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AI-Generated Graffiti Simulation for Building Façade and City Fabric

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Abstract: Graffiti represents a multi-disciplinary social behavior. It is used to annotate urban landscapes under the assumption that building façades will constantly evolve and acquire modified skins. This study aimed to simulate the interaction between building façades and generative AI-based graffiti using Stable Diffusion® (SD v 1.7.0). The context used for graffiti generation considered the graffiti as the third skin, the remodeled façade as the second skin, and the original façade as the first skin. Graffiti was created based on plain-text descriptions, representative images, renderings of scaled 3D prototype models, and characteristic façades obtained from various seed elaborations. It was then generated from either existing graffiti or the abovementioned context; overlaid upon a campus or city; and judged based on various criteria: style, area, altitude, orientation, distribution, and development. I found that rescaling and reinterpreting the context presented the most creative results: it allowed unexpected interactions between the urban fabric and the dynamics created to be foreseen by elaborating on the context and due to the divergent instrumentation used for the first, second, and third skins. With context awareness or homogeneous aggregation, graphic partitions can thus be merged into new topologically re-arranged polygons that enable a cross-gap creative layout. Almost all façades were found to be applicable. AI generation enhances awareness of the urban fabric and facilitates a review of both the human scale and buildings. AI-based virtual governance can use generative graffiti to facilitate the implementation of preventive measures in an urban context.

Keywords: graffiti; generative AI; urban fabric; governance; context transfer; Stable Diffusion®

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1. Introduction

Graffiti on building façades interacts with audiences through a constantly interactive development process; however, does a purposefully designed or planned urban fabric facilitate the act of graffiti, or does the graffiti instead enrich the culture of the urban landscape? The answer is just that graffiti is an unplanned part of the life cycle of building design (Figure 1).

The presentation of graffiti, or more specifically, the interactions between the graffiti and the second skin, i.e., walls, utilities, panels, or openings, represents a behavioral response to the urban fabric. This pattern develops throughout renovations of the second skin and thus creates an interface for mutual conversation, with other graffiti separated by the interstitial space. When the canvas space is insufficient, the graffiti either overlaps or extends to the ground, ceiling, or walls. Thus, a spatial hierarchy applies when space is limited.

This study uses Stable Diffusion® (SD) to simulate the interaction between the "hard" infrastructure of a building façade and the "soft" infrastructure of graffiti created with generative AI. The context used for graffiti generation considers the graffiti as the third skin, the remodeled façade as the second skin, and the original building design as the first skin.



Figure 1. Field surveys.

Although graffiti represents a multi-disciplinary social behavior, making this behavior more meaningful and, at the same time, sustainable is a topic of concern. Here, a generative tool, which is considered to be an active response to social value and behavior, is thus applied as a measure and consequence of, and an explicit response to, this concern.

2. Related Studies

The existing reviews on this topic include the interactions between urban spaces and deployed graphic statements in relation to graffiti. These interactions involve unique spatial structures and the role of artists, visitors, and governors. Reviews were also extended to the social–spatial dialectic and governance, business models, and collaborative tools and environments.

Graffiti is part of the context of the social–spatial dialectic [1]. Visual and built environments have been significantly reconfigured to communicate the transition from conflict [2]. However, public spaces are not simply spaces of conflict but are also places for collective engagement [3]. Urban redevelopment provides a platform and opportunities for increased visibility for graffiti [4,5]. As a part of cultural identity, street art has positive effects on the urban landscape [6].

Graffiti has been considered to be an examination of informality in urbanization through arguing politics and urban governance [7]. It is frequently connected to politics [8,9] since street art is a form of social, political, and cultural protest and critique [10]. It has also been situated as a critical social and spatial practice that challenges cultural planning paradigms [11]. Esthetic orders of graffiti have been considered in the governance of urban landscapes [12]. Moreover, graffiti has been considered a management issue by many city governments in regard to both the colonization and liberation of public spaces [13]. Although similar news has been reported in the USA [14] or promoted by local governments in Taiwan [15,16], regulations have also been introduced [17–19]. Graffiti is a common topic of discussion in Japan [20–24], Taiwan [25,26], and Hong Kong [27]. Cultural regeneration movements seem to provide an alternative to graffiti governance [12].

Public visibility is contingent on the urban environment [28]. Expressive subcultures, like graffiti, appear monolithic in aim, esthetic, and action [29]. New forms include emojis and stickers; the former is a visual language system that uses digital technology for asynchronous communication [30,31] with the potential to increase the clarity of cross-cultural communication [30]. The impact of stickers on emojis deserves future research for enhancing the communication of emotion [32,33].

Graffiti is a tailored form of content that needs to be planned on a virtual platform ahead of time and then promoted afterward. While emojis and stickers are already supported by social platforms and ecommerce, graffiti should also be assisted to enhance urban spaces to minimize concerns around governance in the future. Generative AI could provide the simplest entry point for the virtual modeling of graffiti.

Diffusion models and generative adversarial networks (GANs) are two such techniques; the former produces more varied and realistic images than GANs [34]. In architecture simulation, the former is applied through Midjourney® (v 6) and the latter through SD (v1.7.0) and DALL-E® (v 3). SD is a free, open resource with plenty of tutorials. This novel approach should make it feasible to simulate new emerging designs on an existing scene within the existing urban fabric without needing to combine a scaled 3D physical model.

Few attempts have been made toward graffiti simulation. This study took a different approach by using generative AI to simulate outcomes. The major difference from the existing approaches of 3D modeling, photogrammetry modeling, and 3D scanning [35–37] is that this approach is less dependent on defining 3D geometries first. Field graffiti application should allow a fast and intuitive simulation from an image-based generative approach in AI.

3. Materials and Methods

All graffiti was created in this study, except for that photographed on-site. This study aimed to predict the possible outcomes for a building façade (Figure 2). Graffiti is considered the result of an interaction between an artist and a building surface, with the original empty walls being considered the first skin; the renovated wall or old graffiti as the second skin; and the newly recomposed graffiti, used to fill in an empty space or to cover old graffiti, as the third skin. This approach presumes that graffiti comes from an interaction between graphical statements and a 3D physical urban fabric and building façade and acts as a discrete image or an image sequence that crosses the urban space.



Figure 2. Examples of the generated graffiti.

