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The Versatility of Generative Arts in Digital Media Production

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Main Outline

Abstract

This essay explores the impact of generative art on digital media production. It begins with the examinations of the role of generative art in creating convincing visuals across industries. It then covers the evolution of computational tools and their transformative influence on creativity. The conclusion addresses concerns about technology threatening jobs, emphasizing the importance of embracing these tools for career growth. As generative art evolves, it fosters computational flexibility, collaboration, and innovation. This paper suggests that creative computation will soon be an essential skill in the industry.

Introduction

Digital media has evolved into multiple forms. It is used widely in various creative industries like film, animation, immersive arts, and social media. Due to its versatile purposes, creative tools emerge accordingly. For example, as a 3D artist, there are many software options. Each software may appear differently, but they share many similar functions ranging from simple tasks like beveling a cube, lighting a scene, or building the whole ocean from fluid simulation.

In addition to computers, the spike of media consumption also makes production on smartphones possible. Social media platforms, such as TikTok or Instagram, offer intuitive features to produce reels. This all-in-one tool also includes access to an infinite library of sound and editing capabilities until the end of the production pipeline. As a result, tools appear as wider options, and this remains as an artist's choice which tool they would like to be expert in.

On the other hand, knowing every software used in the industry is impossible. Learning tools wisely will be beneficial for a creative career. As computer technology advances stronger throughout the year, creative computation has become part of many workflows. This growing trend suggests that generative arts and proceduralism will soon be the fundamental skills in the industry.

This paper will introduce the benefit of generative and procedural methods on digital media production. This includes the examinations of how procedural elements work on our perception, leading to countless possibilities to produce convincing imagery in many creative disciplines. Furthermore, the workflow also improves the ability to manage assets while having constant updates of tools, and providing flexibility to rapid changes from current situations in media consumption. Because of this, creative computation is becoming an essential tool for success in a creative career.

Definition of Generative Arts

According to Philip Galanter, generative art refers to any art practice in which the artist uses a system, such as a set of natural language rules, a computer program, a machine, or other procedural invention, that is set into motion with some degree of autonomy, thereby contributing to or resulting in a completed work of art. The author also adds that there is much confusion that comes with the term. For example, generative art does not completely belong in the set of computer art and “procedural invention” can reflect the incorporation of biology, chemistry and other physical processes as well (Galanter 151).

Fig A. 77,000-year-old generative art etched in red ocher. Photo courtesy of Prof. Christopher Henshilwood, University of Bergen.

For example, the author shows that the figure above is an example of generative art, even though it is not created by computer but because the strokes are executed by a symmetry-based algorithm (159). Accordingly, generative art is a form of art that works with many disciplines, bringing in creativity from different directions.

As the term "Generative Arts" has become popular because of its uses across various fields, a wide audience may associate it primarily with generative artificial

intelligence. Generating images from text prompts or transforming images into video with generative AI, shape this broader perception that generative arts is generative AI. Doubtlessly, generative AI is considered generative arts, as there are tons of codes, rules, and algorithms initiating at the back end of the text prompt. However, it is a part of this evolving media creation, and it is not the only element that wholly defines Generative Arts. Generative AI is a generative art, but not all generative arts are AI.

From the above evidence, common ground between generative AI and other methods of generative arts is proceduralism, which plays an equally significant role, where tools and software act as computational resources, reducing the need for manual effort and lessening repetitive tedious tasks. Procedural method allows users to manipulate their creation through algorithms, sets of rules and parameters to generate content systematically(Autodesk).

Judson Rosebush defines proceduralism as an art movement defining “art made by employing scripted, notational directions that specify processes and parameters.” Similar to Galanter, the author points out that proceduralism does not necessarily need a computer but mainly focuses on how an artist manipulates medium (55).

