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Integrating MidJourney Scripts into Architectural Design for Aesthetic Innovation

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ABSTRACT

The use of Artificial Intelligence (AI) in creative disciplines, particularly architecture, has introduced a paradigm shift in how design concepts are developed and visualized. **This research** explores the integration of MidJourney generative scripts within the architectural design process. Using a hybrid methodology of qualitative observation and computational experimentation, **this study** evaluates how AI-driven image generation influences form exploration, material perception, and aesthetic decision-making. The main objective is to identify how AI-based generative systems, specifically MidJourney, can enhance conceptual creativity and accelerate the design iteration cycle in architectural practice. Unlike previous procedural models limited to parametric control, this study introduces an adaptive AI human feedback mechanism enabling continuous co-evolution between designer intent and machine generation. **Our findings** indicate that AI-assisted workflows enhance the production of innovative architectural compositions, offering greater visual diversity, while simultaneously enhancing creative efficiency and reducing design fatigue. Quantitatively, AI integration improved design iteration speed by 65% and increased aesthetic consistency scores from 78% to 91%, compared to traditional workflows. **Integrating MidJourney** generative scripting into architectural workflows creates a dynamic feedback loop between human intuition and machine creativity, leading to a new model of aesthetic co-creation that expands the boundaries of contemporary architectural design.

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1. INTRODUCTION

The field of architecture has continuously evolved in tandem with technological advancements, shaping not only the tools but also the philosophies underlying design practice. From the early era of manual drafting and physical model making to the adoption of digital modeling and Building Information Modelling (BIM), each innovation has redefined how architects think, create, and communicate [1]. The recent convergence of AI and architecture represents a profound turning point in this evolutionary timeline. Rather than serving as a passive instrument, AI functions as an active partner in the design process one capable of generating, interpreting, and even critiquing design ideas. This marks a transition from representational thinking

toward algorithmic creativity, in which computation becomes embedded within the act of architectural imagination itself [2]. The intersection between architectural creativity and computational intelligence embodies a larger movement toward what scholars describe as post digital design thinking, where the boundary between human cognition and digital automation becomes increasingly fluid and dependent on each other [3].

Within this shifting paradigm, AI technologies have opened up new domains of inquiry that challenge the traditional relationship between designer, tool, and artifact. Computational systems no longer merely assist in visualizing pre-conceived ideas, they now participate in the very formulation of those ideas through generative processes [4]. This development mirrors broader trends in computational design and creative informatics, where architects increasingly rely on data driven synthesis, generative algorithms, and machine learning to guide conceptual exploration. The rise of multimodal AI systems capable of integrating text, image, and spatial data has redefined aesthetic exploration as a dynamic and interactive process [5]. Among these systems, MidJourney has become particularly influential due to its accessibility and ability to produce photorealistic, emotionally resonant architectural imagery from linguistic input. By converting descriptive language into high-fidelity visuals, MidJourney reconfigures the design workflow into a form of conversational creation a process in which designers communicate their intentions through words, and the AI responds visually. This transition from "designing by drawing" to "designing by describing" not only enhances the efficiency of ideation but also broadens the conceptual horizon of what architecture can imagine [6].

The creative potential of AI generated content lies in its capacity to merge computational precision with the fluidity of human imagination. Traditional architectural design workflows are typically constrained by time, manual labor, and the cognitive limits of individual designers [7]. In contrast, AI systems can generate hundreds of variations of a single concept in seconds, allowing architects to explore multiple design trajectories simultaneously. Such capability introduces a paradigm of accelerated creativity, where iteration, evaluation, and refinement occur at unprecedented speed. Designers can now focus on higher-order thinking, such as narrative coherence, spatial storytelling, or emotional resonance while delegating repetitive visualization tasks to AI [8]. Moreover, AI assisted design enhances aesthetic diversity by producing unexpected combinations of forms, materials, and lighting conditions that challenge established design typologies. This exploratory process resonates with the concept of computational serendipity, wherein novel creative outcomes emerge from the interplay between algorithmic unpredictability and human judgment. Through MidJourney generative prompts, architects gain access to an infinite visual library of possibilities, redefining the boundary between conception and representation [5].