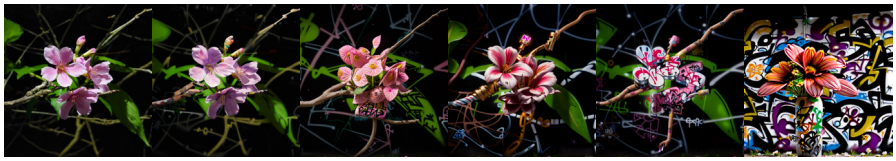
The AI-generated graffiti consists of image sources from the renderings of physical 3D models and pictures taken from real scenes. In order to represent the possibility of graffiti evolving on surfaces, the discrete application of an image started with a text-based description and evolved into iconic design images retrieved from 3D models, images, and renderings from 3D study models produced by the author, and then real scenes (Figure 2) were explored.

The process included three parts: (a) selecting the most meaningful scenes to add graffiti to; (b) selecting the preferred graffiti outcome; and (c) drawing a conclusion on the favored seed and the CFG value, denoising value, and checkpoint model. Attempts made in seed development included taking photographs of physical 3D models or real scenes and SD-generated outcomes (Figure 3).



(**a**) (**b**)

Figure 3. *Cont.*



(**c**)

Figure 3. Attempts at seed development: (**a**) seed development based on 3D model image; (**b**) seed attempt to test image with "reference" option in adding graffiti to void surface; (**c**) an image of a free-formed object.

For the seed-led variable exploration to restricted seed applications, the tests started with abstract form and basic shape models and extended to AI-simulated building forms in the SD platform. The dimensions were switched between 3D and 2D for open and closed models and image resources. The scope extended from a view to a study model with a prototype or a texture, a building, a street block, a city, and a scenario (Figure 4) in graffiti-oriented simulation classification and steps (Figure 5) under the support of software and hardware (Table 1).

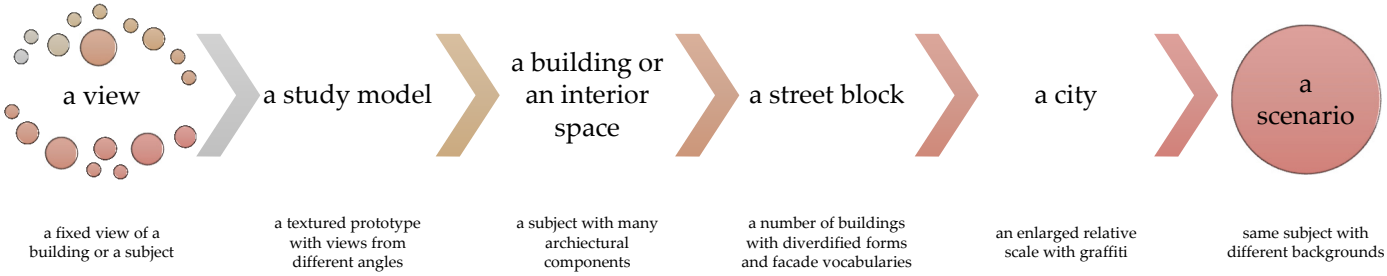


Figure 4. The simulation scope.

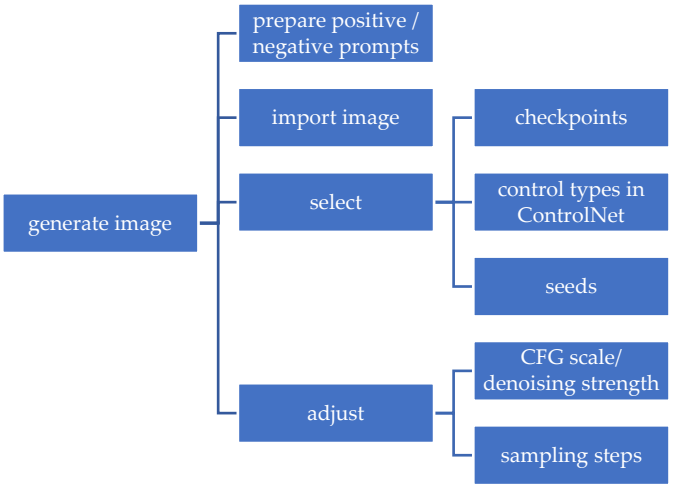


Figure 5. The simulation steps.

Table 1. Software versions, hardware specifications, and settings.

	AI Software	Image Software	Laptop
Name	Stable Diffusion®	Photoshop	MSI Vector GP66 (Micro-Star INT'L Co., Ltd., New Taipei City, Taiwan)
version	v1.7.0	25.4.0	Intel: i7-12700H 2.70 GHz (Intel Corporation, Santa Clara, CA, USA)

Table 1. *Cont.*

	AI Software	Image Software	Laptop
checkpoints/settings	landscapesupermix_v21 architectureExterior_v40Exterior aargArchitecture_v10 dvarchMultiPrompt_dvarchExterior		Ram: 64 GB (Micron Technology Inc., Boise, ID, USA) Graphic card: NVidia RTX 3060Ti, 6 GB VRam (Nvidia Corporation, Santa Clara, CA, USA) Window 11

3.1. Test Sequence

The test sequences started with the selection of representative source images and prototype and non-prototype urban fabrics, and then empty spaces were filled in with and without existing graffiti. The source images were selected from images of buildings with abstract pedagogical forms and compositions, field photographs, and images from competitions, with and without plain backgrounds. The selected non-prototype urban fabric was a campus scene and a city with a sequence of partially overlapping views constructed from an everyday walking and driving route.

3.2. Seed Elaboration

The seed-elaboration process (Figure 3) was divided into three parts: (1) one image was processed through most of the CFG and denoising combinations; (2) one image was processed through all of the checkpoints; and (3) a satisfactory seed was applied to different images to generalize the obtained results. Both graffiti and murals were used under different weight distributions, from 1.2 to 1.7, to mimic a realistic combination.

The choice of seeds is carried out similarly to divergent and convergent window shopping for specific purposes, such as the transfer of urban context from scaled 3D model prototypes or representative images to existing graffiti. The transfer reshapes existing scenes through the zoom-in/-out sequences, the projected planar viewpoint of the 3D fabric, or the enriched hidden creation along a route. Seeds can be selected between generalized production and chaos prevention. The selection also illustrates the generality of direct application, context-aware graphics, and homogeneous aggregation.

3.3. Plain and Textured AI-Generated Description

A number of 3D mass or schematic models of architecture were rendered and tested in SD. These models were used in a design competition to illustrate the basic composition of building components or computer models. The composition was scaled up to match the components of the building façade. General prompts and checkpoints were applied to defined urban scenes. Depending on the applied styles of the checkpoint, both graffiti and murals were added to provide a more realistic result.

