[audio visual performance]

CINEMA BLACKBOX

自己共鳴投影上映開始

by Kyoka and Shohei Fujimoto

Video[3min excerpt]

https://www.youtube.com/watch?v=5qFBEoHOD8w

Concept

Concept

In this project, the human brain, which is like a black box, is captured objectively as an unknown structure and visualized through sound and visual.

MRI data acquisition, brainwave(EEG) acquisition, and reconfirmation of music theory inspired by the brain (new music syntax) - through these processes, the project attempts to show the resonance of the brain and the self by treating the facts that obtains a different perspective from scientist.

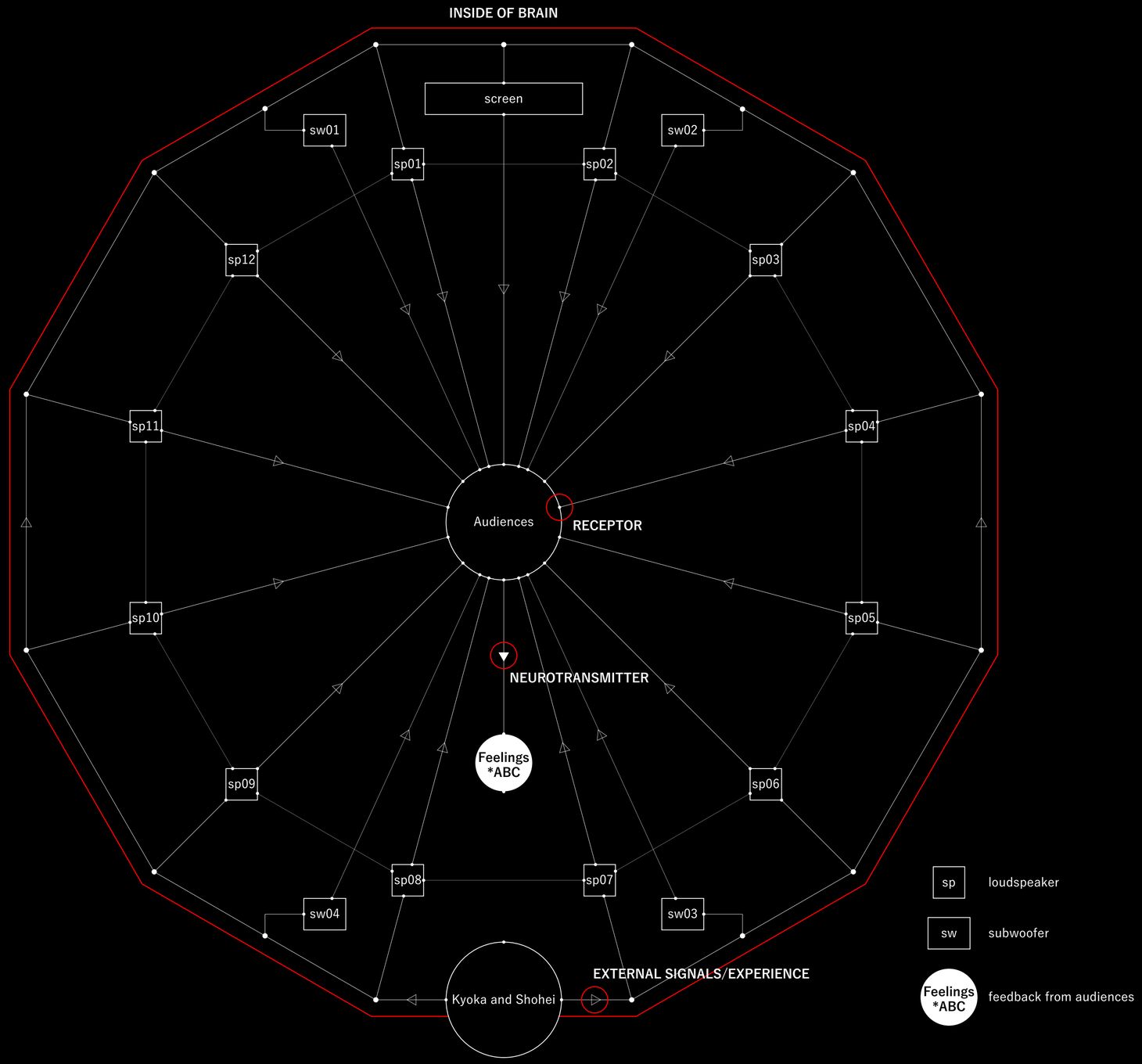
Concept image

*Treating and capturing space as **INSIDE OF BRAIN**.

*All ingredient(people, equipment) are **NEURON**.

*All signals(sound, light) are **EXTERNAL SIGNAL/EXPERIENCE**.

*Feedback from audiences is **NEUROTRANSMITTER**.



