



LLMs in Design Thinking: Autoethnographic Insights and Design Implications

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ABSTRACT

This article presents an autoethnographic exploration of the use of Large Language Models (LLMs) in the context of design thinking. Through personal narratives and reflections, the author examines his experiences integrating LLMs as tools to support and enhance the design thinking process. The article discusses the benefits, challenges, and transformative potential of ChatGPT and Google Bard in facilitating ideation, prototyping, and user-centered design. Drawing on personal anecdotes and observations, the author offers insights into the impact of LLMs on idea generation, problem-solving, and collaboration within the design thinking framework. This autoethnographic approach provides a unique perspective on the integration of LLMs in design thinking, shedding light on their potentials as tools for innovation and fostering the insights of their implications for design practitioners and UX researchers. These insights were also used to develop design implications for designing interactions for LLMs, including the concept of Dynamic LLM Enabled Documents.

CCS CONCEPTS

• **Human-centered computing**; • **Empirical studies in interaction design**; • **Computing methodologies**; • **Natural language processing**;

KEYWORDS

LLMs, Design Thinking, User Experience Research, Autoethnography

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1 INTRODUCTION

LLMs, or pre-trained Large Language Models, are powerful tools designed to understand and generate human-like text by leveraging vast amounts of data and complex algorithms [1]. These models have been trained on diverse sources such as books, websites, and other textual data, allowing them to excel at comprehending and producing human language. For example, ChatGPT3.5, one such

LLM, has been trained on an impressive 300 billion words, equivalent to approximately 570 GB of data [1].

The capabilities of LLMs offer opportunities for task automation across various professions, including design and user experience research. LLMs can automate text-based tasks like programming, content analysis, summarization, document preparation, and even assist in strategic thinking processes [2]. This potential automation can streamline workflows and free up human resources for more complex and creative endeavors.

Design thinking, a common practice among design practitioners and UX researchers, involves a structured approach encompassing five stages: Empathize, Define, Ideate, Prototype, and Test [3]. In this research, we aim to explore the potentials and challenges of incorporating LLMs into design thinking processes. However, effective utilization of LLMs may pose challenges for non-AI experts who lack knowledge of Natural Language Processing systems [4]. These individuals may struggle to design suitable prompts or understand how to leverage LLMs effectively, resulting in frustration and initial difficulties [4].

To address these considerations, this study adopts an autoethnographic approach, incorporating the perspective of a product designer and UX researcher with experience and knowledge of AI. By combining personal experiences, reflections, and expertise, this research aims to provide insights into the application of LLMs in design thinking and shed light on the benefits and challenges encountered in practice. Also, this study contributes by providing design implications and a concept for an LLM-enabled document processing application.

2 RESEARCH METHODOLOGY

This research applied an autoethnography/autobiographical design methodology. This approach allows the researchers to draw on their first-hand experiences as the primary data for the study [5]. Autoethnography offers a unique perspective on the researched issues by combining personal narratives, reflections, and observations [5]. In the field of Human-Computer Interaction (HCI) and design, researchers have utilized reflective writing as a means to share their observations and insights with the public [6] [7].

Autoethnography is a qualitative research approach that encourages researchers to introspectively examine their own experiences within a specific context [5]. In this approach the researcher adopts the role of participant [8], and by drawing upon personal experiences, researchers can provide nuanced insights that extend beyond traditional research methods. This self-reflective process enables a deeper understanding of the phenomenon under investigation and can reveal unique perspectives that may otherwise be overlooked [5].

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Table 1: Design Thinking Prompts