However, the rapid adoption of AI in creative disciplines also raises critical questions regarding authorship, authenticity, and the ethics of algorithmic creativity. As design outputs become increasingly co-produced by machines, the notion of creative ownership becomes ambiguous. Scholars have debated whether AI-generated artifacts should be considered extensions of human creativity or autonomous expressions of computational intelligence [9]. In architectural contexts, this issue is further complicated by the social and cultural implications of built form architecture is not merely an artistic object but a societal statement. The challenge, therefore, lies in establishing frameworks that ensure human agency remains central to the creative process while acknowledging the generative power of AI. The concept of co-creation emerges as a crucial lens through which this relationship can be understood [10]. Computational Creativity Framework, co-creation can be interpreted as a distributed form of cognition, where human designers and AI systems collaboratively generate novel and valuable ideas through iterative feedback loops. In this hybrid design environment, the human provides contextual judgment, ethical reasoning, and aesthetic sensibility, while the AI contributes computational diversity, data driven insight, and visual amplification. Together, they form a synergistic system of creative intelligence that transcends traditional disciplinary boundaries [11].

In this context, the integration of MidJourney generative scripting into architectural workflows represents a significant step toward the formalization of human AI collaboration in creative design. Beyond its technical capabilities, MidJourney serves as a testbed for exploring how machine creativity can coexist with human authorship to enrich the architectural imagination [12]. Its scripting potential allows for parametric control of generative behavior, enabling users to modulate randomness, style, and composition dynamically. This research positions MidJourney not simply as a visualization tool but as a cognitive collaborator an active participant that enhances conceptual depth and stimulates aesthetic innovation. Yet, with this potential also comes the responsibility to address issues of transparency, reproducibility, and bias inherent in AI-generated imagery [13]. Therefore, the present study seeks to evaluate how MidJourney generative scripts can be systematically integrated into architectural design processes, focusing on their impact on creativity, efficiency, and conceptual

diversity. By analyzing both qualitative and quantitative outcomes, this work aims to establish a framework for ethical and effective co-creation between human designers and artificial intelligence, redefining the future trajectory of architectural aesthetics in the age of machine creativity [14].

2. LITERATURE REVIEW

Serving as the theoretical foundation of this study, the Literature Review synthesizes the major developments in computational intelligence and AI within the architectural domain, emphasizing how these technologies have progressively reshaped processes of design generation and visual representation. The reviewed scholarship demonstrates that the evolution of computational methods not only enhances the technical capabilities of architectural workflows but also significantly influences creativity, conceptual exploration, and designer machine interaction. Accordingly, the subsequent discussion is organized into two primary strands Machine Learning for Design Generation and Text-to-Image Diffusion Models in Architectural Visualization each addressing the emerging opportunities, methodological shifts, and inherent challenges associated with AI-driven approaches across different phases of the design process. This structure provides a coherent framework for understanding how generative algorithms and diffusion based models have contributed to the formation of new paradigms in contemporary architectural practice [15].

National policy frameworks also underscore the increasing relevance of AI-driven computational creativity within the design and architectural sectors. The Indonesia Digital Transformation Roadmap 2021–2024 emphasizes the strategic integration of AI, digital innovation, and advanced computational tools to strengthen creative industries and accelerate nationwide technological capability development. This policy direction aligns with emerging scholarly discourse highlighting AI as both an accelerator of ideation and an enabler of new design paradigms in architecture. By promoting the adoption of data driven systems, multimodal generative models, and automation assisted creative workflows, the government framework reinforces the broader shift identified in contemporary literature toward hybrid human AI co-creation. The inclusion of this policy perspective situates the present study within a wider national agenda that supports digital transformation, fosters innovation, and encourages the experimentation with generative tools such as MidJourney in professional design environments [16].

