

## The Impact of Artificial Intelligence AI in Enhancing Experience Design of Physical Products

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### **Abstract:**

This study investigates the integration of Artificial Intelligence (AI) in the experience design of physical products to enhance customer engagement and satisfaction. Focusing on products characterized by repetitive use, low complexity, and high production volumes, the research aims to evaluate both the advantages and challenges of using AI in product design. The study explores how AI-driven approaches can improve the user experience by creating emotionally resonant, memorable interactions through AI-enhanced sensory and interface touchpoints. By using scenario-based research, the study examines how AI can co-design customer experiences alongside designers, contributing to the Physical Design Cycle. The approach is rooted in human-centered design principles, emphasizing the importance of AI in fostering emotionally enriching, personalized user experiences while addressing ethical considerations. Through a literature review and empirical field study, this paper presents an analysis of AI's role in improving experience design across UX, product aesthetics, and smart products. The findings suggest that AI holds substantial potential to transform the design process, enhance consumer engagement, and shape future design practices in academia and industry, setting a foundation for future research.

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1. Algharabat, R., Rana, N. P., Alalwan, A. A., Baabdullah, A., & Gupta, A. (2020). Investigating the antecedents of customer brand engagement and consumer-based brand equity in social media. *Journal of Retailing and Consumer Services*, 53, 101767. [\[Source\]](#)
2. Alter, S. (2020). Making sense of smartness in the context of smart devices and smart systems. *Information Systems Frontiers*. [\[Source\]](#)
3. Ameen, N., Tahrini, A., Reppel, A., & Anand, A. (2021). Customer experiences in the age of artificial intelligence. *Computers in human behavior*. [\[Source\]](#)
4. Armstrong, H. (2021). Big data, big design: Why designers should care about artificial intelligence. [\[Source\]](#)
5. Bawack, R. E., Fosso Wamba, S., & Carillo, K. D. A. (2021). A framework for understanding artificial intelligence research: insights from practice. *Journal of Enterprise Information Management*, 34(2), 645-678. [\[Source\]](#)
6. Benbya, H., Davenport, T. H., & Pachidi, S. (2020). Artificial intelligence in organizations: Current state and future opportunities. *MIS Quarterly Executive*. [\[Source\]](#)
7. Berni, A., Borgianni, Y., Basso, D., & Carbon, C. C. (2023). Fundamentals and issues of user experience in the process of designing consumer products. *Design Science*. [\[Source\]](#)
8. bin Ahsan, W. (2024). The EDIT UX Framework: A User-Centered Approach to Effective Product Redesign. [\[Source\]](#)

