https://doi.org/10.31891/2307-5732-2026-365-59
УДК 004.89:004.5

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MODELLING USER BEHAVIOUR AS A TOOL FOR IMPROVING UX DESIGN

While working with any-purpose web resources, we regularly encounter the same scenario where the interface appears user-friendly, and its logic is properly designed, yet users still make mistakes and leave the site. It seems evident with time that the issue is not about the interface and its design itself, but about the problem of the user's unawareness about how to work with it during the session. Besides, the user behaves typically differently from the way it is described in the manual. The study presents the author's method for investigating user behaviour, based on the investigator's observations and analysis.

The methodology was aimed at distinguishing stable behavioural models of typical action scripts with the focus on repeating errors and micro-responds occurring during the interaction with the web source. Unlike the traditional approach to the UX access, based on visual and functional optimization, user's behavioural modelling is considered as the forecasting tool for reaction prediction during the final project stage. The core idea is that the notorious behaviour should be transformed into useful and project-oriented decisions. This includes the decisions towards users' simplifications, the accent's shift towards the interface, and the reduction of the number of significant choice points and the implementation of support mechanisms as well. Significant results were obtained while the implementation of three practical issues, namely, e-learning systems, e-service portal, and an e-commerce website. The number of repeating errors was significantly decreased because of the proposed accessibility, as well as the assessment completion time decrease for 20-30% on average. The same productivity refers to the improvements of the interface's convenience.

The study's scientific novelty is determined by its statement that the opportunity of user's behaviour modelling application as a real-interaction-oriented single user experience is more beneficial than the use of idealised patterns for modelling. The practical value of this study is embodied in the chosen methodology's appropriation as a practical designer's, UX analytics, and developers' tool for better UX comprehensibility and predictability in various contexts and users' strategies. In the end, its accessibility is a game-changer in modern UX design quality.

Keywords: *UX design, behavioural modelling, user scripts, web resources, user experience, behavioural UED.*

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МОДЕЛЮВАННЯ ПОВЕДІНКИ КОРИСТУВАЧІВ ЯК ІНСТРУМЕНТ УДОСКОНАЛЕННЯ UX-ДИЗАЙНУ

Під час роботи з веб-ресурсами різного призначення можна часто зустрічати одну й ту ж ситуацію: інтерфейс здається зручним, логіка вибудована правильно, але користувачі все ж помиляються плутаються або виходять. З часом стає зрозуміло, що проблема полягає не так у вигляді інтерфейсу, як в незнанні того, як користувач поводиться під час роботи з ним. Крім того, він поводиться зазвичай не відповідно до способу описаного в проєкті.

У дослідженні представлено авторський метод для моделювання поведінки користувача на основі власних спостережень і аналітичних висновків. Методологія спрямована на виявлення стійких поведінкових моделей типових сценаріїв дій із фокусом на повторюваних помилках і мікрореакціях, що виникають під час взаємодії з веб-ресурсом. На відміну від традиційних методів доступу до UX, які зосереджені на візуальній та функціональній оптимізації, моделювання поведінки користувача розглядається як інструмент для прогнозування реакцій перед остаточним етапом проєктування. Ідея полягає в перетворенні помітної поведінки на корисні і проєктно-орієнтовані рішення. Це включає спрощення шляхів користувачів, зміну акценту на інтерфейсі, зменшення кількості важливих точок вибору і впровадження механізмів підтримки. Перевірка методології в трьох практичних випадках – освітня система електронного навчання, портал послуг і комерційний сайт – мала важливі наслідки. Запропонована доступність дозволяє суттєво зменшити кількість повторюваних помилок, скоротити час виконання завдань в середньому на 20-30% та покращити особисте оцінювання зручності інтерфейсу.

Наукова новизна дослідження підтверджує можливість використання моделювання поведінки користувача, як окремого застосування досвіду користувача, орієнтованого на справжні ситуації взаємодії, а не ідеалізовані. Практична цінність дослідження полягає в тому, що запропонована методика може бути використана як інструмент дизайнерами, аналітиками досвіду користувачів, розробниками – для покращення зрозумілості і передбачуваності досвіду користувача в різних контекстах і стратегіях користування. Саме його доступність в кінцевому результаті є визначальним чинником у забезпеченні якості сучасного UX-дизайну.