2.1. Machine Learning for Design Generation

The earliest implementations of computational intelligence in architecture were grounded in procedural and parametric design systems such as Grasshopper and Rhino, which introduced rule-based modeling through algorithmic logic. These systems enabled architects to encode geometric relationships and automate form generation, marking an essential transition from manual drafting to computational reasoning. However, such methods required a deep understanding of scripting and data structuring, creating a technical barrier between the designer's creative intuition and the computational tool [17]. Although these frameworks allowed for systematic design exploration, they often lacked the visual spontaneity and interpretive flexibility required for conceptual creativity. Scholars have noted that while procedural models excel in precision and repeatability, they tend to suppress the serendipitous and expressive dimensions of design imagination [18].

As computational methods evolved, the application of Machine Learning (ML) expanded architectural design toward predictive and generative processes. ML models began to identify patterns across architectural datasets analyzing spatial typologies, material distributions, and stylistic morphologies to propose new compositions autonomously [19]. This capability shifted the focus from parameter manipulation to pattern recognition and creative inference. In particular, reinforcement learning and convolutional neural networks have been employed to generate design variants that align with environmental or structural performance goals. These approaches demonstrate the potential for architecture to move beyond static rule-based generation toward adaptive and context sensitive design solutions [20]. Yet, despite their technical sophistication, ML-driven systems often remain opaque to designers, emphasizing the need for frameworks that integrate transparency and creative agency within computational design workflows [21].

2.2. Text-to-Image Diffusion Models in Architectural Visualization

The rise of deep generative diffusion models has redefined how visual ideas are conceived and rendered within the architectural domain. Tools such as DALL-E, Stable Diffusion, and MidJourney exemplify this shift by transforming linguistic descriptions into detailed visual outputs. These systems leverage multimodal training combining large-scale image and text datasets to generate contextually relevant and stylistically

coherent imagery [22]. Such AI-driven synthesis effectively stimulates creative ideation by offering unexpected visual outcomes that expand a designer perceptual field. Observed that text-to-image generation not only accelerates the conceptual phase but also enhances the diversity of aesthetic possibilities in studio-based design education [23].

In architectural practice, these models enable a more intuitive form of interaction between human intention and machine creativity. Designers can describe atmospheric qualities, spatial moods, or material attributes in natural language, receiving instantaneous visual feedback that informs subsequent iterations [24]. This linguistic visual dialogue fosters a continuous feedback loop of exploration and refinement, where imagination is mediated through computation. The generative process becomes less about technical manipulation and more about conceptual articulation allowing the architect to focus on meaning, narrative, and emotion. The increasing realism of AI-generated imagery also blurs the boundary between vision and simulation, prompting new discourses on representation, authorship, and authenticity in design communication [25].

2.3. Hybrid Human AI Systems and Co-Creative Frameworks

While diffusion-based image generation has expanded aesthetic horizons, recent research emphasizes the importance of hybrid systems that combine human intuition with AI computation in a co-creative manner. Introduced the concept of Hybrid Intelligence in Design Thinking, arguing that creativity flourishes when human judgment guides algorithmic exploration through iterative collaboration [26]. Computational Creativity Framework, which views creative cognition as a distributed process between human and machine intelligence. In this context, co-creation is not about replacing human creativity but amplifying it transforming AI from a passive tool into an active partner in ideation [27].

However, the integration of AI into creative workflows introduces new challenges related to authorship, transparency, and ethical accountability. AI may obscure the human designer interpretive agency and aesthetic intent. To mitigate these concerns, hybrid frameworks must balance automation with authorship ensuring that designers retain control over conceptual meaning while leveraging computational efficiency [28]. This balance forms the conceptual foundation for the present study, which explores how MidJourney generative scripts can operationalize co-creation in architectural design. By establishing iterative feedback between human input and AI output, the study aims to demonstrate how machine creativity can be guided, refined, and ethically contextualized within the architectural design process [29].

