

"The Role of User Experience in Balancing Functionality and Aesthetics in Product Design"

Narges Moradi

Department of Design, Oman College of Management and Technology, Muscat, Sultanate of Oman

Received 15 May 2024; Accepted 31 May 2024

Abstract

User experience (UX) is critical in product design due to it helps to strike a fine balance between utility and aesthetics. While traditional design techniques focus functional objectives, including UX, viewpoints may dramatically increase overall user happiness. By actively engaging users throughout the design and development phases, designers can acquire invaluable insights that are instrumental in crafting premium-quality products tailored to user preferences. Finally, success in product design requires a user-centric approach that considers both utility and aesthetics. This paper discusses the importance of user experience in product design, including both aesthetic and practical components. It investigates the basic mechanisms and repeating patterns linked with different forms of emotional experiences. The findings given here provide critical insights for designers looking to increase the sensory resonance of innovative designs. By prioritizing user requirements, objectives, and affective responses, as well as incorporating User Experience Design (UED) methodologies into the design workflow, designers can create products that not only captivate visually, but also excel in terms of functionality, usability, and engagement. The findings of this study have the ability to guide designers toward adopting UX principles and methodologies to improve user happiness and stimulate the creation of powerful experiences.

Keywords: *User Experience, UX, Product Design, Aesthetics, functionality of products*

I. Introduction

User experience influencing market performance and it shows its important role. It encompasses functionality, aesthetics, usability, and user happiness. Balancing these factors is essential for developing user-centric products with appealing designs. Product design has recently gained attention for its utility and attractiveness. This article investigates the importance of user experience in attaining this balance, drawing on a variety of sources, including literature evaluations and user input. This article discusses how UX improves customer happiness and sales. It also covers the significance of usefulness and aesthetics in design, highlighting the necessity to properly combine these qualities. This study investigates how functionality and aesthetics work together to improve the user experience. It also examines how user preferences impact design, emphasizing the significance of knowing user requirements.

In conclusion, the paper offers insights and recommendations for product managers, designers, and users. This research contributes to the discussion on effective product development by stressing the significance of UX in balancing usefulness and aesthetics.

II. Methodology

This study employs a methodology of reviewing literature to explore the significance of user experience (UX) in finding a balance between functionality and attractiveness in the creation of products. Through a comprehensive examination and selection of relevant research papers, case studies, models, and methods, this study aims to provide a comprehensive understanding of UX principles in product design. The gathered literature is analyzed, and key findings, approaches, and models are integrated to reveal common themes and perspectives. By considering user requirements, goals, and feelings, as well as incorporating User Experience Design (UED) strategies into the design process, designers can develop visually appealing, highly efficient, supportive, and captivating products. This research undertakes a thorough evaluation of the role of UX in harmonizing utility and aesthetics, leading to a deeper insight into how an approach centered on the user can facilitate successful product design.

III. The Role of User Experience in Functionality of product design

By improving the appearance and function of the product, the customer's attention is better captured. A good design that considers what customers want makes the product easier to use. The main goal is to ensure that the things people buy fit their lifestyle. This leads to products that meet people's needs and where people are satisfied with the products they buy. Many aspects of how customers behave and how brands make

things look good.

3.1 Importance of user in understanding user needs and expectations

By understanding what consumers want and expect, designers can create products that meet consumers' needs, preferences, and behaviors. This approach allows the development of deep, efficient, and effective products that meet customer expectations (Serge et al., 2015). This has a huge impact on all users. By fully understanding these requirements, designers can create products that are attractive, easy to use, and provide benefits to users. When consumers feel that a product meets their needs and expectations, they are more likely to be satisfied and loyal. This can lead to increased customer loyalty and purchases (Merino et al., 2012). By understanding users' needs and wants, designers can avoid costly changes and iterations. This can reduce development costs and speed up time to market (Merino et al., 2012). Research suggests that if a product meets the desires of its users, it's far more likely to achieve success within the market. By knowing how consumer desires, designers can broaden merchandise that differentiates their manufacturers and supply them a competitive benefit. It additionally facilitates designers create merchandise that observe the rules. For example, in healthcare, designers can enhance affected person consequences and make certain the FDA meets person desires (Schwab et al., 2018). Therefore, it's far critical to apprehend consumer desires and expectancies while designing merchandise. It facilitates creating person-targeted merchandise, will increase person satisfaction, reduces improvement costs, affords competitive benefit, and guarantees regulatory compliance.

