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Enhancing Efficiency and Creativity in Interior Design Through Diffusion Models

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Abstract: Interior design often faces challenges related to time-consuming processes and limited creative flexibility. Recently, text-based artificial intelligence models have introduced new possibilities for faster, more diverse, and aesthetically rich design generation. This study investigates the performance of diffusion based models, specifically MidJourney, ChatGPT DALL·E, and FLUX.1 Kontext, in interior design visualization and compares them with a traditional rendering tool. Using identical textual prompts, images were generated across all platforms and evaluated based on aesthetic coherence, compositional quality, and alignment with the input descriptions. The findings highlight MidJourney as the most effective tool for transforming conceptual design ideas into visually compelling outputs. It demonstrated clear strengths in capturing stylistic nuance, atmospheric consistency, and visual appeal, making it especially valuable in early stage design workflows such as ideation and client presentations. The results indicate that text to image generation technologies like MidJourney can serve as powerful tools that enhance creativity and streamline communication in interior design. This study contributes to the growing body of research on AI assisted design by demonstrating how generative models can support innovation and efficiency in visual representation practices.

1. Introduction

There is a significant global demand for interior design, but current design methods and approaches may not fully address these needs. One factor contributing to this issue is the complexity of the interior design process, where frequent modifications result in decreased design efficiency (Bao et al., 2022; Park and Hyun, 2022; Wang et al., 2023). Moreover, designers often rely on established methods to streamline their work, which can stifle creativity and limit innovation (Sinha and Fukey, 2022; Wang et al., 2023). Therefore, enhancing the efficiency of interior design processes and fostering greater innovation are crucial.

AI's capacity to rapidly and precisely simulate design alternatives has a profound impact on human traits such as creativity, especially when utilizing various AI platforms. Digital tools and technologies act as enablers for cognitive strategies and skills, fostering creative thinking in design processes (Lessig, 2002). AI technologies offer significant advantages over traditional interior design methods in terms of time savings, improved quality, and a wider range of design options. Studies have shown that AI-powered platforms significantly shorten design timelines, enhance productivity, and reduce costs (Lesmana, 2024). Additionally, AI analyzes user preferences to generate high-quality, personalized, and aesthetically strong interior solutions (Liu, 2024). Thanks to generative AI technologies, designers can produce numerous alternative

solutions in a short time, which fosters creativity and supports more flexible and innovative design decisions (Thakkar, 2024).

Recent developments in artificial intelligence, especially in the fields of image creation and modification, have greatly enhanced the efficiency of interior design workflows. Two widely adopted approaches driving these innovations are Generative Adversarial Networks (GANs) (Zhu, 2016; Jahanian, 2020; Meng, 2024) and Diffusion Models (Rombach, 2021; Lugmayr, 2022; Cheng, 2023). While GAN-based techniques excel in generating high-fidelity images with quick inference times, they often struggle with issues such as training instability and mode collapse. In contrast, Diffusion Models have proven to surpass GANs in terms of generating high-quality, realistic images. The advent of the diffusion model (Dickstein, 2015; Croitoru, 2023) offers a solution to the challenges of inefficiency and limited creativity in interior design (Nichol, 2021; Liu, 2023). The diffusion model's benefit lies in its ability to acquire prior knowledge from extensive pairs of images and text descriptions (Song, 2019; Ramesh, 2022). This paper explores how artificial intelligence diffusion models can enhance efficiency and visual appeal in interior design. By generating customized designs from text descriptions, these models address common design challenges and enable rapid creation of aesthetically pleasing spaces. We compare various models to understand their impact on design innovation and practical applications.

This study contributes to the field of interior design and architectural visualization in the following ways:

1. It offers a structured comparison of diffusion-based text-to-image models—MidJourney, ChatGPT-DALL·E, and FLUX.1 Kontext—assessed through consistent prompts and evaluated on visual coherence, prompt alignment, and usability.
2. It provides empirical insights into how these AI tools perform in early-stage design processes, particularly for ideation and visual communication.
3. It highlights current technical limitations of generative models, such as spatial inconsistency and limited multi-view reliability, suggesting areas for future research and improvement.
4. It proposes a practical framework for incorporating AI-generated visual content into existing design workflows, supporting more efficient and flexible approaches to interior visualization.

