

Methodological Concept for User Experience Research of Interfaces Based on Norman's Model

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Abstract

Aim: The article aims to present a methodological procedure, and tools designed to enable a detailed and systematic analysis of user experience (UX) and user interface (UI) in a selected software solution, using a model based on Norman's design concepts.

Methodology: A literature review was conducted, analysing methods for evaluating user experience and Don Norman's design concept. This review identified Norman's model, developed to evaluate the ePortal platform interface, which served as the foundation for proposing a systematic approach to UX/UI analysis. The approach includes seven stages: compiling a list of interface elements based on the literature, selecting software solutions for analysis, identifying and evaluating interface elements, conducting a comparative analysis, and formulating design recommendations and guidelines.

Results: The proposed methodology led to the creation of structured tables that support the systematic evaluation of user interfaces based on Norman's model. These tables enable the identification, assessment, and comparative analysis of interface elements across the visceral, behavioural, and reflective levels. They provide a basis for generating design recommendations and practical guidelines tailored to the analysed solutions.

Implications and recommendations: The proposed methodology integrates theoretical foundations with practical application, facilitating the identification of usability issues and the formulation of actionable design recommendations. While the initial implementation may be time-intensive due to the need for detailed interface documentation, subsequent iterations become more efficient. Future empirical studies are recommended to validate the methodology's effectiveness in various digital contexts, such as mobile applications, educational platforms, and e-commerce systems.

Originality/value: This article contributes by introducing a structured procedure for evaluating user interfaces based on Norman's design principles. It addresses gaps in the literature by combining robust theoretical underpinnings with practical tools. A notable innovation is the introduction of dedicated tables to guide each phase of the analysis. These tables streamline the evaluation process, document findings, and facilitate the development of comprehensive design recommendations.

Keywords: user experience, user interface, Norman's model, evaluation, heuristics

1. Introduction

In the era of widespread digitalisation, ensuring the quality of digital products has become crucial both for businesses aiming to boost sales and for users whose needs must be met. In this context, the user interface and all aspects associated with it – from design to functionality – play a pivotal role. Despite the increasing number of software tools, there is a lack of studies offering a comprehensive approach to evaluating interfaces, particularly in the context of identifying design flaws and proposing practical solutions (Whaiduzzaman et al., 2023). Various methods exist for evaluating software solutions, but as the literature review reveals, many of these methods are applied in a general, superficial manner, leading to schematic and not particularly accurate assessments (Hornbæk, 2006). One of the most popular methods is the heuristic method which is characterized by simplicity and low implementation costs (Dourado & Canedo, 2018; Nielsen, 2012; Sivaji et al., 2011). However, studies often present only general findings indicating which areas require improvement, without providing specific practical recommendations regarding what exactly is malfunctioning and what solutions could be applied (Følstad et al., 2012). Therefore, this article proposes a methodological procedure that leverages heuristic concepts and tools to conduct an evaluation of the interface of any type of software tool. The goal of the proposed procedure is to precisely identify a list of elements present in the interfaces of a given type and to offer design guidelines for designers. The approach utilizes a model based on Don Norman's concept (Norman, 2004) which advocates a holistic view of the interface, encompassing both visual and functional aspects. Such a theoretical framework ensures that the evaluation is comprehensive and structured, and that the results not only highlight problems but also provide practical solutions. The article is divided into five main sections, presenting the proposed user interface evaluation methodology in a coherent and logical manner. The first section identifies existing gaps in the literature, justifying the need for a new approach to interface evaluation. Subsequently, the literature review discusses selected methods and tools used in user experience (UX) and user interface (UI) research, with a detailed examination of Norman's design concept. The next section outlines the detailed evaluation structure, based on Norman's three levels: visceral, behavioural, and reflective. The section on evaluation tool concepts introduces tables that can serve as practical tools supporting the evaluation procedure. Finally, the concluding section summarizes the key principles and potential applications of the methodology. It also discusses the limitations of the approach and proposes directions for future empirical research to verify the effectiveness of this methodology and contribute to its further development.