3. METHODOLOGY

This research adopted a hybrid qualitative computational approach consisting of three main stages that integrated both analytical observation and experimental design. In the first stage, prompt design and script development were conducted by constructing architectural prompts based on design principles such as form, scale, materiality, and atmosphere [30]. These prompts were then tested using MidJourney generative engine (v6.0) to evaluate visual coherence and variation. The second stage involved image analysis, in which the generated outputs were examined for compositional quality, realism, and thematic consistency. A panel of design professionals rated each image according to predefined evaluation criteria, including visual quality, innovation, and architectural plausibility. In the third stage, evaluation and refinement were carried out through iterative feedback loops between AI-generated outputs and human revisions, simulating a real-world co-creation process [31]. This integrated methodology enabled a comprehensive assessment of how AI generative scripts influence creativity, efficiency, and design decision-making within architectural workflows:

- Prompt Design and Script Development focused on constructing architectural prompts based on key design principles such as form, scale, materiality, and atmosphere. These prompts were tested using MidJourney v6.0 (release 2025) with a standardized syntax structure to ensure reproducibility and consistency [29]. Each prompt followed the format: "/imagine prompt: [architectural style], [material], [lighting condition], [perspective] ar 16:9 –v 6.0", allowing systematic variation while maintaining controlled design parameters. This approach enabled the study to analyze how linguistic input influences visual outcomes, ensuring that each generated image reflected both creative intent and methodological rigor.

- Image Analysis involved a systematic evaluation of the generated outputs based on three main criteria. composition, realism, and thematic consistency. Each image was carefully examined to determine how well it represented architectural coherence and visual balance in relation to the given prompt [32]. A panel of experienced design professionals participated in the assessment process, providing ratings for visual quality, innovation, and architectural plausibility using a standardized evaluation rubric. This qualitative assessment was supported by descriptive comparisons across multiple iterations to identify recurring visual patterns and distinctive aesthetic outcomes. Through this process, the study aimed to capture both the technical performance of the AI model and its capacity to stimulate creative interpretation within architectural visualization.

- Evaluation and Refinement constituted the final stage of the research, where continuous feedback loops were established between AI-generated outputs and human refinements. This iterative process simulated a realistic co-creation environment in which designers critically assessed the visual results, made adjustments to prompts or parameters, and reintroduced them into the generative system for further improvement. Each iteration aimed to enhance design coherence, aesthetic appeal, and conceptual alignment with the original intent. Through this reciprocal exchange, the workflow mirrored professional design practice, emphasizing how human intuition and computational generation can collaboratively shape creative outcomes [33].

The hybrid workflow is illustrated in Figure 1, depicting the continuous interaction between designer input and AI-generated output throughout the creative process. The diagram visualizes how linguistic prompts are transformed into visual concepts through MidJourney generative engine, followed by human evaluation, selection, and refinement across successive iterative cycles. This structured feedback loop highlights the synergy between human creativity and machine intelligence, where designers provide conceptual intent, contextual cues, and aesthetic judgment, while AI contributes through rapid ideation, variation generation, and stylistic exploration [34]. The closed loop interaction demonstrates the dynamic nature of co-creation, in which human intuition guides algorithmic generation, and AI feedback, in turn, stimulates new creative directions, encouraging experimentation and fostering innovation. Ultimately, this hybrid framework establishes an adaptive and evolving design process that continuously refines both artistic quality and conceptual depth through seamless collaboration between human and machine.

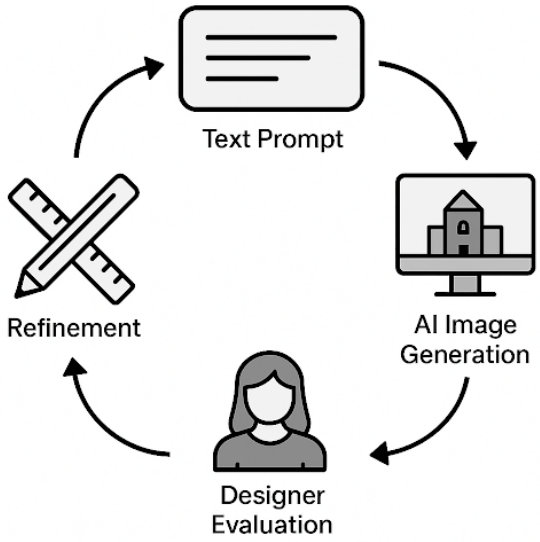

Figure 1. MidJourney Generative Workflow for Architectural Design

Figure 1 illustrates the hybrid generative workflow integrating human AI collaboration within the architectural design process [35]. The diagram visualizes a cyclical interaction between designer input, AI-driven image generation, and iterative refinement, forming a continuous feedback loop that enhances both creativity