This article is structured as follows. The Introduction outlines the study's purpose and the role of AI-based diffusion models in interior design. Section 2 presents a literature review on AI applications and image generation technologies. Section 3 introduces and compares key AI tools used for image rendering, including ChatGPT-DALL·E, MidJourney, and FLUX.1 Kontext. Section 4 explains the methodology used for evaluating these tools. Section 5 concludes the paper with a summary of findings and future research directions.

2. Literature Review

Interior design usually entails designers utilizing their artistic sensibility and technical expertise to craft interior spaces with distinct decorative themes tailored to clients' preferences. They are responsible for choosing the right design components, such as tiles, furniture, color schemes, and patterns, to bring the desired aesthetic to life. A clearly articulated interior design style plays a crucial role in giving the space its distinctive character and differentiating it from others. Designers typically use design visualizations to finalize designs with clients, but this method can be inefficient. The inefficiency arises because the traditional interior design process is linear, requiring designers to spend significant time creating design images and limiting real-time communication with clients, which often leads to numerous revisions (Chen, 2023).

The initial diffusion model, proposed in 2015 by Dickstein, has undergone continuous optimization and improvement since then (Song, 2020). The enhanced model has emerged as a leading generative model due to its outstanding image generation capabilities (Song, 2020; Dhariwal, 2021). Diffusion models operate through two main processes: the forward process, which gradually introduces noise into the original image, and the reverse process, which iteratively removes noise from random noise to reconstruct the image. These models learn the denoising procedure, enabling them to generate images (Dickstein, 2015; Song, 2020). In the forward process, Gaussian noise is systematically added to the data through a Markov chain, progressively destroying the structure of the original image over time. The reverse process then attempts to learn the inverse of this degradation by predicting and removing the noise step by step, effectively generating a coherent image from random noise. This denoising-based reconstruction mechanism is central to the performance of diffusion models and has been further optimized in recent work through techniques like residual denoising and faster sampling schedules (Song, 2020).

Building on this architecture, recent advancements have enabled conditional image generation, particularly through text-to-image diffusion models. To generate an image belonging to a specific category or containing particular features, text guidance is required. Text-to-image diffusion models facilitate controlled image creation by using text as a guiding factor (Dhariwal, 2021; Ho and Salimans, 2021; Gafni, 2022; Liu, 2023). One key benefit of text-guided diffusion models is their ability to produce images that accurately reflect the meaning of the input text.

In diffusion models, new knowledge can be acquired in two ways: by retraining the entire model or by fine-tuning it to adapt to new scenarios. Given the significant expense associated with retraining the entire model, fine-tuning is a more practical approach. There are four widely used methods for fine-tuning models, with the first being textual inversion (Lessig, 2002; Choi, 2021; Dhariwal, 2021; Gal, 2022).

3. AI Tools for Image Rendering

3.1. ChatGPT

The integration of ChatGPT with the DALL·E model has introduced a new approach to generating interior architectural renderings by converting written descriptions into detailed visual outputs. This system enables users to articulate spatial concepts—such as room layout, lighting, materials, and furnishings—and receive realistic design visuals accordingly. Research has shown that such AI-assisted workflows support design students in developing and refining their ideas more efficiently during the early stages of creative work (Abrusci et al., 2023). A separate study focusing on image generation in surrealist styles found that prompts generated through ChatGPT led to higher-quality outputs from DALL·E. These findings emphasize the model's effectiveness in interpreting stylistic language and translating it into coherent visual compositions, which can be especially valuable in conceptual and artistic interior design processes (Ayten et al., 2024).

3.2. MidJourney

MidJourney, a text-to-image AI tool, has emerged as a creative support mechanism in interior architectural design, particularly during the conceptual visualization stage. Its ability to transform textual descriptions into visuals depicting spatial layouts, materials, and lighting enables rapid exploration of design alternatives in the early stages. In a study involving architecture students, MidJourney was found to stimulate idea generation and enhance imagination, although its limitations in structural logic and spatial accuracy were noted (Paananen et al., 2024). Another study highlighted MidJourney's effectiveness in visualizing material combinations and aesthetic elements, especially in traditional architectural contexts.