2. Literature Review

2.1. Interface Evaluation Methods

The evaluation of user interface usability is a critical element in the design process of interactive systems (Plass, 1998). It enables the identification of issues and the alignment of design with user needs at various stages of the product lifecycle, from early design phases to post-implementation (Alomari et al., 2020; Hartson & Pyla, 2018). Evaluation conducted at an early design stage focuses primarily on verifying the alignment of the design with user requirements, allowing potential issues to be detected before the system is fully implemented. The results of early evaluations provide designers with the opportunity to make changes when they are relatively inexpensive and easy to implement. In

contrast, evaluations conducted in later stages focus on analysing the final product, incorporating the experiences of end-users in real-world conditions (Stone et al., 2005). This stage provides insights into user effectiveness and satisfaction, though implementing significant design changes at this point is costlier and more constrained. The literature extensively describes methods for evaluating user interfaces, such as heuristic evaluation, cognitive walkthroughs, and usability testing (Bernhaupt et al., 2008; Lumsden, 2008; Nascimento et al., 2016). Each of these methods has unique strengths and limitations, allowing the approach to be tailored to specific research needs and contexts (Jeffries et al., 1991). Heuristic evaluation, one of the most popular methods, is characterized by relatively low costs and the ability to quickly detect usability issues. This method relies on analysing the interface using a set of principles, such as Nielsen's heuristics, which include guidelines like system status visibility, user control, and error prevention (Nielsen, 1994, 1995). However, as research suggests, heuristic evaluation has its limitations. Nielsen and Molich (1990) observed that individual evaluators identify only 20-51% of usability problems, indicating that a single method is insufficient for a comprehensive interface diagnosis. Additionally, difficulties in interpreting general heuristic criteria can result in overlooking specific aspects of the interface that are critical to users of a given system (Wenham & Zaphiris, 2003). Cognitive walkthroughs, which allow for the analysis of how users interact with system functionality, also have limitations, particularly in evaluating more complex scenarios and visual aspects (Jeffries et al., 1991). Based on a review of the literature (Gunawan et al., 2021; Kumar & Goundar, 2019), the most frequently mentioned elements included in validation checklists for interface evaluations are icons, menus, headers, navigation, images, and buttons. While these are indeed fundamental components of any solution and their analysis is crucial, such an approach may limit the effectiveness of evaluations for tools with specific functionalities. Researchers emphasise the need to consider the context of use and the specifics of the analysed solution to effectively identify unique problems (Wenham & Zaphiris, 2003). Therefore, it may be valuable to propose a more context-sensitive approach that not only identifies usability issues but also enables the development of structures tailored to the unique characteristics of the evaluated tool.

2.2. Norman's Design Concept

Norman proposed a design approach that holistically encompasses all aspects of a product – from its visual appeal and functionality to how it is presented to the user (Norman, 2014). His concept identifies three levels of design: visceral, behavioural, and reflective (Norman, 2002). The visceral level pertains to human primal instincts, relying on perception and automatic assessment of surface-level features of products. Reactions at this level are natural, autonomous, and universal. Features such as colour, shape, and texture evoke immediate impressions – positive or negative – that influence the user's first feelings toward a product (Norman, 2004). The behavioural level focuses on the overall experience derived from using the product – its functionality and usability. Reactions at this level are shaped by the user's previous experiences and expectations of the product's performance. Intuitiveness and ease of use are critical factors that can either evoke satisfaction or, in their absence, frustration (Norman, 2004). The reflective level refers to how a person evaluates a product after interacting with it. This is the highest level of the hierarchy, where the user consciously analyses their experiences, situating the product in the context of their values, lifestyle, or social status. Emotions such as pride in owning the product, brand identification, or negative feelings arising from unmet expectations are evident at this level (Norman, 2004). These three levels differ in their mode of operation and impact on the user, but together they cover the full spectrum of interaction with a product – from first impressions, through usage, to the reflections that remain in the user's memory (Norman & Ortony, 2003). According to Norman and Ortony (2003), emotions and functionality are inseparable, and their harmonious integration forms the foundation of effective design. A model for evaluating any software tool based on Norman's concepts has been proposed in the literature (Jarosz, 2023). The evaluation criteria are divided into three main groups: visceral level, behavioural level, and reflective level. This division enables a comprehensive assessment of a product from various perspectives in the context of user experience. In the visceral level group, nine evaluation criteria are distinguished. These include the

analysis of the page's purpose, its alignment with the target audience, layout, typography, colour scheme, accessibility for individuals with disabilities, responsiveness, as well as the quality of images, icons, and audiovisual elements. The behavioural level group encompasses eight evaluation criteria, such as the ease of learning to use the site, intuitive navigation, visibility of interactive elements, appropriate mapping of functions, consistency of actions, task completion ease, the quality of feedback after interactions, and error-handling effectiveness. Within the reflective level, seven criteria are defined. These focus on aspects related to the user's sense of identity and values, personalization capabilities, self-expression, evoking nostalgia or familiarity, referencing the culture of the target audience, fostering a sense of meaning and purpose, and delivering unique and memorable experiences. This structured framework ensures that a product is evaluated holistically, providing insights that span from its immediate appeal to its deeper emotional and cultural resonance with users.

