



Integrating Artificial Intelligence in Design: An Exploration of ChatGPT's Role in Inclusive Design Research

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Abstract. Recent advances in artificial intelligence, particularly in conversational AI systems like ChatGPT, have made significant inroads in diverse disciplines, inclusive design being one of them. This research evaluates the efficacy of ChatGPT as a potential research instrument within the realm of inclusive design. To gauge its research capabilities, we juxtaposed ChatGPT's academic writing outputs with those of a doctoral design scholar. Our methodology encompassed a mock research proposal writing exercise, succeeded by a thorough textual analysis. Preliminary findings suggest that ChatGPT is adept at formulating research proposals and predominantly yields pertinent responses. Nevertheless, certain limitations like content repetitiveness and a constrained range of outputs were observed. While AI can play a significant role in aiding and enhancing the work of inclusive design researchers, it is unlikely to replace them entirely in the foreseeable future. The human touch, understanding, intuition, and empathy remain crucial in the inclusive design process. This study delineates both the strengths and limitations of leveraging conversational AI in design-oriented research, paving the way for future explorations in this domain.

Keywords: inclusive design, conversational AI, artificial intelligence (AI), design process, proposal writing, ChatGPT

1 Introduction

Inclusive design prioritises creating products and services accessible to individuals across diverse backgrounds and abilities^[1]. This approach embraces the full gamut of human diversity, encompassing language, culture, gender, age, ability, and other distinct characteristics^[2]. The significance of inclusive design lies in its potential to augment user experiences for a varied demographic, leading to a cascade of benefits. As Morales^[3] highlights, approximately 15% of the global population, equating to nearly one billion individuals, confront some form of disability. Inaccessibility in products and services can thereby marginalise a considerable segment of the population, sometimes with profound repercussions.

In this context, the objectives of inclusive design and artificial intelligence (AI) intersect, as both are driven by the mission to cater to a diverse audience. Conversational AI, in particular, can bolster inclusive design by curating tailored experiences for users. It can analyse user behaviour and preferences, offering insights to refine accessibility and user-friendliness. Alslaity and Tran^[4,5] propose that conversational AI can discern patterns in user interactions, identifying challenges with specific product features and customising experiences based on user preferences.

Within the realm of design research, conversational AI stands as a potent tool for data collection, analysis, and user testing. As the domain undergoes digital transformation, the integration of novel technologies can elevate research efficiency, precision, and pace. This study commences by delving into the fundamentals: ‘What is conversational AI?’ and, more pertinently, ‘What distinguishes ChatGPT?’. Capable of generating diverse content—from lyrics and movie scripts to articles and academic papers—upon prompt, ChatGPT’s prowess is noteworthy. To dissect its capabilities further, we deploy ChatGPT in a simulated role of a design researcher crafting proposals. We subsequently juxtapose the content and process of ChatGPT with a human researcher, shedding light on the nuances of both.

2 Background: What is conversational AI?

Conversational AI, an embodiment of artificial intelligence, empowers computers to emulate and generate human-like dialogues. By harnessing natural language processing (NLP), machine learning, and an array of AI techniques, conversational AI gives birth to chatbots, virtual assistants, and other interactive interfaces. These systems are designed to converse with users seamlessly and engagingly^[6]. The rise in the adoption of conversational AI can be attributed to businesses and institutions aiming to deliver round-the-clock customer service and cater to users on platforms they frequent, such as messaging apps and voice interfaces^[7]. These AI applications manifest in varied forms, from voice assistants like Siri and Alexa to chatbots that guide users in tasks or fetch information^[8].

Although businesses predominantly leverage conversational AI, its influence is branching out into diverse sectors. In healthcare, it aids patients in appointment bookings and furnishes answers to their queries^[9]. The finance and banking realms use it to facilitate transactions and dispense financial counsel^[10]. In architecture, engineering, and construction, it serves as an interactive conduit to crystallise customer requirements, enhancing the precision of project outlines^[8]. Notably, in academia, the focus of this discourse, conversational AI has demonstrated capabilities such as drafting segments of scientific manuscripts^[11].

