interaction (ACI), Model Context Protocol (MCP), Generative Design, Human-AI Collaboration.

Introduction

AI adoption in the design industry has increased at an unprecedented pace. Large Language Models (LLMs), generative engines, predictive analytics, and autonomous agent systems are deeply embedded in design workflows that once relied on manual, sequential processes [1, 2]. While early discourse framed AI primarily as a productivity accelerator, contemporary research and industry practice [3] reveal a more profound paradigm shift: AI is fundamentally transforming the ontology of UX/UI design by creating adaptive, proactive, and emotionally aware ecosystems [4]. By 2026, user experience (UX) is expected to evolve beyond screen-centric interfaces into multimodal, distributed environments that incorporate voice, spatial computing, invisible interactions, and agentic behaviors [5]. Designers now assume new responsibilities [6, 7]: orchestrating human – AI collaboration, shaping ethical guardrails, modeling

agent capabilities, and designing experiences that coexist across devices and intelligent systems.

This paper contributes to the UI/UX research field by (1) synthesizing recent developments in AI-driven design and research into a unified conceptual framework, (2) extending existing UX models by incorporating AI agents as distinct users within the Agent–Computer Interaction paradigm, and (3) articulating the evolving role of designers in UX 3.0 as orchestrators of human-AI collaboration, ethical governance, and multimodal experience design. Unlike purely technical or tool-focused studies, this work emphasizes the systemic, ethical, and methodological implications of AI integration in UX practice.

Background

From HCI to AI-Driven UX: Traditional Human-Computer Interaction (HCI) has primarily focused on direct manipulation, cognitive load, and interface usability [8]. However, the emergence of intelligent systems has expanded these foundational concepts to include adaptivity, personalization, prediction, and explainability [9]. In this context, interaction is no longer a simple exchange; it has evolved into a collaboration with dynamic, data-driven systems [10]. As a result, AI-driven user experience (UX) positions designers not only as creators of interfaces but also as architects of intelligent behavior, trust, and system responsiveness.

AI Tools and the changing role of designers: The design landscape is being reshaped by a comprehensive ecosystem of AI technologies rather than isolated tools. This ecosystem comprises Large Language Models (LLMs) for ideation and synthesis, multimodal generative engines for visual asset creation, and automated coding assistants that bridge the gap between design and implementation [11]. Consequently, routine tasks such as layout exploration, component generation, and research synthesis are increasingly automated. This shift allows designers to transition from manual execution to high-level orchestration, focusing on system logic and strategy rather than repetitive pixel-crafting [12] (Fig. 1).

Automated usability and agent-based interaction: AI-driven usability testing, which includes gaze prediction, accessibility audits, and behavioral modeling, enhances precision and efficiency in evaluations [13, 14]. Recent studies on agentic systems show that autonomous agents can navigate interfaces, use tools, and perform tasks on behalf of users [15]. This development lays the groundwork for **Agent–Computer Interaction (ACI)**, where AI agents actively participate in the interaction loop.

The Model Context Protocol (MCP) in AI-Driven UX: As AI agents increasingly interact with external tools, data sources, and interfaces, the Model Context Protocol (MCP) introduces a standardized framework for defining the tools that models can access, outlining structured capabilities, and establishing safe execution boundaries [16]. From a user experience perspective, MCP clarifies the actions that an agent can perform, ensures that these actions are auditable and predictable, and enhances user trust by making the agent's behavior more transparent. Additionally, MCP improves interoperability across the UX ecosystem, facilitating consistent interactions within multimodal and agent-based environments [17].

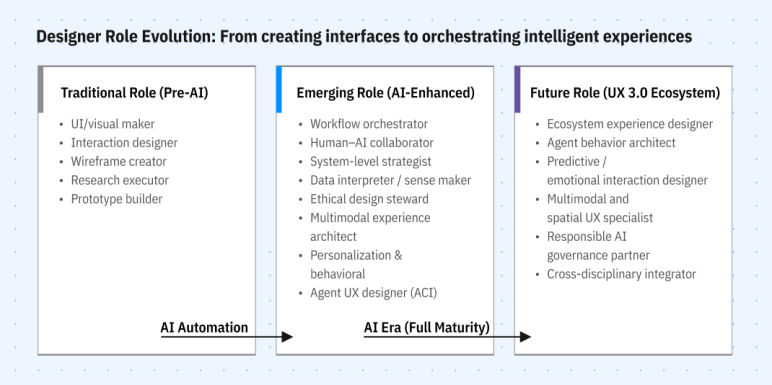

Figure 1. Role Evolution of designers in the AI era

How AI transforms the Design process

Ideation and Generative Creativity: AI augments early-stage ideation by generating concepts, scenarios, user journeys, and visual explorations [20]. Designers become curators rather than sole creators, shaping constraints, validating direction, and infusing domain expertise. However, concerns about aesthetic homogenization fuel counter-movements such as Anti-Design, where expressive typography and irregular layouts counterbalance generative uniformity.