3.2 User-centered design principles and their impact on functionality

The principles of user-centered research (UCD) include a set of guidelines and methods that aim to understand and meet users' needs, preferences, and behaviors. The main purpose of these principles is to develop products that prioritize the user and increase efficiency and productivity. UCD plays an important role in changing the research process by focusing on the importance of better understanding users through effective research and observation. This information is used to make comprehensive research decisions and ensure that products meet the needs of users (LeRouge and Wickramasinghe, 2013). UCD principles support a design process in which research findings are evaluated and improved based on user feedback. This approach helps identify and resolve operational issues early in the design phase, making the product work and helping users (LeRouge and Wickramasinghe, 2013).

It also encourages the use of models to evaluate and improve research results. Prototyping allows designers to quickly and economically create functional product models that can be evaluated and improved based on user feedback (Isa and Liem, 2014). Functional testing is used to ensure that it is easy to use and meets the needs of the user. This testing method provides important information about user behavior and results, allowing designers to identify and resolve performance issues (LeRouge and Wickramasinghe, 2013). UCD principles, on the alternative hand, aid consumer participation within the whole layout process, from studies to assessment and improvement. This guarantees that merchandise is designed mainly with the consumer's desires and alternatives in mind, ensuring higher and extra consumer-pleasant solutions (LeRouge and Wickramasinghe, 2013).

IV. The Role of User Experience in Aesthetics

Aesthetics plays an important role in product format because it has a tremendous impact on many elements which consist of customer experience, product awareness, emotional connection, differentiation, functionality, and sustainability. By incorporating beauty into format, designers can create merchandise that is intuitive and functional, at the same time as stunning clients visually and emotionally. Research is prepared to find out all elements of beauty and the clients' belief of beauty.

4.1 Understanding the role of aesthetics in product design.

Although beauty refers to the beauty and beauty of an object, it is also specific sensory elements consisting of touch, sound, and the emotions it evokes. Incorporating aesthetic format into the format can decorate the customer experience through a better seen experience, developing stages of delight and engagement (Althuisen, 2021). Consistency within the verbal and seen elements of a product sell brand awareness, especially brand popularity and client loyalty through an emotional connection a few of the client and the result (Sridhar and O'Brien, 2013). In addition, enhancing the first-class can differentiate a product from its competitors, making it more attractive and memorable (Sridhar and O'Brien, 2013). Quality can also impact the general overall performance of a product via affecting its appearance. Well, designed, photograph improving products are more usable and better customers (Heimer, 2023). In addition, on account that consumers are interested in products with attractive designs, aesthetics can encourage sustainable behavior that encourages long-term ownership (Montazeri, 2013).

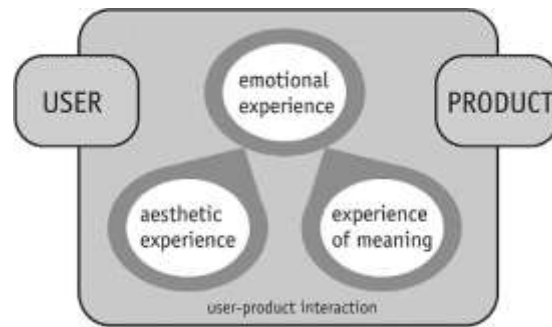


Figure 1. Framework of product experience (Desmet, 2008).

4.2 Visual design principles and their impact on aesthetics

Visual layout ideas are hard and fast hints and strategies for growing stunning and powerful designs. These ideas immediately have an impact on the visible look of product layout through incorporating factors which includes symmetry, balance, etc. Consistency refers to the significance of making sure consistency in color, font, and layout, ensuing in a cohesive and visible effect (Fen, 2015). It may be very vital to set up a visible angle to differentiate vital degrees among diverse layout factors, manual the user's attention, and make contribution to a clean and powerful layout (Fen, 2015). Proportion is every other precept for arranging factors in a visually appealing manner, ensuing in a stunning and cohesive layout (Fen, 2015). Proximity is every other vital element in this area. When associated factors are located near every other, it's far less complicated to create a completely unique and powerful layout through grouping associated factors (Fehn, 2015). But, as a concept, encourages the usage of diverse factors (for example, mild and dark, large, and small) to create visible hobbies and entice attention (Fen, 2015).

