

Agent Experience: Nielsen’s Usability Heuristics Analysis for GenAI Agents

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Generative Artificial Intelligence (GenAI) agents are becoming active participants in digital ecosystems, interacting with web interfaces in new ways, different from human users. Traditional usability heuristics, such as Nielsen’s 10 principles, have long-guided interface designs for humans but their applicability to non-human users has not yet been considered. This paper introduces the concept of "agent experience" by revisiting these heuristics, proposing adaptations to ensure they remain relevant for agent interactions while preserving their universal applicability. By bridging human-centric design with agent-centric requirements, we highlights how interfaces can accommodate both user groups. Our analysis offers actionable insights for creating more inclusive, efficient, and robust digital systems, paving the way for a future where humans and agents coexist seamlessly in shared online environments.

CCS Concepts: • **Human-centered computing** → **Usability testing**; • **Computing methodologies** → *Cognitive robotics*.

Additional Key Words and Phrases: Generative AI, Usability Heuristics, Agent-Computer Interaction, Human-Computer Interaction

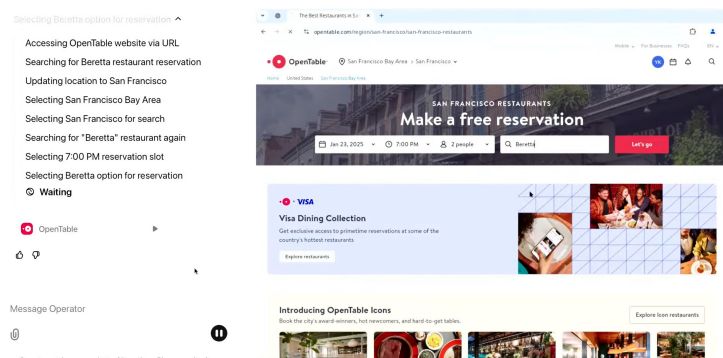


Fig. 1. A Screenshot of OpenAI agent performing a restaurant reservation task. Accessed on Jan 26th, 2025, from the official OpenAI Operator video announcement [20]

1 INTRODUCTION

The growing integration of Generative AI agents into web interfaces [14] signals a pivotal shift in user experience (UX) design. One of the widely used principles for constructing an effective interaction between a human user and an interface is Jakob Nielsen’s 10 usability heuristics as foundational guidelines for creating user-friendly systems [18]. However, the emergence of GenAI agents as active users requires adapting usability principles to accommodate the unique interaction patterns of the agents [22].

GenAI agents now automate workflows, interpret content, and make independent decisions, transitioning from isolated tools to interconnected entities [3, 24]. Unlike humans, they interact with web interfaces through structured data, metadata, and code rather than visual or interactive cues. For example, agents rely on HTTP requests, HTML parsing, and APIs to extract and process information. Figure 1 illustrates an example of an agentic interaction with a website performing a restaurant reservation task, taken from OpenAI operator demo [20].

While significant research explores human-agent interaction [6], a gap remains in addressing how interfaces should be tailored for agents as users. Agents’ distinct interaction methods—emphasizing consistency, structure, and machine

readability should be incorporated into interface design. Despite these differences, Nielsen’s heuristics retain universal relevance. Core principles such as visibility of system status, error prevention, and consistency can guide the creation of interfaces that include both humans and AI agents. Adapting these heuristics involves translating their human-centric insights into actionable practices for agents while preserving their intent.

This paper revisits Nielsen’s usability heuristics through the lens of GenAI agents. Our key contributions are:

- Introducing the concept of *agent experience*, recognizing AI agents as active users.
- Reinterpreting Nielsen’s heuristics for agentic interactions with actionable insights for AI-focused design.
- Exploring broader implications for agent-centric design and its role in future UX practices.

The paper proceeds as follows: Section 2 reviews the evolution of UX and the rise of GenAI agents. Section 3 examines Nielsen’s heuristics from an agent’s perspective. Finally, Section 4 concludes with recommendations for future research.

