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Artificial Intelligence (AI) Art Generators in the Architectural Design Curricula

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Abstract

When a student submits a conceptual sketch in response to an architectural design problem, the instructor may presume that the student researched a couple of precedents then formulated their own ideation. How should the instructor react when an artificial intelligence (AI) art generator created or influenced the image? AI art generators create new or adapt existing architectural representations from imported text within seconds. High quality graphic solutions from text-to-image modelmakers are now confronting the academy. OpenAI's Dall-E 2 and Midjourney are two popular open source and fee-based art generators. Web crawlers regularly scrape the internet to archive digital data. Research companies acquire the data then compile and pair billions of images and associated text descriptors into massive datasets. When a natural language processor interprets a prompt such as 'Pompidou rendering inspired by Mies', the deep learning algorithm seeks out the specific pattern associated with the input. The output is in the form of architectural representations. The design visualizations are a series of composites transformed to illustrate the requested version of a building. Although the AI generators make art more accessible to the population, they invite controversy from the art community regarding attribution. This paper discusses the ethical and legal implications surrounding AI art generators and copyrights, describes how the AI generators operate, considers the positions in the creative process, and concludes with suggested best practices for engaging AI art in the architectural design curricula.

Introduction

A consensus definition of art within the art community is asymptotic as each artist may have a different opinion on what art is. Oxford defines art as "the expression or application of human creative skill and imagination, typically in a visual form such as painting or sculpture, producing works to be appreciated primarily for their beauty or emotional power [1]." One might simplify and suggest that art is a process led by the human mind that results in a product, while beauty remains subjective. Tolstoy shifted away from the creator at the center of defining art and claimed that the observer's experience characterizes art [2].

Art takes on many forms such as painting, sculpture, literature, architecture, cinema, music, theater, poetry, etc. Exemplars include Leonardo DaVinci's Renaissance, Pablo Picasso's cubism, Salvador Dali's realism, Georgia O'Keeffe's American Modernism, Agnes Martin's minimalism, Charlie Parker's bebop jazz, Zaha Hadid's architecture, Charlie Chaplin's films, and on and on as the list of artists and styles are broad and deep. There are times when a new movement arises such as Dadaism, and the community takes pause to consider whether the process or product is art? Then, over time, the new and questionable art method or technique might become normalized, accepted, and an art genre is born.

Appropriation Art and Artificial Intelligence Art

Appropriation art and AI art rely upon the works or products of others. Appropriation art mixes concepts such as found objects and minimalism. The artist repurposes existing art into a different

context and without much modification [3]. Andy Warhol appropriated the designs of Coca-Cola bottles and Campbell's soup cans and developed a subgenre recognized as pop art. Subsequently, Elaine Sturtevant's appropriated Warhol's appropriated work and even used his silk screen equipment in the process [4]. The U.S. legal system considers most of Warhol's works under the fair use exception of copyrighted materials, but that is not always the case with other artists. Jeff Koons appropriated a postcard image into a sculpture titled *String of Puppies* that did not satisfy the parody condition of fair use [5].

Artificial intelligence art relies on non-human interventions that elicit and transform digital information from a large dataset of paired images and texts. AI art garners awards and is becoming successful. Game designer Jason Allen won first place in the Colorado State Fair for *Théâtre D'Opéra Spatial* in the emerging artists division. Although the category was digital arts / digitally manipulated photography, one judge did not know that Midjourney's AI generated the primary image [6]. "Many artists were furious, but Mr. Allen was unmoved: "It's over. A.I. won. Humans lost", he told the paper [7]." A comment reminiscent of Deep Blue when the IBM AI defeated world chess champion Gary Kasparov in 1997.

The Problem with Appropriation and Digital Technology

Appropriation art and AI art operate somewhere between transformative works and derivative works where the former is fair use, and the latter is not. Transformative works reconceive the original source material in a manner different than the original expression and thereby are a fair use of copyrighted material. A derivative work is based on the original source material and expresses the author's personality. Copyright laws protect the original and derivative works [8].