A total of 12 styles were tested, and 8 were selected to represent the theme of regional development. The test cases featured plain, partially occupied, and reorganized façades.

- Plain façade: The simulation started by following each architectural element category and certain configurations of faces or edges for the ceiling, ground, columns, or utility boxes.
- Partially occupied façade: Graffiti was arranged in an empty space or added over existing graffiti with a redefined context. Free creation on a new site is different from that on a wall with existing graffiti.
- Reorganized façade: Graffiti was deployed along with partial rearrangement of configurations via SD. This approach implemented a chaotic style representative of unique identities.

4. Results

Three types of results were obtained: (1) txt2img and img2img attempts at graffiti generation; (2) image transfer from scaled prototype models; and (3) context transfer from original and representative images. The number of tests, each subjected to various building or urban fabric situations, reached 50 for the prototype design scenes; the graffiti with murals; the same 3D models but in different scenes or orientations; and a loop of the initial, developing, fully occupied, and cover-up stages.

The created graffiti was originally retrieved from a surveyed or reported environment by controlling specific checkpoints and prompts. The number of tests carried out confirmed a diversified elaboration of the interface within a well-defined boundary. For the base samples, I took a traditional building element to construct a region with the outcome constrained by a mutually excluded layout. For the contrast samples, I simulated and constructed a region to reveal the outcome without the constraints of a mutually exclusive layout under possible layout rules in zigzagged adjacency with/without self-adjusted sizes and boundaries; partial overlapping; and multiple overlaid themes in a vertical, horizontal, or large–small-scale layout (Figure 6).

The AI models were found to enable the prediction of the distribution, development, style, altitude, orientation, area, and allocation of graffiti on a building façade in general. Little interface-related deployment was found for overlapping, superimposing, or interlacing adjacent graffiti. In contrast to the preference for layouts with graffiti placed in lower-altitude areas, this hierarchy-related behavior was found to be similar to traditional declarations of territory or sovereignty or the principle of "first come, first serve". Unexpectedly, graffiti was also found to be distributed underneath a utility box, which was a novel viewing angle from the street.



Figure 6. Example of zigzagged adjacency with self-adjusted size and boundary; partial overlapping; and multiple overlaid themes in a vertical, horizontal, or large–small-scale layout.

4.1. The txt2img and img2img Attempts at Graffiti Generation

Both the txt2img and img2img attempts contributed to the purpose-driven simulations of graffiti. They enabled a lower-level deployment of graffiti and a near-full-façade deployment of a mural in txt2img (Figure 7). The large supporting base of the checkpoints enabled this part of the study to be performed.



Figure 7. A lower-altitude deployment of graffiti and a full-façade deployment of a mural using the txt2img method.

4.2. Image Transfer from Scaled Prototype Models

An elaboration of the 3D prototype models for the building mass found that they represented space in terms of abstracted metaphor, transparent and semi-transparent depth, and mechanic texture (Figure 8).

The tests were conducted on images from design competitions. The cubic form consisted of multiple volumes and faces in volumetric or linear composition. In addition to the graffiti on faces, linear thin members or fragmental elements were usually deformed. The new graffiti generally followed the original composition of the context and was not oversimulated in the scene. As a result, the preferred outcomes were generated as an extension of the original design in a smaller and more focused elaboration (Figure 9). In contrast to only attaching and reinterpreting the subject surface, reinterpreting the scale and context meant that even small linear elements could be addressed (Figure 9).

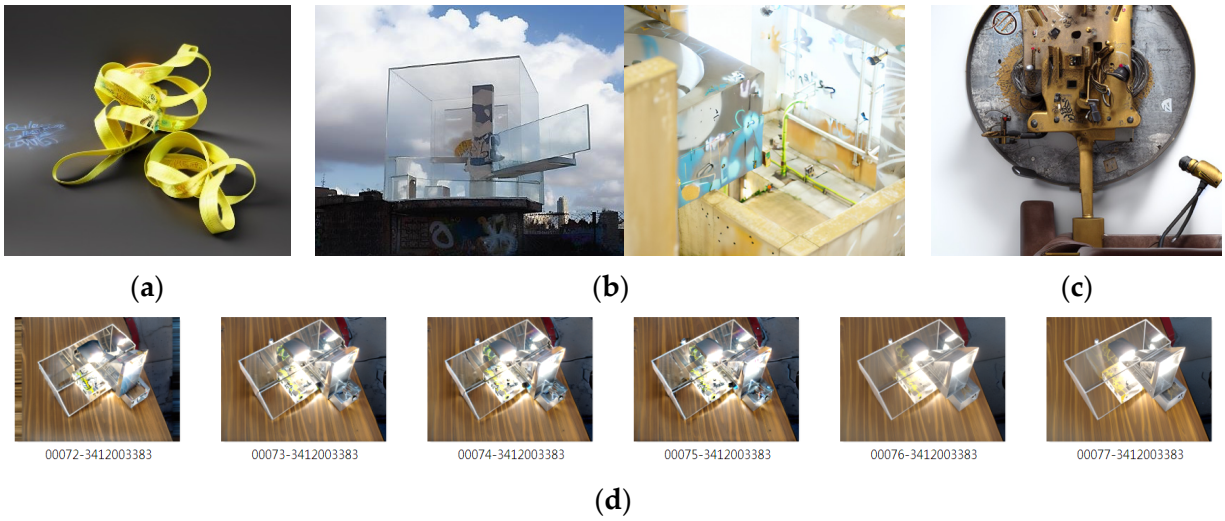


Figure 8. Space in (**a**) abstracted metaphor; (**b**) transparent and semi-transparent depth; (**c**) mechanic texture; and (**d**) an elaboration of the 3D prototype models for the building mass.

