Thoughtful Electronic Music, Vibrating Art Museum – Interview with GRAYCODE and jiiiiin

Colophon

NAM JUNE PAIK ART CENTER
백남준아트센터

GRAYCODE, jiiiiin

As electroacoustic music composers, Jung Jinhee (aka. jiiiiin) and Cho Taebok (aka. GRAYCODE) have been collaborating in the field of sound and new media. These two artists deal with various media in the form of sound, video, installation, and sculpture through their individual work, and also have been working as a collective. As GRAYCODE, jiiiiin, their piece *+3×10^8m/s, beyond the light velocity* (2017-2018) was presented with the Giga-Hertz Award (2018) from ZKM Karlsruhe, Germany.

Kim Yoonseo

As a Curator of Nam June Paik Art Center, she is interested in cultural policy and digital museum practice as well as Nam June Paik. She has curated exhibitions *The Future of Silence* (2020), *Open Codes* (2021), *The Consultant: Paik's papers 1968-1979* (2022), and symposiums *Living in the Postdigital, Reliving the Museum* (2020), *Media Ecology* (2019) with the exhibition catalogue and journal publication.

This is a conversation in the wake of GRAYCODE, jiiiiin's live performance at the annual international symposium series, "Gift of Nam June Paik 14"— *Tunes of Comradeship: Paik and Mekas*.

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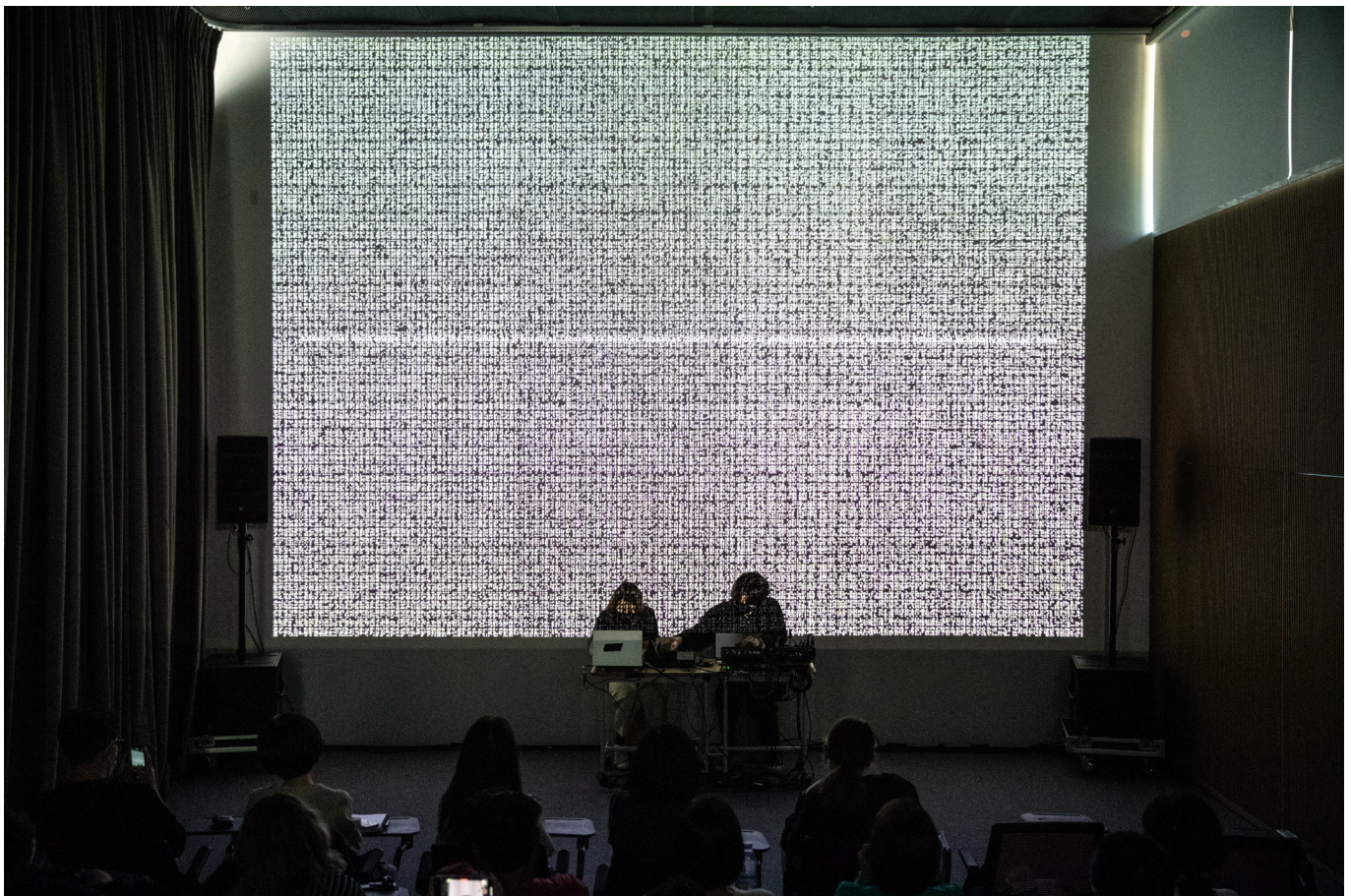
Kim Yoonseo: Let's start with the "THR Resonator," a virtual musical instrument created by GRAYCODE and jiiiiin, two composers. The shape of this instrument can be envisioned by examining the research and modeling data left by the artists. If it were physically present, it would resemble a sphere with a one-centimeter radius. The audio-visual live performance *e^ix, it's necessary*, which begins with this instrument, leads to the discovery of a single sound after a series of playing. The process feels like a journey to find a specific frequency to hear the sound distinctly on the radio with poor reception or to produce a precise sound on a wind instrument like a challenging flute.