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Using data

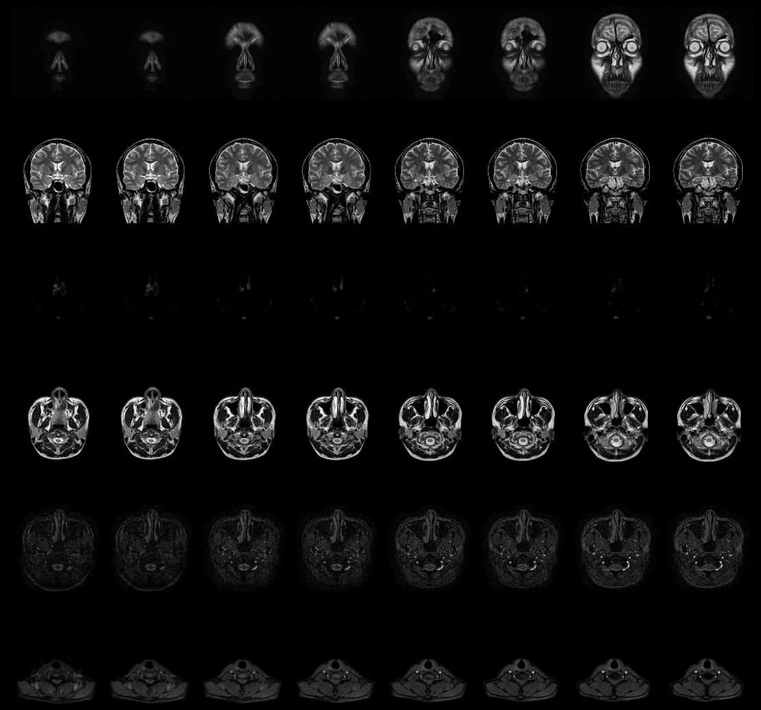
Using data

+MRI sequence

*Shohei’s MRI data

*430 2D images

*Obtained at medical facility

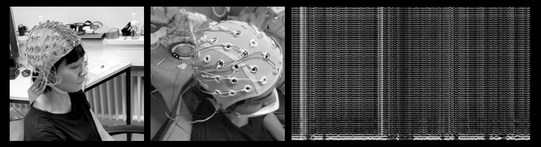


+Brainwave(EEG) 01

*Obtained at Tokyo University

*Kyoka and Shohei’s 62 ch EEG data

*Stereo music with stereo speakers

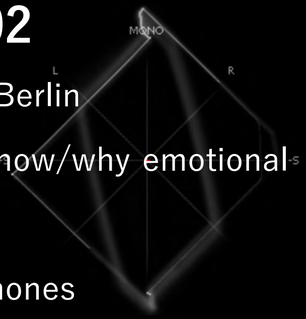


+Brainwave(EEG) 02

*Obtained at Freie Universität Berlin

*Kyoka’s 62 ch EEG data and how/why emotional recordings is good to take

*Binaural music through earphones



+Blinking

*Real-time EEG was obtained using IBVA, a device that can connect MIDI equipment to EEG.

+Music syntax

*By Kyoka

*Complements and reinterprets traditional music theory, or offers an entirely new music theory

*Inspired by the brain

Examples of a syntax

1. Use of Entropy in Composition Dare to put elements in certain sound patterns that the brain judges to be errors to get people's attention.

