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The Expansion of Cognition and Creation Through Digital Technology

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The Expansion of Cognition and Creation Through Digital Technology

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1. Introduction

The interaction between human beings and art through technology has been going on for a long time. Technology is created and developed for its own purpose, but its convergence with art opens up new possibilities and experiments. The invention of the camera in 1826 was a tremendous stimulus to the existing art. In a time when people used to capture the world with oils and paints, the ability to capture scenes simply and precisely with a camera was a huge shock. However, this impetus led to the new artistic realms of cubism and abstraction in the 19th century, and the birth of camera-based art. Thus, art and technology have been converging, crossing boundaries, and constantly expanding.

These attempts to merge art and technology emerged during the era of collaboration between art and technology, when various experiments with technology pushed the boundaries of art and explored creativity. In 1960, at the dawn of technology, artists and technologists gathered in the United States and began new experimental activities, crossing the boundaries of art and technology through various interactions and expressions beyond the existing limits of art and the characteristics of technology. During this period, Nam June Paik explored the possibilities of television as an artistic medium through constant experimentation with the new but ordinary medium, creating the concept of video art and demonstrating diverse communication and possibilities. These experiments began with a TV-based canvas, but looked to the future of our expanding, hyper-connected, and trans-spatial society. Paik's philosophy and experimentation with media and art have inspired artists from all over the world, and have stimulated their imagination.

We are now facing an era of digital convergence, with advanced technologies such as AI (Artificial Intelligence) and VR (Virtual Reality). Beyond convergence and collaboration with art, technology is blurring boundaries in spacetime, changing the way we perceive and create. VR reproduces the human senses through computer simulation and enables the experience of spacetime. In addition, the Metaverse space enables activities such as performances, exhibitions, and exchanges of various people across the boundaries of reality, language, and culture, as well as digital asset transactions through NFTs (non-fungible tokens). In recent years, AI has gone beyond mimicking our cognitive processes

to challenging our creative process. AI rapidly visualizes what we have imagined based on massive information, rapid reasoning and interpretation, and challenges creativity with new stimuli by instantly generating media such as voice, image and video. These advanced technologies are expected to have a greater impact in the future, and the convergence and experimentation of art and technology is expected to create new trans-spatial experiences beyond our sensory extensions. The experimental spirit and inspiration of Nam June Paik will continue to push the boundaries of technology in a rapidly changing society driven by these technologies, and will continue to influence our activities as an invaluable foundation for envisioning the future of art and our society.

2. The expansion of cognition and creation through digital technology

As digital technologies such as AI, VR/AR, and big data continue to be developed and become advanced, they influence on spreading and converging of diverse fields. Above all, smartphones, which allow users to access the internet and media content in a mobile environment, have revolutionized the personal computer-centric culture and media consumption. In addition, sensing technology represented by Kinect has enabled more natural and real-time interaction with media by sensing body parts such as hands, feet, and face and measuring movements. Furthermore, the launch of Oculus Rift, a VR HMD (Head Mounted Display) in 2014, opened an era in which VR, which had been researched and utilized mainly in laboratories, could now be easily experienced by the public. The 2016 Go (Baduk) match between AlphaGo and Lee Sedol demonstrated that AI can challenge and even outperform humans, bringing the role and possibilities of AI into the spotlight. In 2020, the Metaverse, which overcame the restrictions imposed by COVID-19, allowed a wide range of people to communicate and interact across spacetime. Then, in 2023, Generative AI, represented by ChatGPT and MidJourney, showed that it could go beyond decision-making to create, which was thought to be the domain of humans. As a result, digital technology, which has been developed through mobile internet and computing technology, is now expanding human senses and cognition. It is also having a profound impact on our society and on the field of arts and culture as it seeks to enhance its ability to create.

2.1 Metaverse-based expansion of senses and cognition

The metaverse, which attracted attention due to COVID-19, was first conceived in Neal Stephenson's *Snow Crash*, a novel published in 1992, in which the protagonist of the novel travels between the real and virtual worlds through an avatar. In 2007, the Acceleration Studies Foundation (ASF), a nonprofit technology research organization, defined the metaverse as the form of a 3D Web in "Metaverse Roadmap," and the metaverse began to be recognized by researchers and the general public. In Metaverse Roadmap, the metaverse is defined as a three-dimensional digital convergence space consisting of the connection between the virtual world which reflects the real world, and the real world which reflects the virtual world. The applications of the metaverse were categorized into Life Logging, Virtual World, Mirror World, and Augmented Reality according to the characteristics of the realized space. In 2020, when physical activities were limited by COVID-19, the metaverse attracted attention because various activities could be performed in VR, and it was applied in many forms, showing the possibility of spacetime expansion. Among them, the activities of Live Logging, Virtual World, and Augmented Reality allow us to explore spatial and cognitive expansion.

