The Application of Artificial Intelligence in Cinematic Spatial Analysis

A conceptual framework

Hülya Oral-Karakoç[1], Erhan Karakoç[2]
[1]TOBB University of Economics and Technology [2]Ankara Medipol University
[1]hkarakoc@etu.edu.tr [2]erhan.karakoc@ankaramedipol.edu.tr

The evolution of creative industries has been significantly shaped by technological advancements and computational design. While existing studies on scene analysis emphasize the relationship between architecture and filmmaking, integrating generative artificial intelligence into this process holds great potential. Such a framework can deepen our understanding of spatial and visual elements while enabling the parametrization of new set designs. This study investigates the role of artificial intelligence (AI) in the spatial analysis of film scenes, aiming to establish a conceptual framework for enhancing both prompt texting and the spatial qualities of AI-generated images. As a case study, 2001: A Space Odyssey, an iconic sci-fi film, is selected. Key scenes are translated into prompts using LeonardoAI and then parameterized by the DeepSeek chatbot, based on predefined spatial and visual categories of set design. These prompts are iteratively refined to generate new scenes that reflect the spatial and visual characteristics of the original references. The generated and reference scenes are compared in terms of spatial and visual similarity, as well as the effectiveness of the set design in relation to the prompts. Results show that formal spatial properties are initially difficult to generate using text-to-image AI tools but can be improved through prompt refinement. This framework serves as both an analytical and generative tool, offering practical guidance for novice architects and designers to create visually compelling interiors inspired by cinematic themes and atmospheres.

Keywords: *Digitalization, set design, spatial design, scene analysis, generative artificial intelligence, text-to-image generators, 2001: A Space Odyssey.*

INTRODUCTION

Digitalization has permeated all areas of design, creating a new creative landscape where disciplines intertwine. These technological advancements have triggered paradigm shifts across the design field, significantly transforming how creative industries are approached. The evolution of artificial intelligence has further fueled innovation, leading to the emergence of new methodologies, particularly in cinema. Architects and set designers leverage technology to drive these transformations, integrating advanced tools and approaches into the creation of compelling scenes. Computational design tools, AI-driven video processing interfaces, and augmented and virtual reality technologies have become essential for reconstructing reality in film scenes, enhancing both visual storytelling and design precision.

Architecture and cinema have long been interconnected, influencing each other in spatial, visual, and psychological dimensions. Pallasmaa (2001) stated that cinema and architecture share a deeper kinship than cinema and music—not just because they unfold in time and space, but because both give form to the spaces we inhabit. Both disciplines work on creating ambiences by using spatial, visual, and auditory elements such as form, scale, proportion, light, materials, and colors. While ambiences created by architects are experienced as 3-dimensionally, ambiences in films are experienced in specific angles and perspectives defined by a camera and its movement.

Generative Artificial Intelligence (GAI) tools such as Midjourney, DALL-E, Stable Diffusion, and LeonardoAI provide rapid visualization of characters, scenes, and props based on textual or visual prompts. Recently, these tools allowed users to analyze existing texts and images to develop more efficient prompts. While many researchers have been exploring the cinematic space in terms of physical, psychological, and technological characteristics (Bekmezci, 2017; Căplescu, 2016; Jain and Banerjee, 2021), generative-ai-assisted analysis and generation of film scenes are found promising to guide architects through the design of visually appealing spaces and set designs based on existing cinematic scenes. This paper proposes a conceptual framework for analyzing the spatial elements of set designs as represented in film scenes, to improve both prompt texting and the resulting images in terms of spatial characteristics—particularly in cases where no reference image of a 3D model is available. This approach enables the modification of spatial attributes through prompt-based generation. By utilizing accessible and easy-to-use text-to-image tools, the framework aims to lower the barrier to entry for novice architects and designers who may be unfamiliar with AI technologies. Cinematic spatial analysis can enhance the architect's ability to construct specific ambiences in interiors by examining existing film scenes in terms of the form and experience of the cinematic space.