GRAYCODE: I will start by talking about my experience visiting a large bookstore. You may have experienced noise or confusion among too many books. I felt I needed to search for wisdom, not just information or facts, amidst the excessive amount of data in the bookstore. It was then that I realized that AI could potentially provide me with answers. So, The project *e^ix, it's necessary* began. It provided me with an opportunity to work on AI, which had not piqued my interest previously, as a theme of my work at ZKM | Hertz-Lap in 2019. I explored the essence of AI beyond cultural, interpretive, and technical aspects and concluded that AI is a thing "doing a vast number of calculations in a short time." The short time, however, is a space and time that is difficult for me to imagine. I realized, "Your (AI's) time and my time are different." Our THR Resonator calculates a value of '1,683,963,344,932,416' in less than 2-3 seconds of human time. Even the slowing and freezing phenomenon of the laptop was incorporated into the work. The resulting huge noises collide with each other to create distorted sounds, resulting in more daring and physical collisions. The sound eventually stops, and the calculation of data and visual elements also becomes dull. To minimize variables, we must use instruments like the speakers and hardware systems. Unfortunately, the slightest difference in sound pressure or distortion in the speakers' frequency response can prevent the intended sound from being expressed. It's a highly sensitive process. To achieve artistic results through this work, I extended the time of AI to human time, and this is the essential composition method for *e^ix, it's necessary*. This time composition was used as a musical compositional technique to illustrate the microscopic space-time of AI.