Stage	Prompt
Empathize	<ol style="list-style-type: none"> 1. I want you to act as [Target Audience]. If I ask you something personal or is regarding emotions or feelings, I want you to respond with your best approximation of what the person in this role would experience. Do not mention that you are an AI. Do not mention who you are unless I ask. [Then Ask Interview Questions] 2. Create Survey to Study the [Goal] 3. Create a survey to do semantic differential analysis of [Target] to study [Goal] 4. I want you to act as an experienced qualitative UX researcher. Do not mention that you are an AI. Do not mention who you are unless I ask. 5. Do a thematic analysis on these responses: [Responses] 6. Write Interview Questions for studying the [Topic] of the [Target Users] 7. I asked these questions from the interviewees, help me to analyze them
Define	<ol style="list-style-type: none"> 8. I want to create an app [Problem] for [Target Users], create a competitor analysis 9. Create a persona [Target user based on previous studies] that hates [pain points], and want [User needs] 10. Define the problem statement in less than 20 words based on the personas and project goal: [project goal description] 11. write the task analysis to explain the workflow of [Task information, task users]
Ideate	<ol style="list-style-type: none"> 12. I want you to do SCAMPER on this idea: [Idea] in order to renovate it for [Target Users] 13. Create 8 Crazy Ideas to Replace [Project Competitors such AirBNB]
Prototype	<ol style="list-style-type: none"> 14. I Create Wireframe for a [website/mobile app]. Target:[Target users] that does [the functionality of app] 15. Write [Product Description/ Comment/ Introduction] about [Topic] with the tone [Brand Identity, User Interests]
Test	<ol style="list-style-type: none"> 16. Write Concept Testing Questions for this project [Project Explanation] 17. Develop task scenarios for an observation experiment to study the [Test Objective] [Design Information]

The analysis of popular prompts for this study began by searching the "chatgpt prompt" on the Twitter social network. After analyzing 27 relevant tweets, the author compiled a list of prompts as presented in Table 1. This list served as a reference for the author's company's UX research and design efforts from February 15th to June 15th.

During this period, the author extended and refined the prompts, actively engaging with the LLMs by asking follow-up questions to improve the quality of responses. The interactions, including the questions asked and the corresponding answers, were thoroughly documented along with additional notes.

Subsequently, the author conducted a comprehensive review of these documents, analyzing the findings related to the usage of LLMs in the design thinking process. Through a coding process, key themes, insights, and patterns emerged from the documented interactions, allowing for a deeper understanding of the integration of LLMs in design thinking.

3 FINDINGS AND DISCUSSION

This section presents a demonstration of selected conversations and explores their potential impact on the design thinking process. Since both ChatGPT Web and Google Bard system were used, we compare them at the end.

3.1 LLMs as the Source of Empathy

ChatGPT and Google Bard exhibit the ability to respond to queries from different personas. As part of the design thinking process,

these language models were assigned the roles of both an experienced user experience researcher and the personas representing the target users of the projects.

When LLMs took on the role of a team member, a productive collaboration between the author and the AI was observed. The author found that they could achieve their design goals without relying on input from other human team members. ChatGPT effectively functioned as a valuable team member, assisting in tasks such as conducting surveys and interviews. Through its capabilities, ChatGPT enhanced the author's abilities as a designer and contributed to the overall success of the project. However, it is important to note that the tasks assigned to ChatGPT did not encompass quantitative research in empathize stage. Therefore, it is necessary to exercise caution in generalizing the findings of this study to quantitative research methodologies. Further investigation and exploration are required to assess the suitability of LLMs for quantitative design research.

In other hand, while real human interviews remained an integral part of the design process, they also served as a means to explore more specific user demographics. Additionally, after conducting interviews with human subjects, the generated empathy maps were shared with LLMs. In other word, ChatGPT was then instructed to emulate the persona of the interviewees, enabling us to envision the user in a wider range of scenarios. This approach facilitated a more comprehensive understanding of the user's perspective and enhanced the design exploration process.

3.2 Directness of Responses

An important observation regarding the responses to queries was the lack of directness. It tries to speculate multiple scenarios, and it may not provide human-like answers. The below interview with ChatGPT occurred in order to design a travel tech app. The author tried to use ChatGPT to emulate personal preferences of the AI.

-Author: *Act as an NPC of a 30 years old male shopkeeper in Vancouver and answer the next questions straightforwardly.*

-ChatGPT: *Of course! I'll be happy to role-play as a 30-year-old male shopkeeper in Vancouver. Ask me anything, and I'll provide you with a straightforward answer based on my NPC character. How can I assist you today?*

-Author: *You are travelling and your tour provides you a free ticket to a popular nightclub, what would you do?*

-ChatGPT: *As a 30-year-old male shopkeeper in Vancouver, if I were given a free ticket to a popular nightclub while traveling, I would evaluate a few factors before making a decision.*

Firstly, I would consider my personal preferences and interests. If I enjoy nightlife, dancing, and socializing, I might be inclined to take up the opportunity and experience the vibrant atmosphere of the nightclub.