BACKGROUND

In architecture, the articulation of spatial elements in a building, along with the program, define the set of our lives. The spatial qualities define the atmosphere of the space and give an impression of what this space can be used for. Form, proportion, scale, texture, light, and sound are the spatial qualities experienced as a whole by people depending on their culture, background, and tendencies (Ching, 2007). The experience of space is determined by depths, densities, openings, juxtaposition and interpenetration, geometry (spatial characteristics and assembly of rooms), light and shade, and the elements of floor, wall, and ceiling (von Meiss, 1991). Thus, the ambience of space is defined by both material and immaterial elements. While the articulation of structural components such as walls, floors, and ceilings constitutes the material aspect, light, shadow, and the experience of space are considered immaterial.

In cinema, the spatial elements of the set are represented as a visual form on a screen and the program becomes a narrative. The spatial and visual elements in film set design are used for conveying the narrative in a convincing environment. The spatial elements of the set designs are closely tied to the relationship between cinema and architecture, as the film is shot in either virtually constructed spaces, reconstructions of real spaces, or settings that depict actual architectural events (Tanyeli, 2001). Virtually constructed spaces allow for the expression of futuristic aesthetics and technologies that may not be feasible with current construction methods. For instance, in 2001: A Space Odyssey (Kubrick, 1968), a minimalist design is employed to depict a futuristic environment, avoiding horizontal and vertical elements due to the artificial gravity generated by the rotational movement of the inhabitable structure. In reconstructed set designs, real spaces serve as the basis, but spatial and visual features are modified or montaged to reflect the characters' psychological states or thematic elements. The Shining (Kubrick, 1980), for example, portrays the hotel as a labyrinth to convey feelings of entrapment, with the labyrinth motif echoed in the garden layout and even in the pattern on main character's tie. In the depiction of real architectural events, film is used as a tool to convey the new ways of living proposed by modern buildings. In Playtime (Tati, 1967), the director reflects the daily life in Paris through large glass windows of modern buildings.

The interaction between architecture and cinema leads to translations between elements of real and represented space, each inspiring the other. This interaction has given rise to various methods for analyzing the spaces constructed and depicted in films, serving as a foundation for creating visually compelling atmospheres. One approach to understanding the language of film is proposed from a film critic's perspective, focusing on signs, syntax, sound, and montage. Signs carry both denotative and connotative meanings, which can be interpreted differently by each viewer, depending on their cultural, physical, and psychological background. Syntax stems from the codes of the cinema which are sometimes connotated by an architectural element i.e., bathtub and shower. This code is reinterpreted in different mise-en-scènes by directors to convey various meanings and emotions (Monaco, 2009). In films, the character can be framed by architectural elements such as stairs, tunnels, corridors, columns, etc. related to emotional meanings that the director would reflect such as shame and agony. Contrary, characters can be depicted in open spaces when they are relaxed and free. Although cinematic composition is confined to frames, the atmosphere of a scene is created in a manner similar to architectural design.

From an architectural design perspective, several studies have been conducted to decode cinematic space. Architectural aesthetic (intangible) elements used in set design are categorized as lines, mass, composition, space, texture, and colors (Jain and Banerjee, 2021). Since films are visual narratives, elements of visual perception -such as balance, shape, form, growth, space, light, color, movement, tension, and expression (Arnheim, 1954)- apply to the analysis of cinematic composition. In another study, the spatial archetypes depicted in films are categorized based on form and experience as open space, landmark, path, arcade, tunnel, clearance, layered space, grid, labyrinth, shaft, rotunda, and court. The study emphasizes that while cinematic scenes are constructed around form, they are experienced sequentially through the movement of the camera (Al-Saati *et al.*, 2012). Both spatial elements and their visual representations within frames can be generated by AI models and tools.