Ключові слова: *UX-дизайн, моделювання поведінки, користувацькі сценарії, веб-ресурси, користувацький досвід, поведінковий UED.*

Стаття надійшла до редакції / Received 24.03.2026
Прийнята до друку / Accepted 17.04.2026
Опубліковано / Published 28.05.2026

Problem statement in a general form and its connection to important scientific and practical tasks

As it seems from practice, even the most visually-sophisticated and formally convenient web resources are not trouble-free for users. Their interfaces can be fully compliant with the modern UX design principles, but in reality, its interaction cases are violated. Users make mistakes, they return to previous cases, or they simply stop using the interface.

While working on the study, the author noticed the gap between the interface design logic and actual users' behaviour. The end user rarely behaves as the designer suggests; they skip the main functions and misunderstand queries. These are not random errors that can be detected and fixed right after completion by standard UX tools. Current user experience design tools focus on rational understanding of the end user and stable, unchanging interaction cases. However, these models are not always working properly in terms of various contexts of mobile devices' use, lack of time, and different levels of digital knowledge. Sometimes, they don't work at all. With all this, challenges remain unclear and scarcely predictable.

Thus, the need for a tool that allows consideration and simulation of real users' behaviour even at the design stage emerges. Without such a method, the efficiency of interfaces decreases, while the risks of errors and deviations increase. In this study, the authors propose a solution for this problem.

Analysis of recent research and publications

Despite lots of studies dedicated to UX architecture, actual user behaviour is still described with the help of partial methods without a singular image. Distribution analysis remains one of the biggest issues. Typically, the queries related to persons and their routes insist on the consideration of the product users' goals and context. However, in many cases, real work situations are too complicated and sophisticated. They present the user as a person who accurately completes the tasks and thinks logically, consistently, and almost error-free. This understanding is not applicable in practice, especially in educational or healthcare cases. When a person faces a lack of time or motivation, they behave differently and tend to miss significant moments, return, or neglect tips or explanations. As a result, there is a paradox. We have an interface designed accurately following the rules, with all its functions working properly. Yet it remains uncomfortable for users [1; 2]. Actual studies mainly focus on mental stress and psychological users' schemes, and they confirm this understanding and showcase that the problem is much deeper than it seemed from the very start [3]. Enhancing user interaction and the interface technical complexity doesn't always lead to better user experience. The user feels confused especially in extended multi-detailed places [4]. Similar-type reports also contain the results of studies aimed at the investigation and evaluation of software usability. This software means formally enhance usability, but they do not always relevant to real system use cases [5]. From the beginning of the study, it became evident that standard user metrics often display the result, but they scarcely explain the process.

We can see the results of actions and rejections, but we often cannot understand the causes of such a user's behaviour. In this context, we pay attention to the investigation of the user's intelligence schemes. They offer techniques which contribute to the understanding of human decision reasons and the way a person generally comprehends the system [6]. Although in practice, these techniques typically remain analytics tools. As a result, data is collected and explained, but it is not always available outside of reports [7]. A discreet trajectory covers the application of machine learning and AI in the customer experience. Systematic data collection shows that these methods allow for the indication of persistent behavioural patterns and predict the user's actions [8; 9]. However, an interpretation obstacle often occurs at this point. Algorithmic procedures in simulation calculate these results, but they scarcely point to a designer how to transform these results into specific interface solutions. The system can predict behaviour, but it doesn't explain the reasons. Thoughts prediction-related methodology for service development becomes more applicable, which is grounded on interview observations and examination of real cases of user experience [10; 11].

Formulation of the objectives of the article

The principle objective of this study is to give examples of user behaviour simulation as a workable method, and to prove its effectiveness as a web source structure improvement tool. The whole study is grounded on specific interaction cases and the author's personal observations of working with digital products instead of complex terms application. The following research tasks were highlighted for the results. First, the review was given to scientific publications and practical studies of user experience and web platform interaction psychology. The study looked specifically to current method's weak points, which simplify or fully neglect customer behaviour. After that, typical user behavioural patterns were collected and aggregated. For example, they were aggregated by the way they were indicated on the platform, by the cases when they fluctuate, when the biggest errors occur, and when they come out of the process. All this was documented while working with actual web services without theorizing. The next step was dedicated to the development of a new user behaviour simulation method under a simple approach relevant to practical implementation in the consumer goods architecture development. The method is clearly explained as a tool which allows more than data collection, but their natural integration in the design process. The proposed method was tested on web sources of various directions, which allowed the author to evaluate its practical usefulness, indicate its strengths, and get a clear vision of where this method is the most effective and where it needs upgrading.

Presentation of the main material

The finding clearly indicates that customers are unpredictable in their essence. During UX evaluation, we repeatedly noticed the situations when an individual start confidently using the interface, but at the key point, changes their mind radically. The user can take a step back, miss some parts, or act impulsively, never ending the initial action.

