Proceedings of the 12th World Congress on Electrical Engineering and Computer Systems and Sciences (EECSS 2026)
London, United Kingdom - August 2026
Paper No. MHCI 114
DOI: 10.11159/mhci26.114

Mapping The UX Architecture: A Hierarchical Framework from Dimensions to Design Elements and Guidelines

Huseyin Selcuk Kilic[1], Nur Beser [1], Zeynep Tugce Kalender [1], Sevan Katrancioglu[2]
[1]Marmara University, Department of Industrial Engineering
Istanbul, Türkiye
huseyin.kilic@marmara.edu.tr, nur.beser@marmara.edu.tr , tugce.simsit@marmara.edu.tr
[2]Turkcell Technology
Istanbul, Türkiye
sevan.katrancioglu@hotmail.com

Abstract **-** User Experience (UX) has attracted more interest from academics and practitioners than in the past. There are various approaches and concepts for optimizing UX, a complex process that requires coordinated use of multiple tools. However, this variety can cause confusion when handling the topic. Dimensions, principles, heuristics, and methods are treated differently across contexts. Moreover, certain concepts are used inconsistently across studies. Hence, it is necessary to clarify these concepts and their role in optimizing UX. To this end, a five-level pyramid is presented to bridge the gap between the concepts and to show their placement within UX optimization. At the first level is UX optimization. At the second level are the dimensions. The third level consists of heuristics and design elements. The fourth level includes the design elements. Finally, the fifth level comprises the standards and guidelines. Additionally, the evaluation methods and metrics for each of the five levels are presented.

Keywords**:** User Experience, Usability, UX Architecture, UX evaluation, UX metrics

1. Introduction

User Experience (UX) is an essential topic for firms' competitiveness and sustainability. With the increased use of digital platforms, it has become more critical than ever and has introduced new features. It encompasses the user's perceptions of the entire process before, during, and after using a system or product [1]. In addition to this basic definition, the literature offers various definitions, ISO 9241-210 (2010): “User experience is a person's perceptions and responses that result from the use and/or anticipated use of a product, system, or service.” [2] . The common thread among the definitions is that UX has a broad scope and can encompass various components. This also makes it prone to a wide range of comments on the content.

Within the context of UX, there are various terms, with usability being the first. It is the most essential and widely used concept in UX. As Lallemand et al. [3] and Zantjer & Gonzales [4] note, it is even used instead of UX in some studies and practical applications. Additionally, other concepts frequently seen in the UX context include accessibility, learnability, and user-friendliness. These concepts also have different meanings and uses across studies. Hence, in this study, these concepts will be defined, and a hierarchical pyramid will be provided to clarify their positions, with UX optimization as a strategic step at the top. Within the pyramid, the second level contains the dimensions of UX. The third level includes heuristics and design elements. The dimensions are designed using heuristics and design elements. Finally, on the fourth level, which can be regarded as the operational level, there are the standards and usability guidelines.

In addition to the concepts mentioned, the literature also documents various evaluation methods and metrics. There is also confusion about how and where they should be used. Each method has its own characteristics. Hence, after providing the pyramid, a mapping will be presented for the evaluation methods and metrics.

The rest of the study is organized as follows. Section 2 presents the proposed hierarchical pyramid of the UX structure, along with definitions of UX concepts. The evaluation methods and metrics corresponding to the levels proposed in the pyramid are provided in the third section. Finally, the fourth section presents the discussions and conclusions, with the references following.

2. The Proposed Hierarchical Pyramid for UX Structure

The hierarchical pyramid for UX structure consists of five levels. At the top is the UX, which is intended to be optimized. It can be regarded as the strategic level and final goal. UX rises on the dimensions. On the other hand, heuristics and design principles are used to evaluate and improve UX dimensions and serve as guides. At the fourth level are the design elements, and, finally, at the fifth level are the standards and usability guidelines, as shown in Fig. 1.