- 
9. Bruns, M., Ossevoort, S., & Petersen, M. G. (2021). Expressivity in interaction: A framework for design. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (pp. 1-13). [\[Source\]](#)
  10. Bu, L., Chen, C. H., Ng, K. K., Zheng, P., Dong, G., & Liu, H. (2021). A user-centric design approach for smart product-service systems using virtual reality: A case study. *Journal of Cleaner Production*, 280, 124413. [\[Source\]](#)
  11. Burr, C., Taddeo, M., & Floridi, L. (2020). The ethics of digital well-being: A thematic review. *Science and engineering ethics*. [\[Source\]](#)
  12. Cascini, G., O'Hare, J., Dekoninck, E., Becattini, N., Boujut, J. F., Guefrache, F. B., ... & Morosi, F. (2020). Exploring the use of AR technology for co-creative product and packaging design. *Computers in Industry*, 123, 103308. [\[Source\]](#)
  13. Chang, Y. K., & Kuwata, J. (2020). Learning experience design: Challenges for novice designers. *Learner and user experience research: An introduction for the field of learning design & technology*. EdTech Books. [https://edtechbooks.org/ux/LXD\\_challenges](https://edtechbooks.org/ux/LXD_challenges). [\[Source\]](#)
  14. Codiant (2023) How to Use AI for UX Design Process, [\[Source\]](#)
  15. Coelho, M. C. C. D. (2024). AI-driven personalization in beauty retail: exploring how AI-based applications influence customer satisfaction and brand loyalty. [\[Source\]](#)
  16. Cooper, R. G. (2023). The artificial intelligence revolution in new-product development. *IEEE Engineering Management Review*. [\[Source\]](#)
  17. Dahlgren, K., Pink, S., Strengers, Y., Nicholls, L., & Sadowski, J. (2021). Personalization and the Smart Home: Questioning techno-hedonist imaginaries. *Convergence*, 27(5), 1155-1169. [\[Source\]](#)
  18. Dengel, A., Iqbal, M. Z., Grafe, S., & Mangina, E. (2022). A review on augmented reality authoring toolkits for education. *Frontiers in Virtual Reality*. [\[Source\]](#)
  19. Díaz-Rodríguez, N., Del Ser, J., Coeckelbergh, M., de Prado, M. L., Herrera-Viedma, E., & Herrera, F. (2023). Connecting the dots in trustworthy Artificial Intelligence: From AI principles, ethics, and key requirements to responsible AI systems and regulation. *Information Fusion*, 99, 101896. [\[Source\]](#)
  20. Dimitriadou, E. & Lanitis, A. (2023). A critical evaluation, challenges, and future perspectives of using artificial intelligence and emerging technologies in smart classrooms. *Smart Learning Environments*. [\[Source\]](#)
  21. Dunne, R., Morris, T., & Harper, S. (2021). A survey of ambient intelligence. *ACM Computing Surveys (CSUR)*. [\[Source\]](#)
  22. Gkikas, D. C., & Theodoridis, P. K. (2022). AI in consumer behavior. *Advances in Artificial Intelligence-based Technologies: Selected Papers in Honour of Professor Nikolaos G. Bourbakis—Vol. 1*, 147-176. [\[Source\]](#)
  23. Gray, C. M., Parsons, P., Toombs, A. L., Rasche, N., & Vorvoreanu, M. (2020). Designing an Aesthetic Learner Experience: UX, Instructional Design, and Design Pedagogy. *International Journal of Designs for Learning*, 11(1), 41-58. [\[Source\]](#)
  24. Grech, A., Mehnen, J., & Wodehouse, A. (2023). An extended AI-experience: Industry 5.0 in creative product innovation. *Sensors*. [\[Source\]](#)
  25. Haleem, A., Javaid, M., Qadri, M. A., Singh, R. P., & Suman, R. (2022). Artificial intelligence (AI) applications for marketing: A literature-based study. *International Journal of Intelligent Networks*, 3, 119-132. [\[Source\]](#)
  26. Hashemi, M. & Bosnjak, D. (2024). AI and consumer satisfaction: A descriptive study of how AI can strengthen consumer satisfaction. [\[Source\]](#)
  27. Hou, Y. (2020). Research on the application of emotional design in cultural creative product design. *E3S Web of Conferences*. [\[Source\]](#)
  28. Huang, M. H. & Rust, R. T. (2021). A strategic framework for artificial intelligence in marketing. *Journal of the Academy of Marketing Science*. [\[Source\]](#)
  29. Javaid, M., Haleem, A., Singh, R. P., & Suman, R. (2022). Artificial intelligence applications for industry 4.0: A literature-based study. *Journal of Industrial Integration and Management*, 7(01), 83-111. [\[Source\]](#)
  30. Kamrowska-Zaluska, D. (2021). Impact of AI-based tools and urban big data analytics on the design and planning of cities. *Land*. [\[Source\]](#)
  31. Kanungo, D. (2022). UX Decoded: Think and Implement User-Centered Research Methodologies, and Expert-Led UX Best Practices. [\[Source\]](#)
  32. Karunarathna, I., Gunasena, P., Hapuarachchi, T., & Gunathilake, S. (2024). The crucial role of data collection in research: Techniques, challenges, and best practices. [\[Source\]](#)
  33. Laato, S., Tiainen, M., Najmul Islam, A. K. M., & Mäntymäki, M. (2022). How to explain AI systems to
-