While the tool is not capable of producing structurally accurate or technically detailed architectural renderings, it excels in generating compelling textures, color schemes, and atmospheric compositions. As such, MidJourney serves as a valuable tool for designers looking to develop mood boards or communicate early design intentions visually (Tanugraha, 2023)

3.3. FLUX.1 Kontext

FLUX.1 Kontext is a generative flow matching model that unifies text-to-image and image-to-image generation through a simple sequence concatenation of visual and textual inputs. Unlike traditional or diffusion-based editors, it offers fast rendering and excels in preserving object identity and consistency across iterative edits. Evaluated on the KontextBench benchmark with 1,026 real-world image-prompt pairs, it outperforms in tasks like character preservation and text-based editing, proving competitive with both open-source and proprietary systems (Labs, 2025). In interior architecture and design visualization, FLUX.1 Kontext offers a powerful solution for fast and flexible concept development. Designers can begin with a reference image such as a rough sketch or an empty room and iteratively apply natural language instructions like “add a modern sofa” or “change lighting to warm daylight.” With rendering speeds of 3–5 seconds at high resolution and strong spatial and stylistic consistency, the model supports rapid prototyping, virtual staging, and personalized client presentations. Its ability to condition on both text and image inputs without retraining makes it especially useful for aligning outputs with real-world constraints or aesthetic references, enabling efficient and visually coherent design workflows. To better understand the practical implications of these tools, their key strengths and limitations can be compared side by side. In interior design, these AI tools are primarily used for early-stage ideation, rapid visualization of spatial concepts, and exploration of materials, lighting, and atmosphere. They also serve as effective means of communicating design intentions to clients and stakeholders, while supporting iterative refinement and personalized presentations. The following table provides a concise overview of the advantages and disadvantages of ChatGPT, MidJourney, and FLUX.1 Kontext in the context of image rendering and interior architectural design.

Table 1. Advantages and Disadvantages of AI Tools for Image Rendering in Interior Design

AI Tool	Advantages	Disadvantages
ChatGPT (with DALL·E integration)	<ul style="list-style-type: none"> - Converts written descriptions into realistic interior design visuals. - Quickly visualizes spatial concepts (lighting, materials, furniture). - Speeds up idea development for design students. - Effective at interpreting stylistic language and generating artistic designs. 	<ul style="list-style-type: none"> - Generated visuals may lack structural accuracy. - Can struggle with complex spatial relationships. - Independent from real-time or updated data.
MidJourney	<ul style="list-style-type: none"> - Provides fast concept visualization from text prompts. - Strong in generating materials, textures, colors, and atmosphere. - Stimulates creativity and imagination. - Very useful for mood boards and aesthetic combinations. 	<ul style="list-style-type: none"> - Weak in spatial accuracy and structural logic. - Does not generate technical or detailed architectural renderings. - Runs via Discord, which limits ease of access.
FLUX.1 Kontext	<ul style="list-style-type: none"> - Supports both text-to-image and image-to-image workflows. - Preserves object identity and consistency across edits. - Fast (3–5 sec) high-resolution rendering. - Allows realistic and personalized designs with reference images. - High consistency in iterative refinements. 	<ul style="list-style-type: none"> - Smaller community and fewer resources compared to MidJourney. - Higher learning curve for beginners. - Still evolving with limited integrations. - Can be resource-intensive for some workflows

3.4.Methodology

This study employs a comparative visual analysis methodology to evaluate the effectiveness of traditional rendering engines and modern AI-based text-to-image models in interior architectural visualization. By generating interior design images using both conventional rendering tool and AI-driven platforms (ChatGPT-DALL·E, MidJourney, FLUX.1 Kontext), the research investigates visual quality, prompt interpretation accuracy, aesthetic coherence, and spatial realism. Each model is tested using the same textual prompts to maintain consistency in input, enabling a side-by-side assessment of their outputs in terms of creativity, realism, and technical performance.

To ensure a fair and reproducible comparison across all models, we employed a standardized set of textual prompts. Each prompt was designed to represent common interior design scenarios, focusing on spatial qualities, materiality, and atmosphere. The same prompts were applied to MidJourney, ChatGPT-DALL·E, and FLUX.1 Kontext, with only minor adjustments where platform syntax required. Representative examples of the prompts include:

1. A modern interior with natural light, wooden surfaces, and minimalist elements in neutral tones.
2. A contemporary interior with an open layout, ergonomic features, and biophilic design elements.
3. An elegant interior with warm lighting, soft textures, and a balanced composition of decor.