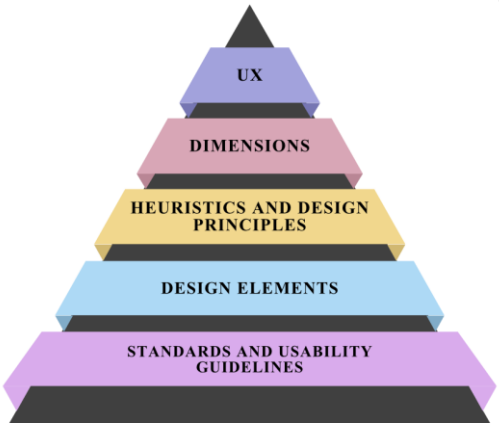

Fig 1. UX structure

The proposed structure can also be considered at the managerial level. The strategic level includes optimizing UX. The tactical level includes dimensions such as “what” and heuristics and design principles as “how”. Similarly, at the operational level, there are the design elements as “what” and standards and usability guidelines as “how”. The details of the proposed structure are presented in the subsections.

2.1 User Experience

UX was first introduced in the literature in the 1990s, defined as encompassing all aspects of a user's experience with a system [5]. The main reason for introducing this term was the limited scope of usability. Although there is no consensus on the definition of UX and usability, both are considered part of human-centered design [3].

There are various definitions of UX in the literature. One of the most widely accepted definitions of UX is the ISO definition. In ISO 9241, user experience is defined as "a person's perceptions and responses that result from the use or anticipated use of a product, system, or service."[6]. Hassenzahl and Tractinsky approached this definition from hedonic and pragmatic perspectives, describing UX as "designing for added value" or "designing for pleasure rather than for the absence of pain" [7]. According to UX expert Donald Norman, user experience is “how products interact with the outside world and play a role”, that is, how people “contact” and “use” [8].

Furthermore, when these definitions are considered together, we can see that UX is not just about design, but a whole system of factors that affect the entire process, influencing every action and every second the user spends on the website. Websites, once created, are not products that can be used continuously in their current state; they require continuous improvement and enhancement, and this is where the concept of continuous UX improvement comes into play. For example, Schön et al. discuss the concept of Agile UX in this context. Agile UX is defined as a continuous

journey aimed at changing and improving user behavior [9]. Considering these definitions, user experience emerges as the most fundamental structure we aim to achieve and improve, occupying the top spot in our pyramid.

2.2 Dimensions

While evaluating this layer of the pyramid, numerous definitions, such as attributes, pillars, facts, or factors, appear in the literature. To eliminate the semantic confusion caused by these terms, we have used the concept of dimensions in our study. The definition of dimensions provides a more comprehensive understanding of the UX concept and brings the literature together under a single umbrella.

When identifying user experience dimensions, it is necessary to mention Peter Morville's honeycomb approach. The honeycomb approach takes UX beyond usability and identifies seven distinct dimensions. Morville presents seven different dimensions to the literature: usable, useful, findable, valuable, desirable, accessible, and credible [10]. Hassenzahl [11], on the other hand, examines UX in terms of its pragmatic and hedonic dimensions. In the pragmatic approach, what the system does is important; whether it helps the user achieve their basic goals is crucial. In the hedonic approach, the focus is on the design's aesthetic aspects and the feelings it evokes in the user.

Another dimension integrated with the UX concept is usability. Usability is a frequently studied dimension because it can be evaluated through surveys, experiments, and other methods described in the literature. Unlike other dimensions, it is central and frequently studied. Furthermore, some of the dimensions mentioned in the existing literature are generally sub-dimensions that influence the concept of usability. For example, readability is a dimension that directly affects usability. Other dimensions that should be mentioned under the concept of usability, as defined in ISO 9241-11 [6], include efficiency, effectiveness, and satisfaction.

Many concepts are expressed as dimensions in the existing literature. While Mary and Baburaj's [12] paper emphasizes the Flexibility dimension, Zheng [13] prioritizes accessibility. Perdana and Suzianti [14] have identified simplicity, readability, consistency, and interactivity as dimensions. Recently, amid increasing security concerns, the Trust dimension has come to the forefront. Bilgihan [15] evaluated trust and UX together in his paper.