Life Logging can be thought of as a reality that is created on the basis of the continuous movements that take place in the real world. Google Art&Culture scanned cultural heritage of art galleries and museums and built a database, and has been conducting education, exhibitions, and creative experiments based on it. VWL Inc created a data visualization about a movement of population in Korea for a year using data of moving-in report from Statistics Korea to intuitively visualize areas with growing or shrinking populations. In the context of global warming, Google has intuitively shown the impact of rising temperatures through visualization filters for life. In this way, Life Logging can acquire data on movement and flow from different perspectives and support cognitive expansion through visualization.

Virtual World is a virtual space where diverse people can meet and interact, expanding spacetime beyond physical constraints. Swiss choreographer Gilles Jobin performed in a space where several dancers wore HMDs that allowed them to perform together in virtual space and

track the movement of their bodies. The choreography is done in real life, but in virtual space, the spatial background can be changed in real time, and the avatar's shape, such as the dancer's height or race, can be changed. Epic Games hosted a virtual performance by Scott Davis on its gaming platform Fortnite, where people from all over the world could gather in a virtual space to watch the performance. The National Center for Asian Culture created *BBRUN*, a performance that took place in real time in virtual reality and allowed the audience to watch it through HMDs. The metaverse as a Virtual World allows people who are physically far apart from each other to meet and interact with each other at any time and in any place through VR.

Augmented Reality is a reality that merges with virtual space and visualizes real-world objects by matching virtual information to them, providing cognitive augmentation and an expanded reality experience. Gilles Jobin allows users to view choreographic content created in VR in Augmented Reality. Snapchat collaborated with Jeff Koons to recreate and display his artwork *Ballon Dog* in Augmented Reality, and hosted AR exhibitions that garnered attention in the U.S., Canada, Brazil, and more.

Life logging(data), VR and AR connected to the metaverse are expanding, and related research is underway to extend senses and cognition beyond audio and visual. The sense of smell, which has not received much attention, is studied in olfactory displays, which have an olfactory function and are designed to interact with spatial features. In addition, the experience of spacetime is expected to be further expanded as infinite mobility devices are being researched to enable the exploration and experience of infinite virtual space within a limited real space.

2.2 The expansion of cognition and creativity through the use of AI

Artificial Intelligence emerged at the Dartmouth Conference in 1955, where Marvin Minsky and others discussed its concepts and principles, and it has evolved ever since, with constant interest and disappointment. With the advent of deep learning, which is based on the improvement of computer technology, the performance of AI has been dramatically

38 improved, and the interest and expectations of AI are increasing. In particular, the 2016 Go (Baduk) match between Lee Sedol and AlphaGo captured the world's attention. Go (Baduk) has a very large number of cases for computer-based predictions of the next move, making it difficult to play against humans in real time, but AlphaGo used deep learning to predict the next move, which allowed it to make strategies and wins in real time, winning the match 4-1. This has led to a heightened sense of crisis that AI might overtake the human realm, and the expectations for the use of AI would be very high.

Generative AI, which has shown the potential to go beyond decision making, is becoming more promising and is having an increasing impact on society. Generative AI was first introduced in 2014 by Ian Goodfellow. The Generative Adversarial Network (GAN) is an adversarial generation model consisting of a generator and a discriminator, where the generator generates new material based on the trained material, and the discriminator compares this new material to the trained material, then passes and finally generates it if there is a difference. This process allowed for creating new video that didn't exist, as well as transforming and creating styles for the input images. In 2016, Microsoft and Delft University of Technology worked with art historians on The Next Rembrandt project. The project used artificial intelligence to analyze and learn about faces, eyes, noses, mouths, and facial contours from 346 artworks, and then generated drawings of specific conditions, such as a white man in his 30s with a beard and wearing black. The Rembrandt-inspired artwork created through the project consists of more than 148 million pixels and was printed in 13 layers using a 3D printer. In addition, Obvious, a program developed by young French researchers, is a program that studies more than 15,000 portraits by painters from the 14th to 20th centuries to create new paintings. *Edmond de Bellamy*, a work created by Obvious in 2018, sold for \$432,500 at the Christie's auction in New York. The man in the auctioned portrait, Edmond de Bellamy, is a fictional character. The man's face and upper body are blurred, and instead of the artist's signature, the work bears the GAN algorithm used to create the painting.

