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## USER INTERFACE AND USER EXPERIENCE IMPROVEMENT POSSIBILITIES USING LARGE LANGUAGE MODELS<sup>1</sup>

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***Abstract:** This paper examines and explores the possibilities of how artificial intelligence and large language models can help in the development of interfaces for control and communication with new and existing software, with the aim of a better user experience. The paper describes methods for integrating artificial intelligence into software products, with the aim of improving the speed of users in performing tasks or finding information.*

***Key words:** Artificial Intelligence, User Interface, User Experience, Large Language Models, Generation.*

### INTRODUCTION

With the advancement of science and technology, the interaction between humans and computing has been continuously improved. From mechanical elements in the late 19th century, through the first computer interfaces in the 1950s to the 1970s, to the graphical user interfaces (GUIs) popularized in the 1990s, human–computer interaction has undergone a profound evolutionary leap in just about a century, with the required set of specialized programming and management skills gradually being minimized.

In the new millennium, the widespread use of web-based, mobile, and touch interfaces has been established, and the familiar buttons have gradually been replaced by virtual peripherals, gesture and voice interaction, and haptic feedback. Nowadays, with the advent of artificial intelligence, innovative solutions such as chatbots, virtual assistants, and AI-based interfaces with adaptive algorithms are being increasingly used. The relationship between humans and machines is about to evolve through augmented and mixed reality, brain-computer and neural interfaces, ultimately enabling intuitive communication through brain signals, gaze, and even emotions.

As a result of the above, it can be said that Artificial Intelligence (AI) and Large Language Models (LLM) have become some of the most significant technological trends in 2024 and 2025. (Durgam, D., Anandhan, N. & Pathak, R., 2025) These algorithms are widely used and already have an impact on almost all areas of modern life, significantly accelerating communication between humans and machines. Modern software and hardware solutions increasingly integrate elements of artificial intelligence in order to improve the user experience and optimize interaction (Sadulov, S. & Shoilekova, K., 2024). Large language models, characterized by huge input parameters and the ability to enter commands by voice, significantly facilitate the process of interaction between the user and computer systems. On the other hand, graphical user interfaces, whose origins can be traced back to the 1980s, have undergone numerous transformations to reach their current level of sophistication. However, today we are witnessing a new stage of technological

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metamorphosis that promises to fundamentally change the way end users interact with both existing and newly created software solutions. (Afifa, Mishra, A., Kumar, P., 2024)

## EXPOSITION

### The S Curve

The S-curve is a model in innovation theory that describes the life cycle of technologies through successive phases of slow start, exponential growth, and saturation. In the context of user interfaces, it illustrates the transition from classical graphical paradigms to new ones based on artificial intelligence, which are emerging as the next wave of development (Tartarotti, 2023).

The S-curve is a widely accepted model in innovation and technological development theory that describes the life cycle of a technology or product (Fig. 1). It has a characteristic shape resembling the Latin letter S, and is conventionally divided into three main phases:

#### 1. Emergence / Introduction phase

In this stage, technologies are in the process of emergence. It is characterized by slow progress and limited effectiveness, as there is a lack of mature solutions, accumulated experience, and a sufficient market base. Investments in research and development are high, but practical applicability is still limited.

#### 2. Growth phase

As knowledge, standards, and a user base accumulate, the technology enters a period of exponential growth. Its effectiveness and capabilities grow rapidly, and its market acceptance increases. This is the stage of intense innovation, when maximum progress in user experience (UX) and mass integration is observed.

#### 3. Maturity / Plateau phase

Once a technology reaches its structural or functional limits, the pace of development slows. Improvement becomes increasingly expensive and less efficient, and innovation brings marginal improvements. At this stage, a new technological paradigm usually emerges, which sets the stage for the next S-curve.

A key observation is that technologies in the growth or maturity stage may have significant patent activity, yet may not be ready for large-scale market implementation and/or processes for markets because many elements of the innovation ecosystem are not functional and/or do not interact properly to ensure reliability in terms of development, marketing and diffusion of innovations (Coccia, 2022).