Generative Artificial Intelligence (GAI) has opened up new opportunities to generate text, images, music, videos, and 3D models. GAI models are categorized as task-specific and foundation models. Task-specific models consist of deep-learning-based methods such as variational autoencoders (VAEs) and generative adversarial networks (GANs), diffusion models (DMs), and flow models. Foundational models are divided into two such as large language (GPT and BERT) and vision models, which are trained by large data sets. Vision models have subcategories of image, 3D, and video generation models and CLIP (Li et al., 2024). In architecture and design, generative AI models have been used for various purposes, including style transfer from the Baroque era to normative forms in the Church of AI (Del Campo *et al.*, 2019), for generating plans (Chaillou, 2020), and hallucinations based on trained data of Zaha Hadid's buildings by Refik

Anadol (Campo and Leach, 2022), serving as early examples of such applications.

GAI models have pervaded through the integration of text-guided generation named prompts. Text-to-image generative models such as Midjourney, DALL-e, Stable Diffusion, and LeonardoAI enable the conceptualization of ideas, developing variants, and combining images related to prompt definition in seconds. A prompt consists of an image for reference, text for description, and parameters for aspect ratios, models, upscalers, etc. depending on the type and complexity of desired image generation (Albaghajati *et al.*, 2023). These tools are introduced to architectural and interior design to serve as a facilitator for generating realistic visuals with several iterations (Hanafy, 2023), to enhance creative thinking in the design process (Paananen *et al.*, 2023; Tong *et al.*, 2023). Recent examples related to interior design are the preliminary design exploration tool named RoomDreaming (Wang *et al.*, 2024), rendering tools such as InteriorAI (*Interior AI™ | AI Interior Design + Virtual Staging AI App*, n.d.), and RoomGPT (*RoomGPT – Redesign Your Room with AI.*, n.d.). These tools enable the generation of preliminary designs based on uploaded images and user preferences.

AI tools are also used in parts of cinematic production such as content development, production, post-production, marketing, and distribution of films (Natarajan et al., 2019; *Video Editing - Fastpedia*, n.d.) and in the design of set/scene and props (Brako and Mensah, 2023) as well as characters. In the content development phase, chatbots such as ChatGPT and DeepSeek can be used to generate texts and scenarios as well as analyze existing ones. AI tools can create detailed models and visuals with advanced effects and alternatives more quickly compared to modeling and rendering tools by saving time and resources. However, it stated that text prompting as a skill should be improved especially for novice users since weak prompts lead to low quality and unexpected results (Paananen *et al.*, 2023). Casting the prompts into categories can reveal the effect of prompt refinement on the generated images.

METHODOLOGY

The methodology of this paper is two-fold (Figure 1). The first phase involves extracting categories for analyzing scenes based on spatial and visual elements. In this stage, analyses from literature studies and prompts generated using Leonardo AI's "Describe with AI" tool are used to define these categories. The second phase focuses on parameterizing the prompts according to these categories for further analysis and refinement using DeepSeek (*DeepSeek*, 2025). DeepSeek (R1) is chosen for analysis due to its DeepThink mode, which employs a specific reasoning methodology to answer questions. New scenes are generated with revised prompts by using the generative AI tool, LeonardoAI (*AI Image Generator - Create Art, Images & Video | Leonardo AI*, n.d.). LeonardoAI is chosen for its capability of prompt generation based on given images.

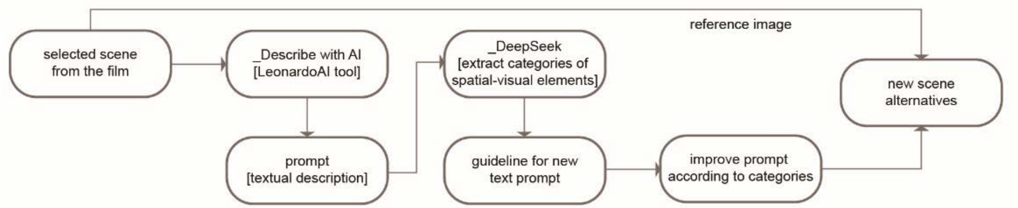


Figure 1
The workflow for the analysis and generation of scenes

To test the suggested framework, 2001: A Space Odyssey (Kubrick, 1968), which is listed under the sci-fi genre, is selected as a case. The generated and original scenes are compared based on the similarity of the spatial and visual elements as well as the execution of the satisficing set design related to the prompts. The following questions will be answered in this paper.