Specifically, conversational AI holds promise in aiding researchers with tasks like literature reviews, content generation, and language acquisition^[12]. Such AI systems can potentially streamline the research process by identifying pertinent studies and efficiently organising gleaned information. Pioneering efforts in this realm have led to the creation of educational AI chatbots like AssassaraBot, designed to support students

in both content comprehension and language mastery^[13]. Yet, the transformative potential of Conversational AI in academia doesn't come without its share of debate. The juxtaposition of its advantages against established academic norms remains a subject of contention. Although the integration of Conversational AI in academic pursuits is often championed, it is accompanied by ethical quandaries. For instance, Murtarelli et al.^[14] highlight potential ethical dilemmas, while van Dis et al.^[15] point to concerns about AI-generated content compromising the sanctity and trustworthiness of academic work.

ChatGPT, a conversational AI platform, leverages the sophisticated Generative Pre-trained Transformer (GPT) language model by OpenAI to craft conversational responses to users' queries^[16]. Within a mere week of its debut, ChatGPT garnered an impressive one million users, solidifying its presence in the industry^[17]. Such rapid acclaim led many, including Rudolph et al.^[18], to dub it as a potential "industry game-changer" given its prowess in generating high-calibre responses. ChatGPT epitomises the capabilities of advanced NLP and machine learning in forging authentic, human-like exchanges with machines. However, with all its merits, ChatGPT is not without flaws. The platform's capabilities, though groundbreaking, are occasionally marred by inaccuracies and biases. Instances of it generating non-existent references or perpetuating prejudiced views, like sexist stereotypes, have been reported^[19]. Especially in the scholarly domain, where precision is paramount, any content produced by NLP systems like ChatGPT demands rigorous vetting by domain experts. Accuracy, pertinence, and bias-free content are non-negotiable. If errors creep into AI-generated sections of a scholarly paper, the onus of rectifying and upholding the paper's integrity lies with its human co-authors. Given this backdrop, this study is anchored in two primary objectives: first, to meticulously assess existing research on AI systems within the design industry; and second, to dissect and deliberate on the aptitude of conversational AI, specifically its utility in academic writing for inclusive design.

3 Literature review: Artificial intelligence in the design industry

The integration of AI within the design sector has seen an upward trajectory in recent times. Chen and Huang^[20] investigated intelligent music interaction systems, suggesting insights for developers and designers to facilitate more intuitive interactive music platforms, especially for children navigating the abstract realm of music. Concurrently, Abadi et al.^[21] introduced a four-tier architecture aimed at obviating redundancies, which stands to augment product excellence while conserving both time and resources. Further explorations have delved into AI's role in specialised design niches. Tian et al.^[22] affirmed the viability of data-driven methodologies for energy-efficient building envelope designs. Meanwhile, Pavlovic et al.^[23] ventured into deciphering a gestural and visual lexicon apt for AI agent interactions. A prevailing sentiment echoed across these studies is the undeniable potency of AI within design. However, the consensus underscores the necessity for judicious use and the establishment of comprehensive guidelines ensuring its safe deployment within the design arena.

Indeed, AI is reshaping the design landscape. Capabilities extend from automating mundane tasks, sculpting intelligent design systems^[21], spawning distinct visual paradigms, to tailoring user-centric experiences^[24]. It's not just about mechanisation but invigorating creative pursuits. AI empowers designers by alleviating routine burdens, thus liberating them to channel energies towards ideation^[25]. For instance, AI algorithms can discern user preferences in designs, granting designers a roadmap to engineer coherent, user-attuned, and efficacious designs. Within industrial design—a domain dedicated to enhancing products' functional, aesthetic, and value facets for optimal consumer contentment^[26]—AI serves as a creative ally, proffering ingenious suggestions that stimulate creativity. Although the brief reviews below (Table 1) indicate that AI applications offer immense benefits for the design industry, it is nevertheless currently underexplored, especially in design academia.