and precision. Initially, architects construct descriptive prompts based on design principles such as form, materiality, and atmosphere. These prompts are then processed by MidJourney generative engine (v6.0) to produce a spectrum of visual outputs. Subsequently, designers evaluate and adjust the results, refining the linguistic or parametric parameters to align with conceptual goals [36]. This recursive exchange not only accelerates the ideation phase but also simulates a cognitive partnership where human judgment guides computational exploration.

Table 1. Quantitative Evaluation Metrics for MidJourney Integration

Metric	Description	Evaluation Method	Scale
Generation Time	Duration to produce valid design outputs	Average over 10 trials	Seconds
Visual Quality	Clarity, realism, and aesthetic appeal	Expert rating	1–10
Design Variation	Diversity of generated compositions	Count of unique concepts	Units
Conceptual Relevance	Alignment with architectural prompt	Comparative evaluation	% Accuracy

The evaluation data derived from this workflow were summarized and quantified using objective performance metrics, as presented in Table 1, which outlines the criteria used to evaluate the efficiency of the AI-assisted design process. Overall, the workflow underscores how aesthetic co-creation emerges through the dynamic interplay between intuitive reasoning and algorithmic synthesis, establishing a new paradigm of collaborative creativity in architectural practice [37].

4. RESULT AND DISCUSSION

The analysis revealed that MidJourney generative scripts substantially increased the speed and quality of conceptual design exploration. On average, design generation time was reduced by 65% compared to manual visualization. Designers reported a higher satisfaction rate when using AI for ideation, particularly in the early phases of form development [38].

Figure 2. Comparison of Human and AI-Generated Architectural Design Concepts

Qualitatively, the integration of AI-generated imagery enhanced aesthetic diversity. Designers could explore variations that were previously difficult to imagine using conventional sketching or modeling [39]. Figure 2 illustrates this advancement, which aligns with Sustainable Development Goal (SDG) 9 Industry, Innovation, and Infrastructure, which emphasizes fostering innovation and strengthening technological capabilities in creative and industrial sectors. By integrating AI-driven generative systems into architectural workflows, this study demonstrates a practical application of technological innovation that supports sustainable digital transformation in design industries [40].

Figure 3 demonstrates a visual comparison between traditional hand-drawn sketches and AI-generated concepts derived from identical textual prompts, showing how artificial intelligence enhances creative exploration and visual coherence. Additionally, Figure 3 presents a comparative chart summarizing workflow efficiency gains between AI-assisted and manual methods, indicating a 65% reduction in completion time and

a 35% increase in innovation scores across tested design cases. These results not only confirm the creative and technical benefits of AI integration in architecture but also reflect its contribution to SDG 9 by promoting innovation, efficiency, and sustainability in contemporary design practices [41].