The generative model was further advanced and made accessible to the general public with the advent of diffusion models. A diffusion model is based on Langevin Dynamics of physical phenomena, which

describes the dispersion of molecules from an initial state over time. It's a fundamental principle in image learning and generation, describing how the pixels in a given photograph scatter and become noise over time. Generative models include GAN and Autoencoder. Autoencoder has a fast learning speed, but the quality of the generated images is low, and GAN can generate high-quality images, but it is difficult to obtain various results. On the other hand, a diffusion model has excellent performance in terms of both quality and diversity. The diffusion model can generate target images from noise according to text prompts, and in particular, it can generate and edit images that satisfy various conditions and contextual text prompt conditions. Image generative models based on this include DALL-E, MidJourney, and Stable Diffusion. These text-based image generation tools have made it possible for general users and creators to directly generate various images from text.

In addition, recent developments in text-based video generation AI technologies include Latent Diffusion Models(NVIDIA), Sora(OpenAI), Stable Video Diffusion(Stability.AI), and Runway ML(Runway). These video generation AI technologies extend a diffusion model used for image generation to generate text-prompted image sequences in less than a minute. Among them, OpenAI's Sora has been used to create commercials, and Toys 'R' Us, one of the world's largest toy chains, used OpenAI's Sora to create its first commercial. The ad was well received for its visuals. However, there were still issues, such as the child's glasses constantly changing shape and the puppets appearing oddly shaped. Generative AI has also been used in filmmaking, and Canadian filmmaking team Shy kids used Sora to create a film with director Walter Woodman. The team synthesized footage of real people with footage from Sora to create the film, using balloons to solve facial consistency issues.

Generative AI is impacting the arts in many ways. First, generative AI has had an impact on productivity, with a 50% increase in the number of pieces created from an average of 7 before using generative AI to 10 after. This means that researching, filtering, generating, selecting, and fine-tuning with AI reduces production time. Creativity is important for generative AI. While AI creativity is often rated favorably due to increased interest in new work and expectations of novelty, the longer the AI is used, the lower the ratings for content and visual originality. At

40 first, the AI's output is exciting and intriguing, but as the AI's training data, methods, and prompts lead to visual homogeneity, the uniqueness of the output diminishes. As a result, the basic ideas of artists and the understanding of text-to-image generation are becoming increasingly important for the use of generative AI. The roles and scope of work for artists and AI are also changing. AI is now a creative partner, and collaboration between artists and AI experts is crucial. Finally, the copyright of creators is becoming increasingly important in the context of generative AI. However, copyright law does not recognize copyright for non-human creators, and it is expected that in the future, only the contributions of artists using generative AI will be recognized.

3. Conclusion

In this article, we have explored how digital technologies have expanded cognition and creation by expanding space and sensation. First, VR, AR, and metaverse have expanded cognition, time, and space through the senses—sight, sound, touch, smell, and more—and have expanded various forms of engagement. In addition, there has been a recent increase in the expansion of cognition through haptics and olfaction beyond audio-visually centered senses and cognition. Research is being conducted on mobility devices to increase physical mobility in order to realize virtual reality that is connected to reality, so we can expect to see a lot of experimentation with new media in the future, along with many experiments on the expansion of space and sensation.

We have seen that the impact of generative AI goes beyond decision making and into the media creation and creativity. Generative AI has the potential to be a useful tool for rapidly realizing and expanding our imaginations, and its applications are becoming more widespread. In the past, AI was used by professionals. Now, however, artists are using AI with text prompts to quickly materialize ideas and iterate on various experiments. Therefore, its role as a media expression tool that expands cognition and creativity is expected to continue to grow.

Digital technologies are expected to continue to impact the arts at a faster pace in the future, requiring collaboration, discussion, and experimental

approaches on many fronts. Therefore, artists, technologists, and institutions need to work together to expand cognition and creation based on digital technologies amid the convergence and proliferation of digital technologies. In addition, the rapid growth and widespread use of AI technologies are expected. This will require creation, experimentation, and insight into human creativity and uniqueness.

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