Prototyping in a Multimodal and Spatial Era: AI enables rapid creation of prototypes across modalities: voice and conversational interaction; gesture-based input; spatial/AR-VR environments; agent-based workflows. These prototypes reflect the shift toward ambient and embodied interaction.

AI-Assisted Research and Dynamic Personas: AI transforms research pipelines by synthesizing transcripts, clustering behavioral segments, predicting user types, and creating dynamic personas that evolve with data [21]. Importantly, AI agents themselves emerge as non-human personas, requiring modeling of goals, constraints, and behavioral logic (Fig. 2).

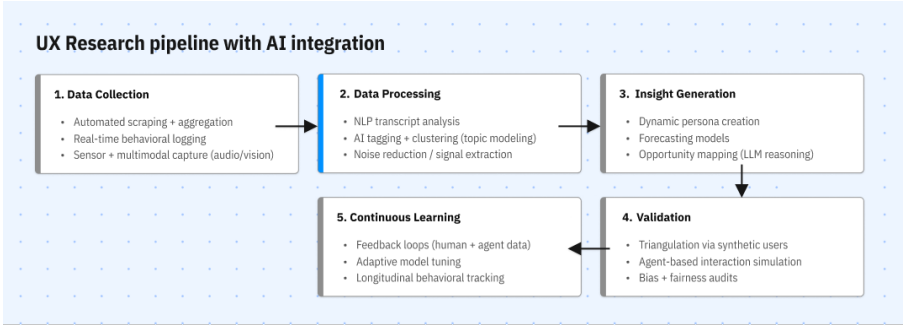

Figure 2. UX Research pipeline with AI integration

Evaluation: Automated Testing and Predictive Analytics: Machine learning facilitates automated usability evaluations, which include gaze prediction, performance diagnostics, cognitive load modeling, sustainability scoring, and agent-based UI simulations [22]. Evaluations now also focus on verifying what AI agents understand, interpret, and act upon [27].

AI Agents as Users: Toward Agent–Computer Interaction

AI agents independently navigate interfaces, interpret UI states, invoke tools, and execute tasks. Designers now create for two types of users [11, 23]:

1. Human Users – Require clarity, control, trust, emotional resonance, and accessible interaction.
2. AI Agents – Require machine-readable structure, semantic clarity, stable hierarchies, and predictable layouts. This duality defines Agent-Computer Interaction, where interfaces must serve both human cognition and machine cognition.

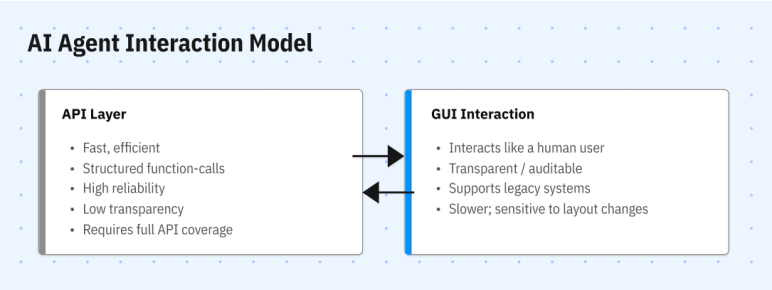

Figure 3. API vs GUI Interaction Model

API vs GUI Interaction [24] (Fig. 3) – Two primary pathways exist for agent interaction: API/Function-Call Integration (Fast, structured, reliable; limited transparency) and GUI-Based Interaction (More transparent and auditable; closer to human interaction; sensitive to layout changes). MCP as an Enabler of Agent UX – MCP adds a safety and interoperability layer, defining

agent capabilities, constraints, and schemas, reducing risks of hallucinated or unauthorized actions.

Ethical, Inclusive, and Responsible AI-Driven UX

AI-driven personalization must balance adaptive experiences with user autonomy, requiring **strict transparency**, **privacy safeguards**, and **user control**. To mitigate bias, systems must be trained on **diverse datasets** and validated early with neurodiverse user groups, ensuring technology preserves human authenticity rather than imposing homogenized aesthetics [19, 25].