The definition of procedural art also appears outside the world of computer graphics production. In *Functional and Procedural Definitions of Art*, Stephen Davies points out the difference between a functionalist and a proceduralist’s point of view toward art. The author mentions Marcel Duchamp’s *The Fountain*, which was a urinal turned on its side and presented as fine art, as an example of the establishment of art status through a proceduralist's view. Duchamp uses his credibility as an artist to establish this typical day-to-day object as art and it was considered as such by the art world. Therefore, the status of being an art is conferred by the artist themselves and this is accepted widely by critics and art institutions. It follows the procedures which in this case, are defined by the process of recognition within the art world (100). In contrast, this raises a controversy suggested by the functionalist's view. The functionalist may argue that *The Fountain* is difficult to be considered art because of its lack of “aesthetic interest" or other functions, like thought, concepts, or motives, compared to traditional sculpture (101).

According to this philosophical context, procedural art can be established through institutional processes, in contrast to its definition in computer graphics that emphasizes algorithmic processes in the creation of art.

Undeniably, “generative arts,” “procedural arts” and “computer-generated arts” are similar, relative, and widely used in many contexts. Non-manual workflow and assistantship of computer-aid procedural generation in the world of computer graphics will be the main focus of the discussion, suggesting generative arts’ versatility and importance to the evolution of digital media production.

Chapter I: Practical Uses of Generative Procedures Across Industry

Digital media production can face multiple constraints. Examination of generative arts’ roles across the creative fields show that the incorporation of these techniques efficiently improves the production pipeline. Implementation of these techniques works well to trick our perception of the art as they help bridge the gap between our immersion of the art and realism.

On the Perception of Endlessness and Continuity

One of many key strengths of generative and procedural methods is the ability to amplify and expand existing media. Procedural elements can be crucial to extend the media source when it needs to serve its audience for a longer period than its actual length. For instance, Immersive art events usually last hours or days, and creating enough content for the whole amount of time can be quite challenging. Consequently, looping animation and visual effects are widely used to keep the audience engaged without interruption. Throughout the year, procedural elements like random noises and patterns have been the key to this looping technique.

Noise, doubtlessly, is one of the most common generative elements that live inside many creative software**.** It has become a fundamental building block of many CG elements. The first ever gradient noise used in CG was created by Ken Perlin in 1983. The creation aided artists and computer scientists in terms of generating natural looking features in a CG world like terrain, random tree placement in forests, visual effects elements like water wave, fire, and other procedural texturing like marble**.** The

implementation of randomness proves to help production become more efficient with time and cost, offering new possibilities quickly and painlessly without excessive computation in the early stage (289). The invention of noise reflects the ability of new tools that shift away from manual workflow to procedural approaches.

Diving into how we perceive images, continuing random noise works with our imperfect perception as it is ineffective to notice gradual changes in light and color. Even though we're great at noticing a tiny odd element among its surroundings, we frequently ignore many things that are different from their surroundings, like how we normalize film grain and scratches while watching old film without being distracted (Feiner 103)**.** This imperfection of our vision aids the production of infinite and continuous media. Even though looping can be achieved by simply fading in and out the beginning and end, the transition of the whole content at the same time can be easily recognizable. To make the looping even more seamless, noises and random patterns can be used to gradually blend the clips with irregular patterns. This technique helps artists to identify different blending regions, so different areas on the clip have different transition timing and value. As a result, this will not abruptly create jump cuts of the beginning and the end and maintain the uninterrupted flow of the content.

In addition to looping existing content, generative patterns can be used to form new content in real-time. For example during a VJ session, noises and random patterns can be used to mask, warp, or distort images or videos. Furthermore, the fact that this creation runs in real-time adds another layer of engagement to the media, both to the audience and the performing artists.

Procedural creation exists prominently in the immersive arts world. Because of the media's live and interactive natures, removing limitations from media endings is very crucial. Procedural elements like noises and irregular patterns make immersive arts live longer on stage and prove that it is important to master this workflow in this creative field.

On the Perception of Depth

Many interesting features live in the perception of depth. Looking out into the cityscape in the middle of the alley, we see buildings recede into the distance. Morning fog looks mesmerizing, as the fog gradually masks objects further away. These details

occur naturally as we are living in 3-dimensional realism. To mimic these manually in media production on the other hand, can be quite challenging and inaccurate.