Undoubtedly, at a time when artificial intelligence is widely used in all walks of life, the way users interact with the digital world must also include intelligent elements to reduce connectivity costs. These costs can be managed by researching and optimizing the problems that users encounter when using interface elements. Improving user experience promotes the development of user interface design in a more user-friendly and intelligent direction. By accurately analysing experience indicators and combining with AI technology to optimize design, the gap between users and the digital world can be greatly reduced, which will make digital products more suitable for users' needs and provide a seamless and enjoyable interactive experience.

## Levels of User Interface (UI) and User Experience (UX) Development and Advancement

### Level 0 – Current State of the S-Curve

The historical development of user interfaces demonstrates their evolutionary and iterative nature. The first computer systems required physical switching and rewiring, which was an extremely complex and slow process, accessible only to specialists with high technical training. With the improvement of transistor

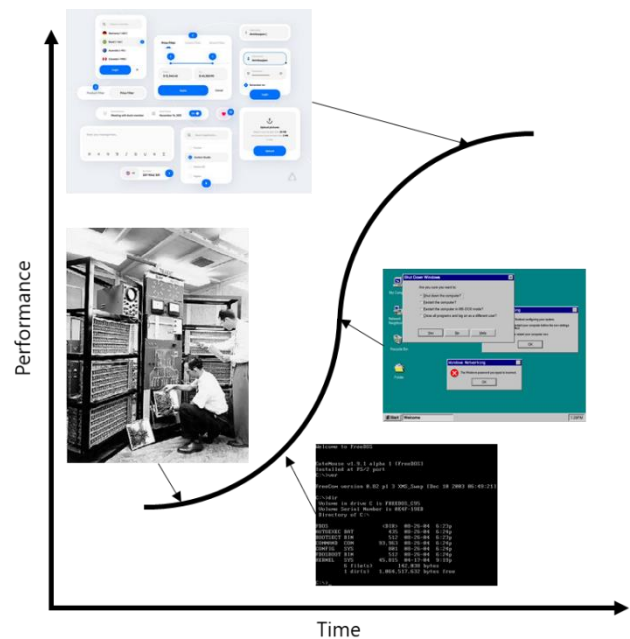


Fig. 1. S-curve of UI/UX advancement

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technology and the miniaturization of computing devices, a new generation of interface appeared - the text terminal. It marked a significant advance, as for the first time it allowed man and machine to communicate through written language, which opened up possibilities for wider use of computers.

The next transformation occurred with the development of the graphical user interface (GUI) by Xerox and its popularization through the Apple Lisa and Macintosh systems. The introduction of visual elements resembling real-world objects (folders, documents, icons) greatly facilitated interaction with personal computers and contributed to their mass use. Over the following decades, the GUI underwent continuous improvements, reaching a high degree of sophistication and efficiency, which today allows the management of even complex software systems.

In the modern context, a new trend is observed: interactions with artificial intelligences, particularly chat assistants, are conducted primarily through long text messages. This pattern is reminiscent of the command interfaces of the early stages of the modern computer era, which can be interpreted as a kind of full-cycle turn in the history of human-machine communication. This phenomenon indicates that the current S-curve of interface development has reached its peak and plateau. However, the nature of the S-curve suggests that after the maturity phase, a new evolutionary wave inevitably occurs, which will shape the future of UI and UX (Fig. 2).

### Level 1 – Integration of AI into User Interfaces (UI/UX + AI/LLM)

The current development of user interfaces can be defined as the initial phase of the new S-curve, marked by the integration of artificial intelligence into UI/UX. The current trend is expressed in combining classic visual interfaces with chat-based agents that use natural language processing to provide information and guidance. Such solutions are already being implemented across a wide range of applications. For example, the Bing Copilot solution built into Microsoft Edge assists users by summarizing voluminous text resources, web pages, as well as multimedia content such as video and audio. Another example is the implementation of AI assistants in integrated software development environments (IDEs), where systems such as Cursor offer direct integration with various language models. A key advantage of these solutions is that large language models have contextual awareness of the entire web page, project or document, which eliminates the need for the user to provide data with each new interaction. This transformation shows how user interfaces are beginning to evolve towards a new paradigm, where AI becomes an active mediator in human-machine communication.

### Level 2 – Autonomous AI Agents and Natural Language Interface Control

The second phase of the new S-curve is characterized by the emergence of intelligent agents that no longer function as separate modules within a given software, but are integrated into it and have the ability to manipulate the interface partially or completely. These agents use architectures such as Model Context Protocol (MCP) and are based on interaction through natural language, written or voice. This transition marks a move away from the classic model of entering text commands and towards a more intuitive, speech-oriented interaction between user and system.