2. Elements that seem to touch the five human memories, from the general to the personal, are placed in the music.

3. Play sound with random personal information that is easily conditioned. For example, a name.

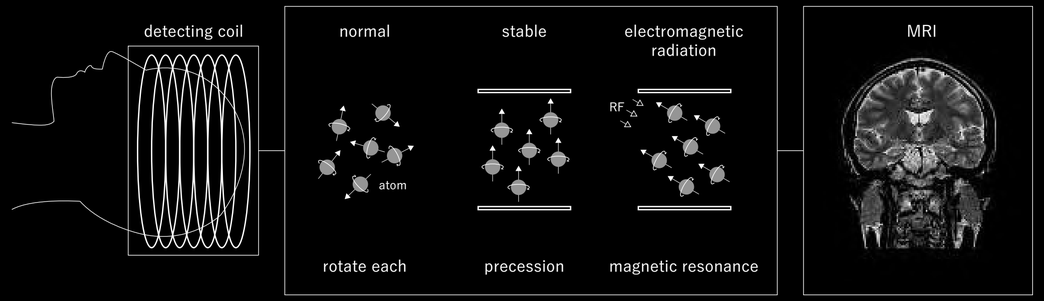
Data - Shohei Fujimoto’s MRI

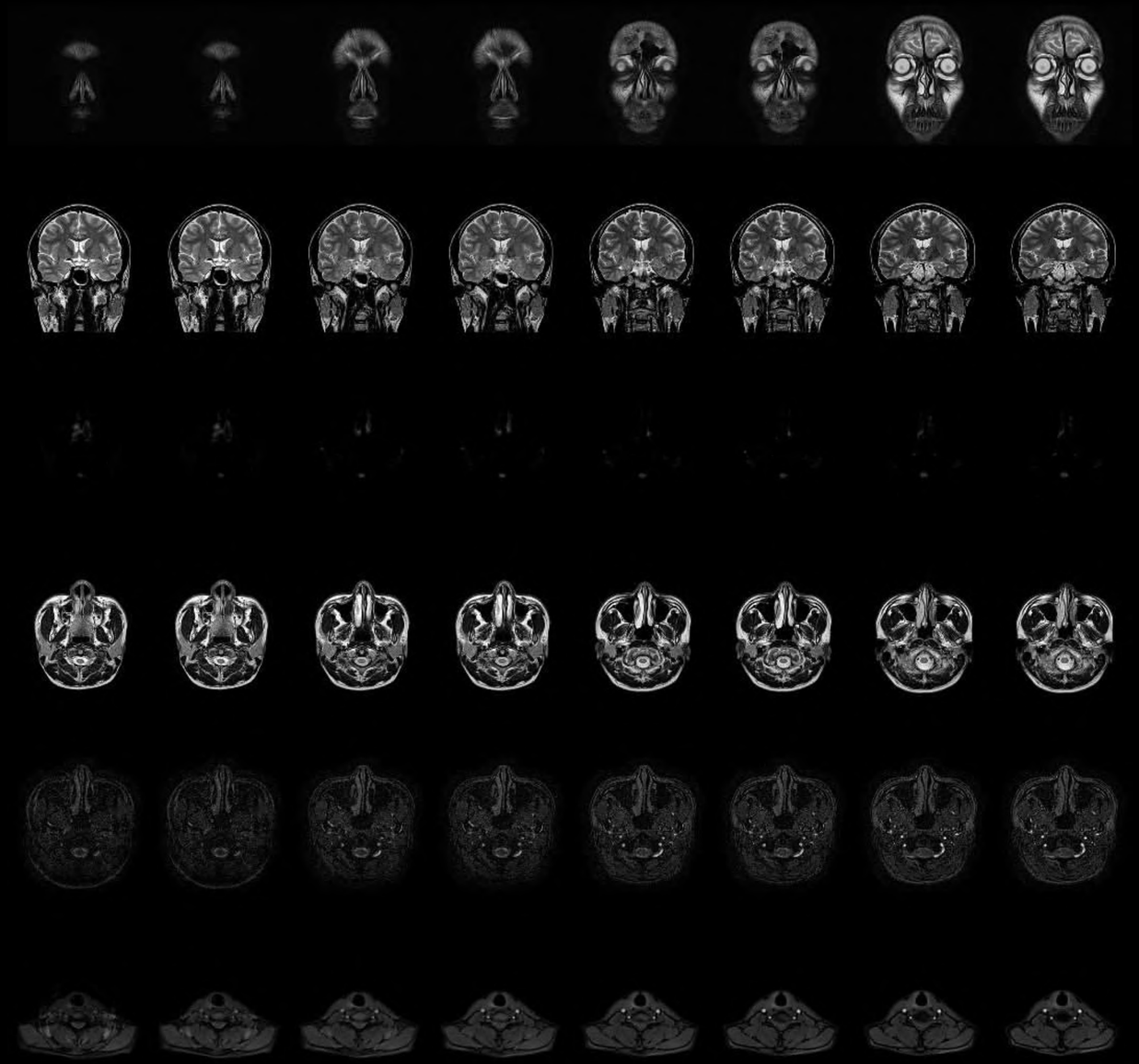
Binarised blackbox

Two-thirds(2/3) of the human body contains water (hydrogen H).

MRI makes use of this structure. MRI can be said to be an observation of the behavior of hydrogen nuclei in the body.

Also, it can be said that it is a resonance between the human body (hydrogen atoms) and technology (magnetic field generation).