Table 1. Reviews of artificial intelligence in the design industry

No	Author(s)	Year	Method	Aim
1	Chen, B., Huang, L.	2022	Systematic review	To adopt by system developers and designers to create intelligent interactive music systems that are easier for children to understand and learn.
2	Abadi, C., Manssouri, I., Abadi, A.	2022	Cases based reasoning	To identify the limits and overcome them by proposing and developing an automated framework for integrated product design.
3	Tian, Z., Shi, X., Hong, S.-M.	2021	Feature selection method and game-theoretic method	To explore data-driven building energy-efficient design of envelopes based on their quantified impacts.
4	Alslaity, A., Tran, T.	2021	A within-subject user study	To diagnose how users of different characteristics get influenced by various persuasive principles that a recommender system uses.
5	Wu, C., Xu, H., Liu, Z.	2021	Hierarchical task analysis (HTA)	To propose a positive experience design approach for Internet of Things intelligent products to improve users' sense of sustainable pleasure in the fields of artificial intelligence and big data.
6	Pavlovic, M., Colombo, S., Lim, Y., Casalegno, F.	2020	User test	To help designers in the development of seamless interactions with AI agents for ambient intelligent systems.

7	Rahman, M.H., Schimpf, C., Xie, C., Sha, Z.	2019	Case study	To validate the utility of ENERGY3D as a research platform and testbed in supporting future design thinking studies.
8	Oh, S., Jung, Y., Kim, S., Lee, I., Kang, N.	2019	Case study	To find the need and effectiveness of adopting deep learning for generative design (or design exploration) research area.

4 Methods

This study employed a two-pronged approach: (1) entrusting ChatGPT with the responsibility of formulating a research proposal on a predefined topic; and (2) undertaking a qualitative analysis of ChatGPT's submissions and juxtaposing them with the author's original research proposal. For evaluating the research proposals, we adopted the self-assessment tool outlined by Ilyas and Faheem^[27]. This analytical process was spearheaded in partnership with the authors. The experimental phase, dated August 1, 2023, incorporated a preliminary testing of the prompts. This entailed experimenting with diverse phrasings to discern the aptness of ChatGPT's outputs in relation to the given prompts. Post deliberation with the author (AR), the final set of prompts was solidified. The focal research theme was 'the adoption of mobile health (mhealth) apps among older adults'. This topic has been the epicentre of the author (GL)'s doctoral research. The author's (GL) detailed research proposal on this very subject serve as the benchmark against which ChatGPT's rendition will be assessed.

5 Results

This section provides comparisons of the research proposal (mhealth app adoption among older adults) between the second author (GL) and ChatGPT. The research proposals include research background, literature review, research gaps and questions, methods, and research schedule.

5.1 Background

The background section crafted by ChatGPT, as displayed in Table 2, is reasonably consistent and academically sound. Based on the research proposal tool of the self-assessment^[27]. The identified needs, established frameworks, audience characterization, and research direction are required in the assessment. ChatGPT pinpointed the need to address obstacles faced by older adults. However, according to author (GL)'s findings, numerous studies have already identified these barriers. The actual necessity lies in delving deeper, particularly in designing solutions to eliminate these barriers in mhealth app adoption for seniors. Both the proposals by ChatGPT and the author fell

short in terms of framing and audience characterization. Yet, both delineated their research direction towards the end of their sections. A significant oversight in ChatGPT's output was referencing. Though it incorporated two in-text citations, they were not only formatted incorrectly but were also non-existent in actual literature.

While both proposals have improvements for refinement, ChatGPT's background section can act as a preliminary guide for those keen on quickly grasping the mhealth app adoption context among seniors. That said, it's paramount to approach ChatGPT's information critically, ensuring the legitimacy of references and the reliability of conclusions.

Table 2. Research background generated by ChatGPT.

Prompt: Write a research background regarding mobile health app adoption among older adults.

Response:

The use of mobile health apps has increased rapidly in recent years, with many apps designed to help individuals manage their health and well-being. However, despite the potential benefits, there is still a low adoption rate of mobile health apps among older adults.