To assess the results, the images were qualitatively evaluated by a senior interior architect from Tabanlıoğlu Architects Design Center, Istanbul, with over 10 years of professional experience in interior design and visualization. The expert provided detailed written assessments for each output based on three structured criteria: aesthetic coherence, compositional quality, and fidelity to the textual input. To ensure consistency across models, the same guiding questions were applied: (1) Does the image maintain aesthetic coherence and visual appeal in line with interior design standards? (2) Is the overall composition balanced and logically organized within the space? (3) To what extent does the generated image accurately reflect the details of the textual input? A single expert was intentionally selected to ensure consistency in applying these criteria, although we acknowledge this as a limitation and recommend future studies incorporate multiple evaluators for greater reliability. Rather than assigning numerical scores, the evaluation focused on descriptive analysis to identify each model's strengths and limitations. These expert insights were then thematically categorized and compared across models. The thematic analysis was conducted manually by the researcher without the use of specialized software, since the dataset was limited in scale. However, future studies with larger samples may benefit from software-assisted coding to increase methodological rigor.

The comparative evaluation in this study also reflects patterns reported in earlier research. MidJourney's strength in generating atmospheric and stylistically compelling images is consistent with Paananen et al. (2024) and Tanugraha (2023). Similarly, ChatGPT-DALL·E's role in supporting ideation and stylistic interpretation aligns with Abrusci et al. (2023) and Ayten et al. (2024). Our findings on FLUX.1 Kontext confirm Labs (2025) regarding object identity preservation and fast iterative editing, while further demonstrating its applicability to virtual staging in interior design practice.

There are many methods and workflows for the traditional rendering process, as numerous competitive software programs have been developed over the last 25 years. In the workflow presented in this study, which is also commonly followed by many architects, a

BIM (Revit) model is used, where different teams from various disciplines collaborate simultaneously on the project according to a defined Level of Development (LOD). The interior designer can then utilize this model and continue the design process, for example by adding furniture modeling. Once the model is completed in modeling programs such as Autodesk 3Ds Max or SketchUp, the rendering phase begins. At this stage, various rendering tools can be employed to achieve photorealism. The tools used in this study are Corona Render and D5 Render, as they are among the most widely preferred rendering engines in architectural visualization. The classic rendering tool delivers high fidelity in terms of architectural accuracy and spatial coherence. It adheres to strict geometric modeling rules, ensuring that lighting, materials, and dimensions are grounded in physical realism. Nevertheless, the rendering process is time-consuming, requires substantial technical expertise, and lacks the flexibility for spontaneous creative exploration offered by AI-based systems. To complement this workflow, Figure 1 presents the AI-assisted image generation process employed in this study. The diagram illustrates how textual prompts are transformed into visual outputs through platforms such as MidJourney, followed by refinement and post-processing stages, ultimately integrating into the broader interior design workflow.