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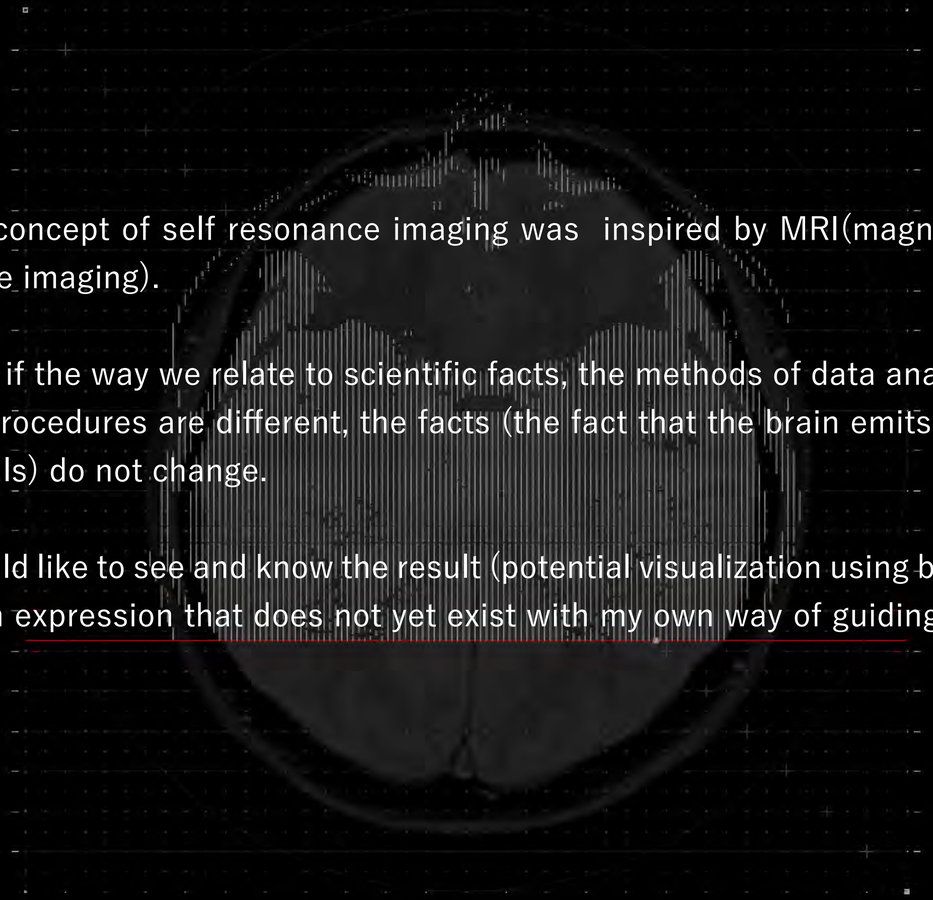
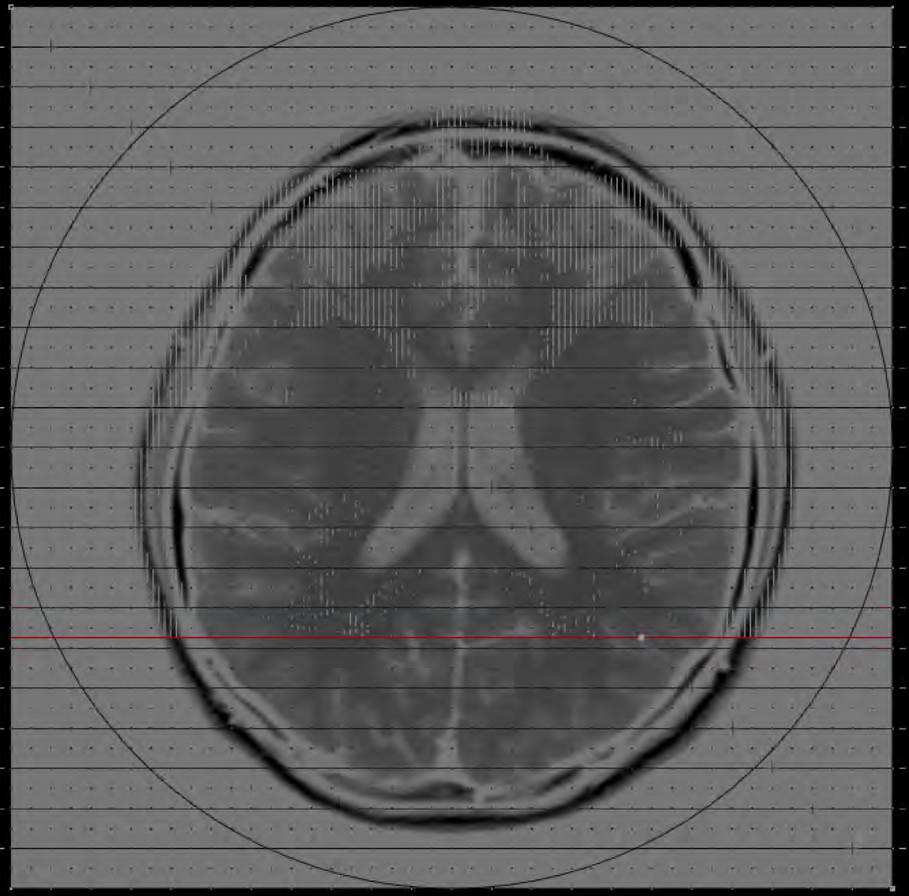
Self resonance imaging



The concept of self resonance imaging was inspired by MRI(magnetic resonance imaging).