Kim Yoonseo: It's fascinating how every object has its unique sound, including humans. I've heard that no two people in the world have

AI RESEARCH

The modeling of THR resonator

THR resonator :
The transcendental resonance discerns from the multivariate Gaussian distribution of the function space of Helmholtz resonator.

$$\text{FREQUENCY} = \frac{\text{SOUND SPEED}}{2\pi} \sqrt{\frac{\text{AREA}}{\text{VOLUME} \times \text{LENGTH}}}$$

Formula of Cavity Resonance
An air cavity will exhibit a single resonant frequency. If extra air is pushed into the volume and then released, the pressure will drive it out. But, acting somewhat like a mass on a spring which is pulled down and then released, it will overshoot and produce a slight vacuum in the cavity. The air will oscillate into and out of the container for a few cycles at a natural frequency.
Actually the frequency depends upon the square root of these factors and also upon the speed of sound, as you can see in the actual calculation of the frequency.
(http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html)

The range of the resonance frequency:

from **1038.277963Hz**
the lowest frequency of 1-909-909-1-1

to **19813.884923Hz**
the highest frequency of 7726-909-1-1136-226, as the components of the resonator.

sphere > (neck inside == neck radius) > neck length > neck outside
4.4 : 1.0 : 0.6 : 0.1

neck outside 0.000227 ~ 0.000001 (m, radius, 0.1, 0.022727) = neck outside
neck length 0.001364 ~ 0.000228 (m, radius, 0.6, 0.136362) = neck length
sphere radius 0.010000 ~ 0.002274 (m, radius, 4.4, 1.000000) = sphere
neck radius 0.002273 ~ 0.001365 (m, radius, 1.0, 0.227273) = neck inside == neck radius
neck inside 0.002273 ~ 0.001365 (m, radius, 1.0, 0.227273) = neck inside == neck radius

number of cases = 1,803,039,983,424

GRAYCODE, jiiiin

INFORMATION BOARDS

e^ix, it's necessary(2019) GRAYCODE, jiiiin(Taeksk Cho, Jinhee Jung)
sphere > (neck inside == neck radius) > neck length > neck outside (4.4:1.0:0.6:0.1)
0.01000 = 0.022274m(radius, 4.4, 1.00000) = sphere
0.002273 = 0.001365m(radius, 1.0, 0.227273) = (neck inside == neck radius)
0.001364 = 0.00228m(radius, 0.6, 0.136362) = neck length
0.000227 = 0.000001m(radius, 0.1, 0.022727) = neck outside

The number of all possible combinations : 1,838,961,344,932,416(=7,726 * 909 * 909 * 1,136 * 226)
The number of training data : 2^16, 65,536
The index of current training data : 14939

The transcendental resonance discerns from the multivariate Gaussian distribution of the function space of Helmholtz resonator.

radius = 10 mm

4.4 :sphere >
1.0 :neck inside == neck radius >
0.1 :neck outside

the same voice due to the differences in the structure of our bodies, including the vocal cords, which create a unique "voiceprint," much like a fingerprint. Similarly, the shape of an instrument is also crucial in producing sound. I'm interested in learning about the process of developing the THR Resonator. Can you tell me more about that?

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GRAYCODE: Our focus is on the artistic expression, sound synthesis, or composition methods that can coexist with this era. The devising of the virtual model THR Resonator is our will and effort to express the orientation of our work. I think the 1% sound synthesis method, not the 99% sound synthesis method currently used, is the Granular Synthesis that the Greek architect and composer Iannis Xenakis created. I think this method is a creative and artistic tool that reflects the era of so-called quantum mechanics' quantization. It is up to the creator to put this tool to the status of an instrument and utilize it. However, as an artist and composer living in the present, I think about topics that can go side by side with this era rather than paying attention to what many are interested in. I think these concerns created a process like THR Resonator. These thoughts originate from the works *+3x10^8m/s, beyond the light velocity* (2017), *10^-33cm* (2018) and led to the work *Data Composition* (2021).

jiiiiin: GRAYCODE has posed a question that composers often ask themselves: "What kind of composing is appropriate for this era?" An example of how music composition can adapt to society is the increase in piano size during the French Civil Revolution. As more people gathered in salons to enjoy music, the piano needed to be louder, which led to its physical enlargement. We understand that society, culture, art, and technology are closely interconnected, but we question whether these relationships are truly reflected in our compositions. In exploring this idea, we invented an imaginary instrument called THR Resonator. To create sound, an instrument requires two holes—one for air to enter and one for air to exit. This is similar to a recorder, which has a hole at the top for air intake and one at the bottom for air release. By blowing into the recorder, the sound is produced through the vibration of its body. With THR Resonator, we have also designed inhalation and exhalation holes. By adjusting their length and size, we can produce different sounds with this instrument.