OpenEXR is a widely used file format that enables manipulation of above 3 dimensional visual effects within screen's resolution space. The invention of OpenEXR comes from Industrial Light Magic (ILM) during their progress on George Lucas' original *Star Wars* trilogy: *Star Wars: Episode 1 – The Phantom Menace*.

Having a sufficient dynamic range image is essential for lighting and compositing, especially dealing with an image of a real-world scene. Failing to have enough range may result in images having crushed shadow or super blown out highlights because of too limited range of image file(rromoff).

ILM successfully overcame this production issue with the creation of OpenEXR. The file format brings a high-dynamic range image with optimized file size for the artists to work with. The film director George Lucas supported this idea as well as ILM's public relation team to have the file format become open source to the public. Later on, the file format became popular among global artists and has been used widely in production in current times (rromoff).

According to *Visual cues and pictorial limitations for computer generated photorealistic images,* the authors point out that two dimensional imagery possesses binocular disparity. The generated imagery is produced from a fixed point of view from a CG camera, in contrast to how our perception naturally receives visual information by two retinas(Barbour 152). To overcome the monocular imagery, incorporation of depth and an emphasis on lighting tends to help ease the flatness of the 2D viewing plane, adding credibility to the work (152)**.**

A depth map procedurally generated from a CG camera can be used to mimic physical camera depth blur, lighting correction in composition, or creating volumetric fog based on the scene distance. The depth buffer has proved to be a powerful solution for screen-space visibility determination**.** Additionally**,** Image space is a good place to solve many graphics problems because solving at the resolution of the output avoids excessive computation (Feiner 1037).

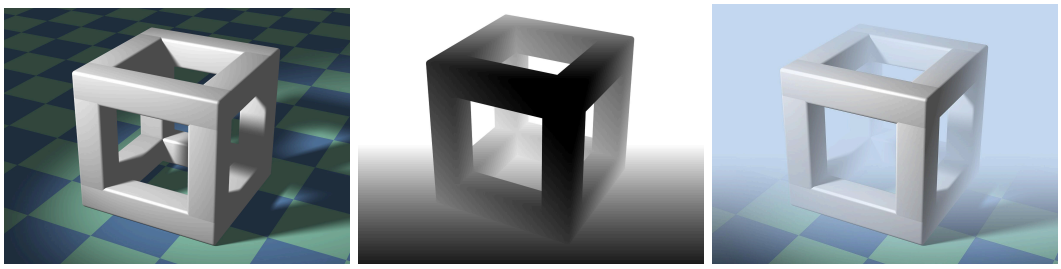

Fig. B. Application of depth map by adding a blue mist based on black-and-white information. https://en.wikipedia.org/wiki/Depth_map. Accessed 24 Jan. 2011 (Dominicos)

Generally, a depth map is rendered in linear color space, simply meaning that numerical intensity values stored in the image file correspond proportionally to their perceived intensity (Sewell). This provides an accurate spatial relationship between objects in the scene and camera, which is the replication of us as a viewer to our environment. The depth information is stored into a single channel, viewable as a black-and-white image. Objects that are closer to the camera will be darker and objects that are further away into the background will gradually fade into white. Areas that appear to be darker (closer to the camera) will have a lower value closer to 0, and brighter areas (further away from camera) will have a higher value into the distance (Feiner 1039).

Figure B above shows the example of depth information, extracted from a 3D render. It closely appears as a scene filled with heavy fog, leading to multiple use cases like creatively grade color based on the distance, or blurring objects in certain areas to guide focus. These techniques can be achieved mostly through post production, which require less computation than achieving this look straight from 3D rendering.

Consequently, working with these effects at the post-production stage simplifies image correction while maintaining flexibility and creative freedom. The role of creative computation extends beyond its impact to continuity. Similarly to immersive arts, procedurally generated depth information can be used to convince our perception of depth on a flat two-dimensional screen. The application of depth information has been used widely in film, animation and games, especially to create a convincing view of vast environments.