2 BACKGROUND AND RELATED WORK

The rapid evolution of Generative AI (GenAI) agents necessitates revisiting user experience (UX) design principles to address the needs of both human and agent users. This section reviews foundational usability frameworks, the capabilities of GenAI agents, and advancements in human-agent interaction.

2.1 User Experience, Human-Centered Design, and Usability Heuristics

User Experience (UX) emphasizes the creation of systems that are intuitive, functional, and satisfying to users, based on the principles of human-centered design [13, 19]. Jakob Nielsen’s usability heuristics, a foundational aspect of UX, outline ten core guidelines for designing user-friendly interfaces [18]. These principles focus on key aspects such as maintaining visibility of system status, aligning system language with real-world conventions, providing users with control and freedom, and ensuring consistency across designs. They also address the importance of preventing errors, reducing cognitive load by relying on recognition rather than recall, and incorporating flexibility to cater to different skill levels. Additionally, they emphasize simplicity through aesthetic and minimalist design while promoting clear error recognition and recovery mechanisms and the availability of helpful documentation. These heuristics have been instrumental in shaping interface design practices across various domains.

2.2 Capabilities of Generative AI Agents

GenAI agents, powered by advanced models such as GPT-4, have transitioned from isolated tools to autonomous systems capable of automating workflows, interpreting content, and making decisions [4]. Their interactions rely on visual analysis, parsing HTML, DOM manipulation, API usage, and error-handling strategies [5, 16, 20]. Accessibility features such as ARIA roles and `alt` text further enhance their ability to process content [26]. These methods enable agents to efficiently extract data and simulate user actions, adapting as web technologies evolve.

2.3 Human-Agent Interaction and Agent-Centered UX

Human-Agent Interaction (HAI) research has traditionally focused on optimizing how humans interact with AI systems, emphasizing collaboration, communication, and shared decision-making [9, 21]. However, the rise of GenAI agents as autonomous participants in digital ecosystems demands a shift toward agent-centered UX design, recognizing agents as primary users [22, 25]. Agents interact with systems differently than humans, prioritizing consistency, predictability, and machine-readable formats over visual or interactive cues [14]. For example, while humans benefit from flexible

interfaces, agents require standardized structures to avoid misinterpretation and errors [10]. Addressing these differences involves extending usability heuristics to account for agent-specific behaviors.

The growing integration of agents into workflows also raises ethical and practical concerns. Misalignment between human and agent goals can result in inefficiencies or unintended outcomes [2, 24]. Ensuring transparency, accountability, and trust in agentic systems is crucial for fostering seamless collaboration [15, 19].

By adapting established UX frameworks to support both human and agent users, designers can create inclusive and efficient systems that meet the demands of increasingly complex digital environments.

3 ANALYZING USABILITY HEURISTICS FOR GENAI AGENTS

Jakob Nielsen's usability heuristics have long guided the design of intuitive and accessible systems for human users [18]. However, the emergence of GenAI agents requires a reinterpreting of these principles to meet the unique demands of machine interactions. Below, we evaluate the heuristics' applicability for AI agents and propose actionable adaptations.

3.1 Heuristics Review

3.1.1 Visibility of System Status. Clear feedback is essential for both human users and AI agents. While humans benefit from visual indicators, agents may also rely on structured responses such as HTTP status codes and JSON messages. Ambiguity in feedback may hinder agents' ability to diagnose issues. [7, 8, 12].

3.1.2 Match Between System and the Real World. Human users rely on familiar metaphors to simplify interactions [11]. GenAI agents, however, interpret interfaces based on training data and standardized structures. Inconsistent labels or unconventional designs, such as "Narrow Down Options" instead of "Filters," confuse agents and impede automation. Consistency in terminology and predictable formats benefits both user groups.

3.1.3 User Control and Freedom. Features like "undo" buttons and exit options prevent irreversible errors for humans [23]. For agents, clear navigation paths and structured feedback are critical to avoid dead ends or repetitive loops. In multi-step tasks like form submission, explicit error messages (e.g., "Missing passenger name") and consistent page structures enable efficient recovery.