The problem is threefold based on the lack of attribution, minimal workload, and novelty. First, artists are upset because the datasets include their unauthorized copyrighted material. The Large-scale Artificial Intelligence Open Network-5B (LAION-5B) makes one of the larger dataset repositories which holds 5.85 billion usable image and text pairings [9]. Then product vendors access the dataset and deploy diffusion models to train the AI. The text-to-image generators do not attribute the original work [10]. Second, computers do too much of the work and not the artist. Using minimal effort, Ammar Reshi engages ChatGPT to write and AI art to illustrate the children's book *Alice and Sparkle* [11]. Third, AI art is novel, and scholars have not vetted and researched the curriculum for its impact on architecture education and meaningful student learning. "Further discussion in educational institutions is needed to evaluate and understand the possible impact of AI in architecture [12]."

The Academic Consequences of Appropriation

Institutions have plagiarism policies to inform students about the consequences that may lead to expulsion. The academy takes plagiarism very seriously since learning is the cornerstone of higher education. Plagiarism is the intentional avoidance of learning. Academic dishonesty occurs when the student submits another's work as their own. Furthermore, the intervention of AI technology in the classroom leads to different and thereby unknown learning outcomes. If the computer program is performing the search and delivering the product, then who or what is engaged in the creative experience or the meaningful learning?

This paper explores the ethical and legal implications surrounding appropriation, illustrates a novice user experience of an AI art generator, and finds prior scholarship to arrive at some suggested best practices for engaging AI art generators in the design curricula.

Ethical and Legal Implications Surrounding Appropriation Art and AI Art

This section broaches the topics of copyright laws and fair use exceptions in industry through court outcomes on appropriation art, and recent court filings against using AI art generators, and describes plagiarism in higher education at the institutional and departmental levels.

Millet et al [13] recognizes that the trained human artist perceives the non-human making of art as a threat. "AI-made art poses an ontological threat to anthropocentric worldviews that artistic creativity is uniquely human" and "Humans perceive the same artwork as less creative and awe-inspiring when it is labeled as AI-made (vs. human made) [13]." The first threat identifies that non-humans may also create art, thereby humankind is no longer the center of existence. Fortunately, "According to the US Copyright Office, artificial intelligence programs are unable to hold copyright [14]." The second threat of cheapening creativity is subjective but has an ethical undertone.

Shaffi [10] identifies the common complaints about the gathering and use of pirated intellectual property and the attempts to make creations 'in the style of' artists without their consent. Rob Biddulph notes the difference between human and non-human art where, "A human artist is also adding emotion and nuance into the mix, and memory – specifically its failings [10]?" Syed elaborates about human appropriation of art where to "mimic a style, or pass off a piece of artwork as their own, it is incredibly frowned upon – and in some cases could be seen as copyright infringement. This is essentially what AI art is doing [10]." Appropriation in art is the use of pre-existing objects or images with little or no transformation applied to them [15]. U.S. copyright law offers protections for art against improper appropriation.

U.S. Copyright Law

The Copyright Act of 1976 [16], the Visual Artist Rights Act of 1990 (VARA) [17], and the Architectural Works Copyright Act of 1990 (AWCPA) [18] protect artists and architects. Copyright law classifies the artists' products as a work of visual art such as a painting, drawing, or sculpture. These exist as a single or limited number of consecutively signed copies [16 §101]. The subject matter of copyright for visual art includes two and three-dimensional pictorial, graphic, and sculptural works [16 §102]. Architectural works are the design of a building as evidenced by the drawings or the built product [16 §102]. The copyright owner has exclusive rights to reproduce, prepare derivative works, and to distribute copies [16 §106]. Furthermore, through VARA [17] the owner now has moral rights that include attribution and integrity. They have the right to claim authorship and prevent the use of their name on works they did not create or that become modified when their reputation or honor becomes harmed [16 §106A(2)].