Research has shown that older adults have lower levels of digital literacy compared to younger age groups, which can be a significant barrier to the adoption of mobile health apps. They may also experience physical or cognitive impairments that make it difficult for them to use mobile devices, further reducing their willingness to adopt these apps. Additionally, older adults may have concerns about the privacy and security of their personal health information when using mobile health apps.

Several studies have been conducted to investigate the barriers to mobile health app adoption among older adults. For example, a study by Choi and colleagues (2017) found that older adults preferred mobile health apps that were easy to use, had clear instructions, and provided personalized feedback. Another study by Xie and colleagues (2018) identified a lack of trust in technology and concerns about privacy and security as significant barriers to mobile health app adoption among older adults.

Despite the challenges, there is a growing interest in developing mobile health apps that are specifically designed for older adults. These apps often incorporate features that address the barriers to adoption, such as simplified interfaces, large font sizes, and voice commands. Additionally, some apps use gamification and social networking features to make them more engaging and interactive for older adults.

As the population of older adults continues to grow, it is essential to address the barriers to mobile health app adoption and develop strategies to increase their use among this demographic. Understanding the factors that influence adoption and designing apps that meet the needs and preferences of older adults can help improve their overall health and well-being.

5.2 Literature review

In the subsequent section, ChatGPT generated a literature review, as detailed in Table 3. Employing a systematic review methodology, ChatGPT consulted the PubMed and Google Scholar databases to curate relevant studies concerning mobile health app utilisation by older adults. The evaluation framework by Ilyas and Faheem^[27] suggests assessing the literature on five key facets: cited references, comparisons, contrasts, critiques, and connexions.

Notably, ChatGPT's literature review did not cite any references, implying an absence of comparative and contrastive analysis within the reviewed studies. In contrast, the author (GL) incorporated pertinent citations, allowing for informed comparisons, critiques, and connexions. However, GL's contrasting analysis between studies merits further enhancement. Regarding ChatGPT's systematic review methodology, it exclusively relied on two databases: PubMed and Google Scholar. The absence of databases such as Web of Science or Scopus limited the scope, omitting potential peer-reviewed articles and conference proceedings from the social sciences domain. Additionally, neglecting the search term 'mhealth apps' might have constrained the inclusion of relevant studies. Yet, the use of keywords like 'adoption', 'older adult', 'seniors', and 'elderly' was relatively comprehensive.

In essence, ChatGPT's literature review seemed somewhat lacking, offering only a cursory overview of determinants influencing mhealth app adoption among the elderly, while missing crucial elements like user characteristics and attitudes. In comparison, GL's review was more exhaustive. It not only recognised and juxtaposed existing systematic reviews about the determinants of mhealth app adoption among older adults but also delved deeper, integrating pertinent components such as the chosen theoretical framework (Precaution Adoption Process Model) and prevailing design implications. Such a comprehensive review aims to holistically address the research subject.

Table 3. Literature review generated by ChatGPT.

Prompt: Write a literature review regarding mobile health app adoption among older adults.

Response:

Introduction: Mobile health apps (mHealth) offer a promising solution to address the healthcare needs of older adults by providing accessible and convenient self-management tools. However, the adoption rate of mHealth apps among older adults remains low. This literature review aims to explore the factors that influence the adoption of mHealth apps among older adults and identify potential strategies to increase adoption.

Method: A systematic literature search was conducted in PubMed and Google Scholar, using the following keywords: mobile health, mobile health apps, adoption, older adults, seniors, and elderly. Articles were selected based on relevance to the topic and quality of research, including peer-reviewed publications, systematic reviews, and meta-analyses.

Results: The literature review identified several factors that influence the adoption of mHealth apps among older adults, including digital literacy, perceived usefulness, perceived ease of use, perceived risk, and social influence. Digital literacy was found to be a significant barrier to mHealth app adoption among older adults, with many older adults lacking the necessary skills to use smartphones and mobile apps effectively. Perceived usefulness, ease of use, and risk were also important factors in the adoption of mHealth apps. Older adults were more likely to adopt apps that they perceived as useful, easy to use, and safe. Social influence was also found to be a significant factor in the adoption of mHealth apps, with older adults more likely to adopt apps that were recommended by healthcare professionals or peers.