In summary, visible layout concepts are very crucial in developing any kind of product layout with emphasis on consistency, organization, balance, proximity, contrast, grouping and use of space. By following those guidelines, designers can create lovely and hit merchandises that meet the desires and expectancies of users.

4.3 Emotional design and its influence on aesthetics

Emotional design aims to elicit emotional responses from users as they interact with products. Aesthetics have a great influence on emotions because they play a major role in creating the user's emotional experience. The main goal of emotional design is to create products that satisfy emotional needs by understanding the emotions of users. Focusing on the user's emotions, this approach allows designers to use elements such as color, shape, and texture to enhance the visual appeal of the product (Nin, 2009). For example, a product with bright colors and a dynamic layout creates excitement and energy, while a product with a curved shape and good design creates a sense of calm and stability (Wang & Hsu, 2020). Design with an emphasis on emotion can also influence how a brand feels and how people feel when they interact with the brand, always fostering an emotional experience. By introducing emotional design, companies can build brand loyalty and promote emotional connections with customers (Kalmakurki & Healy, 2022).

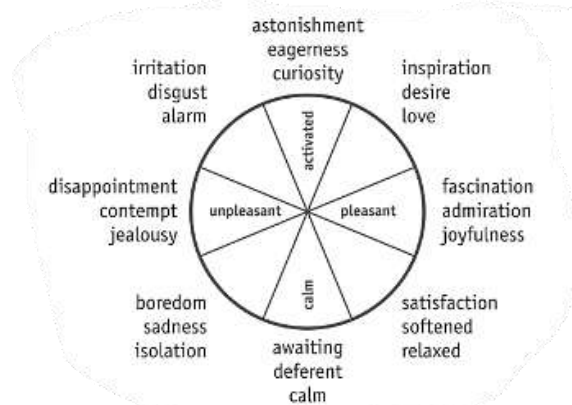


Figure 2. Circumplex model of core affect with product relevant emotions (Desmet, 2008).

In the context of digital products, emotional design can influence the appearance of user interfaces by focusing on the emotional aspects of interaction, such as responsiveness, animation, and mic. This approach improves the user experience by creating interaction and fun (Wang & Hsu, 2020). Emotional design also influences the aesthetics of product development by emphasizing emotional aspects such as functionality, ease of use, and user satisfaction. This helps to create products that are not only visually appealing, but also emotionally appealing to customers (Roos & Veryday, 2015). In summary, emotional design plays an important role in defining product design style by addressing the emotional needs of users and creating designs that evoke emotional responses. By understanding the emotional aspects of design, designers can develop products that are emotional, intuitive, and user-friendly.

4.4 Case studies or examples illustrating the role of user experience design in enhancing aesthetics.

Here are some case studies and examples illustrating the role of user experience design in enhancing aesthetics:

4.4.1 Two Case Studies of User Experience Design and Agile Development, (Najafi & Toyoshiba, 2008): This article presents two case studies of integrating user experience design (UED) practices into agile development to improve product usability. The first case study describes a project management software application in which UED techniques were used to define user needs and goals through user research and testing. The second case study describes a security software application whose UED techniques were used to refine the design to improve usability.

4.4.2 Enhanced Ergonomics Approaches for Product Design: A User Experience Ecosystem Perspective and Case Studies, (Xu, 2014), This article presents three case studies of improved ergonomic design approaches to address challenges faced by human factors and ergonomics (HFE) approaches. Case studies show how to use a user experience ecology (UXE) framework to strategically influence product companies and technology roadmaps from a UX perspective, identify new opportunity markets and influence the capabilities of platform architecture where the UX of the latter results.

4.4.3 From the definition of user experience to a framework to a classify its application in design, (Berni & Borgianni, 2021). This article presents a framework for classifying UX applications in design along two axes: the main elements of interaction (user, system, context) and the elements of experience (ergonomic, cognitive and emotional). The framework is used to classify UX case studies based on a sample of experimental UX-related articles published in design journals.

4.4.4 User Experience as Innovative Academic Practice (2022), (LeRouge & Wickramasinghe, 2013). This book presents case studies where UX methodologies such as user profiles, journey maps, usability studies, diary entries, affinity diagramming, and so on were applied in various aspects of pedagogical design and redesign. The case studies demonstrate how UX methodologies can be used to gain greater insight into the student user's needs, challenges, and environments, thereby not only making student users the center of the course design process, but also co-creators of instructional materials and strategies.