3.1.4 Consistency and Standards. Predictable design conventions reduce confusion for humans and enhance machine interpretability. Variations in terminology—such as "Women's Apparel" versus "Ladies' Clothing"—can lead to misclassification by agents. Adhering to standard naming conventions ensures smooth interactions across platforms.

3.1.5 Error Prevention. Preventing errors before they occur is vital for both humans and agents. For agents, mechanisms like syntax validation and structured inputs mitigate cascading failures. Tools such as Google's Jules, which auto-corrects coding errors using contextual understanding, exemplify effective error prevention strategies.

3.1.6 Recognition Rather Than Recall. This heuristic, designed to reduce cognitive load for humans, requires adaptation for agents, which excel at recall. Rather than recognition-based cues like dropdown menus, agents benefit from structured data formats that directly leverage their memory capabilities.

3.1.7 Flexibility and Efficiency of Use. For humans, flexibility means providing shortcuts and customization options. For agents, consistent and standardized interfaces are key. Personalized or adaptive content, designed for human users, can disrupt agent workflows by introducing unpredictability.

3.1.8 Aesthetic and Minimalist Design. Minimalist design benefits humans by reducing visual clutter and improving usability. For agents, the focus shifts to clean, well-organized HTML and CSS structures. Tools like Readability.js simplify parsing, enabling agents to process content efficiently [17].

3.1.9 Help Users Recognize, Diagnose, and Recover from Errors. Humans rely on actionable error messages to troubleshoot problems. For agents, structured error responses and transparent APIs are critical. Clear error codes and diagnostics streamline agents' ability to identify and resolve issues autonomously [1].

3.1.10 Help and Documentation. While humans often overlook manuals, agents depend on detailed and structured documentation. Comprehensive API specifications, workflows, and metadata facilitate seamless interactions. Documentation tailored to agents, or even generated by AI, optimizes processing efficiency.

3.2 Analysis Discussion

This analysis underscores the enduring relevance of Nielsen's heuristics, demonstrating their adaptability for GenAI agents. Key principles, such as visibility, consistency, and error prevention, require only minor adjustments to accommodate machine interactions. For example, while humans benefit from visual cues, agents rely on structured, machine-readable formats. Similarly, minimizing ambiguity in navigation and terminology benefits both humans and agents. Designing for dual user groups—humans and agents—requires balancing personalization with standardization. Dynamic content and adaptive layouts, while useful for humans, can disrupt agent workflows, highlighting the need for consistent structures. Moreover, by aligning interface design with universal principles like clarity and simplicity, systems can address the needs of both user types without compromising usability.

As AI agents become integral to digital ecosystems, these adaptations will ensure that usability principles remain robust and inclusive, guiding the development of interfaces that are accessible and efficient for all users.

4 CONCLUSION

This paper reexamines Jakob Nielsen's usability heuristics to address the unique requirements of GenAI agents as active participants in digital ecosystems. While agents interact with interfaces differently—relying on machine-readable formats rather than visual cues—Nielsen's principles remain adaptable and relevant for these new users. Their universality underscores their value as a foundation for inclusive design.

Our analysis demonstrates how heuristics such as visibility of system status, consistency, and error prevention can be reframed to support agent-specific needs. Structured feedback, clean and standardized code, and accessible APIs are practical adaptations that bridge the gap between human-centric and agent-centric design. These changes ensure that interfaces remain functional, efficient, and intuitive for both humans and agents.

Looking ahead, the balance between human and agent requirements will be central to interface design. Designers must address ethical and practical challenges, such as defining appropriate levels of agent autonomy and ensuring equitable design for all stakeholders. Interdisciplinary research will be key to navigating these complexities, ensuring the integration of AI agents is both effective and ethical.

By adapting usability principles for AI agents, this work lays the foundation for a future where humans and agents coexist seamlessly in digital spaces. As technology evolves, Nielsen's heuristics provide a timeless framework for creating systems that are inclusive, robust, and ready to meet the challenges of the AI era.

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