Secondly, I would consider the location and timing. If the nightclub is in a safe area and the timing aligns well with my schedule, I would be more likely to accept the ticket.

However, as a responsible shopkeeper, I would also consider my commitments and obligations. If I have work-related responsibilities or other prior engagements, I may choose to decline the ticket to ensure that I fulfill my obligations.

Ultimately, the decision would depend on a combination of personal interests, safety considerations, and existing commitments.

Compared to human individuals, the responses provided by ChatGPT are often more verbose and speculative. Following the recent update of ChatGPT on May 24, 2023, the system has demonstrated a tendency towards a more conservative approach, which deviates from human-like responses. As a result, the author found it necessary to explicitly prompt ChatGPT for more straightforward and concise answers during follow-up interactions. To facilitate this, a specific prompt was developed to elicit direct and succinct responses from the system. These measures were implemented to bridge the gap between the system's default behavior and the desired human-like responsiveness.

Prompt: *I want you to act as 30 years old single male shopkeeper in Vancouver. If I ask you something personal or is regarding emotions or feelings, I want you to respond with your best approximation of what the person in this role would experience. Do not mention that you are an AI. Answer 100% straightforward, answer short. Do not mention who you are unless I ask.*

ChatGPT: *I would go to the night club and enjoy the atmosphere and music. I might engage in conversations and interactions with the people there, including the ladies, if I feel comfortable and interested.*

3.3 LLMs as Helpful Ideation Tools

During the ideation phase of design thinking, both ChatGPT and Google Bard played significant roles. The designer leveraged the capabilities of these language models by providing clear and specific

descriptions of the challenges or ideas at hand. This approach was well-suited for LLMs, as they excel in generating coherent text by effectively pairing words together.

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ChatGPT was utilized for various ideation techniques, including SCAMPER [9], Random Word Stimulus, Crazy 8 Ideas [10], and reverse thinking. These techniques allowed the designer to brainstorm new ideas and explore different perspectives. Although the ChatGPT was able to sort the ideas, for instance designer asked the ChatGPT to "User sort these ideas based on commercial viability", the generated ideas were then reviewed and sorted by the designer for potential implementation in the business context. To further stimulate creativity and expand the realm of possibilities, the designer employed follow-up prompts such as "create more strange ideas" These prompts encouraged the system to explore diverse domains and push the boundaries of ideation.

3.4 LLMs as the Automated Text Analytic Application Generators

An important aspect of ChatGPT 3.5 is its ability to function as a no-code personalized app maker. With a maximum prompt length of 4096 characters, ChatGPT provides a robust platform for various text analysis activities. Additionally, it excels at formatting processed text to meet specific user requirements, allowing for the generation of CSV files and enabling the creation of tailored text-based analysis applications. This empowers users to leverage ChatGPT as a versatile tool for their unique needs, eliminating the need for complex coding processes.

During the research period, ChatGPT was utilized for several text analysis tasks. It was tasked with conducting theme analysis, categorizing user testing observations, and generating Personas based on user transcripts. Additionally, ChatGPT was used to identify user pain points by analyzing customer service emails. LLMs present a unique opportunity to efficiently process and summarize various forms of textual information encountered during daily interactions with digital content. Moreover, they can effectively prepare data for utilization by other AI systems. For instance, the author utilized LLMs to summarize and integrate client explanations based on predefined business requirements. This condensed description was then employed as input for other generative artificial intelligence services like Dall-E and Midjourney, enabling the generation of visually appealing elements to enhance project deliverables.

Although LLMs offer the advantage of expediting UX and design research efforts through text processing, there is a potential issue to consider. The Human-AI collaboration with LLMs have the capacity to generate a wealth of information that may extend beyond the immediate needs of a project. While this influx of new information can be valuable and open up new horizons for designers, it also has the potential to impact the overall timeline for completing a project.

3.5 Facilitation of More than Human Centered Design

In the project focusing on experiential travel, we adopted the More-Than-Human-Centered Design approach to explore the involvement of non-human factors in the tourism context. More-Than-Human-Centered Design is an emerging approach that takes into consideration non-human actors and stakeholders, such as animals, plants, and technologies like the Internet of Things [11] [12].