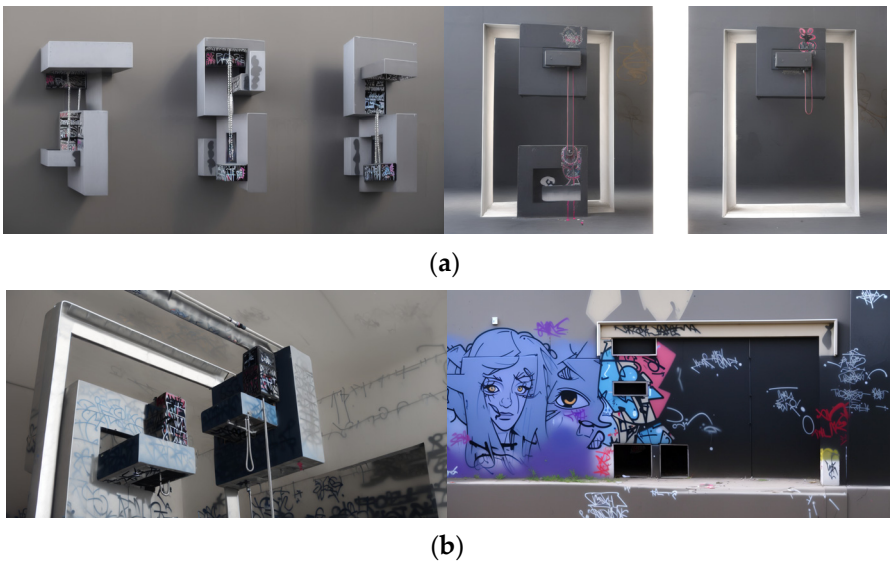


Figure 9. (**a**) The outcomes generated as an extension of the original design; (**b**) the reinterpreted element scale and context.

4.3. Context Transfer of Situated Walking or Driving Images

As mentioned earlier, the context used for graffiti generation involved the graffiti as the third skin, the remodeled façade as the second skin, and the original façade as the first skin. The second skin added remodeled parts to the first. The third added graffiti to the second. Each phase caused context transfer due to the addition of new components and shuffled the topological layout of the previous one. When graffiti joins or divides different parts of the façade to suit the needs of the canvas, details can be merged. As a result, a façade or parts of it are recomposed recursively whenever new artists are involved.

Context transfer was conducted along a daily route on campus and from a car windshield. A matrix of results was created as a reference point for a follow-up study. The original and representative images were obtained from casual pictures and study model samples (Figure 10). The former presented more visual and structural details from the real world than the presentational, abstract style of the latter. Although the graffiti generally followed the segmentation of a face layout in the orthogonal form, the free form enabled a similar configuration in terms of curved edges and boundaries.

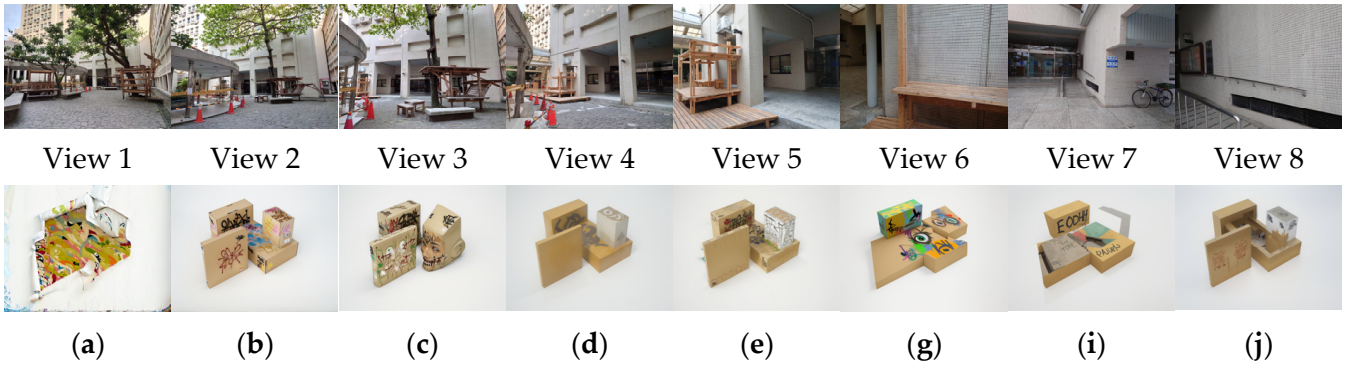


Figure 10. View 1–8: the sequential images to be applied along a walking route; (**a**–**e**,**g**,**i**,**j**): exemplified images in different settings to be applied ("f" and "h" were rejected).

The two sets of traversal experiences created very important spatial scenarios since the images contained different foreground depths, wall sizes, linear member sizes, composition weights, void–solid alternations, and visual foci. The approaching sequence was also very important in scaling the graffiti to a courtyard (Figure 11a) or driveway (Figure 11b). Walking inside a graffiti corridor was similar to an enclosed tour experience. The connection between scenes enabled a deeper insight into to how graffiti may change the context of a space or redefine an element's appearance in SD. Therefore, this approach to landscapes or building exteriors brings attention to detail with the new potential role of the SD model database.

Scenarios can be applied for a more situated simulation in addition to the most sufficient SE model, image database, and training cases. In this case, graffiti is judged on whether it follows the context in the image exactly, differentiates between the foreground and background, creates new grounds in a remote dark background, identifies thin and linear objects for creation in vertical or horizontal layouts, maintains the original texture, generates results out of the predefined context, merges adjacent non-coplanar polygons into one large flat canvas, or transforms the foreground object into new symbolic images. The self-contained SD images are currently the most representative. However, without reference to a human-scale feasible object, the result may be out of context.

Combining prototype 3D shape and seed effects is better than just learning from txt2img. The alternation between the CFG and the denoising function makes context transfer from a familiar scene or experience easier, allowing prediction in new scenes under subjective or more objective tolerance and enriching the previously familiar composition of the urban context. The former seed tests came from image samples of typical architec-

tural study models produced by the author. The adoption of formerly tested seed sets was very useful for enriching the generating branches in the following cases.