The copyright protection for architectural products safeguards the form and composition and is time dependent. The architectural work includes "the overall form of the building – the exterior elevations of the building when viewed from the front, rear, and sides – as well as any

arrangement and composition of walls or other permanent structures that divide the interior into separate rooms and spaces [19].” Architectural works created after December 1, 1990, are available for automatic protection upon creation, while works prior to that date may or may not depend on substantial completion and its publication [19].

Although architects do not have to apply for a copyright to receive protection, they must possess a valid copyright to enter a civil claim. A valid copyright requires that the structure be habitable, permanent, and stationary and registered through the Copyright Office [19]. Bowser reminds architects about two important legal criteria where one “cannot copyright an idea, only original expressions of that idea [and] certain elements of architectural design are so common that they are, by law, unprotected [20].”

The U.S. legal system places limitations on the owner’s copyright exclusivity by permitting the fair use by others under certain circumstances. Fair use is a defense for utilizing copyrighted and unpublished works and is applicable under certain conditions. The limitations are the purpose of use, the nature of the work, the amount of the work, and its effect on the market [16 §107]. As educators, we engage in fair use of copyrighted material to bring course content to life in the classroom. We only use smaller portions of the original work and provide the appropriate attribution. When utilizing a sizable portion of the work, the basis of fair use should be for criticism or review, or parody or satire. The appropriation art genre deploys a significant amount of the original source material for the creation of new work. There are several instances where the original artist of the source material takes the appropriation artists to court.

Resolved Court Cases Regarding Appropriating Art

The appropriation art court cases reveal a pattern where the plaintiff claims copyright infringement and the defendant claims the fair use exception. The civil courts require two conditions to prove copyright infringement. The “plaintiff is the owner of a valid copyright” and that the “defendant copied original expression from the copyrighted work” [20]. Rogers v. Koon, Cariou v. Prince, and Fairey v. Associated Press are three notable cases.

Rogers (plaintiff) v. Koons (defendant) (1992) is a copyright infringement civil court case where the defendant allegedly appropriates a postcard image to create a nearly identical sculpture [5]. Art Rogers is a photographer and Jeff Koons is a sculptor. Rogers created the original source work which was a postcard of two people holding puppies. Koons replicated the two-dimensional black-and-white postcard image into a three-dimensional colored sculpture. Rogers claimed that Koons committed copyright infringement. Koons defended the action through fair use by parody. The court found in favor of the plaintiff and stated that the resulting work had substantial similarity to the original source work. The high value of the resulting sculpture negatively impacted Rogers’ market potential.

Cariou (plaintiff) v. Prince (defendant) (2010) is a copyright infringement civil court case that addresses appropriating a published photograph for collages [21]. The Gagosian Gallery, Lawrence Gagosian, and Rizzoli International Publications are the other defendants involved in the exhibition of the work. Patrick Cariou is a French photographer and Richard Prince is an appropriation artist, and a rephotographer. Cariou captured the original source work through

photograph portraits and landscapes representing the Jamaican Rastafarian community. In 2000, Powerhouse Books published the photobook *Yes, Rasta* [22]. Richard Prince appropriated 30 photographs and transformed them into collages. Cariou claimed copyright infringement and Prince defended it with fair use. The original ruling was in favor of Cariou which an appeals court later overturned. The court subsequently found 25 of Prince's resulting works protected under fair use [23]. The presiding judge noted that the collages were at a different scale and expressed an entirely different aesthetic [24]. The parties settled the remaining five works.

Fairey (plaintiff) v. Associated Press (AP) (defendant) (2010) is a copyright infringement civil court case for appropriating a photograph portrait to create a poster [25]. Shepard Fairey is a street artist, and the Associated Press is a news reporting agency. Mannie Garcia is a freelance photojournalist that created the original source work for the AP, a photograph of Barak Obama. Fairey created the resulting work by appropriating the Obama photograph and then transforming it into the Hope political campaign poster. Fairey claimed that AP was unfairly citing copyright infringement through unlicensed appropriation and was engaging in discovery abuse. Fairey later recognized that the photograph belonged to the AP [26]. The parties settled the case privately to share the rights to the poster. Ellison noted that, "It's unlikely that Garcia's work could have ever reached the level of fame it did, if not for Fairey's poster [27]."