4.4.5 Impact of the Visual Design Language of Social Media Advertisements on Consumer Perceptions (2021), (Schwab et al., 2018): This study investigates how the visual design language of social media advertisements impacts consumer perceptions. The study establishes the principles or a framework that an advertiser keeps in mind while trying to appeal to the consumer's principles of a brand offering. The findings from the study demonstrate how important visual design and imagery are in impacting the mind of the consumer. These studies and real-life stories show how focusing on what users want, how they feel and think can make things look better. Good design starts with the user not the product. It understands what matters to the person using it. Integrating user-centered ideas into quick design, how things look, and online ads can create things that are beautiful to use not just look at. Products, websites, and services that use this approach end up working well for people in ways that keep them interested too. Designing from the user's view makes everything better in a way that can be used and engages users. This makes people happy with what they get.

V. Balancing Functionality and Aesthetics and its challenges

Balancing functionality and aesthetics in product design is a complex challenge that requires careful consideration of various factors. Here are some key considerations and challenges in achieving this balance:

5.1 User needs and preferences: Understanding user needs and preferences is crucial in balancing functionality and aesthetics. Designers must consider the user's emotional and aesthetic

requirements, as well as their practical needs. This requires a deep understanding of the user's cultural background, education, and living environment, as well as their functional needs.

5.2 **Aesthetic principles:** The way things look is very important for defining what something is. Designers need to think about how visual rules and styles shape how they make products. However, beauty is complex and not always clear. Designers frequently use visual guidelines in ways that feel right based on their own opinions. More work is needed to truly understand aesthetics, so designers have solid ideas to intentionally guide their choices instead of depending on feelings alone. Appearance affects the core of what is being created, so studying this area more could enhance how designers approach defining the look of what they bring to the world.

5.3 **Symmetry, complexity, and shape:** The way balancing, detail level, and form work together on phone screen layouts can strongly affect how users feel emotionally. Users respond to these visual traits in ways that designers need to think about. Carefully crafting the arrangement, intricacy, and looks of screen elements can help ensure what people experience emotionally when using something is what the designer intends to create. To really meet people's needs and desires, designers must understand how aesthetics influence feelings and make intentional choices accordingly. Appearance touches people in ways that matter for enjoying and sticking with what's been made.

To balance how things look and work, take thoughtful attention to what users really want and need, common visual rules, arrangement, level of intricacy, form, comfort, feelings, and visual communication. Designers who study these elements can craft products that are beautiful to view as well as functional to use in practical ways that interest people. Careful work judging all of these areas ensures what gets made delights both the eyes and effectively fits user goals. This approach leads to creations that serve people while engaging their emotions positively through well-designed appearances. The path to success combines focus on both outer beauty and inner usefulness (Костина et al., 2019), (Wang & Hsu, 2020), (Xu, 2014).

VI. Challenges of implementing user experience design in product design

Making sure design puts users first isn't always easy. One issue could be not having the means or know-how for user testing. Without really studying how people act, what they like and what's frustrating, designs may miss what users truly want. Another problem can involve an environment where people think design is only about looks, not about how the person feels using something. If an organization isn't serious about user-centered design, what gets made risks being not very useful or pleasing to users. Overcoming issues like resources, experience and company mindset takes work but is important so design serves real people in a useful way that keeps them satisfied and engaged in the long run.

Other challenges may include companies wanting to stick with tradition, making it hard to try new styles of working. It's not always easy to adjust habits. Research also finds designing with a few users in mind differs from creating things for many. Large groups have varying needs that don't always mix. Organizations face dilemmas balancing user focus with security, especially in fields handling private information like health and banking where privacy protects people but should not come before usability. Checking how well actual users are served versus other goals demands ongoing testing. Progress demands acknowledging tensions while orienting around improving what real people experience.

VII. Discussion and Analysis

The search results provide insights into the role of user experience in balancing functionality and aesthetics in product design. Here are some key findings:

7.1 **User-Driven Conceptual Design Specification:** A proposal has been put forward for a design specification that combines functional reasoning and aesthetic information analysis, driven by user input. (Hu et al., 2022). The objective of this approach is to improve user contentment by taking into account both functionality and aesthetics.