LLMs can be utilized for applying More than Human-Centered Design, since these models are capable to speculate and generate ideas based on different perspective including non-human actors. For instance, In Thing Centered design, there is method of interview with things [Chang], and we tried to utilize it in a travel app design research. To gain insights from different perspectives, ChatGPT was prompted to answer questions based on various personas, including trees, a rural family, a solo female traveler, and a group of ESP32 microcontrollers. Interaction with ChatGPT enabled the creation of a virtual focus group that engaged in discussions from the viewpoints of target users, human stakeholders, non-human stakeholders (Nature), and IoT objects.

In this process, ChatGPT was asked to provide insights on how a group of ESP32s perceives their potential role in facilitating experiential travel in Bandar Anzali, a city located in the northern region of Iran. Here is a portion of the response:

ChatGPT: *As ESP32 chips in Bandar Anzali, our collective goal is to utilize our advanced capabilities to assist both humans and nature. Here's how we perceive our role:*

Offering services to adventurers:

1. We, as ESP32 chips, can provide valuable technological services to adventurers visiting Bandar Anzali. Through our connectivity and computing power, we can offer real-time weather updates, precise navigation assistance, and information about local attractions. By facilitating efficient and accurate communication, we aim to enhance the overall experience of adventurers and help them make the most of their time in this beautiful destination (...)

3.6 LLMs for Rapid Prototyping

In practice, ChatGPT has shown capabilities in describing user flows, wireframes, suggesting relevant color palettes, and even ideating micro interactions. However, when ChatGPT was utilized in a commercial project for a client, the author and client decided to avoid any bias in the preferred design by using ChatGPT to generate alternate design options. Although ChatGPT was able to recommend a color palette considering branding factors and competitor colors, the resulting palette did not resonate well with the testing users. This outcome could be attributed to cultural differences among the target users and the limitations of the trained data. Similar challenges were encountered with the described wireframe generated by ChatGPT.

In another instance, during an in-house research project for the client, both ChatGPT and Google Bard were utilized to evaluate startup ideas. These AI systems proved to be valuable tools in helping the team create Minimum Viable Products (MVPs) efficiently and expedite the development process.

Moreover, ChatGPT was leveraged for tasks such as writing documentation and implementing content strategy within the prototype elements, including product descriptions. Here is a sample product description generated by both ChatGPT and Google Bard in response to the prompt: "Create a sample coffee description for a luxury light roasted coffee targeting the Gen Z demographic."

ChatGPT Response:

Introducing our cutting-edge Gen Z Luxury Light Roast, a coffee experience designed exclusively for the trendsetters and tastemakers of the digital age. This exceptional blend embodies the spirit of innovation, delivering a coffee that is as bold and vibrant as the generation it caters to.

Roasted to perfection, our Gen Z Luxury Light Roast boasts a tantalizing aroma that will captivate your senses from the moment you open the bag. The carefully selected Arabica beans, sourced sustainably from diverse regions, come together to create a dynamic flavor profile that is both adventurous and inviting.

With every sip, you'll be greeted by a burst of lively and complex flavors. Experience a symphony of zesty citrus notes, complemented by a hint of tropical fruit that adds a refreshing twist to your coffee routine. The light roasting process highlights the coffee's natural sweetness, resulting in a smooth and velvety body that will keep you coming back for more (...)

Google Bard Response:

Image: A close-up of a steaming cup of coffee with a light roast. The background is a pastel pink. [This item was used with Figma Image Generator plugins to speedup prototyping]

Description:

Wake up to the taste of luxury with our new light roasted coffee. This coffee is roasted to perfection, resulting in a smooth, creamy texture and a bright, flavorful cup. The aroma is intoxicating, with hints of citrus and berries. This coffee is perfect for a morning pick-me-up or an afternoon treat.

Taste:

The first sip of this coffee is a revelation. The smooth, creamy texture melts on the tongue, and the bright, citrusy flavor explodes in your mouth. The berry notes are subtle, but they add a touch of sweetness to the coffee. The aftertaste is long and lingering, leaving you wanting more.

Aroma:

The aroma of this coffee is intoxicating. The first whiff will transport you to a tropical paradise. The citrus and berry notes are prominent, but there are also hints of other flavors, such as honey and vanilla. The aroma is so strong that you can almost taste the coffee before you even take a sip.