Translating these principles into practice [26] necessitates a rigorous framework: establishing clear usage guardrails, validating AI insights through inclusive research with real participants, and assessing sustainability impacts. Furthermore, as interfaces evolve, designers must create flexible systems that support multimodal interactions and define semantic standards for agent readability, ensuring reliability for both human users and AI agents.

Applied design scenario: AI-Augmented UX workflow with human and agent users

This applied scenario illustrates how AI-driven UX methods, agent interaction, and ethical considerations can be integrated within a contemporary design workflow. The scenario focuses on the redesign of a digital service platform supporting both human users and AI agents. For instance, consider a **travel booking system**: while the human user interacts with a visual interface for inspiration, the AI agent utilizes a structured API to check availability and execute bookings efficiently. AI-assisted research tools synthesize qualitative data to generate dynamic user personas, while agent personas are defined through goals and constraints. Generative AI supports rapid ideation and multimodal prototyping, with designers curating outputs to ensure accessibility, ethical alignment, and system coherence. Evaluation combines automated usability testing with agent-based simulations to assess interpretability, transparency, and user control. The Model Context Protocol (MCP) is employed to ensure safe, predictable, and auditable agent–tool interactions. Overall, the scenario demonstrates how AI augments the UX lifecycle while reinforcing the designer's evolving role as an orchestrator of human–AI collaboration and responsible system design.

Conclusion

The integration of AI into UX represents a fundamental structural shift toward User Experience 3.0, moving beyond simple automation to the creation

of intelligent, dual-layer ecosystems. This paper underscores the emergence of Agent–Computer Interaction (ACI), where designers must architect interfaces that simultaneously serve human emotion and machine logic through standardized frameworks like the Model Context Protocol. Consequently, the design profession is evolving from visual craftsmanship to system orchestration, requiring a rigorous commitment to ethical guardrails and transparency. Ultimately, the evolution of design depends on harmonizing autonomous capabilities with human oversight, ensuring that intelligent environments serve to augment, rather than supplant, human agency.

References

[1] I. Olamilekan Adeleye, The AI Effect: Rethinking Design Workflows for Enhanced Productivity and Creativity, *International Journal of Science and Technology Innovation (IJSSTI)*, 2023, DOI:10.70560/c9m3kd97

[2] S. Amershi, Guidelines for Human–AI Interaction, *CHI (Conference on Human Factors in Computing Systems)*, 2019, https://www.microsoft.com/en-us/research/publication/guidelines-for-human-ai-interaction/

[3] B. Adewusi, B. Adekunle, S. Damilola Mustapha, A. Chukwuemeke Uzoka, Advances in AI-Augmented User Experience Design for Personalized Public and Enterprise Digital Services, *International Journal of Advanced Multidisciplinary Research and Studies*, 2023, DOI:10.62225/2583049X.2023.3.6.4408

[4] AI Adoption and Inference Market, AI Inference Market Size, Share & Trends, 2025 To 2030, 2025, https://www.marketsandmarkets.com/Market-Reports/ai-inference-market-189921964.html?gad_source=1&gad_campaignid=17611014407&gclid=EAIaIQobChMIzbLelsKIkQMVdmlBAh1BHQ7_EAAYBCAAEgLR_fD_BwE

[5] B. Shneiderman, Human-Centered AI (Oxford, 2022; online edition, Oxford Academic), 2025, https://doi.org/10.1093/oso/9780192845290.001.0001

[6] Apple Machine Learning Research at NeurIPS 2025, https://machinelearning.apple.com/research/neurips-2025, November 21, 2025, last access at 07.11.2025

[7] Google PAIR, The People + AI Guidebook is a collection of practical guidance for designing human-centered AI products, https://pair.withgoogle.com/guidebook/, last access at 07.11.2025

[8] D. Norman, *The Design of Everyday Things*, MIT Press, Revised and expanded edition, New York 2013, ISBN: 978-0-465-07299-6 (ebook)

[9] Questioning the AI: Informing Design Practices for Explainable AI User Experiences, *CHI Conference on Human Factors in Computing Systems*, 2020, https://doi.org/10.1145/3313831.3376590

[10] What is explainable AI?, https://www.ibm.com/think/topics/explainable-ai, IBM, last access at 07.11.2025

[11] AI tools for designers, https://www.toools.design/ai-tools-for-designers-and-marketing, https://www.ibm.com/products/watsonx-ai, https://www.uxpin.com/studio/blog/ai-tools-for-designers/, last access November 2025

[12] M. Cramer, The Evolution of UX: Designing for Intelligence, Agency, and the Unknown, 2025, https://mennocramer.medium.com/the-evolution-of-ux-designing-for-intelligence-agency-and-the-unknown-3f624c54d145