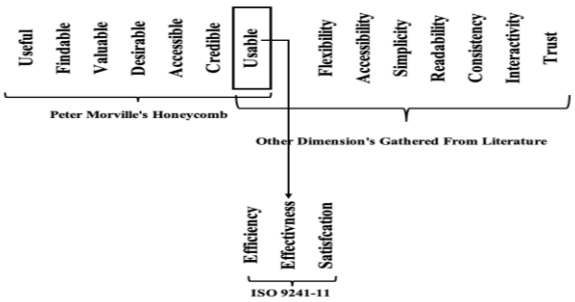

Fig 2. Positioning of UX Dimensions'

Figure 2 lists the most frequently recurring dimensions identified in the literature review. These concepts are abstract and can be shaped and expanded from different perspectives. In addition, usability and its sub-dimensions are presented in a separate framework.

2.3 Heuristics and Design Principles

Heuristic and design principles define how dimensions should be and offer guidelines for improving specific dimensions. A transitional structure exists here; some principles can affect multiple dimensions, while others focus on a single dimension. For example, Nielsen [16] generally focused on the usability dimension, while Gesfalt [17] was more concerned with visuality. These principles can be applied to improve specific dimensions depending on the intended use and needs.

Table 1. Heuristics and Design Principles

Methodology		Scope	Source
Nielsen's 10 Usability Heuristics	1. Visibility of System Status 2. Match Between System and the Real World 3. User Control and Freedom 4. Consistency and Standards 5. Error Prevention 6. Recognition Rather Than Recall 7. Flexibility and Efficiency of Use 8. Aesthetic and Minimalist Design 9. Help Users Recognize, Diagnose, and Recover from Errors 10. Help and Documentation	It includes general usability requirements.	[16]
Gestalt Principles of Visual Perception	1. Proximity 2. Similarity 3. Continuity 4. Closure 5. Figure/Ground	It is generally concerned with Visuality.	[17]
Shneiderman's 8 Golden Rules of Interface Design	1. Strive for Consistency 2. Seek Universal Usability 3. Offer Informative Feedback 4. Design Dialogs to Yield Closure 5. Prevent Errors 6. Permit Easy Reversal of Actions 7. Support Internal Locus of Control 8. Reduce Short-Term Memory Load	It deals with usability and error prevention.	[18]
Don Norman's 6 Design Principles	1. Visibility 2. Feedback 3. Affordance 4. Mapping 5. Constraints 6. Consistency	It is related to design elements.	[19]

Table 1 presents Nielsen's 10 usability heuristics standards, Gestalt principles of visual perception, Shneiderman's 8 golden rules of interface design, and Don Norman's 6 design principles together. When all of these are examined, it becomes clear that each may serve one or more dimensions. Although they have permeable structures, their use in line with the evaluation purpose will increase the evaluation's accuracy.

2.4 Design Element

This layer examines the tangible components that make up the system. Figure 3 shows that the components are grouped under three main headings, and the specific elements within these headings were identified during a literature review. These headings are navigation, interaction, and data display elements. These are the primary structures that the

user concretely observes and uses. Firstly, navigation elements consist of menu structures, breadcrumbs, search interfaces, etc. These structures guide the user's journey on the website.