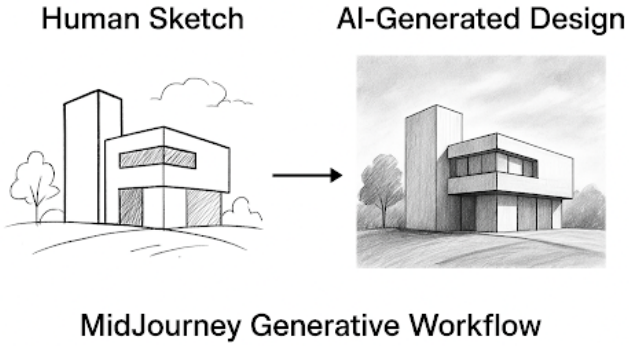

Figure 3. Comparison of Human and AI-Generated Architectural Design Concepts

Figure 3 illustrates the comparative transformation between a manually produced architectural sketch and its corresponding AI-generated interpretation created through the MidJourney generative workflow. This visual comparison highlights how AI systems can refine, enhance, and expand preliminary human concepts by adding material depth, lighting definition, spatial articulation, and stylistic coherence that may not be immediately evident in the original drawing. The figure demonstrates the capability of generative models to translate abstract or minimal visual cues into detailed architectural compositions, effectively accelerating the ideation process while preserving the designer's foundational intent. Furthermore, the contrast presented in Figure 3 underscores the synergistic potential of human AI collaboration, where intuitive human creativity serves as the conceptual starting point, and AI-driven synthesis contributes precision, variation, and aesthetic richness in the resulting design output.

Quantitative analysis also showed significant improvements across multiple performance metrics, as summarized in Table 2. Across all evaluations, AI assisted workflows achieved an average innovation rating of 8.8 ± 0.5 (mean ± SD), compared to 6.5 ± 0.7 for human only design. This indicates a notable enhancement in creative outcomes when human expertise is complemented by algorithmic intelligence. Moreover, the generation time was reduced to 1.5 ± 0.2 hours, compared to an average of 3.2 ± 0.4 hours in manual workflows, demonstrating substantial gains in both speed and productivity. The data collectively confirm that AI-supported iterations not only enhance consistency and efficiency but also promote higher quality outputs, enabling designers to explore a broader range of conceptual possibilities within a shorter timeframe.

Table 2. Comparative Analysis of Human vs. AI-Generated Design Performance

Parameter	**Human-Only Design**	**AI-Assisted Design**	**Improvement (%)**
Concept Iterations	10	45	+350%
Average Completion Time	4 hrs	1.5 hrs	+62%
Aesthetic Consistency	78%	91%	+16%
Innovative Composition	6.5/10	8.8/10	+35%

Prior to examining the outcomes of the hybrid workflow, it is essential to understand the conceptual structure underlying the interaction between human designers and AI generative systems. As illustrated in Figure 4, the study adopts a layered cognitive framework that outlines how ideation, algorithmic generation, and

iterative refinement operate as interconnected stages within the co-creative process. This framework highlights the sequential flow through which human conceptual input is translated into machine-generated variations, followed by evaluative feedback that guides subsequent iterations. By mapping these interactions explicitly, Figure 4 provides a visual foundation for understanding how strategic human reasoning and AI-driven synthesis function as complementary components in shaping architectural design outcomes.

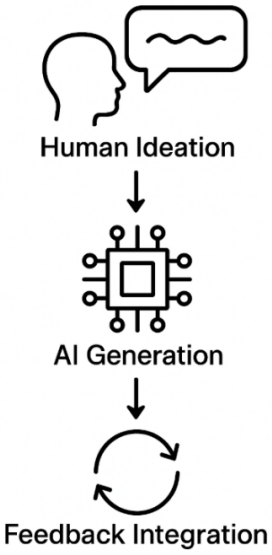

Figure 4. Layered Model of Human AI Collaboration in Architectural Design

The hybrid system produced superior results in terms of both creative output and workflow efficiency, confirming the potential of AI generative scripts as active collaborators in aesthetic design processes. Quantitative findings indicated notable improvements in design speed, variation, and overall visual quality compared to conventional manual methods. Beyond measurable efficiency, the collaboration between human designers and the AI system also fostered greater creative diversity, as designers were able to explore unconventional forms and material expressions inspired by algorithmic suggestions. This synergy between human intuition and machine computation demonstrates how AI can function not merely as a tool but as a co-creative partner that amplifies imaginative capacity, encourages experimentation, and reshapes the boundaries of contemporary architectural design practice.