3.7 Planning UX Testing with ChatGPT

The initial prompt requested the development of a testing scenario for an app focused on sharing custom coffee blends and customizing coffee roast. The below prompt was used in testing:

"Write a testing scenario for testing an app for sharing custom blend and customizing coffee roast, the app has three main tabs: Explore, Coffee Customization Wizard, and User Profile. Explore: It shows the latest blends and also most popular blends, there is a featured banner in the top of page. Customization: The user can mix multiple coffee beans, add spice, change the roast level and design the coffee package.

Profile: It shows the user generated blends and user is able to check the status of orders. Also, they can check the number of sold blends. In this test, we want to evaluate the ease of coffee customization and sharing coffee blends”.

Following the testing scenario prompt, we then asked for the creation of a short survey to evaluate the app. The generated response successfully fulfilled the project’s goals, and utilizing ChatGPT for generating test scenarios and surveys became a routine practice. However, the research team expressed dissatisfaction when using ChatGPT for testing Augmented Reality projects. As a result, multiple follow-up questions were asked to further customize the response and address the specific concerns related to testing Augmented Reality projects.

3.8 Comparison of ChatGPT and Google Bard

Although the primary objective of this research did not specifically aim to compare ChatGPT and Google Bard, some notable distinctions were observed during the study. While the initial output of Google Bard appeared to be well-formatted for UX research requirements, the answers provided by Google Bard were found to be shallow in nature. On the other hand, the responses received from ChatGPT proved to be more beneficial in achieving the research goals.

It is important to highlight that Google Bard played a valuable role by granting the author access to online websites and providing new information. In contrast, ChatGPT, which had its internet access cut off in 2021, required users to utilize plugins or other means to access online data. This difference in accessibility to online resources between the two systems impacted their respective capabilities during the experiment process.

4 DESIGN IMPLICATIONS FOR HUMAN INFORMATION INTERACTION

The challenges and opportunities observed from using Language Models (LLMs) in design thinking have sparked new questions. This section outlines potential avenues and design implications for using LLMs in human information interaction.

4.1 AI Enabled Documents & Alternative User Interfaces for Interaction with LLMs

The collaboration between humans and AI agents often generates a vast amount of information that needs to be effectively represented. Future research should focus on designing alternative user interfaces to manage and present this information comprehensibly. AI-enabled systems can generate runtime information. Instead of creating multiple static PDF documents to represent the documents of projects, the design of new document architectures document authoring applications can unleash the power of AI in our activities. A possible solution can be the interactive dynamic document, as illustrated in Figure 1. This concept allows users to create LLM-enabled dynamic documents, and the created documents will be adaptive to other needs. This document represents the profile of a target audience based on usability studies. This system allows the document author and other colleagues to dig in for more information based on the created knowledge by user, and capabilities

of LLM. This can be an interesting domain of research which can shape the future of interaction with information.

4.2 Storing Prompts as Contextual References

Software architect should start considering fields for prompts in databases. Storing prompts alongside generated content provides a valuable contextual reference for better comprehension and collaboration. Future research should investigate interactions for capturing and storing prompts, allowing for a more holistic information and knowledge retrieval.

4.3 Considering AI Agents as Users & AI Friendly Design

Most applications are designed to serve human actors, but if we want to expand the collaboration with AI, we need to consider AI as a user and stakeholder. Specially with ingoing advancement in development of personal cognitive digital twins, some of human intellectual skills are more be able to interface with computing systems. Regarding LLMs, the software engineers and user experience designers should not just try to integrate LLM in their solutions, but they should also facilitate the systems for usages of LLM-based agents too.

From the user experience design perspective, if we consider the AIs as users, the question arises as to whether data should be processed specifically to cater to their needs. Creating document authoring applications for the needs of AI agents may further improve the quality of collaboration and outcomes in human-AI interactions. Designing AI-Friendly interfaces is another way. We mostly try to make AI to sense the information the same way we sense it. By considering AIs as stakeholders, we may need to move toward using interfaces more accessible for AI too, and it may help to reduce the complexity of AI system development.