7.2 **Design Patterns:** Design patterns can be used to evaluate web applications, focusing on usability and aesthetics (Georgiakis et al., 2010). This approach can help novice usability evaluators systematically assess the usability of web applications.

7.3 **Eye-Tracking Experiments:** Eye-tracking technology can be used to compare the user experience of different products, providing insights into the functions, interactive process architecture, and interface layout design (Huan et al., 2023).

7.4 **User Interaction and Personas:** Combining rich user interaction with the persona technique can lead to innovative product designs that balance functionality and aesthetics (Corremans & Standaert, 2013).

7.5 **Design and Healthcare:** Design interventions in healthcare can improve patient satisfaction and reduce negative emotions by considering both formal and emotional aspects (Iacono et al., 2023).

7.6 **Wearable Activity Trackers:** The relationship between activity trackers and wearers, as well as the resulting aesthetic experience, has been investigated (Pateman, 2015).

In conclusion, the search results suggest that user experience plays a significant role in balancing functionality and aesthetics in product design. Methods such as user-driven conceptual design specifications, design patterns, eye-tracking experiments, open-source software usability, user interaction and personas, design and healthcare interventions, and wearable activity tracker research can provide insights into how to create products that meet both functional and aesthetic requirements.

VIII. Comparison and synthesis

Based on the research papers provided, the comparison and synthesis of existing literature with research results regarding the role of UX in balancing functionality and aesthetics can be summarized as follows:

8.1 **User-Driven Conceptual Design Specification:** The research by Hu et al. (2022) proposes a user-driven conceptual design specification that integrates functional reasoning with aesthetic information analysis. This approach aims to enhance user satisfaction by considering both functionality and aesthetics.

8.2 **Design Patterns:** Georgiakis et al. (2010) highlight the use of design patterns to evaluate web applications, focusing on usability and aesthetics. This method can assist novice usability evaluators in systematically assessing the usability of web applications.

8.3 **Eye-Tracking Experiments:** Huang et al. (2023) demonstrate the use of eye-tracking technology to compare the user experience of different products. This approach provides insights into the functions, interactive process architecture, and interface layout design.

8.4 **Open-Source Software Usability:** Nichols & Twidale (2006) discuss the usability of open-source software, noting that usability is often a limiting factor in its distribution. However, successful examples like Mozilla Firefox show that usable open-source applications can be developed.

8.5 **User Interaction and Personas:** Corremans & Standaert (2013) emphasize the importance of combining rich user interaction with the personas technique to create innovative product designs that balance functionality and aesthetics.

IX. Limitations of the study and areas for future research

As with many studies, this study presents several problems. These issues might also additionally encompass troubles which include the effectiveness of merchandise throughout exceptional merchandise, industries, and patron groups, in addition to methodological weaknesses, which include small pattern sizes and restrained manipulation variables. In addition, measuring the client experience, all sports and aesthetics are memorable and face effective obstacles.

Areas for future research might include:

9.1 Analyzing the customer experience, capabilities, and competencies of numerous packages to pick out similarities and differences.

9.2 Evaluate how user's experience, performance, and aesthetics have modified over time in a product or industry.

9.3 Evaluate how consumer experience, performance, and aesthetics have modified over the years in a product or industry.

9.4 Develop product-related research principles to help product designers combine functionality and aesthetics.

9.5 Research on the impact of user experience on the balance between functionality and aesthetics of products for people with disabilities.

X. Conclusion

In summary, this study's paper explored the position of person experience (UX) in putting the stability among capability and aesthetics in product design. The motive of the look is to apprehend how UX can make contributions to the mixing of those vital factors. By accomplishing a complete literature evaluation and studying numerous studies, contexts and applications, the look at proves the significance of UX in numerous areas.

Observations display the fee of UX sports inclusive of person research, testing, layout optimization, and integrating person joy principles (UED) into agile development, product layout, academic layout, and internet marketing. This app will play a crucial function in enhancing quality, usability, and integration. By information users' thoughts, needs, goals, and emotions, designers can create products, services, and reports that paintings and assist users. The observation additionally indicates the significance of thinking about the lively function of the person within the layout and participation within the advent of equipment and strategies. Moreover, research articles provide a framework that includes aesthetic experience, meaning, and emotional experience to understand the product experience in a different and unique way. This list provides designers with useful information to demonstrate the impact of new design experiences.