[13] Y. Yang, X. Xia, D. Lo, T. Bi, J. Grundy, X. Yang, Predictive Models in Software Engineering: Challenges and Opportunities, *ACM Transactions on Software Engineering and Methodology (TOSEM)*, 2022, Vol. 31, Iss. 3, 1–72, https://dl.acm.org/doi/10.1145/3503509

[14] A. Mastrianni, H. Twedi, A. Sarcevic, J. Wander, C. Austin-Tse, S. Saponas, H. Rehm. A. Vonard, A. Hall, AI-Enhanced Sensemaking: Exploring the Design of a Generative AI-Based Assistant to Support Genetic Professionals, *ACM Transactions on Interactive Intelligent Systems*, 2025, https://doi.org/10.1145/375632

[15] Z. Chen, Z. Xiong, X. Ruan, S. Jiang, W. Wei, K. Fang, Exploring Learners' Interactions with GenAI Agents in Educational Games: Typologies and Emotional Factors in Human-Computer Interaction, *4th International Conference on Educational Technology (ICET)*, Wuhan, China, 2024, pp. 136–140, doi:10.1109/ICET62460.2024.10868064

[16] Model Context Protocol: Introduction to MCP, https://modelcontextprotocol.io/docs/getting-started/intro, last access at 07.11.2025

[17] A. Mishra, How MCPs Are Reshaping UX: The Fusion of Managed Cloud, Model Context Protocols, Enterprise Tools, and LLMs, Medium, May 2025, last access at 07.11.2025

[18] S. Anasuri, L. Pappula, Human-AI Co-Creation Systems in Design and Art, *IJAIBDCMS*, 2024, 30, 5(1), 102–13, https://doi.org/10.63282/3050-9416.IJAIBDCMS-V5I1P111

[19] M. Kumar, UX Trends to Watch in 2026: Designing for Empathy, Intelligence, and Experience, Medium, September 2025, https://medium.com/design-bootcamp/ux-trends-to-watch-in-2026-designing-for-empathy-intelligence-and-experience-1bd276fdf7e6, last access at

07.11.2025

[20] J. Xu, K. Papangeius, G. Tigwell, Spatial Computing: Defining the Vision for the Future, *CHI EA '24: Extended Abstracts of the CHI Conference on Human Factors in Computing Systems*, 2024, Article No.: 583, Pages 1–4, https://doi.org/10.1145/3613905.3643978

[21] Qualtrics Research Labs, AI to Drive Massive Changes to Market Research in 2025, Qualtrics Report Says, 2024, https://www.qualtrics.com/articles/news/ai-to-drive-massive-changes-to-market-research-in-2025-qualtrics-report-says/, last access at 07.11.2025

[22] A. Klaib, N. Alsrehin, W. Melhem, H. Bashtawi, A. Magableh, Eye Tracking Algorithms, Techniques, Tools, and Applications with an Emphasis on Machine Learning and Internet of Things Technologies, *Expert Systems with Appl.*, 2020, https://doi.org/10.1016/j.eswa.2020.114037

[23] A. Füßl, V. Nissen, Design of explanation user interfaces for interactive machine learning using the example of a knowledge graph-based approach to explainable process analysis, *Requirements Eng.*, 2025, 30, 81–108, https://doi.org/10.1007/s00766-025-00437-6

[24] Z. Zhang, From Interaction to Impact: Towards Safer AI Agents Through Understanding and Evaluating Mobile UI Operation Impacts, Cornel University, Arxiv, 2025, https://doi.org/10.48550/arXiv.2410.09006

[25] Rythm, 10 AI-Driven UX Patterns That Will Dominate Every App by 2026, Medium, https://medium.com/design-bootcamp/10-ai-driven-ux-patterns-that-will-dominate-every-app-by-2026-cb4965dcd129, last access at 07.11.2025

[26] L. Dixon, M. Terry, co-leads, PAIR, Google Research, Responsible AI at Google Research: PAIR, 2023, https://research.google/blog/responsible-ai-at-google-research-pair/, last access 07.11.2025

[27] P. Perez, Treating AI Agents as personas Introducing the Agent Computer Interaction era, Medium, 2024, last access at 07.11.2025

Maya Stoeva,
Paisii Hilendarski University of Plovdiv,
Faculty of Mathematics and Informatics,
236 Bulgaria Blvd., 4027 Plovdiv, Bulgaria
Corresponding author: mstoeva@uni-plovdiv.bg