RQ1: How can text-to-image AI tools be used to analyze and generate spatial and visual elements for a film set design?

RQ2: What are the potential and limitations of the proposed workflow for refining the spatial qualities of the generated scene?

CINEMATIC SPATIAL ANALYSIS: A CONCEPTUAL FRAMEWORK

Cinematic spatial analysis is introduced as a method to define categories for generating novel scene designs depending on the spatial and visual elements used in set design. While spatial elements describe the physical characteristics of space such as structural elements, building materials and textures, lighting fixtures, and furniture, visual elements define the atmosphere of space such as void, light and shadow, and colors.

The conceptual framework is developed by converging the knowledge from the architectural design and visual analysis of the existing scenes by the selected AI tool. The reviewed studies on spatial analysis and LeonardoAI's "Describe with AI" tool are used for demystifying the spatial and visual elements to be used as categories for prompts. The literature review reveals that scene analysis varies based on spatial elements used as cinematic codes—such as layout, functional elements, and details—as well as styles, including ambiance and atmospheres shaped by materials, textures, colors, and lighting. Considering these various perspectives for analyzing the spatial characteristics of films and the scenes, the spatial and visual elements used in set and scene design can be categorized as follows: spatial layout, lighting, materials and textures, color palette, furniture and décor, functional elements and zones (e.g., corridors, doors, structures), atmosphere and mood, and architectural details (e.g., curved walls, screens, panels). These categories suggest a guideline for analyzing existing scene designs and improving prompts to achieve visually appealing and satisficing scenes based on inspired films.

The Case Study of 2001: Space Odyssey

Sci-fi cinema, with its innovative space and city designs, was found worthy of research in terms of cinematic spatial analysis. The spatial analysis of such films reveals two main trends in scene design: black box and white cube environments. In black box-style films, scenes are characterized by dark tones, often filled with steam and smoke generated by machines, creating a dystopian or industrial atmosphere. In contrast, white cube-style films feature scenes that are bright, clean, translucent, and glossy, using materials such as glass, concrete, and metal to convey a hopeful, futuristic vision (Căplescu, 2016).

In this paper, 2001: Space Odyssey directed by Stanley Kubrick is chosen as a case to test the proposed framework. 2001: Space Odyssey is a sci-fi film about a space mission to Jupiter after the discovery of a monolith possibly left by extraterrestrial intelligence. Spatial elements used in set design are often visionary and experimental, incorporating novel technologies such as AI assistance, rotational gravity-based spaces, credit cards, and video chat (Chodorov and Cha, 2019), typically within a white cube environment.

In the first phase of the scene generation, two images are selected among the iconic interior scenes where spatial elements are dominant and extraordinary. By using LeonardoAI's "Describe with AI Tool", the selected image of the film is uploaded and described as a prompt. The generated prompt is analyzed by using the scene analysis categories to further improve the prompt and extract prominent adjectives related to the spatial and visual qualities of the selected scene. Then, this prompt is fed into LeonardoAI's image generation along with the reference image, which is also the initial image for the prompt generation. The outputs are compared with the original scenes according to the similarity of the architectural elements depicted in the prompt.

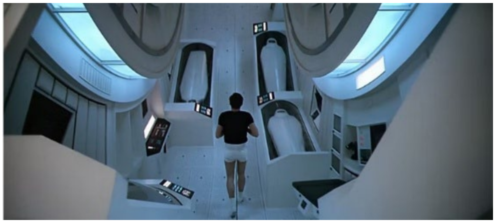


Figure 2
A scene from 2001: Space Odyssey (Kubrick, 1968)

The first scene depicts a man running in a circular space in Discovery One Spaceship (Figure 2). The initial prompt generated by the "Describe with AI" tool is shown below.