Kim Yoonseo: In the end, the essence of this instrument appears to be the machine-learning algorithm created by the two composers. The value of '1,683,963,344,932,416' extracted from it is the total number of sounds that can be produced from this virtual instrument. If a performance is a journey to find the perfect sound, then the various digitized sounds can be considered noise.

jiiiiin: "Finding the perfect sound" is a crucial aspect of our approach. However, we don't try to narrow it down to a single precise sound due to the immense

amount of data. We may all know the Korean alphabet, but that doesn't make us all poets. Similarly, pressing every key on a piano doesn't make us all pianists. Our composing method is to find the correct sound that best fits our intention with virtual instruments able to produce an endless variety of sounds.

Kim Yoonseo: Let's discuss your performance at Nam June Paik Art Center. GRAYCODE and jiiiiin brought all the equipment you usually use, such as speakers, to perform. As previously mentioned by GRAYCODE, you used the same personal speaker and hardware system to minimize variables in their elaborate work, as you did when making the song. Can you provide us with a list of the instruments you used on the day of the performance? I'm interested in the materials needed to achieve the correct sound. Would you consider everything from the virtual THR Resonator created online to the speakers installed in the physical space to fall under the category of musical instruments?

> GRAYCODE: To convey the wavelength and fluctuation generated by physically colliding two low frequencies, which are the main elements in our music, we used Meyer Sound X-40 speakers and 750-LFC woofers in the front and Genelec 8050B speakers in the rear. We view these as one musical instrument rather than just technical hardware. Like a musical instrument, the speaker aims to effectively deliver the composed music, designed sound, and direction of the sound. Our work is not limited to a specific platform. As long as we can clearly express what we want to convey, we can present our ideas in any format. The platform or form of the work is simply a tool.

> jiiiiin: The speaker that was mentioned earlier is an essential material in our work. Understanding the material we use is crucial for our performance. For example, the sound output from a speaker is something that anyone can easily imagine. If we consider the speaker as an instrument, THR resonator is more like a tool for composition and a quest for composition methods.

Kim Yoonseo: The audio-visual live performance, *e^ix, it's necessary*, which was introduced in the 14th *Gift of Nam June Paik* program, won the 2018 Giga-Hertz Award for electronic music composition, which was jointly sponsored and presented by ZKM Karlsruhe, Germany, and SWR (Southwest German Broadcasting Corporation) in Stuttgart. Additionally, this piece was commissioned by ZKM as a new work the year after winning the award. Furthermore, they also premiered a new

work commissioned by the NJP Art Center, *Poetic Canon* (2022), as part of the 14th *Gift of Nam June Paik* program. As composers, what is your perspective on the legacy of Hertz and Paik, and their influence on your work?

jiiiiin: As I have mentioned previously, I always question whether my creative pursuits align with the present times. When I examine Paik through this lens, I cannot help but consider him as an artist of our time who created art that speaks to the contemporary world. With this perspective in mind, I developed the new work *Poetic Canon*, with the belief that Paik was an artist who comprehended the society, culture, art, and technology of our era.