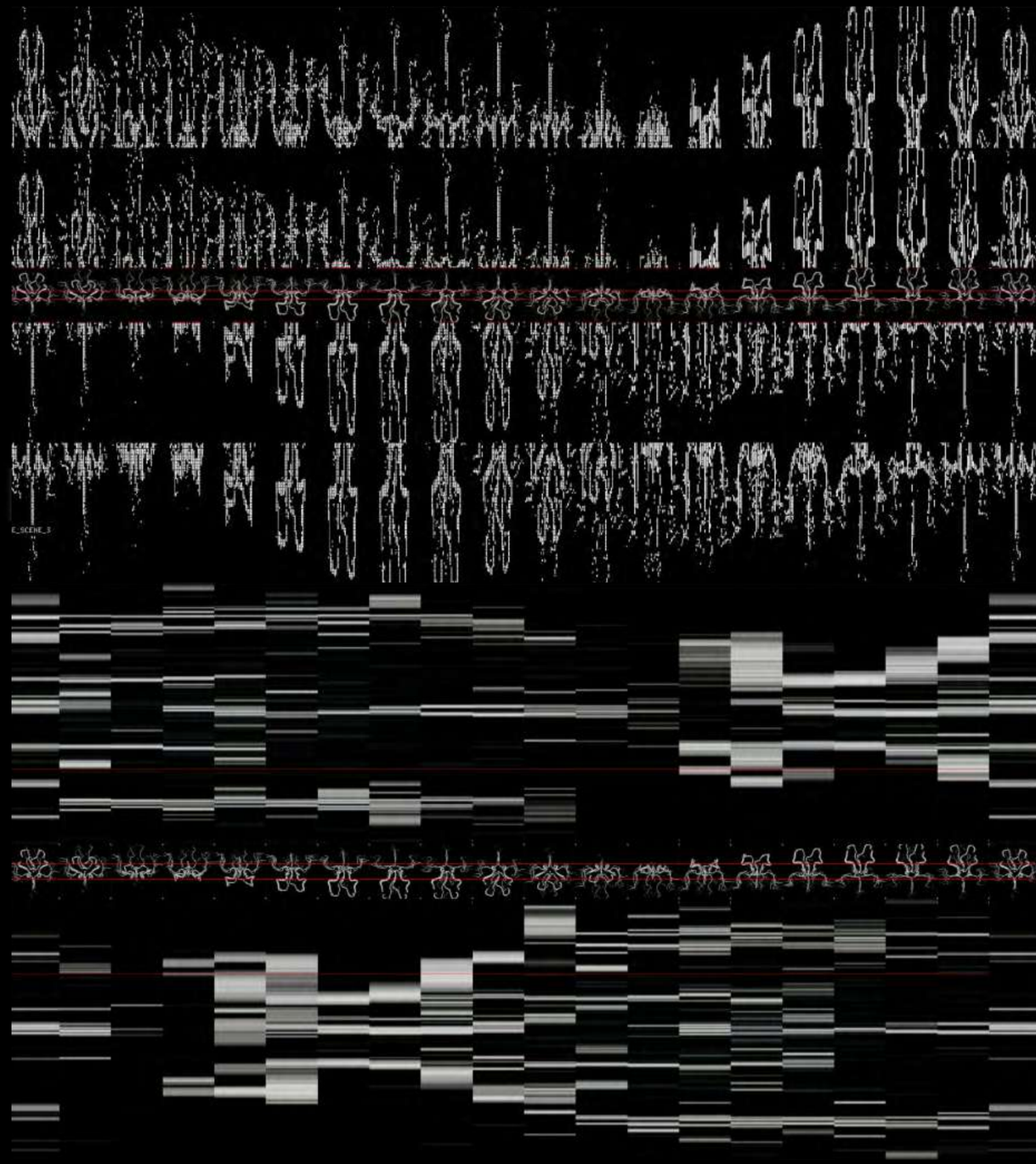
Even if the way we relate to scientific facts, the methods of data analysis, and the procedures are different, the facts (the fact that the brain emits electrical signals) do not change.

I would like to see and know the result (potential visualization using brain data) as an expression that does not yet exist with my own way of guiding information.



Close relationship with the data

All the elements used for visualization are the potential result of the properties of data (images) as an expression that does not yet exist with my own way of guiding information.



Resonance and Kyoka’s music syntax

In collaboration with Kyoka,
we constructed a form as an audiovisual performance.

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Data - Brainwave(EEG)

Hello Brainwave(EEG)

Purpose of Brainwave Acquisition

The process of creating audio visual works based on Neuroscience. This work explores new music theory, visual and sensory representations of the natural phenomenon of the human body.

Why do so many people move, laugh, cry, dance, and shout at audio, visual, and light concerts in the first place? What is the difference between that and the fact that few people impulsively cry in front of works of art in museums?