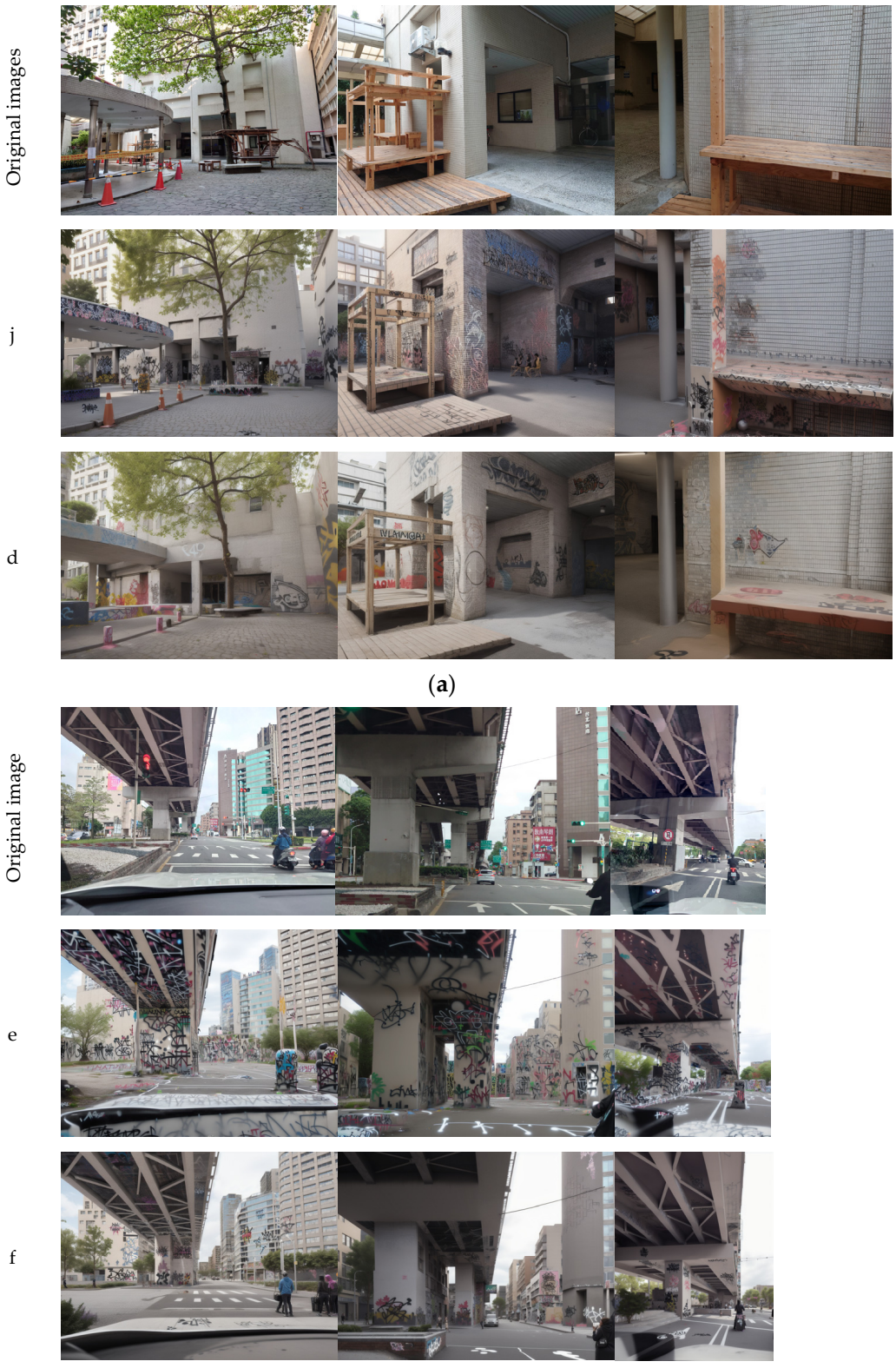


Figure 11. Context transfer generated by SD for a daily route: (**a**) on campus; (**b**) in a city (The "j", "d", "e", and "f" are settings originated from Figure 10).

The viewing frustum, which zoomed in and out along the route, switched periodically between a detailed view and a wider angle to reflect the graffiti layout and the scale of the second skin of the fabric. Close-up looks introduced richer details into the AI generation. It was found that the graffiti was dense on the lower part of the walls and sparse on high walls. Mosaics with dividends and divergent symbols resulted in rich, filled, and novel contexts. It may be difficult to identify the faces as completely different entities in the overlapped area after the final generation. It was also checked whether the ceiling or ground had graffiti, for generality and in terms of difficulty when it was not a reachable height.

4.4. Context Transfer of Existing Graffiti

A unique site was found and analyzed for the development of graffiti (Figure 12). It included a rich composition of fabric on the second skin: a planar wall, extruded HVAC utilities, linear pipes, occupied graffiti areas, and small, unoccupied wall regions. There were a number of areas of overlapped graffiti on the two large areas, behind structures under a cooling fan, on a window cover, or over small plastic tubes, that created a gradually evolving second skin and graffiti under mutual influence. It showed an intensified development of the graffiti and murals at the final stage that not only occupied further surface areas but also redefined the already painted areas with new graphic characters and styles. Moreover, the edges of the bubble graffiti remained unique, similar to the style created in the peripheral areas.



(**a**) (**b**)

Figure 12. Context transfer generated by SD for rich composition on the second skin: (**a**) original image; (**b**) generated image.

One of the most significant differences was that the old semi-revealed graffiti under the two major pieces was either ignored or reinterpreted as a different entity. In other words, the chronological interaction, which is usually an important aspect of the interface, was missing in the current stage of development. An interesting result was that it developed a unique surface under the HVAC utility boxes and on the curved surfaces of linear elements (e.g., the insulated pipes under a cooling unit) as a novel type of canvas space.

The degenerated graphics and reactivated faces may have come from accidental or algorithmic execution of simulation intentions. By observing the differences, I found that they enriched the graphic layers, enlarged the potential area of the building façade, preserved the history of the art on the wall, and reorganized the connections between daily creations. This graffiti was created on the building façade just to the right of the entrance of a convenience store.

It is recommended that the AI-generated results be examined to determine the feasibility of using these newly developed simulations. Although the results were enlightening,

this approach has been used as an observational tool rather than a creation tool and had a predefined model.

4.5. Illuminated and Abstract Contexts

Some of the generated results were produced under high-contrast illumination, such as spot-lighted installations or city night scenes (Figure 13). The dark surface also enabled a rich configuration and layout of graffiti, which reminded people of traditional creation environments and novel urban night landscapes.



Figure 13. Three examples of generated night scenes of graffiti.

From the foliage pattern of a tree to the abstract form of Mondrian, the allocation of graffiti represents a familiar spatial structure under hidden partitions in simulated reality (Figure 14). Although graffiti is attached to existing building components, it can also be considered as an alternating arrangement of void and solid forms. I explored graffiti as an annotation added to the composition, similar to applying spotting moss in Chinese landscape painting to create a visual balance, hide-out, or interface between tree and ground level. Moreover, the passive gesture and application of moss are replaced here with a more actively displayed statement in the form of graffiti.