XI. References

- Althuizen, N. (2021). Revisiting Berlyne's inverted U-shape relationship between complexity and liking: The role of effort, arousal, and status in the appreciation of product design aesthetics. *Psychology & Marketing*, 38(3), 481–503. <https://doi.org/10.1002/mar.21449>
- Berni, A., & Borgianni, Y. (2021). FROM THE DEFINITION OF USER EXPERIENCE TO A FRAMEWORK TO CLASSIFY ITS APPLICATIONS IN DESIGN. *Proceedings of the Design Society, 1*, 1627–1636. <https://doi.org/10.1017/pds.2021.424>
- Chun Liu, Y., & Fen Wang, C. (2022). *E-commerce product image design—An example of Shopee*. Human Interaction & Emerging Technologies (IHET 2022): Artificial Intelligence & Future Applications. <https://doi.org/10.54941/ahfe1002708>
- Corremans, J., & Standaert, A. (2013). *Combining rich user interaction with the personas technique in a student user experience design project*. <https://www.semanticscholar.org/paper/Combining-rich-user-interaction-with-the-personas-a-Corremans-Standaert/f3eefd2780b5c5785d517307ca729f6615b0bade>
- Fen, X. (2015). Leading Role of Visual Information in the Interface Design. *Packaging Engineering*. <https://www.semanticscholar.org/paper/Leading-Role-of-Visual-Information-in-the-Interface-Fen/062d4901e7e4479c67953bea2d770bde1eb0a519>
- Georgiakakis, P., Tzanavari, A., Retalis, S., & Psaromiligkos, Y. (2010). *Evaluation of Web applications Using Design Patterns*. <https://www.semanticscholar.org/paper/Evaluation-of-Web-applications-Using-Design-Georgiakakis-Tzanavari/e7d2bfd36572b20ac202008b54f9eedaebbb06d2>
- Glanznig, M., & Kordes, U. (2012, June 22). *Approaching user experience: Moving between abstract and in-depth*. <https://www.semanticscholar.org/paper/Approaching-user-experience%3A-moving-between-and-Glanznig-Kordes/78bef6022641df3f1349cbbd4c5e25a27a8adf5d>
- Heimer, A. M. (2023). The role of aesthetics in design education: Leverage of creativity through concrete and abstract form exploration. *Techne Serien - Forskning i Slöjdpedagogik Och Slöjdvetenskap*, 30(1), 31–45. <https://doi.org/10.7577/TechneA.5259>
- Hu, H., Liu, Y., Guo, X., & Fu, C. (2022). A Conceptual Design Specification Based on User Aesthetic Information Analysis and Product Functional Reasoning. *Machines*, 10(10), 868. <https://doi.org/10.3390/machines10100868>
- Huang, R., Zhu, Y., & Xue, C. (2023). *A comparative study on user experience of four apps for renting house based on D-Lab eye-tracking experiment*. Intelligent Human Systems Integration (IHSI 2023) Integrating People and Intelligent Systems. <https://doi.org/10.54941/ahfe1002919>
- Iacono, E., Vagnoli, L., Ciucci, E., & Tosi, F. (2023). *Design and Healthcare: Evaluation of emotional experience in pediatric radiology*. 14th International Conference on Applied Human Factors and Ergonomics (AHFE 2023). <https://doi.org/10.54941/ahfe1003383>
- Isa, S. S., & Liem, A. (2014). *CLASSIFYING PHYSICAL MODELS AND PROTOTYPES IN THE DESIGN PROCESS: A STUDY ON THE ECONOMIC AND USABILITY IMPACT OF ADOPTING MODELS AND PROTOTYPES IN THE DESIGN PROCESS*. <https://www.semanticscholar.org/paper/CLASSIFYING-PHYSICAL-MODELS-AND-PROTOTYPES-IN-THE-A-Isa-Liem/cc43bdab233072e789bd7b64cc36503383caf33>
- Kalmakurki, M., & Healy, M. (2022). 'Who wants the pressure of being super all the time?': Mid-century modern fashions and their influence on costume development in *The Incredibles* and *Incredibles 2*. *Film, Fashion & Consumption*, 11(1), 91–108. https://doi.org/10.1386/ffc_00041_1