Roles in Social Media

Social media has become the mainstream source of information for users around the world. Surprisingly, we often see new forms of posts starting from photos, videos, ads, and reels. One of the most noticeable presences of the newly emerged form is split screen content. Its general appearance does not require a highly polished look, resulting in the opportunity for generative arts to play a role in content creation.

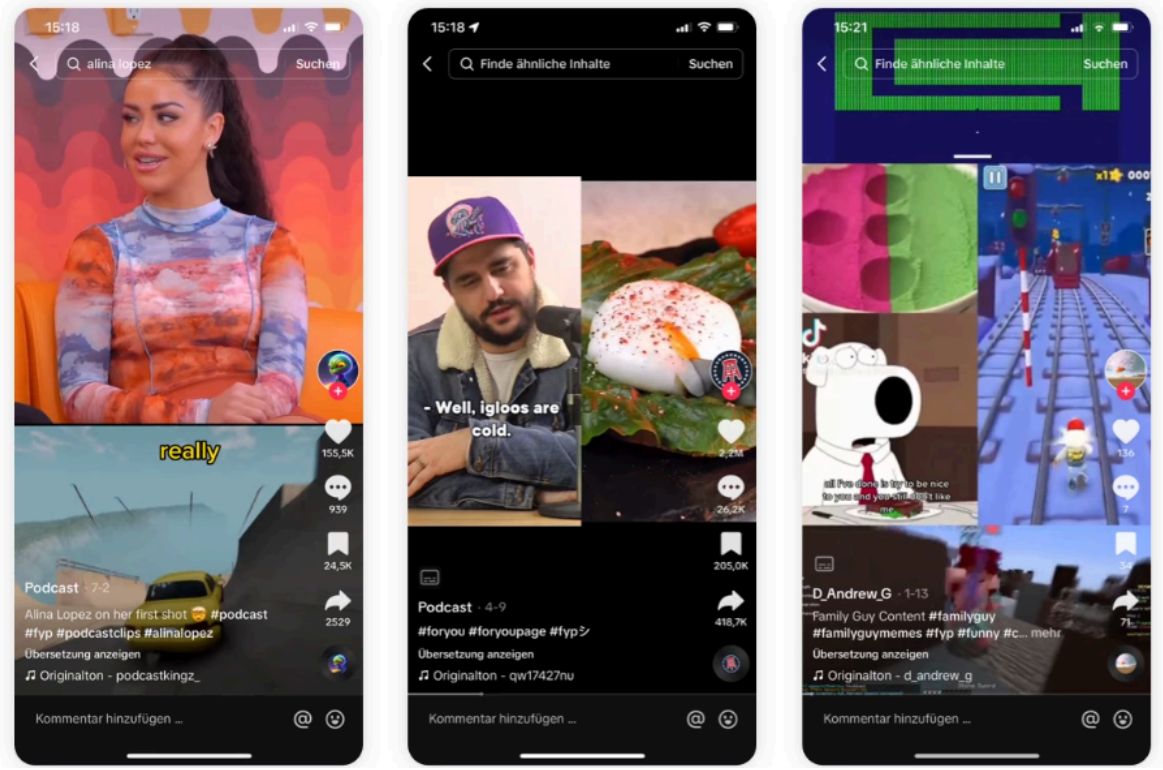

Fig. C. Common appearance of sludge content on social media.
https://placid.app/blog/what-is-sludge-content-and-how-to-create. Accessed 6 Nov 2024 (Ulrich)

This “sludge content” has been produced popularly because of its ability to grab attention and its simplicity to produce. They usually appear as split screen, with main content side by side to the unrelated content. The unrelated content usually appears as video gameplays, memes, celebrity interviews, or satisfying imagery.

As the combination of videos does not require specification, procedural generation can be used to quickly automate multiple videos at once. Online tools like *placid.app* offer generative services to quickly create these videos. This automation includes a feature to access databases to determine popularity of the content, rising

hashtags, and visual trends, shortening the production workflow as the automation makes the decision making process faster on a non-specific element on the content.