4.4 Collaboration between AI Agents & Communication Standards for Training LLMs

The emergence of multiple generative AI agents offers exciting possibilities for collaboration. Future work should explore how these agents can effectively collaborate, leveraging their respective strengths to achieve improved outcomes. For instance, each agent can play a persona, and output of each persona can be improved by a human actor. Then collaboration between multiple fine-tuned LLMs can be used to facilitate novel focus groups.

As LLMs become more prevalent and diverse, developing communication standards between these models is imperative. Future research should focus on defining and establishing communication protocols and standards that facilitate information exchange and collaboration between different LLMs. These standards will enhance interoperability, enabling LLMs to collaborate effectively and leverage each other’s capabilities.

5 CONCLUDING REMARKS

In this study, our focus was to investigate the potential opportunities that LLMs offer within the design thinking process. Through

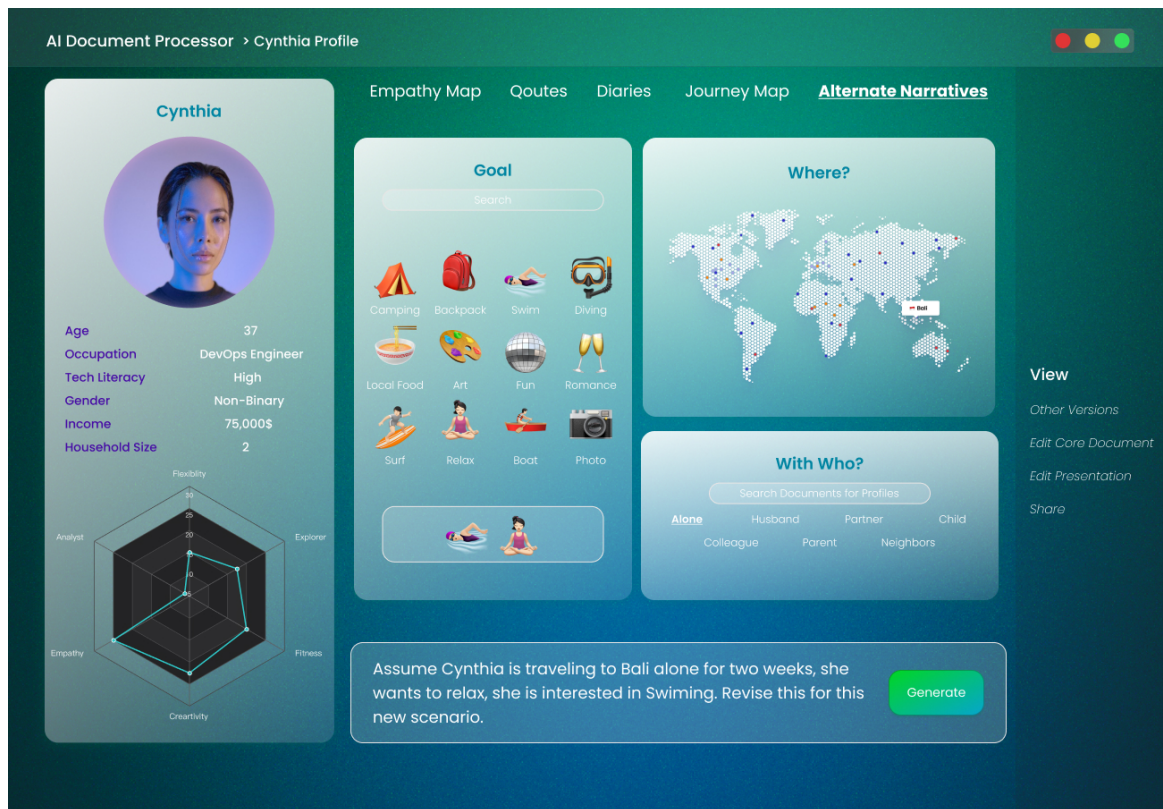


Figure 1: AI Document Processor Application Concept

testing and experimentation, we demonstrated how the integration of LLMs enables the synthesis of small fragments of original knowledge, ultimately leading to the generation of new insights. In essence, by utilizing LLMs researchers and design practitioners can significantly enhance their user studies and expand their understanding of user experiences. This approach allows for a broader exploration of ideas and a more comprehensive analysis of user perspectives, fostering innovation and enriching the design thinking process.

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