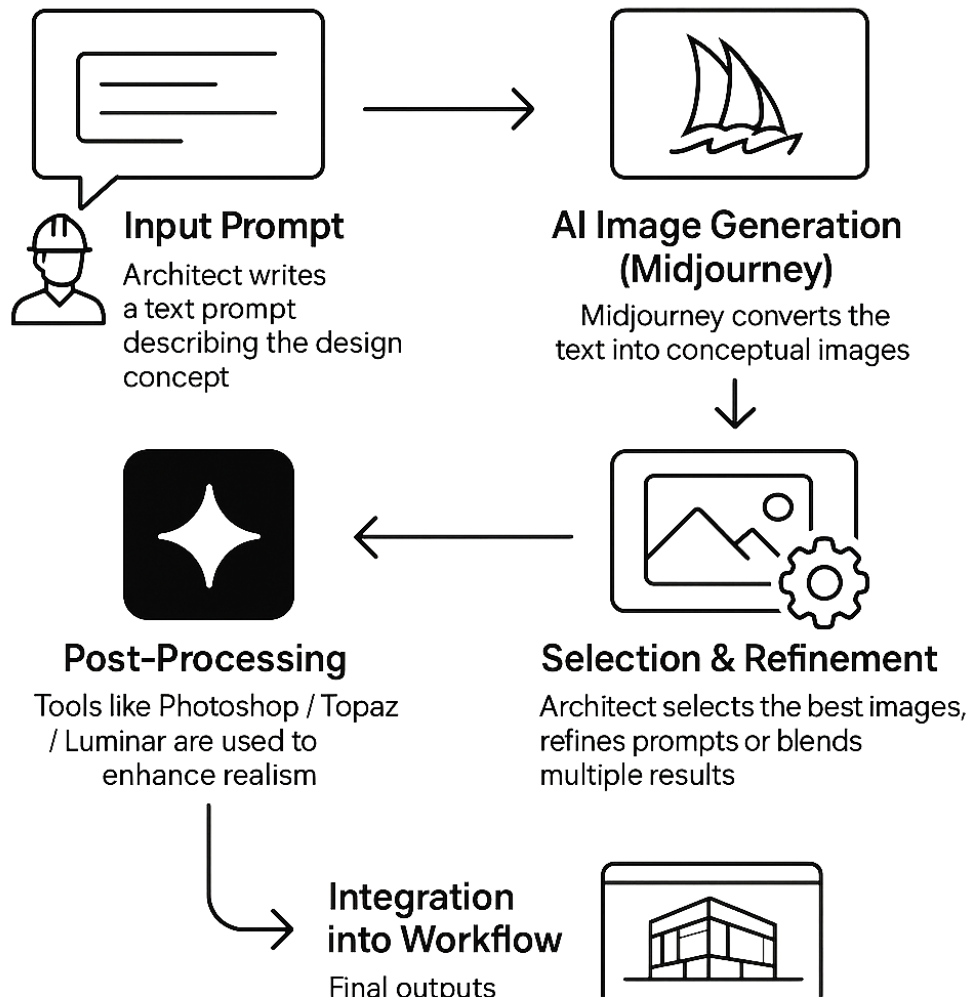


Figure 1. AI-assisted image generation workflow (MidJourney-based)

For comparison, the images generated through a traditional rendering tool are shown in Figure 2 and Figure 3.

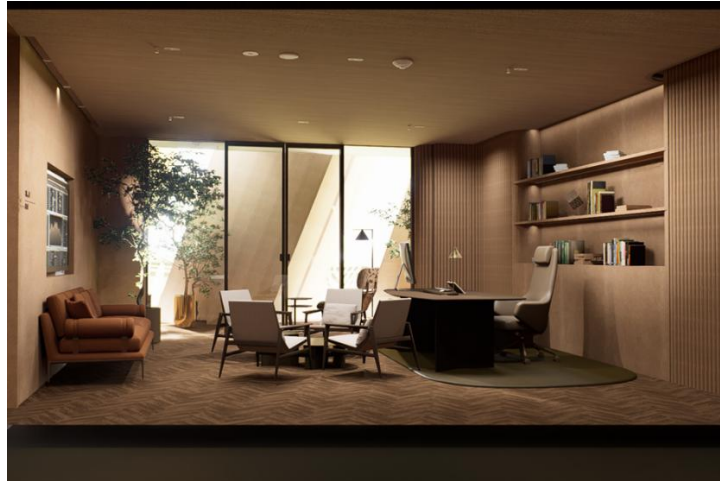


Figure 2. Interior office image generated through a classic rendering tool



Figure 3. Exterior office visual produced with a classic rendering tool

Images generated through ChatGPT with DALL·E integration demonstrate a basic but limited spatial understanding, offering value primarily in early ideation and conceptual exploration. These outputs are helpful for translating abstract ideas into quick visual references, yet they often lack spatial logic, structural precision, and prompt-specific stylistic fidelity. In cases involving more complex layouts or nuanced architectural styles, the results tend to shift toward artistic abstraction rather than realistic architectural representation. In our evaluation, ChatGPT-DALL·E achieved only about 30–40% spatial consistency across different perspectives, reflecting its limited reliability for multi-view interior visualization. The images generated through ChatGPT are shown in Figure 4 and Figure 5.