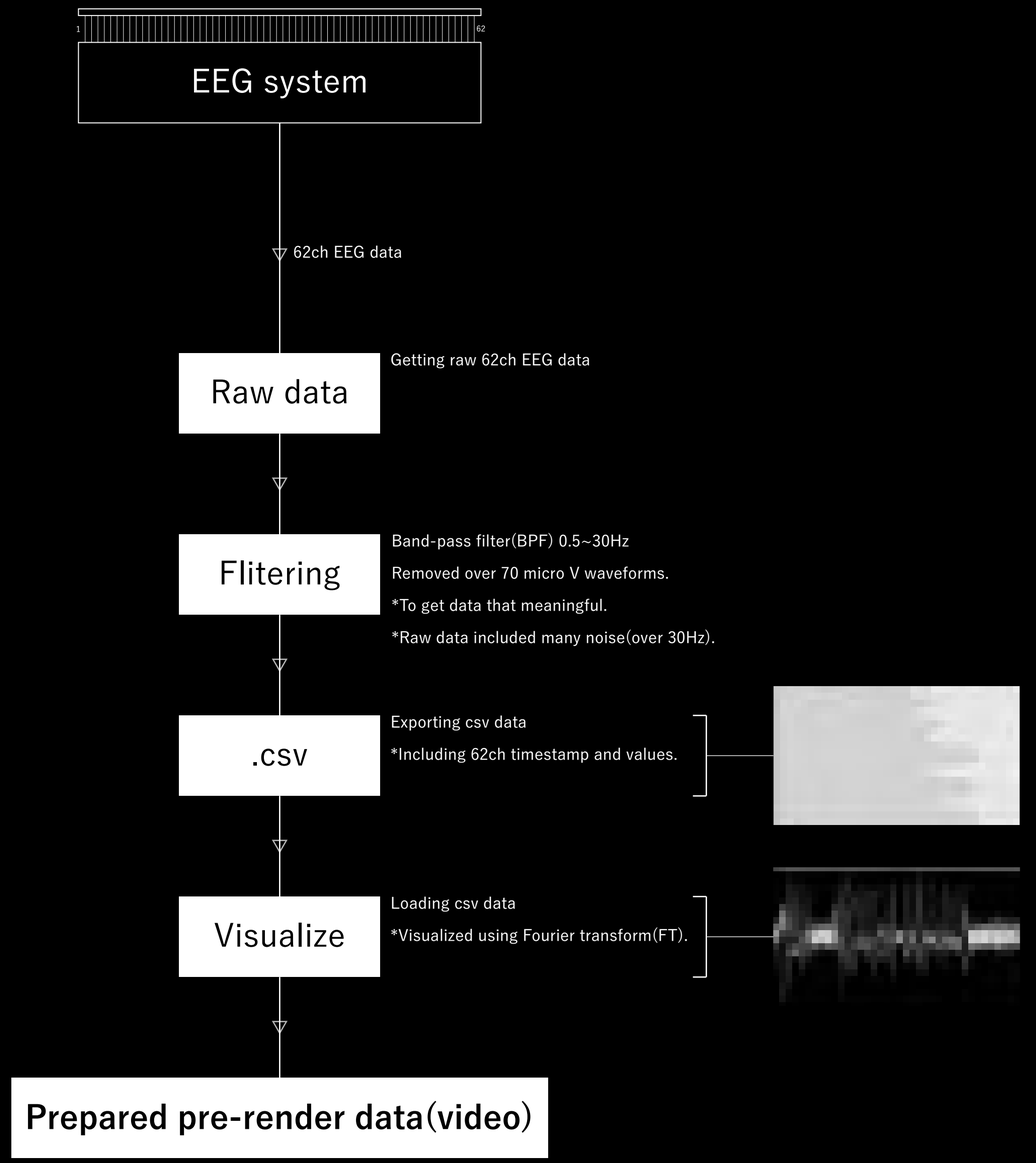
The difference is also noteworthy. Perhaps Audio, Visual and Light can quickly access the instinctive part of human emotions. If so, what is emotion?

It is the result of the secretion of neurotransmitters such as dopamine and adrenaline. This means that Audio Visual works can provide an experience in which one not only enjoys the work, but also feels the balance of neurotransmitters, which is probably an emotion, as a scientific concept. So, the first step was to acquire brain waves. This would naturally lead to a focus on the balance of the autonomic nervous system.

Future Plans

Since EEG is good for obtaining data on states of relaxation and concentration, we now know that we need to measure skin information such as goose bumps. This is because it is necessary to measure respiration, heart rate, etc., to learn about states other than relaxation. We will need to continue to interact with scientists to find realistic and effective ways to measure this information.