Despite its viral aspects, generative tools for social media production can be a double-edged sword: Research by Suzan Deenal Pinto and Malavika Anakkathil Anil suggests that social media can be an effective tool to produce entertainment but negatively impact the ability to focus on daily life tasks, including inability to focus, promoting laziness, and creating mental exhaustion. Furthermore, nonlinear information processing like internet surfing can discourage productive learning strategies like ability to read linearly (390). Research by Dekkers and van Hoorn links social media use to individuals with attention-deficit/ hyperactivity disorder (ADHD). The authors point out that social media exacerbates impulsivity which also leads to increased symptoms of inattention as well (3). The review concludes that adolescents with ADHD are likely to show problematic use and social media addiction (10).

Above all, generative workflow and automation aids social media content production as it can produce high-quantity output in a shorter period of time. The rapid and random creation of generative content aligns perfectly with its consumption, where users frequently switch between pieces, often absorbing them with just a quick glance. However, quality of content must come from the producer's own creative direction. Rapidly creating sludge content is just an example of generative workflow's ability to catch up with media consumption trends. However, flooding the platforms with this content may not have a positive impact on the audience.

Overall Impact to the Industry

Techniques mentioned above are examples of how generative elements and procedural workflow trick our perception and attention to media. This consequently can help utilize digital assets efficiently as well as optimize production timeline. Beside their specialty in each creative discipline, some of the techniques can be transferable to the others. For instance, looping techniques from live events can be used in commercial videos, or procedural depth information in games can be used in film and animation as well. As these media types share many similarities of working with the audience's attention, generative elements and procedural techniques are the foundation of many possibilities behind their production.

Because of the vast possibilities of generative arts, artists and tool developers see the importance in these positive impacts, leading to software development that offer procedural approaches and non-destructive asset manipulation.

Chapter II: Current Trends in Creative Computation and Their Impact to the Industry

By examining notable inventions in the computer graphics world, we observe positive trends in how the industry embraces collaborative and customizable workflows. As a result of these features, Artificial Intelligence, Real-time Workflows, and Open-Source Technology have become the leading topics in computer graphics innovations.

Artificial Intelligence

Artificial intelligence is undeniably a prominent topic of discussion today. As previously discussed in this paper regarding the definition of generative arts, AI has become widely integrated and rapidly reaches audiences, already shaping the collective understanding of generative arts.

The history of artificial intelligence dates back to 1959, when Allen Newell and Herbert Simon invented the first functional "thinking machine," called the Logic Theorist. This program could prove mathematical theorems, simulate human reasoning through heuristic search, and generate logical proofs (Gugerty 4). It successfully operated problem-solving processes similar to human reasoning, raising questions about whether it should be classified as artificial intelligence or cognitive simulation (5). By demonstrating intellectual capabilities in both domains, the program paved the way for the ongoing development of artificial intelligence.

Sixty years later, artificial intelligence is embedded in our daily lives, performing numerous tasks and serving diverse purposes. One example is MidJourney, one of the most popular generative AI platforms available online. Recently, MidJourney reported approximately 20 million users worldwide, generating an annual revenue of $300 million (Mortensen).

An article by Cliff Edwards highlights the transformative potential of AI, as noted by NVIDIA executives and experts. Edwards explains that enterprises are leveraging AI to drive innovation, estimating that deep learning algorithms like OpenAI's ChatGPT—further refined with corporate data—could add $2.6 trillion to $4.4 trillion annually across 63 business use cases (16). For example, Richard Kerris, Vice President of Developer Relations and Head of Media and Entertainment at NVIDIA, emphasizes that generative AI will empower creators to transform media through prompt-based tools. He believes that concerns about job displacement will eventually diminish as task-specific training and artist-friendly tools will enhance creative freedom (18).