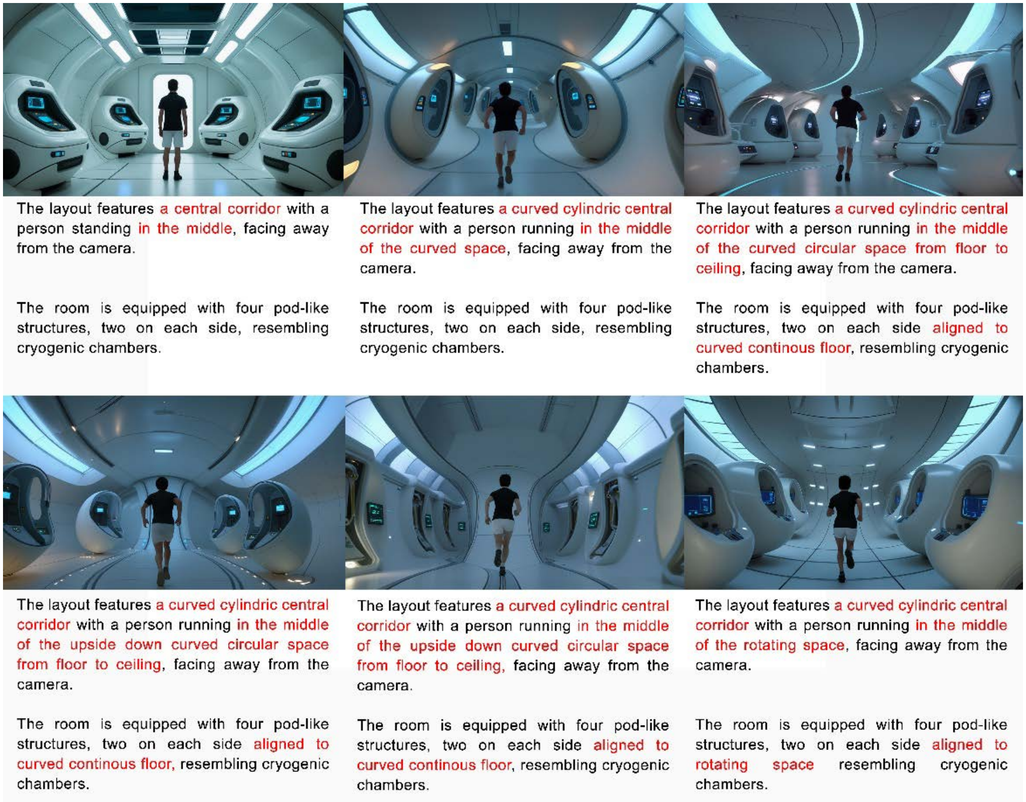
"Image is a still from a science fiction film, showcasing a futuristic interior with a sleek, minimalist design. The layout features a central corridor with a person standing in the middle, facing away from the camera. The individual has short dark hair and is wearing a black shirt and white shorts. The room is equipped with four pod-like structures, two on each side, resembling cryogenic chambers. Each pod has a digital display panel with illuminated buttons and screens, adding to the high-tech ambiance. The walls and ceiling are curved, with a predominantly white color scheme, accented by soft blue lighting from overhead panels. The overall atmosphere is sterile and advanced, suggesting a space or research facility setting."

The generated prompt is then entered into the DeepSeek chatbot, which is tasked with categorizing it according to predefined categories. Table 1 presents these categories along with their definitions, representing the spatial and visual elements of the analyzed scene. Figure 3 shows the images generated along with the partial changes in prompt definitions. The initial prompt is iteratively revised to achieve the desired formal similarity with the reference image, especially for prominent spatial characteristics of the scene, which is, in this case, a curved continuous space and pods that are aligned to that space. Iteratively, the adjectives in prompts are modified to achieve this space, which aligns with the act of running.