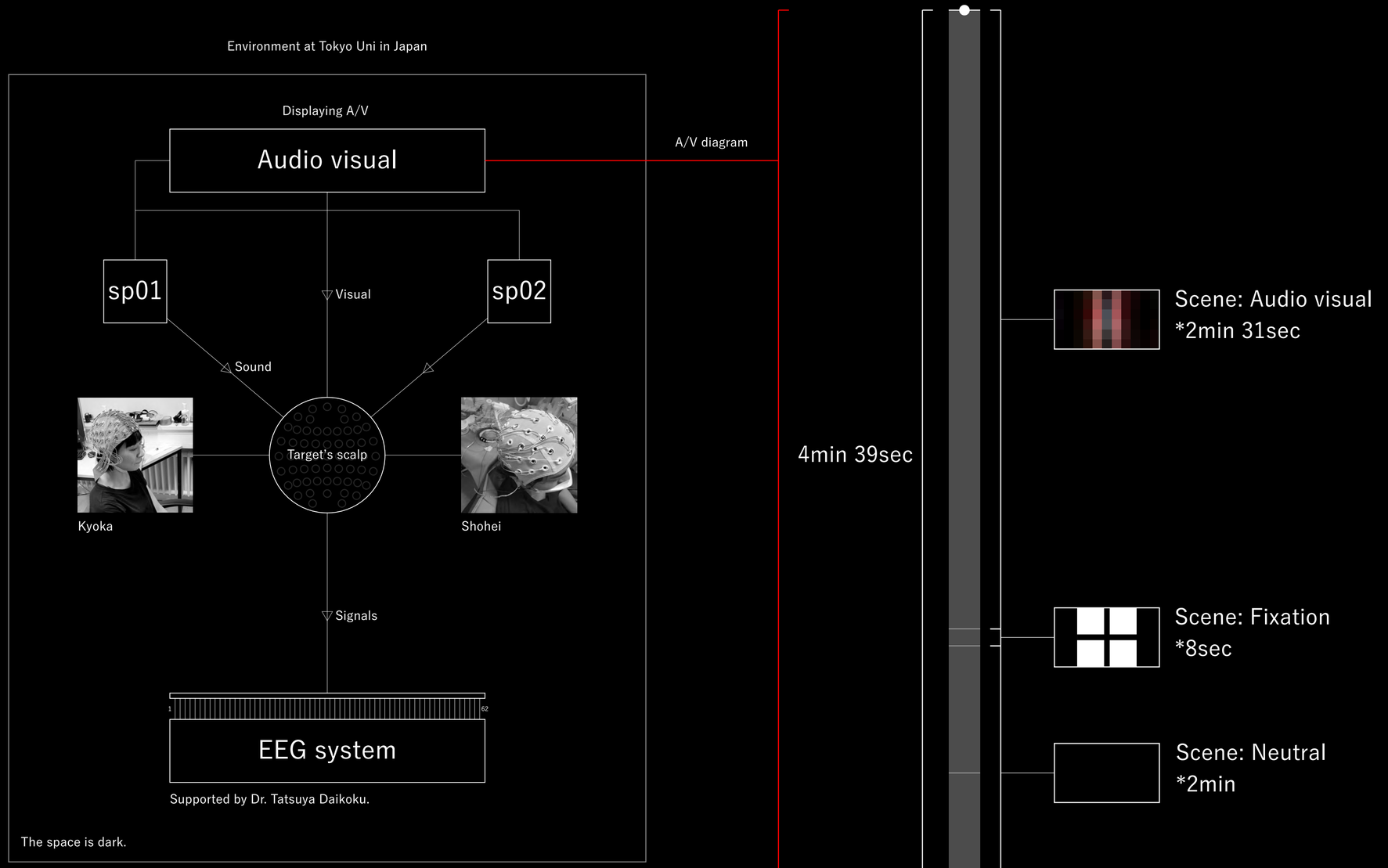
Processing process



Data - Brainwave(EEG) 01 at **Tokyo**

Case using audio visual

Prepared an environment



We prepared an environment inspired by Prof. Tatsuya Daikoku(Tokyo University).

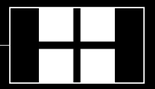
Material - Audio visual

By Kyoka and Shohei Fujimoto

4min 39sec

Scene: Audio visual
*2min 31sec

Created in Oct 2020.