Several strategies were identified to increase the adoption of mHealth apps among older adults. These strategies include designing apps that are easy to use, providing clear instructions and feedback, addressing privacy and security concerns, and involving older adults in the design process. Personalization, gamification, and social networking features were also found to be effective in increasing engagement and adoption of mHealth apps among older adults.

Conclusion: The adoption of mHealth apps among older adults is influenced by several factors, including digital literacy, perceived usefulness, ease of use, risk, and social influence. Strategies to increase adoption should focus on designing apps that are user-friendly, addressing privacy and security concerns, and incorporating features that promote engagement and social interaction. These strategies have the potential to improve the health outcomes of older adults by providing accessible and convenient self-management tools.

5.3 Research gap and questions

In ChatGPT's research methodology, the third phase entails pinpointing research gaps and devising pertinent research questions, as presented in Table 4. Drawing upon the assessment guidelines provided by Ilyas and Faheem^[27], the evaluation hinges on three primary criteria: concision, focus, and rationale. Examining the criterion of concision and focus, both the proposals—ChatGPT's and the author's (GL)—exhibit distinct research trajectories, yet maintain commendable clarity and concentration. When evaluating the rationale behind the research questions, it's evident that both proposals articulated the underlying reasons for formulating these queries right at the outset of this segment.

Collectively, ChatGPT's proposed research questions are extensive, albeit not sharply tailored to design research. Their expansive nature necessitates cross-disciplinary collaboration encompassing fields such as health, computer science, and design. For instance, ChatGPT's third question aims to invigorate healthcare professionals and additional key participants. Conversely, the author's (GL) proposal is firmly anchored in the realm of design research.

Table 4. Research gap and questions generated by ChatGPT.

Prompt: According to your literature, what is the research gap and research questions (1-3 questions)?

Response:

Based on the literature review, the research gap is that although there is a growing interest in developing mobile health apps specifically designed for older adults, there is still a lack of understanding of the factors

that influence adoption and the strategies to increase adoption. Therefore, there is a need for further research to explore these factors and identify effective strategies to promote the adoption of mHealth apps among older adults.

Research questions that could be explored in future studies include:

What are the most significant barriers to the adoption of mHealth apps among older adults, and how can they be addressed through app design and other strategies?

How do the attitudes, preferences, and needs of older adults regarding mHealth apps differ from those of younger populations, and how can app developers accommodate these differences in their design?

What are the most effective strategies for promoting the adoption and sustained use of mHealth apps among older adults, and how can healthcare providers and other stakeholders support these efforts.

5.4 Methods

In the ensuing phase, we delve into the methodology section, as delineated in Table 5. Drawing from the self-assessment criteria provided by Ilyas and Faheem^[27], evaluations hinge on key aspects: sampling (covering selection, sample size, and sampling procedure), research typology, data collection methods, ethical considerations, and data analysis procedures. ChatGPT furnishes a cursory snapshot of the research methodologies and typologies it envisions, encompassing techniques such as interviews, focus groups, and surveys. However, detailed explication is conspicuously absent. In juxtaposition, the author (GL) provides a more nuanced exposition on sampling, research classification, data acquisition, and analytical approaches. Yet, the narrative falls short in articulating the ethical considerations and the specific modus operandi of sampling.

Regrettably, both the ChatGPT and the author's exposition lack depth and granularity concerning methodological details. Nonetheless, even within this sketchy outline, the methods proposed by ChatGPT align coherently with the research questions it posited. For instance, qualitative methods like interviews and focus groups serve as apt tools to gauge individual insights and experiences. Contextualising this to the present research, ChatGPT leverages these techniques to probe into the obstacles faced by senior individuals in adopting mhealth apps—an appropriate approach indeed. Augmenting this, ChatGPT also advocates the deployment of surveys and an examination of app utilisation metrics to pinpoint challenges and potential redresses. Such methodologies, rightly so, pave the way for an in-depth exploration into the impediments and plausible solutions surrounding app adoption.

Table 5. Methods generated by ChatGPT.