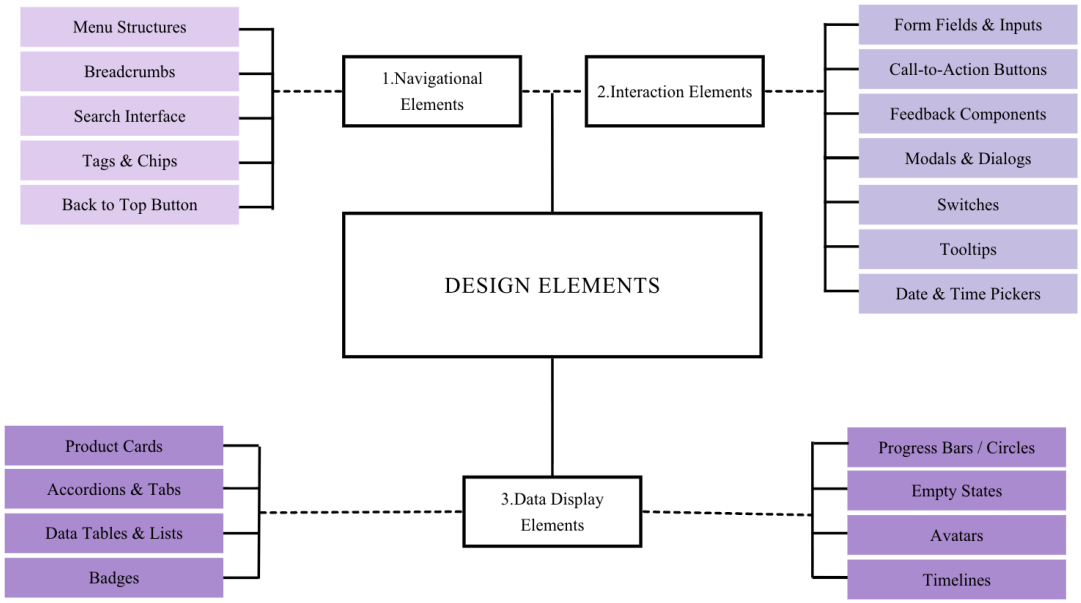

Fig 3. UX Design Elements

2.5 Standards and Usability Guidelines

The fundamental, layered standards and usability guidelines provide us with the design rules and technical basis. These rules are clear and unquestionable; strict adherence will lead to the desired results and identify the system's needs. They have been tested by experts and are accepted and approved in the literature. These guidelines include ISO technical standards, accessibility guidelines, and guidelines from platform operating systems. Although the guidelines are created for different purposes, they all aim to enhance the UX journey for users.

Although there is no standard approach to usability guidelines [20], the guidelines are generally classified into three difficulty levels: hard, medium, and easy. Hard-level UX standards are ISO and technical standards. At the hard-level, they clearly define the rules, have inflexible structures, and require more labor-intensive applications than at other levels. ISO standards dealing with User Experience include ISO 9241-201 [2] and ISO 9241-11 [6]. The medium-level consists of accessibility standards. These standards are generally neither too flexible nor too rigid. An example of this level is the Web Content Guidelines (WCAG) [21], which apply POUR principles [22]. These guidelines ensure that web content is perceptible, operable, understandable, and robust, based on four fundamental principles [22]. The easy-level and the final level include platform and operating system guidelines. These are open to interpretation and flexible. Examples include OS Guidelines, Apple Human Interface Guidelines (HIG), and Google Material Design.

3. UX Evaluation Methods and Metrics

In the presented 5-layered pyramid structure, each level has its own objectives, evaluation methods, and key metrics. These collectively answer questions such as which evaluation method measures which metric at what level in the overall picture,

as shown in Table 2. Furthermore, while concrete and technical features are addressed at level 5, as one moves up, the objectives gradually become more abstract, and the structure encompasses the entire UX journey.

Table 2. Mapping Methods and Metrics Concerning UX Architecture Hierarchy

HIERARCHY LEVEL	PURPOSE	EVALUATION METHOD	KEY METRICS
L1: UX (Optimization)	Overall experience quality and strategic business goal achievement	UX Benchmarking, Customer Journey Analytics, Longitudinal Field Studies, Business Intelligence Integration	Conversion Rate, Churn Rate, Customer Lifetime Value, Support Ticket Volume, Time to Value, Google HEART Framework (Happiness, Engagement, Adoption, Retention, Task Success)
L2: Dimensions	Qualitative success of the product (Usability, Credibility, etc.).	SUS, NPS, Hassenzahl's AttrakDiff Scale, User Surveys, UEQ	SUS Score (0-100), NPS Score, CSAT (Customer Satisfaction), Pragmatic/Hedonic Quality Scores
L3: Heuristics & Design Principles	Accuracy of design laws and mental models.	Heuristic Evaluation, Cognitive Walkthrough, Gestalt Principles Audit	Severity Ratings (0-4), Number of Heuristic Violations, Compliance Percentage
L4: Design Elements	Functional performance of atomic building blocks (buttons, forms, etc.)	A/B Testing, Eye-Tracking, First Click Testing, Form Analytics	Click-Through Rate (CTR), Fixation Duration, Heatmap Density, Error Rates per Element
L5: Standards & Usability Guidelines	Compliance with technical and legal foundations (Accessibility, OS rules)	Accessibility Audit (WCAG Compliance), Technical Validation Tests, Platform Guideline Review	WCAG Compliance Level (A/AA/AAA), Accessibility Score, Technical Validation Errors, Contrast Ratio, Screen Reader Compatibility