Table 1
The categorization of the spatial and visual elements for cinematic spatial analysis

Category	**Words/Phrases**
Spatial Layout	futuristic interior; central corridor; four pod-like structures, two on each side; walls and ceiling are curved
Functional Elements / Zones	central corridor; pod-like structures; digital display panel
Architectural Details	curved walls and ceiling; illuminated buttons and screens; overhead panels
Lighting	soft blue lighting from overhead panels; illuminated buttons and screens
Materials / Textures	sleek, minimalist design; predominantly white color scheme; digital display panel
Color Palette	predominantly white color scheme; soft blue lighting
Furniture/Decor	pod-like structures resembling cryogenic chambers; digital display panel with illuminated buttons and screens
Atmosphere/Mood	futuristic; sleek, minimalist design; sterile and advanced; high-tech ambience

Figure 3
The modification of spatial layout and architectural detail descriptions to achieve desired spatial characteristics



The definition of “a central corridor” is changed to “a curved cylindric central corridor”. However, this modification in the prompt is not enough to generate the desired layout. Then, the definition of “standing in the middle” is modified to “running in the middle of the curved space”, ”running in the middle of the curved circular space from floor to ceiling”, and finally “running in the middle of the rotating space”, respectively. The last two definitions have the desired impact on the layout and architectural elements such as the floor and ceiling. Although the circularity of the space is achieved after several iterations, the alignment of the pods is difficult because of the connectivity of two spatial variables in 3-dimensional space.

The second selected scene is shown in Figure 4. This scene depicts a hotel lobby decorated with a minimalist futuristic style. The initial prompt generated by the “Describe with AI” tool is shown below.

Figure 4
Hotel lobby scene from 2001: Space Odyssey (Kubrick, 1968)

"Image depicts a futuristic and minimalist interior space, characterized by a sleek, white color scheme and modern design elements. The layout features a spacious room with a grid-patterned ceiling that emits a soft, diffused light. The floor is smooth and white, complementing the overall clean aesthetic. The room is furnished with bold, red, sculptural chairs and small, round white tables, creating a striking contrast against the white background. On the left wall, there are framed posters with text, including one that reads 'COFFEE SHOP' in bold, black letters. Another poster displays the word 'HILTON' in a similar style. In the background, a few people are visible, dressed in contemporary attire, walking or sitting, adding a sense of scale and activity to the scene. The overall atmosphere is one of modernity and sophistication, reminiscent of a high-end lounge or waiting area."

In the initial prompt, the layout is described only as spacious, with no mention of the slight curvilinearity of the floor and ceiling of rotating structure. The same modifications applied to the previous prompt are made to this prompt as well to achieve similar spatial characteristics with the reference image. The adjectives such as curved, curvilinear, and rotating are added to the prompt definition. The adjectives describing the curvilinearity of space influenced only the rectangular plan organization, resulting in an oval or circular forms in the ceiling and floor. The generated images resemble the initial reference scene mainly in furniture, style, and colors rather than spatial characteristics (Figure 5).