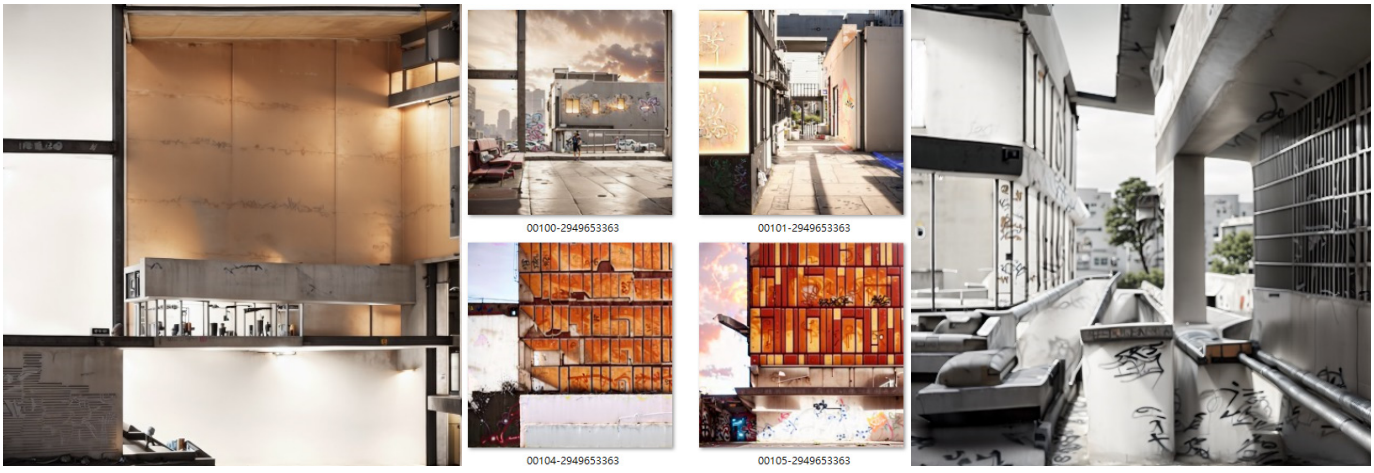


Figure 14. Mondrian-based elaboration of spatial partitioning and grouping.

The forward and backward elaboration highlighted the interaction between graffiti and the space context as a design-oriented development. The forward elaboration created graffiti within a matrix of base image, new context, and composition. This is a direct deployment of graffiti. The backward elaboration reconstructed the context before deploying graffiti. This is used to reconstruct spaces for graffiti.

5. Discussion

This approach presented a divergent measure using an AI generation tool instead of a design tool. In the simulation, however, the boundary between both aspects was blurred in terms of the forward development and the confirmation of the original intention. It was found that each fabric style contributed to an interesting seed range of mapping. The fabric was proven to be closely related to the unique style and context of the geospatial composition. Although a similar framing and seed can be selected for different locations, a zoomed-out frame showing the landmarks and context of a subject exhibited the unique identity of a place. Prompt keywords were applied to specific compositions where a new layout was applied.

This study was more concerned with the dynamics of the context elaboration than with the effects. This is similar to how the urban fabric evolves through and is adopted by graffiti as a positive design-oriented solution. The urban fabric was developed with a prototype street scene using seeds from already developed surfaces. While the proof or adjustment of the fabric is followed by observation in surveys, SD may not follow this under different models of the checkpoint; for example, the geometric configuration was changed as well as the final allocation of the graffiti.

5.1. Chaos Prediction from the Study Models

Well-predefined subjects or issues include the cultural landscape, graphic databases, and public recognition. It is still undetermined whether a typical form can be used to represent graffiti in general. However, with the assistance of an AI model, a well-defined generated environment was applied to provide a thorough description of a hidden but familiar form on a background. Additive generation on the plain faces resulted in the universal application of graffiti on all surfaces through the adaption of background knowledge to the urban fabric.

The fabrics featured thought-provoking ideas of hidden graffiti composition brought to reality. The interaction with urban fabric planning results in a hierarchical engineering of graffiti application on the first, second, and third skins (Figure 15). The sequence of occupied void spaces on façades presented both culture and identity in a virtual construction. SD was used for chaos prevention, not for the presentation of the fabric. As a result, the forward prediction foresaw a possible evolving or changed third skin.



Figure 15. *Cont.*



Figure 15. Recursive application of SD to generative filled Photoshop® outputs.

5.2. Generalization, Context-Aware Graphics, and Homogeneous Aggregation

Negative graffiti simulations were created more easily compared with the compositions of artist murals. Most of the results followed the traditional form of graffiti, being more character-based rather than mural-based in terms of the layout and size of the scene. Variation may result from an adjusted relative scale between humans and the second skin.

- Generalization: Here, any image can be applied. Graffiti can be imposed on almost all images with a proper seed to match a similar reference of a common view of a street composition on the background. It is a scene that is renewed, redefined, merged, or changed into a completely different one, which is not trivial. It retains the result as a whole in any space segment. Different checkpoints can be applied. A large difference was even created with a semi-transparent scene since the see-through scene became a unique view in contrast to painting on an opaque surface (Figure 16). A black background may produce a less appealing result as it is merely a black-colored façade rather than a void space.

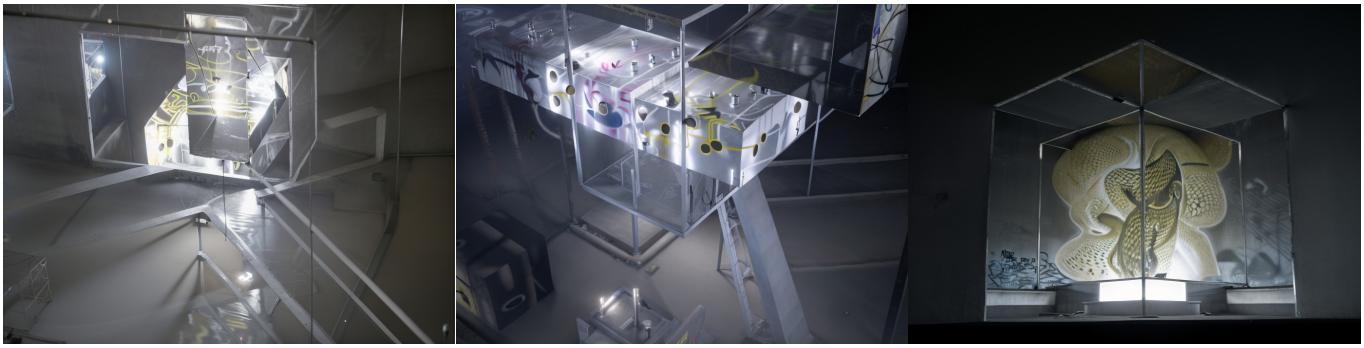


Figure 16. Semi-transparent scenes.