Concrete examples of this trend are already observed in practice. The Todoist application, through its experimental Rumble feature, allows users to interact with the interface via voice commands, with visual changes occurring dynamically in real time. Another illustrative example is the Flask platform, designed for building complex statistical panels (dashboards). Tasks that traditionally require significant configuration time can be completed in minutes thanks to the built-in AI assistant, which automatically creates interfaces from predefined components tailored to the needs of the end user.

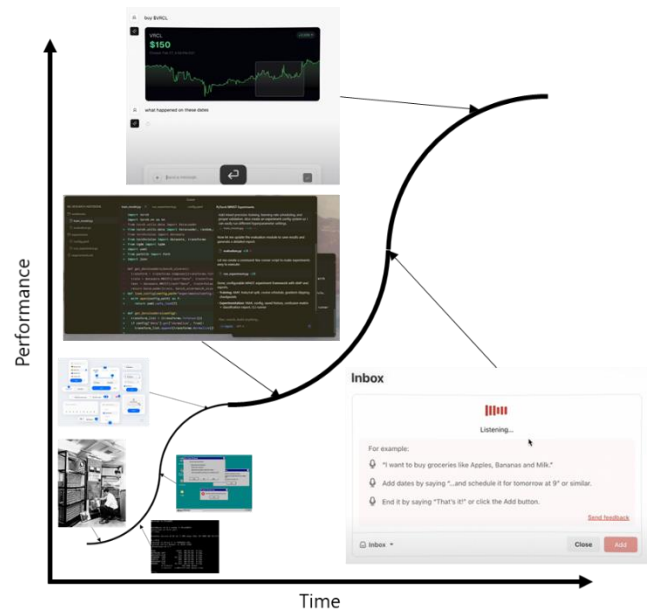


Fig. 2. S-curve of UI/UX advancement using AI/LLMs

These examples illustrate the emerging transition toward interfaces where AI functions not merely as an assistant, but as an active mediator, capable of changing and adapting the structure of interaction itself.

### Level 3 – Dynamic generation of user interfaces and components through AI

The third stage of the new S-curve represents the most radical phase in the evolution of user interfaces, in which AI does not simply assist or manipulate existing elements, but generates interfaces entirely in real time. Developments at this level are still in the prototype phase, as a number of technical and conceptual challenges hinder their widespread implementation. The main idea is that the user will not have a predefined graphical interface. Instead, interaction will be performed through text or voice commands in natural language, and the returned result will not be static text or images, but a dynamically built graphical interface adapted to the specific task.

A potential application of such an approach is the construction of complex web applications, for example, travel planning systems. Instead of the user navigating through multiple pages containing information about destinations, routes, transportation, and places to stay, the AI assistant would collect, process, and integrate relevant data to return an interface that maximally satisfies the user’s specific needs.

Despite the promising possibilities, this model also raises a number of questions related to the consistency and usability of the interface. For example, when is it more appropriate to visualize information in a list, when in a tabular form, and when to use a calendar or an interactive map. Solving these problems is a critical condition for moving from experimental prototypes to stable solutions that can be implemented for a mass audience.

### FocusUI – A Conceptual Framework for Third-Level User Interfaces

FocusUI is a concept for user interface design, developed as a result of research on emerging trends in the field of UI/UX. The main goal of the approach is to define clear and simple rules for building graphical interfaces generated based on commands formulated in natural language. For the purposes of the demonstration, a conceptual prototype representing the design of a new generation web browser, conditionally called Minimal Focus Browser (MFB) (Fig. 3), was prepared.