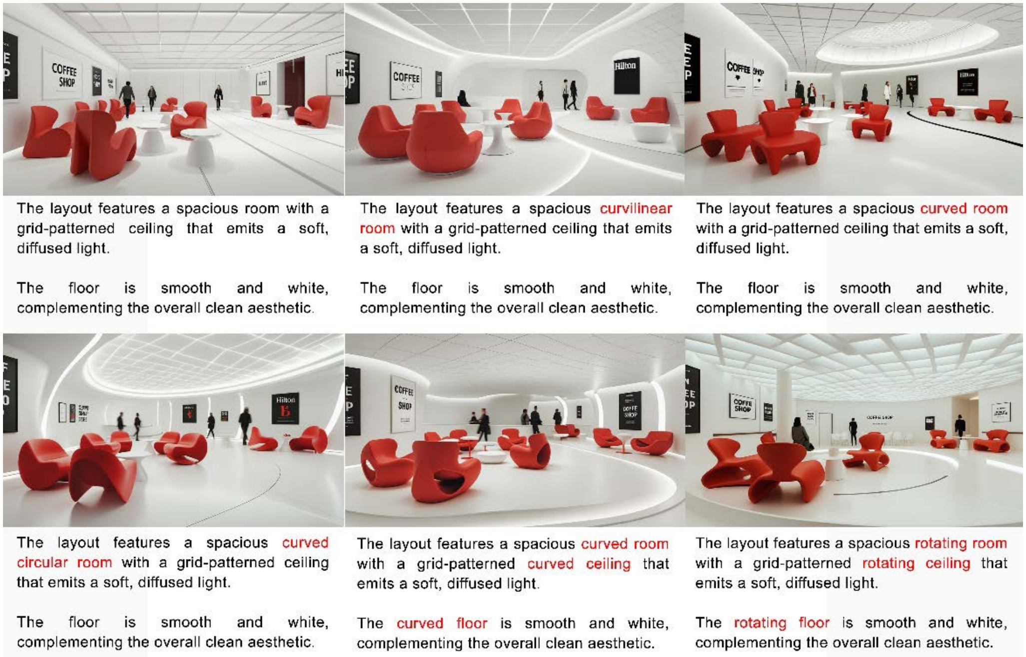


Figure 5
The modification of spatial layout and architectural detail descriptions to achieve desired spatial characteristics

CONCLUSION

This paper suggests a conceptual framework for cinematic spatial analysis by integrating AI tools to analyze existing set designs and generate new scenes based on this analysis. Key scenes from 2001: A Space Odyssey are translated into prompts using LeonardoAI and subsequently parameterized by the DeepSeek chatbot based on predefined spatial and visual categories of set design. The prompts are iteratively refined to generate new scenes that retain the spatial and visual characteristics of the reference images.

The results indicate formal spatial properties of functional elements such as curved walls and floors, and the alignments of furniture and decor to those functional elements are initially challenging to generate using text-to-image AI tools. Although the spatial qualities of elements can be progressively improved by refining the descriptions within prompts, the complex relationship between language and image generation makes it difficult to replicate the same process and achieve consistent results (Albaghajati *et al.*, 2023). The categorization of spatial and visual elements in set design can serve as a foundation for crafting detailed prompts by trial and error, allowing users to emphasize specific features to achieve the desired atmosphere in interiors.

The potential of this study lies in developing set design interfaces by parameterizing movie scenes through computational design approaches. Building on this preliminary analysis and generation framework, selected film scenes can serve as a database for machine learning models in terms of depiction of the spatial characteristics of space. This framework can also be applied to interior design scenarios where no reference image of a 3D model is available, enabling the modification of spatial characteristics through prompt-based generation. The limitations of this study are the movie genre, the number of selected scenes, and the capacities of selected AI tools. The depiction of spatial and visual categories can vary across different film genres, as these elements are influenced by the narrative and the nature of the space—whether real or virtual. The modification of descriptions can be enhanced by extending the selected key frames from the film. The proposed workflow can be further tested using various AI tools. Utilizing text-to-image generators as rapid tools for scene analysis and generation offers a foundation for envisioning interior atmospheres, even for novice architects and designers.

REFERENCES

AI Image Generator— Create Art, Images & Video | Leonardo *AI*. (n.d.). Available at: https://leonardo.ai/

Albaghajati, Z. M., Bettaieb, D. M., and Malek, R. B. (2023). 'Exploring text-to-image application in architectural design: Insights and implications' *Architecture, Structures and Construction*, *3*(4), 475–497.

Al-Saati, M., Botta, D., and Woodbury, R. (2012). 'Depictions of Architectural Spaces in Film' *The International Journal of the Image*.

Arnheim, R. (1954). *Art and Visual Perception: A Psychology of the Creative Eye*. University of California Press.

Bekmezci, C. (2017). '*The Analysis of Living Spaces Used in Sci-Fi Movies: The Case of Joseph Kosinski,* (Master Thesis, İzmir Ekonomi Üniversitesi)

Brako, D. K., and Mensah, A. K. (2023). 'Robots over humans? The place of artificial intelligence in the pedagogy of art direction in film education' *Journal of Emerging Technologies*, *3*(2) https://doi.org/10.57040/jet.v3i2.484.

Campo, M. del, and Leach, N. (Eds.). (2022). *Machine hallucinations: Architecture and artificial intelligence*. John Wiley & Sons.