At the top of the hierarchy is Level 1: UX (Optimization), where outputs from the lower levels (L2–L5) converge to deliver final business value and enhance overall user satisfaction. Here, the focus moves from interface features (like button colors) to evaluating how the product affects user experience and supports the organization's final goals. There are various evaluation methods and metrics that can be used at this level. They are briefly described as follows:

- UX Benchmarking
- Customer Journey Analytics
- Longitudinal Field Studies
- Business Intelligence (BI) Integration

There are dimensions at the second level. At this level, users' subjective perceptions are evaluated using various methods and multiple evaluation metrics. The methods and which dimension they evaluate are indicated below:

- The System Usability Scale (SUS), developed by Brooke (1996), is a ten-question survey that evaluates usability and learnability. It mainly measures the pragmatic aspect of the user.
- AttrakDiff scale proposed by Hassenzahl (2003) evaluates both pragmatic and hedonic aspects. The dimensions focused are Useful, Desirable and Stimulation.
- Net Promoter Score (NPS). It mainly measures the reliability and credibility aspects of the user experience.
- Tree Testing mainly measures the findability dimension.
- Web Accessibility Audit measures the accessibility dimension.

- The User Experience Questionnaire focuses on hedonic quality.
- Performance Testing focuses on pragmatic quality.

There are the heuristics and design principles at the third level, where the design's logical correctness is checked concerning expert views and cognitive analyses. The related methods are provided as follows.

- Heuristics Evaluation includes the interface analysis of experts within the framework of predetermined principles, such as Nielsen's 10 principles.
- Cognitive Walkthrough simulates the cognitive processes of a user when the user uses the system for the first time.
- Gestalt Principles Audit involves examining whether the design's visual hierarchy aligns with human perception principles, such as the Gestalt laws.

The fourth level consists of the design elements. The methods used at this level measure users' physical and visual interactions with these specific components.

- A/B Testing
- Eye-Tracking
- First Click Testing
- Form Analytics

The fifth level, Standards & Usability Guidelines, measures compliance rather than the correctness of the design. The related methods used at this level are:

- Accessibility Auditing
- Technical Validation
- Platform Guideline Review

4. Discussion and Conclusion

UX measurement and evaluation are rather abstract concepts that are quite difficult. Although hundreds of approaches have been developed to improve and refine this concept, our study addresses the need for a simplified, categorized presentation of these approaches within the UX literature.

In conclusion, our study seeks to unravel the deep complexity of the UX literature. UX is positioned at the top of the pyramid, and the abstract output, which is developed by improving the concrete factors in the lower layers, is defined as our goal. All the factors commonly used in the UX literature are carefully placed within the pyramid's structure, which moves from concrete to abstract, aiming to instill a common understanding among users who read this map.

Furthermore, there are no clear boundaries between the hierarchical levels identified in the study; that is, the boundaries are structurally permeable. Different subjective evaluators can position the factors at different levels, which may allow future studies to measure interactions across hierarchical levels

References

[1] A. Chevalier, A.-C. Maury, and N. Fouquereau, "The influence of the search complexity and the familiarity with the website on the subjective appraisal of aesthetics, mental effort and usability," *Behaviour & Information Technology*, vol. 33, no. 2, pp. 117–132, 2014.