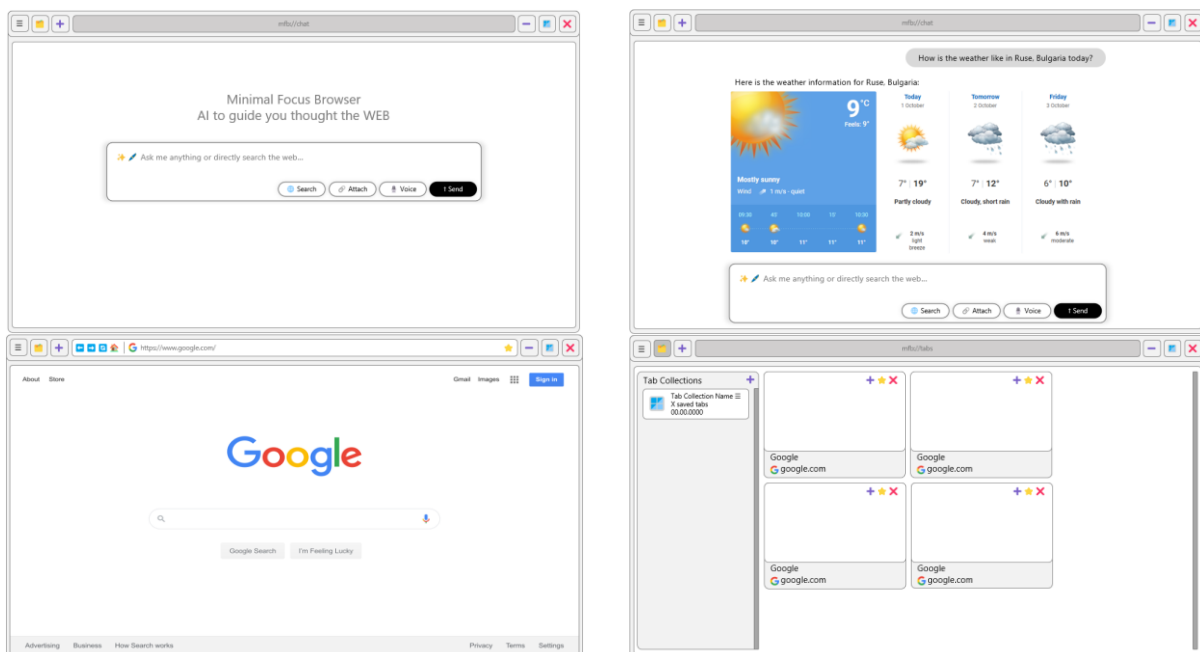


Fig. 3. Minimal Focus Browser – design mockup, prepared using FocusUI

The concept is based on a minimalist predefined interface, in which traditional navigation elements are replaced by an integrated assistant. This assistant does not exist as an additional functionality, but is an organic part of the browser architecture itself. Instead of relying primarily on classic search mechanisms, user interaction is carried out by asking questions or commands in natural language. In response, the system

returns a result not in the form of a static list or links, but as a dynamically built graphical interface, adapted to the specific needs of the user.

### **Advantages and Challenges of FocusUI**

The proposed FocusUI concept reveals a number of potential advantages. First, it provides the opportunity for a higher degree of personalization, as the generated interfaces can be tailored to the specific needs and preferences of each individual user. Second, by eliminating redundant navigation elements and transitions, FocusUI can contribute to reducing cognitive load and accelerating access to information. Additionally, the built-in ability of AI to interpret and synthesize data from diverse sources opens up opportunities for multimodal interaction and integrated user scenarios that go beyond the limitations of traditional interfaces.

Along with the advantages, the concept also poses a number of challenges. Among them, the issue of design consistency can be distinguished, since dynamically generated interfaces can lead to differences in presentation and structure for repetitive tasks. Another critical aspect is related to accessibility and standardization, as the lack of unified rules can create difficulties for users with different needs. Last but not least, security and trust are important issues, especially when the AI system aggregates and visualizes data from external sources, the quality and reliability of which cannot always be guaranteed.

In this sense, FocusUI can be seen both as an innovative model with transformative potential and a research challenge requiring additional work on developing methodologies, standards, and mechanisms to ensure a reliable and sustainable user experience.

### **CONCLUSION**

The development of user interfaces follows the logic of the S-curve, moving from early hardware and text solutions through graphical interfaces to modern AI-based models. Today, we are witnessing a new phase in which AI is integrated first as a chat assistant (Level 1), then as an agent manipulating the interface (Level 2), and in the future, as a system for dynamic generation of interfaces through natural language (Level 3). In this context, the FocusUI concept was proposed, which presents a model for a minimalist interface with a built-in AI assistant capable of creating personalized interfaces in real time. Although there are challenges related to consistency, accessibility and security, such solutions outline a new paradigm in human-machine communication and set a direction for future research and practical applications.

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