Real-Time Workflow

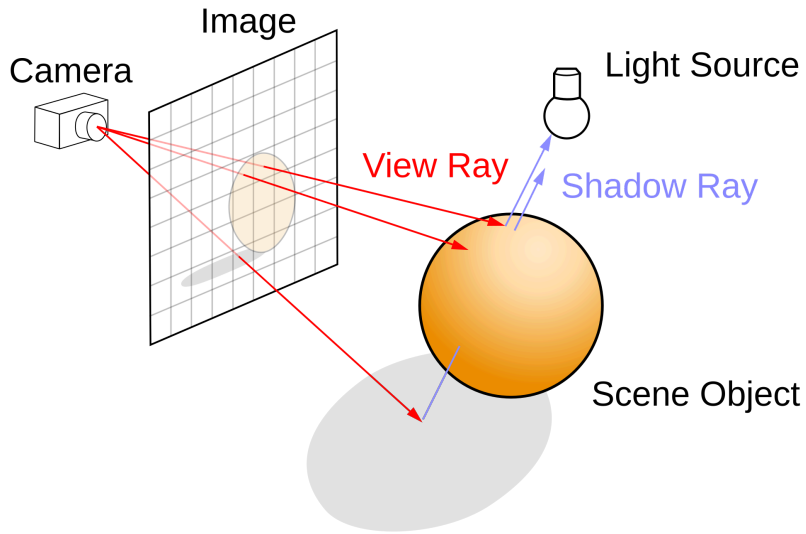

Fig D. This Diagram Illustrates the Ray Tracing Algorithm for Rendering an Image. 12 Apr. 2008, Wikipedia, https://en.wikipedia.org/wiki/Ray_tracing_(graphics). Accessed 27 Nov. 2024 (Henrik).

History of raytracing in computer graphics starts in 1963 by Arthur Appel. In his paper, *Some Techniques for Shading Machine Renderings of Solids,* Appel introduces the technique to simulate objects shading and shadow by tracing the path of light ray from an observer viewpoint, colliding onto objects in the scene, and bouncing to the light source. Shading and shadow then can be determined by the ray reception of the light source from the objects. In the scene, If the ray can successfully reach the light source,

the point that emits the ray will be considered as a bright spot. On the other hand, if there is a surface blocking the ray before reaching the light source, this point in the space will be rendered as shadow. As each pixel from the 2D viewing plane emits a ray for this calculation, the combination of all pixels in the image resolution will form a complete image of the rendered scene (Appel 40).

Who would have known that 60 years later, technological advancement allows this heavy computation to run in real time. This is enabled through NVIDIA's RTX graphic processing unit's highly innovative architecture. Equipped with RT Cores and Tensor Cores, the features are dedicated to specifically enhance ability to accelerate ray tracing operations, and to resample, upscale and sharpen images at the screen space with Deep Learning Super Sampling powered by artificial intelligence (NVIDIA).

RTX GPU from Nvidia has become the game changer in this field. The new invention aids creativity in real time production not limited to game, but also virtual production, architecture visualization, film, and animation. Able to see the scene being lit when moving around totally changes the process of scene building.

USD File Format

In a production pipeline, USD improves collaboration across departments by offering a consistent framework for managing assets, animations, and environments, reducing redundancy and enabling better scalability and performance. Its adoption leads to faster iterations, more flexibility in scene management, and overall enhanced pipeline efficiency. The file format has become the first open source tool that points out the benefits of scalability and interchangeability of 3D scene files.(Introduction to USD).

In the article by Delconte Ross, the author also points out that USD file format will soon become the common language for 3D file sharing as Its open architecture enables smooth integration with various industry-standard software and allows studios to adopt USD without overhauling their existing infrastructure(27). However, not many studios have adopted USD into their main production workflow yet. To become industry standard, the tools must be used widely enough by studios in the industry. The studios require investment in artist and developer training, as the USD pipeline is very technical. Gradual and stable adaptation may take some time before this actually happens(27).