Kim Yoonseo: In *Poetic Canon*, the words of Paik regarding the *Paik-Abe video synthesizer* are quoted, describing it as an apparatus that can be created "as precisely as Leonardo, as freely as Picasso, as gorgeously as Renoir, as profoundly as Mondrian, as intensely as Pollock, and as lyrically as Jasper Johns." Could you explain the context of referencing the *Paik-Abe video synthesizer* in your work from 2022? I'm interested in learning more about your motivation and work process for incorporating AI-based text-to-speech technology.

jiiiiin: Around 1969, when the *Paik-Abe video synthesizer* was created, European radio stations synthesized various sounds by using the vibrations of reel tapes or oscillators. We believed that the *Paik-Abe video synthesizer* had a similar concept to the technology developed in electronic music during that time, as both synthesized wavelengths. During the making of *Poetic Canon*, we discovered a new side of Paik as an artist who freely moved between different arts and technologies, going beyond the title of "father of video art." In working on *Poetic Canon* using the latest technology available in 2022, we opted for a relatively simple and direct approach. We used AI-based text-to-speech technology to create the voice heard in the performance space, which was then played back in stereophonic sound. Paik's words, mentioned earlier, are repeatedly played throughout the work using an AI-generated voice, and they become the theme of the piece. While the voice is played honestly and repeatedly, the position of the sound in the space changes gradually using stereophonic sound technology. The repetition of the voice (sound) moves in the same way as the visual patterns of the video. *Poetic Canon* is structured similarly to a musical form of the Baroque era called "canon," and it transforms slowly as it repeats. This work is an attempt to reveal Paik, an artist who fully

embraced the era in which he lived, from a contemporary perspective by using a classical music form directly.

Kim Yoonseo: As is evident from the titles of GRAYCODE and jiiiiin's works, they begin their creative process with the principles of mathematics and physics, which are building blocks of music. Using computer language represented by 'YES' or 'NO' or '0' or '1', they aim for accuracy while simultaneously engaging in a complex and diligent process. Their work extends beyond exhibitions or performances as they continually search for signals and adjust sound frequencies. They write and distribute code in the form of performances or publications, and it seems that their sincere commitment to continue writing code and fixing bugs forms the basis of their work. As you experiment with sound through various mediums like exhibitions, publications, and YouTube channels, what are your primary focus points, and what do you anticipate when performing in front of an audience?

jiiiiin: While I have not predetermined what I wish to present or anticipate on each platform, I unconsciously hope my performance will be thrilling. Perhaps it is the thought of experiencing a rush or catharsis, and it's a sentiment that most performers share, I suppose. Regardless of the platform type, I consider my attitude toward work and objectives the most important aspects.

Kim Yoonseo: When it comes to my experience as a spectator, being in the same space as the performers, I felt a physical vibration throughout the performance as the collision of sounds gradually intensified. For instance, on the morning of the show, during the rehearsals and performance recordings, which took place before the opening hours of the NJP Art Center, I wanted to note the moment when I could feel the walls and floor vibrate with low bass sounds. It was a synesthetic moment in which I sensed a complex magnetic field that shook the conventional visuality embodied in art museums and among art museum workers. Nowadays, museums aim to offer diverse art experiences, functioning as a platform for various experiments with keywords such as multidisciplinary art, convergence, and new media. However, it's still true that museum collections, exhibitions, and programs depend largely on visuality and materiality. As Kwon Seok Joon, Ph. D points out, considering that both hearing and vision are different senses transmitted through the medium of "vibration," the experience of sound

and visual art convergence is nothing new. Just like Paik started with music and created a flow of exhibiting and collecting video art that stayed out of the interest of mainstream art, GRAYCODE and jiiiiin started with language diversity to expand the scope of art museums and engage audiences. I think it's a significant clue. I hope those real-life art museums, not just virtual ones, emit thousands of signals and vibrate loudly in various languages. Perhaps an art museum is a place to find wisdom in the noise, or vibrant itself.

GRAYCODE, jiiiiin
Poetic Canon, 2022
Nam June Paik Art Center
Commission
https://youtu.be/SemIh-LhKnk

a device that would enable us to shape the TV canvas as precisely as Leonardo as freely as Picasso as colorfully as Renoir as profoundly as Mondrian as violently as Pollack and as lyrically as Jasper Johns