- Leclercq, T., Abbasi, E. K., Dumas, B., Remiche, M.-A., & Heymans, P. (2022). Essential Expectations of Users of Web Configurators: An Empirical Survey. *Proceedings of the ACM on Human-Computer Interaction*, 6(EICS), 1–26. <https://doi.org/10.1145/3534519>
- LeRouge, C., & Wickramasinghe, N. (2013). A review of user-centered design for diabetes-related consumer health informatics technologies. *Journal of Diabetes Science and Technology*, 7(4), 1039–1056. <https://doi.org/10.1177/193229681300700429>
- Merino, G. S. A. D., Teixeira, C. S., Schoenardie, R. P., Merino, E. A. D., & Gontijo, L. A. (2012). Usability in product design—The importance and need for systematic assessment models in product development—Usa-Design Model (U-D) ©. *Work (Reading, Mass.)*, 41 Suppl 1, 1045–1052. <https://doi.org/10.3233/WOR-2012-1011-1045>
- Montazeri, S. (2013). *Design for Behavior Change: The Role of Product Visual Aesthetics in Promoting Sustainable Behavior*. <https://www.semanticscholar.org/paper/Design-for-Behavior-Change%3A-The-Role-of-Product-in-Montazeri/276d538825dc652f0e07fc29b0f43d5069d71fce>
- Najafi, M., & Toyoshiba, L. (2008). Two Case Studies of User Experience Design and Agile Development. *Agile 2008 Conference*, 531–536. <https://doi.org/10.1109/Agile.2008.67>
- Nichols, D., & Twidale, M. (2006). *The usability of open source software: Analysis and prospects*. <https://www.semanticscholar.org/paper/The-usability-of-open-source-software%3A-analysis-and-Nichols-Twidale/74f780f297a85296183adee1948ec12a4b1539f7>
- Nin, D. (2009). *Scan the Emotional Design of Production through the Aesthetics*. <https://www.semanticscholar.org/paper/Scan-the-Emotional-Design-of-Production-through-the-Nin/a920d3ab7a30caf93adba07ef76306ad1da8139b>
- Pateman, M. (2015). *The design and aesthetics of wearable activity trackers*. <https://www.semanticscholar.org/paper/The-design-and-aesthetics-of-wearable-activity-Pateman/ff8c8aa9faea38b7d04558629ad6bfd0ba6eed14>
- Roos, J., & Veryday. (2015). *IN THE EYE OF THE PATIENT INDIVIDUAL DIFFERENCES IN EMOTIONAL REACTION TO VISUAL DESIGN AESTHETICS OF HEALTH-CARE PRODUCTS*. <https://www.semanticscholar.org/paper/IN-THE-EYE-OF-THE-PATIENT-INDIVIDUAL-DIFFERENCES-IN-Roos-Veryday/e7e0a7f432c6021a1e4964c919d8586fd3cf36f8>
- Schwab, T., Fassl, B., & Langell, J. (2018). The Importance of Design Validation in Global Health Surgical Innovation. *Surgical Innovation*, 1553350618814644. <https://doi.org/10.1177/1553350618814644>
- Serge, S. R., Stevens, J. A., & Eifert, L. (2015). Make it usable: Highlighting the importance of improving the intuitiveness and usability of a computer-based training simulation. *2015 Winter Simulation Conference (WSC)*, 1056–1067. <https://doi.org/10.1109/WSC.2015.7408233>
- Wang, J., & Hsu, Y. (2020). The Relationship of Symmetry, Complexity, and Shape in Mobile Interface Aesthetics, from an Emotional Perspective—A Case Study of the Smartwatch. *Symmetry*, 12(9), 1403. <https://doi.org/10.3390/sym12091403>
- Xu, W. (2014). Enhanced ergonomics approaches for product design: A user experience ecosystem perspective and case studies. *Ergonomics*, 57(1), 34–51. <https://doi.org/10.1080/00140139.2013.861023>
 - Костина, Е., Kostina, E., Попов, А., & Popov, A. (2019). DESIGN TECHNIQUE BASED ON AESTHETIC PRINCIPLES OF FORMATION. *Bulletin of Belgorod State Technological University Named after V. G. Shukhov*, 57–62. https://doi.org/10.34031/article_5d495e26aa0d32.51936754