- Context-aware graphics: The alternation of the CFG (7.5) and denoising strength (0.5) tests determined whether a predefined 3D form could be faithfully followed to designate graffiti and whether partitions existed (Figure 17a). The early tests found the preferred checkpoint and sampling methods (Euler a), in addition to the above-mentioned measurements, using the "graffiti on all faces" prompt in img2img. However, the partition may be merged into a new topologic re-arrangement of the surface polygons and cause a cross-gapped creation layout.

This finding is very important for a field composition in which special graffiti may be applied to a number of façade polygons or even across streets. It shows the intention of an artist to deliver a complete image instead of fragmented ones.

Mosaics with dividends and divergent symbols resulted in rich, filled, and differentiated contexts (Figure 17b). More rich details appeared in a close-up observation. Due to an incorrectly enlarged scale, the ground had extra graffiti at a general reachable height.

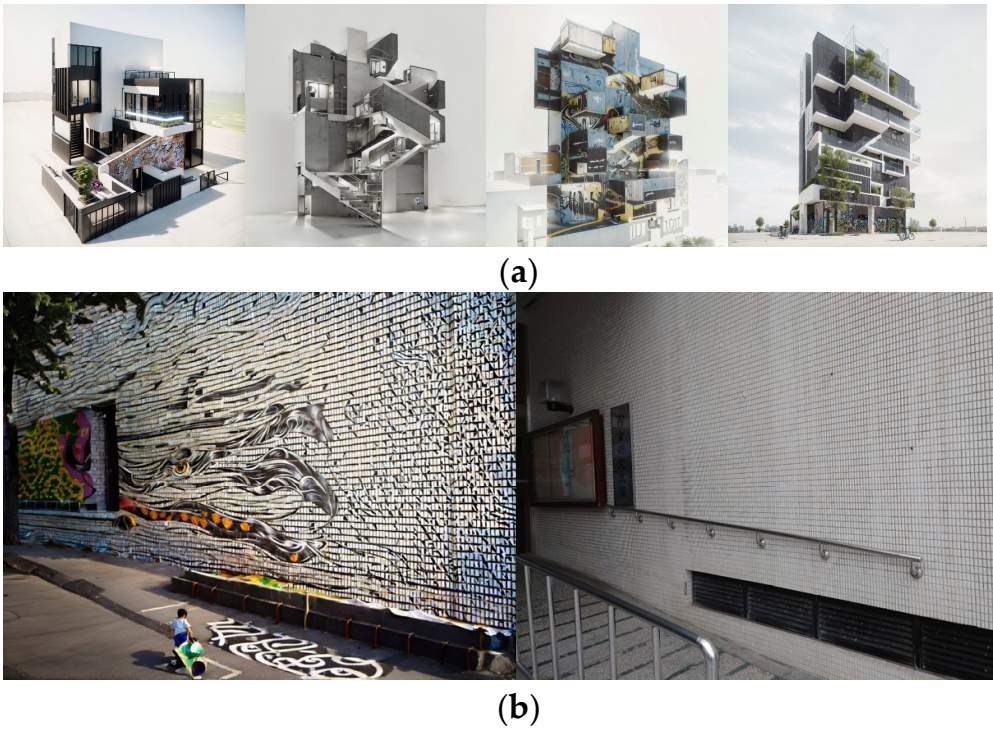


Figure 17. Graffiti: (**a**) partition-referenced deployment; (**b**) under redefined scales.

- Homogeneous aggregation: SD generation aims to center around a similar context and content of graffiti (Figure 18), while the reflected scene may not provide a correct reference for AI generation. It seems that the generative process can follow the description of context in an image. The result created a homogeneous aggregative effect of a group of graffiti near the edges or within faces.



Figure 18. The effect of homogeneous aggregation on graffiti stickers.

5.3. A Sequence of Scenarios

Contexts were semi-transferred along a route through AI, although the same viewpoint was not revisited.

- Zoom-in/-out sequences: The zoom-in sequence, which presented a visual experience from a broader scope to the detailed part of a façade, generated dramatically different AI-assisted results. This variation came from the predefined relative scale between a human and the second skin, in which most of the graffiti was created within a relatively reachable boundary of the canvas. The generative AI mostly presented the results in the above-mentioned relative proportions. However, murals enable larger scales and may cover an entire façade. The tests also presented an evolving result, which gradually occupied all the available area.
- The upward landscape of 3D fabric: A low viewing angle or upward landscape, such as that of a pedestrian or a car driver, has a different projected planar viewport of the higher 3D fabric. The image-based generation that included faces perceptually hidden under a utility box still generated creations underneath. It was found that the eye level of a pedestrian or a driver should be considered and can be captured using a camera. Although the viewpoint may be different from the one perceived by the artist during painting, the alternative viewpoint enabled the graffiti to be designated on the situated layout as proof of a unique type of conversation between graffiti, artists, façades, and visitors.
- Prelude and postlude: Graffiti and murals are usually preceded by a graphic symbol or quote as a signature. Graffiti wants to be introduced. It represents a demanded formal social gesture on both sides of visual depth. The campus walk scenario illustrated the prelude and postlude of graffiti clusters from one end to the other, subject to a gradually changing scale, level of detail, and visual depth. Similarly, graffiti was created through planning, followed by a web cast during the process, and ended with a group photograph, a signature layout, and a hidden remark as the postlude.

A three-level hierarchy of a personal ID along a path was found in a real case, represented by (1) an iconic portrait-like name card on the entrance, (2) the graffiti, and (3) a portrait on the back side of a notice panel. It was similar to an artist's portrait being attached outside a showroom, which was the bicycle route and the pavement in this case. An additional two-level hierarchy was also created by the graffiti on the wall and the name painted on the ground level in front. In fact, the name as a postmark is usually maintained long after the graffiti or mural is replaced.

5.4. Reinterpreted Combination of Context

I found that the rescaled and reinterpreted context was the most creative result from the generation since it provided an unexpected perspective on the interrelation between the people who apply this tool. The number of iterations in generative AI helps a researcher to learn or apply almost every available variable or resource to the original or second skin of a building façade. The presumption of a well-controlled iteration or generation is a shared learning model of the uncertainty defined by seeds. This is an important learning process stemming from unexpectedness, which has since developed into a popular region for subjective exploration. It provides an assessment of uncertainty with a fuzzy boundary, which is subject to evolvement even when using the enriched language model.