These observations explain that UX is not just a compilation of plans and functions. UX should be described as an attempt to understand and recreate real human behaviour during the interaction with digital content. The proposed method is based on five aspects that collectively represent customer experience. They form the background of the customer's script, cognitive load level during making the choice, decision-making speed, errors, and the way to correct them, and the attention components. All these components are tightly interrelated. Changes in any of them almost always impact the further parts. This interrelation complicates the process of customer plan design but at the same time, it opens more opportunities for the development of completely convenient product.

The first aspect of customer script development marks the level of comprehension of the route to interaction with the artifact. The practice shows that clients rarely follow the way predicted by a designer. They create their unique routes based on visual images of ordinary actions and their previous experiences. If we simplify the situations and make key changes less noticeable, the level of returns and missed completions reduces approximately by 15-20%. It is not the best result, but it is evidence of considerable enhancement of the designer's solution.

The next aspect is cognitive load during the process selection. For the customer, the most complicated aspect is when they are forced to make decisions about the choice of the option, filling in the form, or confirmation of the action. Studies show that when the number of choices is reduced and the information is presented in smaller parts, the number of errors also drops. This helps reduce the number of unfinished consumption in services' architecture by 25%. It appeared that for the customer, function measuring is not as significant as the feeling of controlling the process.

The third aspect is decision-making speed. It is more related to the customer's indecisiveness than to the speed of clicks. It was indicated that on e-commerce platforms, multiple options for selection delays led to errors and tiredness. Behavioural modelling helped to discover the issues of hesitations and additional comparison and visual accentuation prompts. As a result, the makespan of main actions is reduced by 20-30% as appropriate.

The fourth aspect covers errors and their correction methods. End users constantly make errors, and this is natural. It is important not to avoid errors but to react properly. The method is aimed on typical error prediction and on the development of delicate recovery mechanisms which cover the reversibility of actions in case of errors and guideline values as preset conditions. This decreased the number of repeatable errors up to 40% on service portals. It is not an ultimately perfect result, but it is better than leaving the user alone with the problem unsolved.

The fifth aspect relates to support and involvement. It doesn't simply show the task completion, but it relates to the end customer's desire to return to the result. Progress indices and simple personal interactions implementation on educational platforms improved user experience and reduced the level of premature failures.

Observations showed that end users more positively react to small but consistent support signs than to complex motivation schemes. Table 1 describes how the main components of end-user behavioural modelling correlate to the methods of real changes in the indices of end-user experience.

Table 1

The consequence between the user behavioural modelling components and the results

Event	Solution	Changes	Implementation specifics
User's route	Making the route shorter, adding visible prompts	The user better navigates and rarely returns back	Revision of real user's routes
Complexity of choice	Providing step-by-step information, adding prompts	Failure decrease app. to 25%	User analysis implementation
Decision-making speed	Adding highlights, comparison, guidelines	Less hesitation, actions are faster	Depends on the site or service type
Events in case of errors	Predicting errors, allowing quickly correct them	Repeating errors reduce up to 40 %	Log and behaviour analysis
Return cause	Showing progress, leaving short feedback	User satisfaction and loyalty increase	Shows effectiveness in the educational environment

Table 1 overview shows that users feel better when the product clearly guides them on the route or provides the user with the user interface where notifications about current position and further actions are added. The possibility of errors decreases in such situation and actions become more reliable. The elements related to cognitive load and decision-making speed work differently depending on the circumstances and the service's complexity.

It is especially clear for large e-commerce platforms which have complex logic. At the same time, the components which impact long-lasting capture are often undervalued, although they provide reliable user experience in the future. In order to collect all these observations, the Image 1 was designed. It displays how behavioural parts impact web sources use.