Current Court Cases Regarding AI Art

Andersen et al (plaintiff) v. Stability AI Ltd. et al (defendant) (2023) is a current copyright infringement class action lawsuit for using a dataset to generate derivative works [28]. The plaintiff filed the suit on January 13, 2023, in the U.S. District Court for the Northern District of California. The plaintiffs include Sarah Andersen, Kelly McKernan, and Karla Ortiz. Andersen is a cartoonist, Ortiz is an illustrator, and McKernan is an artist [29]. The defendants are Stability AI Ltd., Stability AI, Inc., Midjourney, Inc., and DeviantArt, Inc. The defendants developed and or applied the same text-to-image generators. The cause of action is "for direct and vicarious copyright infringement under 17 U.S.C. § 501; violation of the Digital Millennium Copyright Act, 17 U.S.C. §§ 1201–1205 (the "DMCA"); violation of Plaintiffs' statutory and common law rights of publicity, Cal. Civ. Code section 3344; violation of Unfair Competition law, Cal. Bus. & Prof. Code §§ 17200, et seq.; and declaratory relief [28]." The underpinning of the complaint is that Stable Diffusion allegedly downloaded and used compressed images of unauthorized copyrighted work from a dataset to use as training images to create derivative works. The training is a fundamental part of the diffusion model process.

Getty Images (US), Inc. (plaintiff) v. Stability AI, Inc. (defendant) (2023) is a current copyright infringement lawsuit for using images from a dataset to train a diffusion model [30]. The plaintiff is filing the suit in the U.S. District Court for the District of Delaware. Getty Images is a stock photography company. The cause of action is for violating the "Copyright Act of 1976, 17 U.S.C. §101 et seq., the Lanham Act, 15 U.S.C. § 1051 et seq., and Delaware trademark and unfair competition laws [30]." Getty alleges that, "Stability AI has copied at least 12 million copyrighted images from Getty Images' websites, along with associated text and metadata, in order to train its Stable Diffusion model [30]." Furthermore, "Getty has licensed its images and metadata to other AI art generators, underscoring the fact that Stability AI willfully scraped its images without permission [31]."

Institutional Policies for Plagiarisms

The primary difference between plagiarism and copyright infringement is that the former is unethical although legal while the latter is illegal. “Plagiarism is an ethical violation that occurs most often in academic situations when a party takes credit for work that was not of their own authorship while copyright infringements occur when a party copies, reproduces, distributes, displays or performs, or makes a derivate version of a protected work without permission of the copyright owner or the law [32].” Plagiarism has no attribution, while infringement might have attribution but is an unauthorized replication. Academia has consequences for plagiarism.

Each university and some departments have plagiarism policies that respond to a student’s lack of attribution. Drury University has a policy at the institutional level and at the departmental level in the architecture program. The University’s policy on academic and creative honesty defines plagiarism as, “a particular kind of academic misconduct in that one person takes another person’s ideas, words, or images and falsely presents them as his or her own. If a student submits any work that is not entirely his or her own, the student is plagiarizing [33].” The result of a single offense is a failing grade for the assignment, with multiple offenses leading towards course failure, and institutional expulsion. The architecture department elaborates [34]:

> 1. Taking “another person’s ideas… or images,” in the context of architectural design, includes when students directly appropriate others’ design motifs, forms, and formal arrangements, or presentation materials.
> 2. Since architecture (like other creative disciplines) depends on the influence of and critical engagement with others’ work, the above phrase “directly appropriate” refers to situations in which appropriation occurs without a critical process that recognizes the influence of the original work and integrates it into the student’s own design process and solutions.
> 3. Merely manipulating or altering others’ images through digital or other processes does not in itself constitute legitimate appropriation, and may qualify as copyright violation.
> 4. Attribution of uses of others’ creative work is essential, and can be handled in a number of ways:
> – In presentations summarizing research or precedent analysis, any representation of source projects should be accompanied by identifying information (building, location, designers, date). Students should also be aware that rights to photographic imagery are also often held by photographers independently of the source project’s designers.
> – In cases in which precedent analysis and other influences are integrated with the students’ own creative process, this influence and process should be directly recognized by the student and discussed with studio critics during the process.