3. Methodological Procedure Concept

This section presents the concept of a methodological procedure aimed at a thorough and systematic analysis of the UX/UI of a selected software interface, utilizing a model based on Norman's design concept (Jarosz, 2023).

The procedure consists of the following stages.

1. Developing a list of interface elements to be evaluated – based on the literature review.
2. Selecting software solutions for analysis.
3. Identifying interface elements.
4. Describing and evaluating interface elements in terms of their implementation.
5. Comparative analysis of the interfaces of selected software tools.
6. Formulating design recommendations.
7. Developing design guidelines.

Stage 1. In the first stage, a literature review was conducted to develop a list of interface elements most frequently subjected to evaluation. The resulting list serves as a starting point for further analysis of interface elements in subsequent stages.

Stage 2. At this stage, the selection of software solutions for analysis takes place. The choice should align with the research objective and be adequately justified. It is important that the selected tools vary in terms of functionality, design, and key user interactions while remaining within the same category of tools. Such diversity allows for a broader perspective on the analysed UX/UI aspects and facilitates the identification of both exemplary solutions and potential issues. Justifications for the selection may include factors such as popularity, availability, or functional diversity. Additionally, a brief description of each selected tool is recommended to highlight its relevance in the context of the analysis.

Stage 3. Following the selection of tools, the interface elements that fulfil specific criteria derived from Norman's model are identified. It is essential to thoroughly analyse the interface of each tool, paying particular attention to elements identified through the literature review – such as icons, menus, headers, navigation, images, and buttons – as well as those not immediately visible. The outcome of this stage is a comprehensive list of key interface components, which will serve as the foundation for further analysis.

Stage 4. This stage involves the evaluation of interface elements identified in relation to the selected software solutions based on their fulfilment of specific criteria. The evaluation should determine how well each element is implemented and identify any features that indicate poor implementation. It is crucial to establish a hierarchy of importance, identifying which elements are critical for meeting the criteria and which are less significant. The result of this stage is an organized list of elements that highlights the strengths and weaknesses of the analysed software solutions, along with priorities for UX/UI analysis.

Stage 5. At this stage, an analysis is conducted to examine how the previously identified interface elements are implemented in each of the analysed software solutions, in the context of the selected

criteria. Each element is described in detail, considering the specifics of its implementation. Comparative analysis allows for identifying differences and similarities in the approaches to interface design, providing a more comprehensive view of how key elements are executed.

Stage 6. Conclusions are drawn based on the comparative analysis, summarising key observations regarding the implementation of individual interface elements. These conclusions highlight both strengths that can serve as exemplary practices and weaknesses that indicate areas requiring improvement. Based on this analysis, design recommendations are formulated, outlining the actions needed to enhance the fulfilment of specific criteria. The outcome of this stage is a set of practical recommendations that can be applied in further design efforts.

Stage 7. The final stage involves developing universal design guidelines that summarise the results of the analysis and recommendations. These guidelines are practical and based on the earlier conclusions, transformed into general design principles. They should be concise, specific, and actionable, clearly indicating directions for interface design. The outcome of this stage is a document containing a cohesive set of guidelines consistent with Norman's model, addressing user needs and the design objectives of the given type of software solution. These guidelines can serve as a knowledge base for designers and a reference point in future UX/UI development processes.

In summary, the practical result of this research procedure will be a compilation consisting of three key elements.

1. A list of interface elements that most frequently appear in a given type of software solution (Stage 3).
2. A hierarchically structured list of elements, enriched with a description of their strong and weak implementations within the selected criteria (Stage 6).
3. Final design guidelines, providing practical recommendations for designers, summarizing conclusions and recommendations (Stage 7).

Such a research outcome provides a cohesive knowledge base that can be used both for analysing existing interfaces and designing new UX/UI solutions.

4. Tools Concept for Implementing the Methodological Procedure

To facilitate and structure the implementation of the methodological procedure, it is proposed to use dedicated tables as the primary tool supporting the analysis at each stage. These tables allow for the clear presentation of results, the organization of data, and the documentation of individual stages in a transparent and easily interpretable manner. Each table is tailored to the specifics of a given stage of the procedure, enabling a systematic progression through the analysis process. Below, the concept of tables for each stage of the procedure is presented.

Table 1 has been designed as a tool to support the second stage of the research procedure, in which interface elements assigned to specific criteria of Norman's model are identified. The table consists of three main sections: a column containing the criteria, columns assigned to the analysed software solutions, and rows where identified interface elements for each software solution (SS) under the given criterion are recorded.