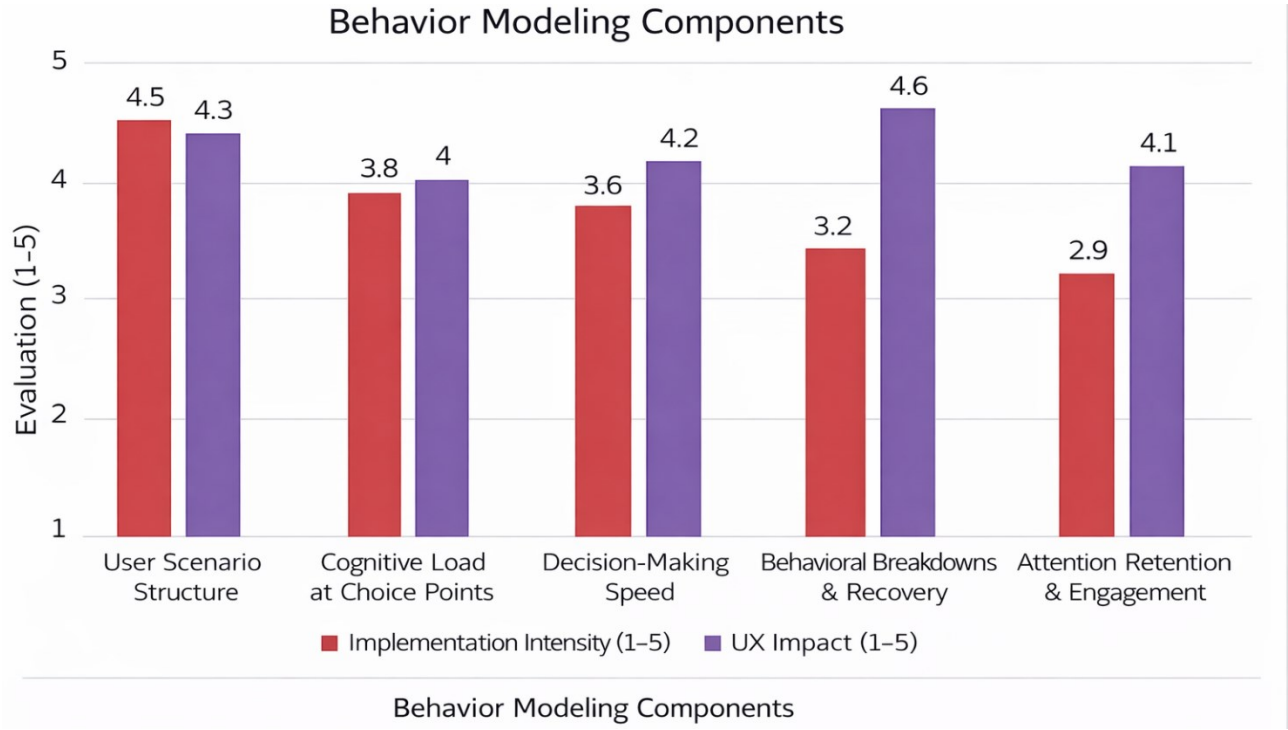

Fig. 1. Correlation between the intensity of user behaviour modelling components deployment and their impact on user design

Quantitative data on the Figure 1 displays how the components of the authorship evaluation system are distributed between two main dimensions. This relates to the depth of their involvement in the product and the implications for user experience they have. From the user's point of view, this scheme helps to understand what exactly is effective for user experience, and which elements look significant only in documents. The elements related to user history logic and careful error management, which have a powerful impact and great practical opportunities for their direct exposure on the interface accuracy and ease, possess the most advantageous place. The components aimed at decreasing the cognitive load (namely, mental pressure, decision-making processes speeding up, and choice-making speed) are gathered in the central zone, where the context of the product type, situational use, and emotional state of the person define everything. The factors that influence user retaining on the platform were defined, and even with the minor implementation, they provide considerable impact, although in everyday user-oriented design practice, they are often neglected or taken to the back seat. The structure described helps transition from generalized vision of an attractive UX to simple design actions based on real attempts of the user to interact with the product. Unlike simple descriptions, this method creates a new model of user behaviour which includes more than the user sees on the screen but also the way they understand the design and the actions they make when needed.

Conclusions and prospects for further research in this area

The study shows that the customer actions role model is not an additional tool but a full-fledged UX design enhancement method. The experience obtained in practice and during the analysis of real situations highlighted a considerable share of problems. Inconvenience often occurs because of neglect of how a person acts in a digital environment, not because of design or interface logic errors. A customer rarely visits template sites, and this imbalance leads to failures and uncompleted tasks. The author's method of behavioural simulation radically transforms the user's approach to design. The focus shifts from hypotheses to real action models. Demonstration of such components as script structure, intelligence load levels in the case of choices, decision-making speed, behavioural drawbacks and their mitigation methods, as well as factors of attention maintenance allowed to consider user design as a dynamic scheme. Test results confirmed that changes in any of these factors inevitably lead to changes in other ones. This shows the necessity of a comprehensive approach to the user design.

Practical implementation of this method on e-commerce and educational digital platforms showed positive results. Assigned tasks' makespan reduction was detected, as well as a decrease in repeating errors and an increase in subjective quality evaluation of the interface. It is crucial to highlight at this point that the improvements achieved are not totally perfect. However, they always have higher levels than those obtained by traditional users' methods. This approves the proposed solution's practical possibility.

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