Generating AI Art

This section documents the steps required and the processes behind generating AI art ‘in the style of’ a designer for a generalized building. LAION-5B is the dataset provider. Midjourney is the AI text-to-image algorithm generator. Discord is an instant messaging application with an embedded bot that communicates with the user through prompt commands.

How the Diffusion Model Works

The AI art process requires a web crawler, dataset of images and associated text descriptions, a deep learning algorithm, a natural language processor, a text-to-image generator, and a bot. A web crawler, such as the non-profit Common Crawl, is a bot that trolls and scrapes the web for

information on a regular basis for archival purposes and supplies data to the public [35]. The non-profit LAION-5B makes a usable dataset of text and image pairings [9]. Text-to-image modelers such as Stable Diffusion use the LAION-5B to train the AI, where it transforms natural language input into graphic outputs. The images are in the form of Joint Photographic Experts Group or more commonly referred to as JPEG files that the AI artist may digitally edit or print.

The diffusion model process of machine learning trains the AI. The process begins with the AI interpreting the text from the user prompt, then the AI searches the dataset for images and associated descriptions. The AI performs a concept mapping procedure where it converts images and texts into numbers to assign probabilities. The AI displays the diffusion process through an increasingly pixelated set of images that conceals the original images. The concealment is analogous to silk screen printing as something added on top of or covering the original image. The purpose is "to train the model to recognize that the underlying image still contains [36]" the prompted information then the "AI learns to subtract noise [36]" or the concealment layers and reveals a clear image for the user. Some may appreciate the related irony of Sturtevant's double appropriation. Sturtevant used Warhol's actual silk screen equipment to appropriate his already appropriated work when he created *Marylin*.

Generating AI Sample Images

Ploennings and Berger [37] isolated the frequencies of the prompt terms by studying over 40 million visible inputs of Midjourney users inside the Discord instant messaging platform. The top fifteen architect and artist queries in order of most to lesser frequency are: Zaha Hadid, Michelangelo, Frank Lloyd Wright, Adrian Smith, William Morris, Tadao Ando, Frank Gehry, Kengo Kuma, Lebbeus Woods, Peter Zumthor, Carlo Scarpa, Antonio Gaudi, Santiago Calatrava, Le Corbusier, and Norman Foster. Hadid and Michelangelo are the most popular and more than triple the number of other searches. The word prompts in order of most to lesser frequency are: detailed, lighting, realistic, cinematic, style, render, octane, hyper, high, ultra, intricate, unreal, engine, light, beautiful, dark, photorealistic, detail, etc. Some of these terms are specific to the type of diffusion generator. The individual keywords are architecture, house, interior, building, window, floor, architectural, concrete, cathedral, pool, bedroom, roof, construction, exterior, façade, kitchen, skyscraper, plan, etc. This author uses the instant messaging application Discord to communicate with the Midjourney bot to generate new images and to adapt existing user images.

Generating New Images The Midjourney art generator creates new images from text prompts. This author kept the prompts simple and between five to seven words. The prompts identify an image type such as floor plan, drawing, rendering, etc. and a style type such as Mies, Wright, Calatrava, etc. Figure 1 presents the JPEGs of the four exterior views and Figure 2 illustrates the plan views. The prompts are above the four images in white font. The prompts did not include information for the color palette, the isometric or elevation view, background sky, people, etc. The images are the result of the AI's interpretation of the author's prompts entered in a dialogue box. Please note that the quality of the graphics is far better than what the author creates without AI. The high degree of quality implies a finality to the product even though the plans have no understanding of spatial relationships. The images inspire some design ideas and representation techniques, but the process removes and replaces my ideation.