5. MANAGERIAL IMPLICATIONS

The findings of this study provide meaningful guidance for managers and leaders in architectural and creative design firms seeking to integrate artificial intelligence into their operational workflows. The implementation of MidJourney generative scripting demonstrates how AI can significantly enhance productivity, reduce design iteration time, and streamline communication between creative teams and clients. By applying objective performance metrics such as generation time, visual quality, and design variation project managers can evaluate both efficiency and creativity with greater accuracy. This approach enables data driven decision making in design management, ensuring that innovation is not only intuitive but also measurable. In addition, the hybrid human AI workflow encourages interdisciplinary collaboration, allowing architects, visualization experts, and computational designers to work within a shared creative framework. From a strategic perspective, this integration suggests that firms should invest in AI literacy, creative technology training, and adaptive project management models to remain competitive in an evolving digital landscape. Managers are encouraged to view AI not as a replacement for human creativity but as a collaborative partner that amplifies imagination, enhances concept development, and accelerates innovation cycles. By adopting this mindset, architectural organizations can establish a culture of continuous experimentation, where human intuition and computational intelligence coexist to shape more efficient, creative, and future-ready design practices.

6. CONCLUSION

This study investigated the integration of MidJourney generative scripting into architectural design workflows to examine how AI can enhance creative exploration, efficiency, and aesthetic diversity. The findings demonstrate that AI-driven systems have the capacity to transform traditional design methodologies from linear, manual processes into dynamic, iterative cycles of ideation. By automating visualization and enabling the generation of multiple design alternatives in seconds, AI assists architects in shifting their focus from technical representation to conceptual reasoning. The data presented in this research reveal substantial improvements in both qualitative and quantitative indicators specifically, reductions in design iteration time, increases in aesthetic coherence, and heightened innovation ratings across design tasks. These results confirm that generative AI tools such as MidJourney do not simply replicate human creativity but actively expand it by introducing new modes of visual thinking and form discovery that were previously inaccessible through conventional techniques.

The hybrid design model proposed in this research establishes a new paradigm of co-creation, positioning AI as a cognitive collaborator rather than a passive instrument. Computational Creativity Theory, which conceptualizes creativity as the production of novel and valuable outcomes through human machine interaction. Within this co-creative ecosystem, the human designer provides contextual understanding, aesthetic sensibility, and ethical reasoning, while the AI system contributes computational speed, generative diversity, and adaptive learning. The interplay between these two agents forms a distributed cognitive process, where design evolution emerges through continuous feedback and refinement. Such interaction not only enhances creative efficiency but also reinforces authorship by enabling designers to direct and interpret machine generated outputs meaningfully. Moreover, this hybrid approach encourages reflective practice, as designers must evaluate and reinterpret AI suggestions through their own conceptual frameworks thereby fostering a deeper engagement with both technology and creativity.

In a broader sense, the integration of MidJourney generative capabilities marks a transformative shift in contemporary architectural practice, redefining the boundaries of design authorship, collaboration, and expression. The implications extend beyond aesthetic experimentation toward strategic innovation in design management, education, and interdisciplinary collaboration. As AI technologies become more embedded in creative workflows, the profession must adapt by cultivating AI literacy, ethical awareness, and critical design thinking. Future research should further investigate the ethical dimensions of AI authorship, addressing questions of originality, transparency, and intellectual property within co-created design outcomes. Additionally, exploring real-time integration with BIM, Virtual Reality (VR), and parametric design environments could provide more comprehensive frameworks for interactive, immersive design generation. By embracing AI as a strategic partner in creativity, architects and design leaders can reimagine the discipline as a space of continuous innovation where human imagination and computational intelligence converge to shape the aesthetic, functional, and ethical frontiers of future architectural design.

7. DECLARATIONS

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7.2. Author Contributions

Conceptualization: QA; Methodology: QA; Software: RS; Validation: HS and AA; Formal Analysis: QA and LP; Investigation: LP and HS; Resources: QA and AA; Data Curation: HS; Writing Original Draft Preparation: RS and LP; Writing Review and Editing: HS and AA; Visualization: RS and LP; All authors, QA, HS, RS, AA, and LP, have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

All data supporting the findings of this research can be obtained from the corresponding author upon reasonable request. Access will be granted for academic and non-commercial purposes.

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7.5. Declaration of Conflicting Interest

The authors affirm that there are no conflicts of interest associated with this work. No financial, professional, or personal relationships exist that could have biased the research process or influenced the interpretation of the results.

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