Table 1. Identification of interface elements within a given criterion

Level (visceral / behavioural / reflective)				
Criterion	Interface elements implementing the criterion			
	SS 1	SS 2	SS 3	SS $n + 1$
Clearly defined page goal	page header, welcome text, CTA button	page footer, icons, graphics, navigation menu	element 1, element 2, element n	element $n + 1$
Criterion n				
Criterion $n + 1$				

Source: own elaboration.

Table 2 supports the fourth stage of the procedure, where the interface elements identified earlier are evaluated, creating a set of good and bad practices in their implementation. The purpose of the table is to structure the conclusions from the conducted evaluation. In the 'Good Implementation' column, the evaluator can record features or practices that, in their opinion, contribute to an element effectively meeting the criterion. In the 'Poor Implementation' column, potential shortcomings are noted, which may hinder usability.

Table 2. Description of the implementation of a given interface element within a specific category

Level (visceral / behavioural / reflective)			
Criterion	Interface element	Good implementation	Poor implementation
Clearly defined page goal	CTA button	<ul style="list-style-type: none"> Button with clear text explaining what happens after clicking, e.g. "Buy now" Button clearly visible on the page, e.g., in the top section or central area, in a distinguishable colour 	<ul style="list-style-type: none"> Button with poorly understood text, e.g. "Click here" Button barely visible, hidden, small, in a colour like the background
	element 2		
	element n		
Criterion n	element $n + 1$		
	...		

Source: own elaboration.

Table 3 has been developed for the fifth stage of the procedure, which focuses on comparing how specific interface elements are implemented in the analysed software solutions. The table enables the compilation of descriptions of the implementation of a given element within a selected criterion for each software solution, facilitating the identification of differences and similarities in interface design approaches.

Table 3. Comparative analysis of interface elements in selected software solutions

Level (visceral / behavioural / reflective)				
Criterion	Interface elements implementing the criterion			
	Interface element	SS 1	SS 2	SS 3
Clearly defined page goal	CTA button	Button "Buy now", large, red, placed centrally on the main page	Button "See more", small, blue, hidden in the menu	Button "Buy now", medium-sized, green, visible on the main page
	element 2			
	element n			

Source: own elaboration.

Table 4 supports the sixth stage of the procedure, enabling the organization of formulated conclusions and design recommendations based on the identified interface elements and their evaluation in the context of the selected criteria. The structure of the table allows for detailed assignment of conclusions and recommendations to each interface element within the individual criteria.

Table 4. Conclusions and design recommendations

Level (visceral / behavioural / reflective)			
Criterion	Interface element	Conclusions	Recommendations
Clearly defined page goal	CTA button	<ul style="list-style-type: none"> SS1: good implementation, the button is visible with clear messaging SS2: poor implementation, the button is barely visible and unclear SS3: good implementation, but the green colour may not stand out enough 	<ul style="list-style-type: none"> SS1: the "Buy now" button is well designed and requires no changes SS2: change the "See more" text to a direct message, e.g. "Buy now" SS3: change the colour to a more contrasting one, e.g. blue
	element 2		
	element 3		
Criterion n	element n		
	...		

Source: own elaboration.

Table 5 serves as a summary of the entire procedure, enabling the recording of final design guidelines for each analysis criterion. These guidelines are created based on previous conclusions and recommendations, aiming to provide practical design principles that account for the specifics of individual criteria.

Table 5. Design guidelines for each criterion

Level (visceral / behavioural / reflective)	
Criterion	Guidelines
Clearly defined page goal	<ul style="list-style-type: none"> The CTA button should be clearly defined, visible, with a direct message (e.g., "Buy now"), placed in a strategic location (e.g., centrally on the main page) and have a contrasting colour Guideline 2 Guideline <i>n</i>
Criterion 2	
Criterion <i>n</i>	

Source: own elaboration.

The proposed tables constitute a key tool supporting the process of analysing user interfaces based on Norman's model. Their structured design enables the organization of the research process and systematic documentation of results at every stage of the procedure. These tables facilitate the identification of interface elements, evaluation of their implementation, comparative analysis, and the formulation of practical design recommendations.