Modifying User Images The Midjourney art generator can edit imported JPEG image files. A situation may exist where the designer has some specific images or completed elevations in mind and requests refinement or upscaling from the AI generator. These prompts include a combination of image files and text prompts.

Figure 1. Exterior views of new AI generated images from Midjourney.

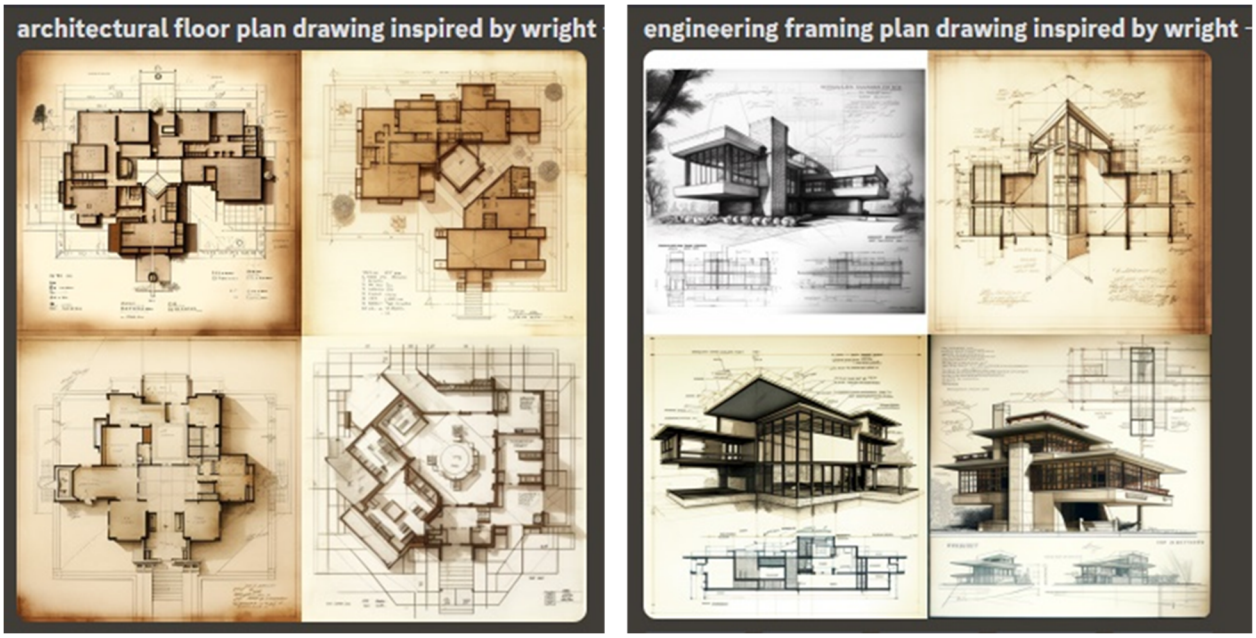

Figure 2. Plan views of new AI generated images from Midjourney.

AI Art in the Creative Process

Wallas [38] lists the four steps of the creative process as preparation, incubation, inspiration, and verification. Kampylis and Valtanen [39] researched dozens of definitions for creativity and found a pattern where the process is individual and intentional, and that the product has novelty. Borglund [40] contends that AI can find and process more information than humans. Therefore, the AI should have the greatest impact on the preparation step since the stage is based on found information. Preparation is where the suitability of AI differs between foundational design students and design professionals. The machine learning performed by the AI should not replace the creative experience in novices, whereas seasoned professionals may benefit.

Notable architects are using Midjourney's AI in the preparation stage of creativity, while also extending into verification through the built environment. Tim Fu is generating an Antonio Gaudi inspired villa design and Chantal Matar is eliciting fluid and curvy structures with wave themes [41]. Stephen Coorlas explained the that, "It's not that I couldn't find inspiration images online, but instead of hours of Google Image searches, it cut straight to the chase, and gave me more control to make tweaks [41]." Coorlas makes his prompts available to the public. The industry use aligns with some of the academic research where AI in architectural painting courses became more popular as the building shifted from the background to the foreground becoming the primary focus [42].