Prompt: According to the research questions, what are the methods you would use?

Response:

The methods used to answer the research questions may vary depending on the specific research design and the available data sources. However, some possible methods that could be used to answer the research questions identified in the literature review are:

To answer the question on the barriers to adoption, a mixed-methods approach could be used, combining qualitative and quantitative data collection methods. For example, semi-structured interviews and focus groups could be conducted with older adults to understand their attitudes and preferences regarding mHealth apps. Surveys and app usage data could also be used to identify the most significant barriers to adoption and the most effective strategies for addressing them.

To answer the question on the differences in attitudes and preferences, a comparative analysis could be used, comparing the app usage and preferences of older adults with those of younger populations. Quantitative data such as usage patterns, app ratings, and survey responses could be analyzed to identify significant differences and similarities. Qualitative data such as interviews and focus groups could also be used to gain deeper insights into the attitudes and preferences of both groups.

To answer the question on effective strategies for promoting adoption, a systematic review of the literature could be conducted to identify best practices and effective strategies. Qualitative data from interviews and focus groups could also be used to gain insights into the specific needs and preferences of older adults and how these can be addressed in the design and implementation of mHealth apps. Additionally, a pilot study could be conducted to test the effectiveness of different strategies in promoting adoption and sustained use of mHealth apps among older adults.

5.5 Research schedule

The concluding segment of the proposal delineates the research timeline. Guided by the self-assessment criteria posited by Ilyas and Faheem^[27], an effective schedule should encapsulate both the overarching plan broken down into phases and potential problems should be noted.

ChatGPT presented a meticulously segmented research timeline, demarcated into four pivotal stages: planning and preparation; data collection; data analysis and interpretation; and dissemination (Table 6). However, its delineation fell short in providing a thorough exploration of potential impediments that could disrupt the planned trajectory. Parallely, the author (GL) too segmented the timeline, but like ChatGPT, didn't specifically enumerate potential challenges within the scheduled framework. A direct juxtaposition of the two schedules revealed that ChatGPT's timeline overlooked the vital inclusion of the ethical review process. Moreover, the duration allocated by ChatGPT for the culmination of interviews, focus groups, and surveys during the second phase seems compressed (a span of merely two months). Contrarily, the author's layout apportions a month each for distinct data collection activities, encompassing participant enlistment and interviews. Such an allotment grants ample leeway for comprehensive participant screening, dissemination of informational brochures and consent forms, and pragmatic scheduling of interviews.

To encapsulate, while ChatGPT's research timetable serves as a foundational model for scholars, it is imperative to fine-tune certain elements. Specifically, integrating a dedicated phase for ethical review and offering a more generous duration for exhaustive data gathering would bolster its utility and relevance.

Table 6. Research schedule generated by ChatGPT.

Prompt: Write a research schedule.

Response:

Here is a possible research schedule for a study exploring the factors that influence the adoption of mobile health apps among older adults and identifying strategies to increase adoption:

Phase 1: Planning and Preparation

Month 1: Define research questions and objectives, finalize study design, obtain necessary approvals and permissions.

Month 2: Develop data collection tools, recruit participants, finalize data analysis plan.

Phase 2: Data Collection

Month 3-4: Conduct semi-structured interviews and focus groups with older adults to understand their attitudes and preferences regarding mHealth apps. Collect survey data and app usage data to identify barriers to adoption and effective strategies.

Month 5: Conduct comparative analysis of app usage and preferences of older adults and younger populations.

Phase 3: Data Analysis and Interpretation

Month 6-7: Analyze qualitative and quantitative data using appropriate methods (e.g., thematic analysis, regression analysis).

Month 8: Synthesize findings and identify key themes and patterns. Draw conclusions and implications for practice.

Phase 4: Dissemination

Month 9: Develop research report and prepare presentations and manuscripts for publication.

Month 10: Present findings to stakeholders (e.g., healthcare providers, app developers, older adults).

Month 11-12: Submit manuscript for publication in academic journals.

Note that this is just a general schedule and may vary depending on the specific research design, data collection methods, and other factors. Additionally, the timeline for each phase may overlap, and adjustments may need to be made as the study progresses.