The common trend in tools sharing

The tools discussed above are a few examples of many great inventions in the creative industry. Their significance is not only their practical applications, but also the mindset that the tools themselves and developers bring to the creative industry. They offer flexibility, transferability, speed, and non-destructive workflow.

From examining the current invention, we can see that these tools are developed in the way that they complement each other. For example, AI's generative power enhances graphic processors which allow real-time workflow to work smoothly in many CG software. Also, NVIDIA's plan to incorporate more USD pipelines into professional production can be seen prominently from the upcoming NVIDIA Omniverse as well (NVIDIA).

Even though these inventions were created by creative giants in the industry. But most importantly, these tools will soon become adopted to the broader artistic community as well. This commonality from developers has been living in the industry for a long time, and the emergence of tools based on these principles has been showing positive growth. As an individual, it is important to embrace these new workflows as it does not only improve media production but also connects us to the wider community.

Chapter III: The Fear and Myth of Technology

As the emergence of new tools shows promising efficiency to the workforce, questions of whether automation and creative computation may replace us as individual artists rise as well. "Robots will take over jobs" is a common sentiment, whether from the news, television, or especially, social media.

First, there is no significant proof strengthening the idea of how these new tools will wipe out job opportunities. An article by Pew Research Organization shows that the correlation between exposure to AI and job losses remains unclear. The article suggests that "AI could be used either to replace or compliment what workers do"(Kochhar). Instead, including the ability to manipulate automation and generative workflow may increase credibility and versatility in one's resume. Ziv Epstein and the others may agree with this statement according to their article *Art and the science of generative AI: A deeper dive.* The authors point out the relationship between the rise of photography

and painting that instead of completely replacing traditional painting, the camera forms a new artistic representation, a style that breaks painting away from realism (Epstein, 2). For instance, it is true that photography may threaten the jobs of portraitists or documentation painters, but this is only true in just short periods of time (Epstein, 9). Once the overall community adapts to the new tools, they settle as choices for the consumer regarding which media they would like to purchase or consume. Many people still like the painterly effects and actual brush strokes for their portraits, and courtroom painting is still appreciated. Photography is widely used in these situations but it remains an option among various mediums.

Similar to the situation between digital artists and creative computation, instead of replacing job opportunities, generative arts and procedural workflow introduces a new experimental art style. Some may argue that these arts look less polished or unintentional, but it is also undeniable that they are very effective at grabbing attention. Due to the current trend of short-form and non-linear content, these less-structured forms of arts are satisfying to look at. And above all, it remains a media option for the audience.

In addition to experimental uses, generative arts and procedural tools are not only good at surface-level entertainment. At the professional level, the creative industry also admires extensive knowledge on these tools as well. Many job applications ask their applicants what software they have experience with and doubtlessly, having experience with these new tools can increase the likelihood of securing a position in the field.

However, only having extensive experience with these tools does not guarantee future success in a creative career unless the artist themselves possess their own uniqueness and creativity. Above all, procedural software or generative AI are nothing more than just tools. They are made to serve artists. It is true in some cases that some of the tasks will be replaced by these new technologies, and who knows how much automation can take place in the creative process in the future. However, the more important question is, how much is an artist willing to try and adapt to these new technologies? As these tools are available to use and provide less and less creative limitations, what will an artist do with them? Ultimately, the value of art and design

comes from the core concept from the artist themselves. The outer appearance of them may be replicated or generated, but what actually sells the final product are the artist's execution and unique creativity. The fear of generative arts and procedural mindset only exist among those who know less to nothing about these new technologies. Embracing and exploring the new technologies will transcend these fears and take us a step further to the success in this creative career.

Conclusion

Generative arts and procedural workflows play important roles in digital media production. Their versatility lays across multiple creative disciplines and expands endless possibilities. The benefit of these new technologies also positively impacts the creative community from the individual level to bigger corporations. As tools expand and artists keep experimenting and exploring new techniques, proceduralism transforms the ability to create, share, and learn across the digital media industry. This is also a growing trend and proves to be necessary for artists to have hands-on experience with creative computation.

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