<u>Suggestions for Best Practices in the Classroom</u>

This section elicits some of the themes as we begin to map out education standards for AI art as it intervenes in the classroom.

- *Midjourney and other AI generators will become part of the curriculum*

Industry's digital technologies inevitably intervene in the higher education classroom. Computer aided drafting, building information modeling, etc. have found positions in the curriculum alongside freehand sketching and mechanical drafting. Digital technologies commonly begin as a student preference to illustrate their design ideas in the studios. An elective course is eventually born that may subsequently transition into a required course.

- *AI art should supplement and not replace ideation in the design process*

If the diffusion model boasts its machine learning, then one might infer that AI is replacing the meaningful creative learning experience of the human. The best utility for AI art is its capacity for high quality illustrations in the style of famous architects and designers. Ploennings and Berger [37] ranked ideation as the most effective use case for text-to-image processing. Professors should be aware that the tool is doing the searching and refinement instead of the students. This creates a new knowledge gap in learning. Students can become skillful in recognizing specific prompts to elicit a range of illustrated outcomes for exterior elevations and perspectives. The images might inspire design and the students could use them in a broader precedent analysis. The exterior views are only a small part of a precedent study. Clark and Pause [43] dissect a few dozen criteria applied in a traditional precedent analysis.

- *Departments should establish appropriation policies that require the students to cite the AI art generator and identify their prompt language*

If the students use an AI art generator, then they should attribute the generator. Citations will avoid any illusions of impropriety and chances of becoming accused of plagiarism. Furthermore, students could provide the prompts or the search parameters alongside the AI art images when presenting the projects. This will attribute the designers that are 'in the style of' that the images are based upon (see Figures 1 and 2). Furthermore, academia and the profession will benefit from a coordinated effort to develop a National AI Standard similar to those for CAD and BIM.

- *AI art revives the Beaux Arts pedagogy through an emphasis on the façade*

The Beaux Arts and Bauhaus pedagogies clashed between 1925 and 1950 resulting in a decline of the Beaux Arts influence [44]. Henry Kamphoefner [45] describes the Beaux Arts education as having a focus on the rendered drawing of the façade where the students "ignore the structure," as others will design. The Bauhaus education has an elevated emphasis on integrating technologies within architectural design. "The Schools have been re-thinking their programs to bring mathematics, mechanics and the science of structure into sharper focus and into a clearer relationship with the design of space [45]." When using AI art in conjunction with building information modeling, the Beaux Arts and Bauhaus traditions may coexist and flourish.

- *AI art is not yet suitable for floor planning*

Ploennings and Berger note the shortcoming of the diffusion models not having floor plan training, "This is due to the fact that AI art tools replicate the style, but have no semantic understanding of the meaning of the lines in a floor plan [37]." Architectural design concepts such as room adjacencies, door swing directions, overhead planes, window locations, furniture placement, and more, lack coordination, function, and code compliance. A student may choose to prompt floor plans to view various illustration techniques but should avoid using the program to solve horizontal planning problems.

Concluding Thought

> The world comes to me in a series of associated visual images, like scrolling through Google Images or watching the short videos on Instagram or Tic Tok. It's true that I now have language, but I still think primarily in pictures. – Temple Grandin, Ph.D. [46]

AI makes art more accessible to the public. Some individuals abandon the architecture and engineering design fields because they could not perform basic physical tasks such as mechanical drafting. The advent of computer aided drafting has expanded architectural opportunities. In a comparable manner, AI art may increase artistic opportunities by making the process more accessible to others such as visual learners. In *Visual Thinking*, Grandin [46] comments on the American education system and how it caters to language learners. We should be open to the idea that there are other avenues for learning that align with machine learning. Centieiro [47] describes that machine learning can be either supervised or unsupervised. The demarcation point is whether the outcome is known in advance.

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