5. Discussion and Conclusions

The user interface evaluation procedure presented in the article proposes a tool that systematically integrates theory with practice. Utilizing Norman's model, which encompasses the visceral, behavioural, and reflective levels, it enables a comprehensive analysis of user interfaces across various dimensions. This approach addresses existing gaps in the literature, highlighting the need for more contextual evaluation methods that consider the specificity of the analysed solutions (Hornbæk, 2006; Whaiduzzaman et al., 2023). The methodology allows for systematic organization of interface elements and their analysis within the three design levels. Additionally, the proposed evaluation criteria and checklist structure support the process of identifying usability issues while providing practical guidance for designers. As a result, the presented concept not only facilitates the analysis of interfaces but also aids in developing design recommendations. While the methodology has significant potential, its application requires further research and validation in practice. One of the key challenges remains the initial implementation, which demands a detailed description and evaluation of interface elements. This stage can be time-consuming, but subsequent iterations should be more efficient, enabling quicker analyses even for less experienced users. In the future, incorporating this methodology into empirical studies would not only validate its effectiveness but also support the development of practical design guidelines tailored to various types of digital tools, such as mobile applications, educational platforms, and e-commerce systems. These studies could focus on identifying common design patterns and specific solutions adapted to the unique needs of users in different contexts. The findings would enable the creation of standardized design practices that could serve as a valuable reference for both designers and researchers. Furthermore, this approach would refine the methodology to accommodate diverse application scenarios while fostering the design of more intuitive and functional user interfaces. In summary, the proposed user interface evaluation methodology represents a significant contribution to the development of research tools in the UX/UI field. Its structured approach and holistic perspective, grounded in Norman's framework of visceral, behavioural, and reflective levels (Norman, 2004), provide a robust foundation for further research and practical application. Additionally, the methodology emphasises the importance of considering the context of use and the specific characteristics of the analysed solution to effectively identify unique problems and propose tailored recommendations (Wenham & Zaphiris, 2003). The next step involves

conducting empirical studies to validate the assumptions and effectiveness of the proposed tool in practice, contributing to its further development and adaptation to the specific needs of different user groups and digital tools.

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Koncepcja procedury metodycznej dla badań doświadczeń użytkowników z wykorzystaniem modelu Normana

Streszczenie

Cel: Celem artykułu jest przedstawienie koncepcji procedury metodycznej oraz narzędzi umożliwiających szczegółową i systematyczną analizę doświadczeń użytkownika (*user experience*) oraz interfejsu użytkownika (*user interface*) wybranego rozwiązania informatycznego, z wykorzystaniem modelu opracowanego w oparciu o koncepcje projektowe Dona Normana.

Metodyka: W artykule zastosowano przegląd literatury, obejmujący analizę metod oceny doświadczeń użytkownika oraz koncepcji projektowej Normana. W jego ramach zidentyfikowano również model Normana, opracowany do oceny interfejsu platformy ePortal, który stał się punktem wyjścia do zaproponowania podejścia do systematycznej analizy interfejsów użytkownika. Obejmuje ono siedem etapów: opracowanie listy elementów interfejsu na podstawie literatury, wybór rozwiązań informatycznych do analizy, identyfikację i ocenę elementów interfejsu, analizę porównawczą, a także sformułowanie rekomendacji i wytycznych projektowych.

Wyniki: W wyniku opracowanej metodyki stworzono zestaw ustrukturyzowanych tabel wspierających systematyczną ocenę interfejsów użytkownika w oparciu o model Normana. Tabele umożliwiają identyfikację, ocenę oraz analizę porównawczą elementów interfejsu na poziomach: instynktownym, behawioralnym i refleksyjnym. Stanowią podstawę do formułowania rekomendacji projektowych oraz tworzenia praktycznych wytycznych dostosowanych do ocenianych rozwiązań.

Implikacje i rekomendacje: Proponowana metodyka łączy teorię z praktyką, umożliwiając identyfikację problemów związanych z użytecznością oraz dostarczając praktyczne wskazówki projektowe. Wdrożenie metodyki wymaga szczegółowego opisu elementów interfejsu, co w pierwszych iteracjach może być czasochłonne. Jednak w kolejnych cyklach proces staje się bardziej efektywny. W przyszłości zaleca się przeprowadzenie badań empirycznych w celu oceny skuteczności metodyki w różnych środowiskach cyfrowych, takich jak aplikacje mobilne, platformy edukacyjne czy rozwiązania e-commerce.

Oryginalność/wartość: Wartość artykułu polega na opracowaniu ustrukturyzowanej procedury oceny interfejsów użytkownika, opartej na koncepcjach projektowych Normana. Proponowana metodyka wypełnia istniejące luki w literaturze, oferując podejście, które łączy solidne podstawy teoretyczne z praktycznym zastosowaniem. Szczególną wartością jest wprowadzenie zestawu dedykowanych tabel wspierających każdą fazę analizy interfejsów. Tabele te systematyzują proces oceny, dokumentują wyniki, a także ułatwiają porównanie i formułowanie wytycznych projektowych.

Słowa kluczowe: *user experience*, *user interface*, model Normana, ocena, heurystyki