- 
- end users: a systematic literature review and research agenda. *Internet Research*, 32(7), 1-31. [\[Source\]](#)
34. Larsen, N. A. (2023). Advances in the Design of Online Controlled Experiments with Network and Baseline Factorial Effects. [\[Source\]](#)
35. Lee, Y. I. & Trim, P. R. J. (2022). Enhancing marketing provision through increased online safety that imbues consumer confidence: coupling AI and ML with the AIDA Model. *Big Data and Cognitive Computing*. [\[Source\]](#)
36. Lewis, J. R., & Sauro, J. (2021). Usability and user experience: Design and evaluation. *Handbook of human factors and ergonomics*, 972-1015. [\[Source\]](#)
37. Liang, M., Li, Y., Weber, T., & Hussmann, H. (2021, June). Tangible interaction for children's creative learning: A review. In *Proceedings of the 13th Conference on Creativity and Cognition* (pp. 1-14). [\[Source\]](#)
38. Lo, C. K., Chen, C. H., & Zhong, R. Y. (2021). A review of digital twin in product design and development. *Advanced Engineering Informatics*. [\[Source\]](#)
39. Lu, Y. & Zhou, Y. (2021). A review on the economics of artificial intelligence. *Journal of Economic Surveys*. [\[Source\]](#)
40. Mühlroth, C., & Grottko, M. (2020). Artificial intelligence in innovation: how to spot emerging trends and technologies. *IEEE Transactions on Engineering Management*, 69(2), 493-510. [\[Source\]](#)
41. Nadikattu, A. K. R. (2021). Influence of artificial intelligence on robotics industry. *International Journal of Creative Research Thoughts (IJCRT)*, ISSN, 2320-2882. [\[Source\]](#)
42. Nagaraj, V., Berente, N., Lyytinen, K., & Gaskin, J. (2020). Team design thinking, product innovativeness, and the moderating role of problem unfamiliarity. *Journal of Product innovation management*, 37(4), 297-323. [\[Source\]](#)
43. Nunes, J. C., Ordanini, A., & Giambastiani, G. (2021). The concept of authenticity: What it means to consumers. *Journal of Marketing*, 85(4), 1-20. [\[Source\]](#)
44. Quach, S., Thaichon, P., Martin, K. D., Weaven, S., & Palmatier, R. W. (2022). Digital technologies: tensions in privacy and data. *Journal of the Academy of Marketing Science*, 50(6), 1299-1323. [\[Source\]](#)
45. Raff, S., Wentzel, D., & Obwegeser, N. (2020). Smart products: conceptual review, synthesis, and research directions. *Journal of Product Innovation Management*, 37(5), 379-404. [\[Source\]](#)
46. Rasool, A., Shah, F. A., & Islam, J. U. (2020). Customer engagement in the digital age: A review and research agenda. *Current Opinion in Psychology*. [\[Source\]](#)
47. Sarker, I. H. (2022). AI-based modeling: techniques, applications and research issues towards automation, intelligent and smart systems. *SN Computer Science*. [\[Source\]](#)
48. Shneiderman, B. (2020). Human-centered artificial intelligence: Three fresh ideas. *AIS Transactions on Human-Computer Interaction*. [\[Source\]](#)
49. Shneiderman, B. (2022). Human-centered AI. [\[Source\]](#)
50. Subramonyam, H., Seifert, C., & Adar, E. (2021, June). Towards a process model for co-creating AI experiences. In *Proceedings of the 2021 ACM Designing Interactive Systems Conference* (pp. 1529-1543). [\[Source\]](#)
51. Taye, M. M. (2023). Understanding of machine learning with deep learning: architectures, workflow, applications and future directions. *Computers*. [\[Source\]](#)
52. Tomazzoli, C., Scannapieco, S., & Cristani, M. (2023). Internet of things and artificial intelligence enable energy efficiency. *Journal of Ambient Intelligence and Humanized Computing*, 14(5), 4933-4954. [\[Source\]](#)
53. Tschang, F. T. & Almirall, E. (2021). Artificial intelligence as augmenting automation: Implications for employment. *Academy of Management Perspectives*. [\[Source\]](#)
54. Unger, R. & Chandler, C. (2023). *A Project Guide to UX Design: For user experience designers in the field or in the making*. [\[Source\]](#)
55. Urban, W., Łukaszewicz, K., & Krawczyk-Dembicka, E. (2022). Development process of customised products, supported by technologies, a case of tailor-made furniture. In *International Scientific-Technical Conference Manufacturing* (pp. 90-104). [\[Source\]](#)
56. Verganti, R., Vendraminelli, L., & Iansiti, M. (2020). Innovation and design in the age of artificial intelligence. *Journal of product innovation management*, 37(3), 212-227. [\[Source\]](#)
57. Vidili, I. (2021). Customer experience: the new competitive advantage for companies that want their customer at the center of their business. In *Handbook of research on user experience in Web 2.0 technologies and its impact on universities and businesses* (pp. 183-209). IGI Global. [\[Source\]](#)
58. Wamba-Taguimdje, S. L., Wamba, S. F., Kamdjoug, J. R. K., & Wanko, C. E. T. (2020). Influence of artificial intelligence (AI) on firm performance: the business value of AI-based transformation projects.
-

---

Business process management journal, 26(7), 1893-1924. [\[Source\]](#)

59. Wang, X. Q., Chen, P., Chow, C. L., & Lau, D. (2023). Artificial-intelligence-led revolution of construction materials: From molecules to Industry 4.0. *Matter*. [\[Source\]](#)
60. Wong, S. Y., Ong, L. Y., & Leow, M. C. (2024). AIDA-based Customer Segmentation with User Journey Analysis for Wi-Fi Advertising System. *IEEE Access*. [\[Source\]](#)
61. Yang, Q., Steinfeld, A., Rosé, C., & Zimmerman, J. (2020, April). Re-examining whether, why, and how human-AI interaction is uniquely difficult to design. In *Proceedings of the 2020 chi conference on human factors in computing systems* (pp. 1-13). [\[Source\]](#)
62. Yin, J., Ngiam, K. Y., & Teo, H. H. (2021). Role of artificial intelligence applications in real-life clinical practice: systematic review. *Journal of medical Internet research*. [\[Source\]](#)
63. Yuan, S. M., Hong, Z. W., & Cheng, W. K. (2024). Artificial Intelligence and Deep Learning in Sensors and Applications. *Sensors*. [\[Source\]](#)
64. Yüksel, N., Börklü, H. R., Sezer, H. K., & Canyurt, O. E. (2023). Review of artificial intelligence applications in engineering design perspective. *Engineering Applications of Artificial Intelligence*, 118, 105697. [\[Source\]](#)
65. Yusa, I. M. M., Ardhana, I. K., Putra, I. N. D., & Pujaastawa, I. B. G. (2023). Emotional Design: A Review Of Theoretical Foundations, Methodologies, And Applications. *Journal of Aesthetics, Design, and Art Management*, 3(1), 1-14. [\[Source\]](#)
66. Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., ... & Li, Y. (2021). A Review of Artificial Intelligence (AI) in Education from 2010 to 2020. *Complexity*, 2021(1), 8812542. [\[Source\]](#)

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