Figure 4. Interior office rendering generated through ChatGPT



Figure 5. Alternative interior office rendering generated through ChatGPT

FLUX.1 Kontext stands out for its ability to integrate both image and text inputs, offering iterative editing while maintaining visual consistency across design variations. Its rendering is both fast (3–5 seconds) and coherent, with higher spatial stability than other AI models. Unique among current tools, it enables reference-based prompt editing and achieves up to 70–80% accuracy in preserving spatial identity making it particularly valuable for applications requiring design consistency and real-time workflow adaptability. The image generated with FLUX.1 Kontext are shown in Figure 6.



Figure 6. Interior office rendering generated through FLUX.1 Kontext

MidJourney provided the strongest overall results among the tested platforms, as highlighted by the expert evaluation. Its leading position stems from its ability to interpret user prompts with high fidelity and translate both descriptive and stylistic nuances into compelling visuals. The outputs not only capture the intended concept but also convey mood, atmosphere, and compositional style with remarkable clarity. This makes MidJourney particularly effective for designers and creatives seeking fast, visually striking outcomes during the early ideation stages. In our evaluation, MidJourney achieved approximately 80 – 90% spatial consistency across perspectives, demonstrating both structural reliability and strong atmospheric performance. The images generated through MidJourney are shown in Figure 7 and Figure 8.



Figure 7. Interior office rendering generated through MidJourney



Figure 8. Alternative interior office rendering generated through MidJourney

4. Conclusion

This study explored the transformative potential of AI-powered diffusion models in the field of interior architecture, focusing on image generation and design visualization. Through a comparative analysis between traditional rendering engines and advanced AI platforms including ChatGPT-DALL·E, MidJourney, and FLUX.1 Kontext the research highlighted the distinct advantages AI models offer in terms of speed, aesthetic quality, and creative flexibility. Findings indicate that while traditional render in spatial accuracy and technical realism, they often fall short in visual appeal and efficiency when compared to AI-generated images. Although specialized visualization firms can achieve highly realistic and aesthetically rich outputs using traditional tools, this typically comes at a significantly higher cost and time investment. In contrast, AI-based models enable rapid concept development, stylistic diversity, and enhanced design ideation, making them particularly valuable in early-stage visualization and client presentations. However, a critical limitation of current AI tools remains spatial accuracy and consistency. While model-based renders can produce multiple views of the same space with exact fidelity, AI-generated images even when prompted with detailed references struggle to maintain spatial coherence across different angles. FLUX.1 Kontext has shown notable progress in this area, offering approximately 70–80% consistency across viewpoints, setting it apart from other platforms. Among the evaluated tools, MidJourney demonstrated a leading capacity in interpreting prompts and generating visuals

closely aligned with user intent. In contrast, ChatGPT-DALL·E lags behind in terms of both prompt comprehension particularly for specific architectural styles or firm references and in achieving visual realism without an overly artistic effect. FLUX.1 Kontext appears to strike a promising balance, nearing MidJourney's level of prompt understanding while producing more realistic visuals than DALL·E, though further refinement is still needed. In terms of practical applications, these findings suggest clear integration points into interior design workflows. For example, MidJourney's strength in stylistic interpretation makes it particularly useful for developing mood boards and early client concept presentations. ChatGPT-DALL·E, despite its limitations, can support design education and brainstorming sessions by quickly transforming abstract ideas into visual references. FLUX.1 Kontext, with its capacity for iterative text- and image-based editing, shows strong potential for virtual staging workflows, where designers can progressively adapt a base room image according to client feedback. These applications illustrate that AI tools complement rather than replace traditional rendering, enhancing efficiency and expanding creative exploration in practice. Future research could focus on improving spatial fidelity and multi-angle coherence in AI-generated interiors, particularly for models like FLUX.1 Kontext. Given the rapid development of AI-based rendering platforms that increasingly challenge the dominance of text-to-image systems, future investigations may also consider the capabilities and design implications of these alternative approaches. Incorporating evaluation methods based on designer and client feedback, alongside real-time editing functionality, could enhance the practical integration of such tools into professional contexts. The extension of diffusion models into 3D rendering and virtual reality continues to offer a promising direction for creating immersive and interactive architectural environments.

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