Do we need tidy graffiti anyway? Do we need to change graffiti from a chaotic to a tidy form? Routes are always full of combinations of types of graffiti. Four combinations are identified: simple form—simple graffiti; simple form—chaotic graffiti; chaotic form—simple graffiti; and chaotic form—chaotic graffiti (Figure 19).



Figure 19. (**a**) Simple form—simple graffiti; (**b**) simple form—chaotic graffiti; (**c**) chaotic form—simple graffiti; (**d**) chaotic form—chaotic graffiti.

5.5. Filling in Void Space

Two stages were applied to the original surface and the secondary infill of any remaining void space (Figure 20). The infill was more a form of casual creation, which changed both the prefilled graffiti and the remaining void space. The void preference, which is one of the most basic and general interfaces with other existing graffiti, may or may not develop as expected.

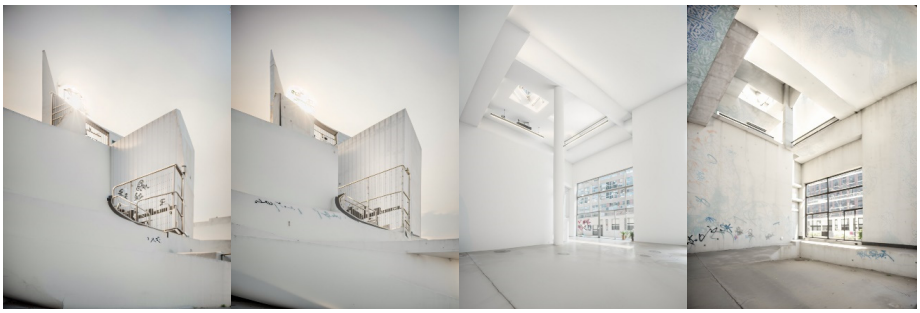


Figure 20. Sequence for a surface with graffiti and for an empty space filled in with graffiti.

In the set generated from the campus images, Photoshop® was used to define the void regions and to further assess the relative percentage. The divergent selective tools enable a well-controlled region for generative AI, although the final scaled effect may imply less divergent outcomes. The "inpainting" of graffiti presented a way to control the occurrence of graffiti in a specific region. However, it does not seem to be a preferable way to predict the natural development of graffiti amongst existing pieces. A more variable setting should be explored to develop the appearance behind the evolved hidden context.

5.6. Contribution and Limitations

The generation of graffiti using AI contributed to the reinterpreted resources under exploration in this study, with fundamental attributes of texture or fabric. The diversified resources included images from the physical world, SD-generated results, Photoshop® generative fill, and 2D icons. The expanded elaboration included different scales and scenarios of the urban fabric, and the fundamental attributes of transparency, texture, and low-lighting conditions. To summarize the contribution of this study, it was the categories of static frames and progress layout (Figure 21) that are accomplished from generative graffiti as a reference base to enrich the following case. The settings and scenarios are to be applied and possibly be used to evaluate the feasibility of generative requirements.



Figure 21. The working settings and scenarios in static frames and progressive layouts.

The novelty of this approach includes the elaboration of cross-generative platforms and a broad context evolvement defined through variable-led exploration, even with a similar allocation composition applied. Comparing real-life graffiti and its connection to AI-generated pieces will allow the old urban fabric to be reconsidered with a re-established spatial hierarchy of social behavior and graffiti on existing sites (Figure 22).



(**a**) (**b**) (**c**)

Figure 22. The development of social hierarchy: (**a**) the original view; (**b**) the image with few articulated mutual layout; (**c**) the image with chaotic deployment of hierarchy.

It seems that SD generates graffiti for all kinds of urban fabrics wherever an opaque and textured wall is located. Graffiti can be generated for small-scale urban scenes, too, but usually at a size too small to identify. For the best evaluation, sufficient space should be maintained for creation on the solid part of the building façade.

Should a tool have the ability to generate graffiti where none existed before without altering the scene? It also seems that more tests are needed on the transparency of glass windows or curtain walls if these areas are to be painted. Since the glass areas within window frames are fully transparent, it is unlikely that anything will be applied to them. There were situations when the graffiti required a more detailed tuning of scale value. Like painting, nevertheless, void spaces and plain areas were usually the first places available to apply graffiti. Unless a specific range of scale value was selected to cover the entire scene with graffiti, graffiti in the void part was usually limited, as shown in Figure 20. It

usually occurred when a part of the façade was zoomed in so much that no variation in color, texture, or geometry was presented in that area.

There is a trade-off between a general and specific scenario of application to the materials on building façades. Future research should emphasize intelligent image segmentation to help designers identify specific building parts for generative AI. This is similar to a series of controlnet types working together, for example, to paint graffiti only on the second glazing within a totally transparent triple-glazed window.

It is difficult to evaluate the process and results. The deployment of graffiti is considered a design process, which is created based on as-built buildings and urban design. The evaluation of a designed result is based on the fulfillment of requirements, which is case-dependent. In addition to the quantitative setting in SD, the experience of application is additive in a new design.

Most of the figures were generative images purposely selected from sets of tests. The images were used as iconic notes with PNG information accessible. However, each image was unique, and the inherited tension may not be fully duplicated. An example can be found in "4.5. Illuminated and abstract contexts": the abstract form originated from Mondrian. Similar compositions or seeds can be applied to match the original composition but end up within totally different contexts.

6. Conclusions

All designs should include AI-generated graffiti in multiple scales on building façades and the adjacent city fabric. AI-generated graffiti shares the same levels of creativity as traditional graffiti despite their different measures. Is graffiti always governed? For planning purposes, graffiti that is coherent with the urban context also seems to be subject to the constraints of AI governance. The ability to transfer context represents an important similarity to traditional graffiti, which is also a novel advantage.

Visualization was conducted on the urban fabric based on negative and opposite generations along a route or using representative imagery. The AI-aided visualization of a building façade and the urban fabric enabled us to perceive a city by referencing the existing graffiti. The interaction between an engineered graffiti hierarchy and building façades should be foreseen and added as part of the architectural design process.

A spatial structure with an equal hierarchical allocation of graffiti resulted from multiple evolved and chained behaviors in a more complicated and intensive combination of the prelude and postlude. The approach to the context transfer along a route or from a windshield presented here was an extended simulation of this. Almost all façades were found to be applicable. AI generation enhances awareness of the urban fabric and facilitates a review of both the human scale and buildings. It provides valuable insight into spatial traversal in creation through the deployment of graffiti.

Future research will focus on the difficulties that arose during the aggregation and segregation of sub-regions in the generation process, which is often a very straightforward process for humans.

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