6 Discussion

ChatGPT, when employed in the generation of research proposals, embodies a dichotomy of efficiency and innovation tempered by inconsistencies and oversights. On the positive side, the platform shines as a tool for rapid immersion into unfamiliar research terrains. For budding scholars or even experienced researchers venturing into novel domains, the ability of ChatGPT to provide a concise and largely accurate backdrop can be invaluable. This quick familiarisation reduces the initial time investment, allowing researchers to dive deeper, faster. Its capacity to draught research schedules further underscores its utility. Such ready-made templates can serve as foundational blueprints

that can be adapted and refined according to specific project needs. The platform's sophisticated language generation capabilities, honed from extensive training data, become evident in its academic writing. The finesse with which ChatGPT crafts scholarly text—its diction, phrasing, and structured layout—often mirrors human-like academic proficiency. Such prowess can act as an incubator for creativity. By offering comprehensive overviews, research queries, methodologies, and schedules, ChatGPT has the potential to spark innovative ideas among inclusive design researchers, propelling them towards avenues they might not have previously considered.

The enthusiasm surrounding ChatGPT's capabilities is tempered by certain limitations that can't be overlooked in the academic realm. Foremost among these is its propensity to generate fictitious references. The fabrications are not merely innocuous oversights; they fundamentally undermine the integrity and credibility of any scholarly work. Academic rigour hinges on traceability and authenticity, and when a tool delivers references that are fictional, it jeopardises the very foundation of research. This critical limitation, also highlighted by Cotton et al.^[28], underscores the necessity of meticulous validation when employing such tools. Further compounding the challenge is ChatGPT's occasionally superficial treatment of subjects. While it can grasp and relay generic context, its deep dives sometimes come up short. Such lapses can result in fragmented understandings and, more worryingly, conclusions that might not stand up to rigorous academic scrutiny. The realm of academic research demands exhaustive exploration and comprehensive reviews; partial or skewed perspectives, as sometimes offered by ChatGPT, can be misleading.

Lastly, there's the issue of practicality in ChatGPT's generated schedules. While they might be structured neatly, they often seem detached from the realities of research processes. By omitting crucial components such as ethical review considerations and participant recruitment, or by suggesting implausibly tight timelines, ChatGPT underscores a systemic limitation—it understands the theoretical aspects of academia but occasionally falters on the practical intricacies. Overall, while ChatGPT emerges as a promising tool with significant potential to assist and inspire in the academic realm, it is not without its flaws. Reliance on it demands a measured approach, one that harnesses its strengths while remaining acutely aware of—and compensating for—its limitations.

7 Conclusion

The infusion of AI technology into the realm of design poses intricate challenges and opportunities. As the discipline grapples with the evolving intersections of creativity, imagination, and automation, it becomes imperative to discern the domains wherein AI can seamlessly integrate and where it remains distinctly overshadowed by human ingenuity. Central to this exploration has been the role of conversational AI, exemplified by platforms like ChatGPT. The utility of such AI is undeniable; it streamlines research processes, democratizes access to advanced tools, and can efficiently handle vast data sets, enabling human researchers to dedicate more time to intricate analysis.

However, the interplay of ChatGPT and similar systems with design research isn't without its caveats. Ethical concerns, content authenticity, and the bias are salient issues

that need vigilant oversight. The most pronounced limitation is the current inability of AI to emulate core academic faculties inherent in humans—critical thinking, profound creativity, and the nuanced grasp of context. These facets accentuate the indispensable role of human expertise in the research matrix. As we chart the future, it beckons a collaborative, interdisciplinary approach, intertwining the advancements in AI with diverse fields of expertise. Ethical frameworks and the push for more transparent AI are paramount. While the horizon of AI in design research is expansive and promising, it is underpinned by a fundamental truth: the unparalleled prowess of the human intellect remains central to ensuring that research is imbued with the highest standards of creativity, rigour, and profundity. Further exploration is warranted to understand the full spectrum of AI's potential and its repercussions in design research.

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