Căplescu, O. A. (2016). 'New Media in Architecture: Media Façades' in M. Boştenaru Dan and C. Crăciun (Eds.), *Space and Time*

Visualisation. Springer International Publishing, pp. 127–140.
Chaillou, S. (2020). 'ArchiGAN: Artificial Intelligence x Architecture', in P. F. Yuan, M. Xie, N. Leach, J. Yao, & X. Wang (Eds.), *Architectural Intelligence: Selected Papers from the 1st International Conference on Computational Design and Robotic Fabrication (CDRF 2019)*. Springer Nature, pp. 117–127.
Ching, F. D. K. (2007). *Architecture: Form, space, & order* (3rd ed.). Wiley.
Chodorov, P., and Cha, M. (2019). '2001: A Space Odyssey as a Work of Experimental Cinema: Focused on Its Convergence of Technical Innovations and Aesthetic Challenges' *International Journal of Advanced Culture Technology*, *7*(2), pp. 113–124.
DeepSeek. (2025). Available at: https://www.deepseek.com/
Del Campo, M., Manninger, S., Sanche, M., and Wang, L. (2019). 'The Church of AI—An examination of architecture in a posthuman design ecology' in *Proceedings of the 24th CAADRIA Conference*, pp. 767–772.
Hanafy, N. O. (2023). 'Artificial intelligence's effects on design process creativity: A study on used A.I. Text-to-Image in architecture' *Journal of Building Engineering*, *80*, 107999.
Interior AI™ | AI Interior Design + Virtual Staging AI App. (n.d.). Available at: https://interiorai.com/
Jain, P. and Banerjee, S. (2021) 'Role of intangible elements of architecture in set design of fiction films' *Journal of Emerging Technologies and Innovative Research (JETIR)*, 8(3), pp. 202–207.
Kubrick, S. (Director). (1968). *2001: A Space Odyssey* [Adventure, Sci-Fi]. Metro-Goldwyn-Mayer (MGM), Stanley Kubrick Productions.
Kubrick, S. (Director). (1980). *The Shining* [Drama, Horror]. Warner Bros., Hawk Films, Peregrine.
Li, C., Zhang, T., Du, X., Zhang, Y., and Xie, H. (2024). 'Generative AI Models for Different Steps in Architectural Design: A Literature Review' *Frontiers of Architectural Research*. https://doi.org/10.1016/j.foar.2024.10.001
Monaco, J. (2009). *How to Read a Film: Movies, Media, and Beyond*. Oxford University Press.
Natarajan, S., Bauer, J., and Fjord. (2019, June 17). *AI: Hollywood's Rising Star*. Broadcasting Cable. Available at: https://www.nexttv.com/blog/ai-hollywoods-rising-star
Paananen, V., Oppenlaender, J., and Visuri, A. (2023). 'Using text-to-image generation for architectural design ideation' *International Journal of Architectural Computing*,
Pallasmaa, J. (2001). *The Architecture of Image: Existential Space in Cinema*. Rakennustieto.
RoomGPT – Redesign your room with AI. (n.d.). roomGPT.Io. Available at: https://www.roomgpt.io/
Tanyeli, U. (2001). Temsiliyet Nesnenin Temsili Sanalın Sanallıkla İfadesi. *Arradamento Mimarlık*, *11*.
Tati, J. (Director). (1967). *Playtime* [Comedy]. Specta Films, Jolly Film.
Tong, H., Türel, A., Şenkal, H., Ergun, S. F. Y., Güzelci, O. Z., and Alaçam, S. (2023). 'Can AI Function As A New Mode of Sketching: A Teaching Experiment with Freshman' *International Journal of Emerging Technologies in Learning (iJET)*, *18*(18). https://doi.org/10.3991/ijet.v18i18.42603
Video editing—Fastpedia. (n.d.). Available at: https://fastpedia.io/listing-category/video-editing/page/2/
von Meiss, P. (1991). *Elements of Architecture | From Form to Place*. Taylor & Francis.
Wang, S.-Y., Su, W.-C., Chen, S., Tsai, C.-Y., Misztal, M., Cheng, K. M., Lin, A., Chen, Y., and Chen, M. Y. (2024). 'RoomDreaming: Generative-AI Approach to Facilitating Iterative, Preliminary Interior Design Exploration' in *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems*, 1–20.