[2] A. G. Mirnig, A. Meschtscherjakov, D. Wurhofer, T. Meneweger, and M. Tscheligi, "A formal analysis of the ISO 9241-210 definition of user experience," in *Proc. 33rd Annu. ACM Conf. Extended Abstracts on Human Factors in Computing Systems (CHI EA)*, 2015, pp. 437–450.
[3] C. Lallemand, G. Gronier, and V. Koenig, "User experience: A concept without consensus? Exploring practitioners' perspectives through an international survey," *Computers in Human Behavior*, vol. 43, pp. 35–48, 2015.
[4] R. Zantjer and L. Gonzales, "What is meant by user experience? Analyzing usability/user experience professionals' dynamic representations of self," *Journal of Usability Studies*, vol. 10, no. 4, 2015.
[5] D. Norman, J. Miller, and A. Henderson, "What you see, some of what's in the future, and how we go about doing it: HI at Apple Computer," in *Proc. Conf. Companion on Human Factors in Computing Systems (CHI)*, 1995, p. 155.
[6] *ISO 9241-11: Ergonomic requirements for office work with visual display terminals (VDTs) — Part 11: Guidance on usability*, 1998. [Online]. Available: https://standards.iteh.ai/catalog/standards/sist/c4f936de-9ec3-4eae-91ee-
[7] M. Hassenzahl and N. Tractinsky, "User experience—A research agenda," *Behaviour & Information Technology*, vol. 25, no. 2, pp. 91–97, 2006.
[8] H. J. Hu, J. Yen, and S. S. Guan, "A study on the interface usability of B2C hypermarket e-commerce website," in *Proc. IEEE Asia-Pacific Services Computing Conf.*, 2008, pp. 1202–1207.
[9] E. M. Schön, T. S. da Silva, A. Hinderks, H. Sharp, and J. Thomaschewski, "Introduction to special issue on Agile UX: Challenges, successes and barriers to improvement," *Information and Software Technology*, vol. 158, Art. no. 107193, 2023.
[10] P. Morville and P. Sullenger, "Ambient findability: Libraries, serials, and the internet of things," *The Serials Librarian*, vol. 58, no. 1–4, pp. 33–38, 2010.
[11] M. Hassenzahl, "The interplay of beauty, goodness, and usability in interactive products," *Human–Computer Interaction*, vol. 19, no. 4, pp. 319–349, 2004.
[12] S. P. Mary and E. Baburaj, "Genetic based approach to improve e-commerce web site usability," in *Proc. 5th Int. Conf. on Advanced Computing (ICoAC)*, 2013, pp. 395–399.
[13] H. Zheng, "A study on the usability of e-commerce websites between China and Thailand," *International Journal of Simulation: Systems, Science and Technology*, vol. 17, no. 1, pp. 34–31, 2016.
[14] R. A. Perdana and A. Suzianti, "Analysis of usability factors affecting purchase intention in online e-commerce sites," in *IOP Conf. Ser.: Mater. Sci. Eng.*, vol. 185, no. 1, Art. no. 012015, 2017.
[15] A. Bilgihan, "Gen Y customer loyalty in online shopping: An integrated model of trust, user experience and branding," *Computers in Human Behavior*, vol. 61, pp. 103–113, 2016.
[16] J. Nielsen, "Finding usability problems through heuristic evaluation," in *Proc. SIGCHI Conf. on Human Factors in Computing Systems*, 1992, pp. 373–380.
[17] Z. Mennan, "From Simple to Complex Configuration: Sustainability of Gestalt Principles of Visual Perception Within the Complexity Paradigm," *ODTÜ Mimarlık Fakültesi Dergisi*, vol. 26, no. 2, pp. 309–323, 2009, Accessed: 00, 2020. [Online]. Available: https://hdl.handle.net/11511/44169.
[18] B. Shneiderman, *Designing the User Interface: Strategies for Effective Human–Computer Interaction*, 5th ed. New Delhi, India: Pearson Education India, 2010.
[19] D. Norman, *The Design of Everyday Things: Revised and Expanded Edition*. New York, NY, USA: Basic Books, 2013.
[20] M. S. Goundar, B. A. Kumar, and A. S. Ali, "Development of usability guidelines: A systematic literature review," *International Journal of Human–Computer Interaction*, vol. 40, no. 5, pp. 1298–1316, 2024.
[21] World Wide Web Consortium (W3C), *Web Content Accessibility Guidelines (WCAG) 2.0*, 2008. [Online]. Available: https://www.w3.org/TR/WCAG20/
[22] F. Elavsky, C. Bennett, and D. Moritz, "How accessible is my visualization? Evaluating visualization accessibility with Chartability," in *Comput. Graph. Forum*, vol. 41, no. 3, pp. 57–70, 2022.