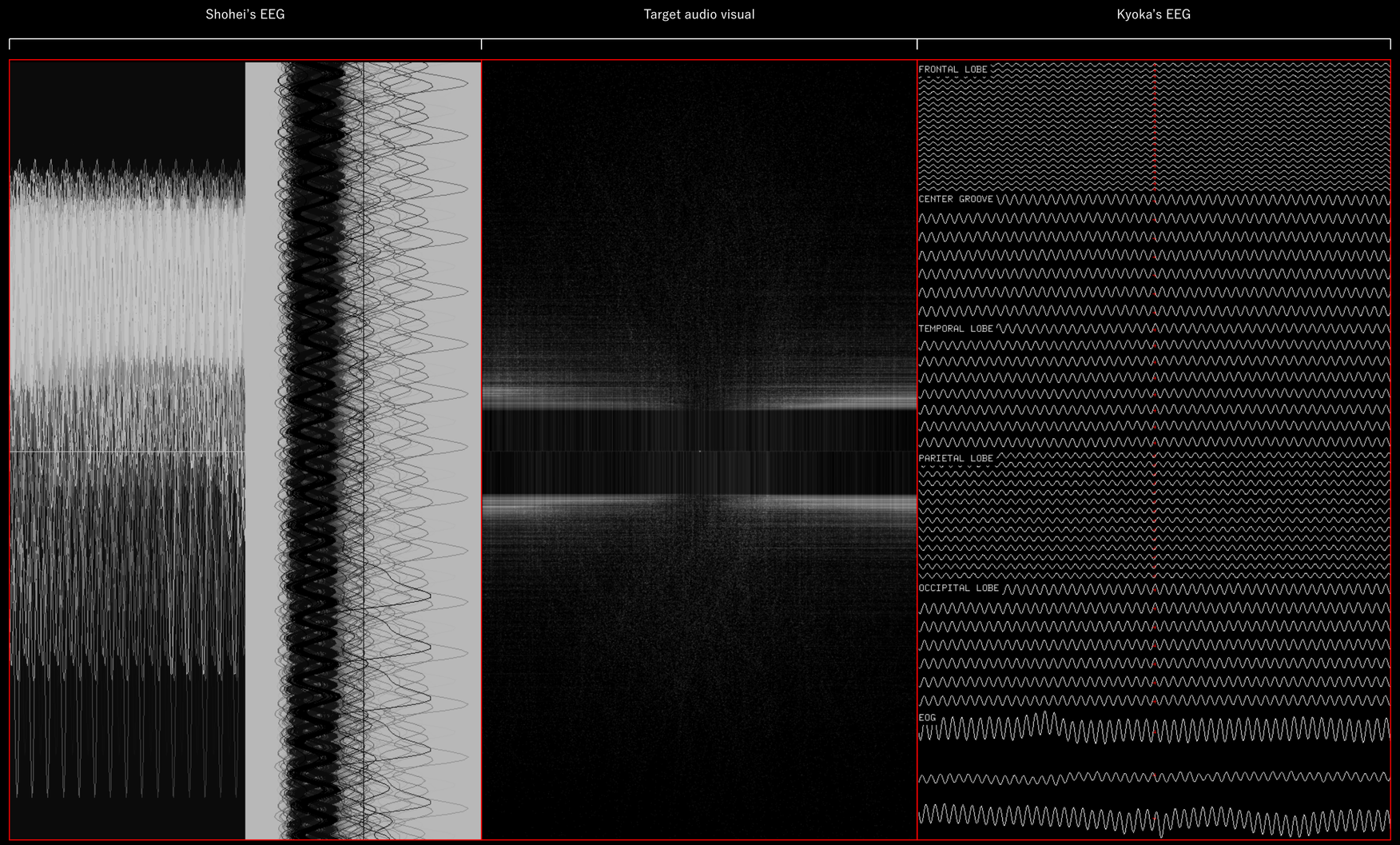
Scene: Fixation
*8sec

To focus on screen.

Scene: Neutral
*2min

No sound and visual, To calm brainwave.

Visualization Kyoka and Shohei’s EEG - diagram 01

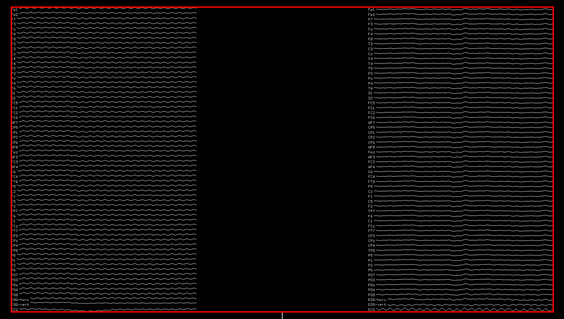


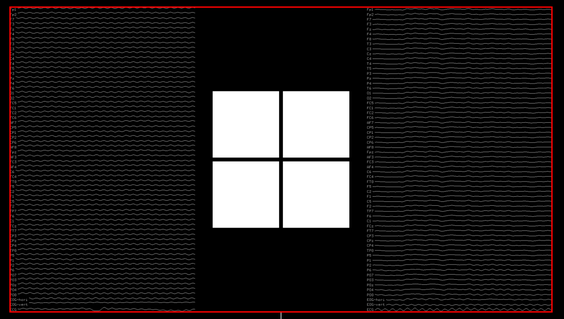
The EEG visualizations on the left and right respectively match the time axis
when we were seeing the central audiovisual(date: 20 Sept 2022).

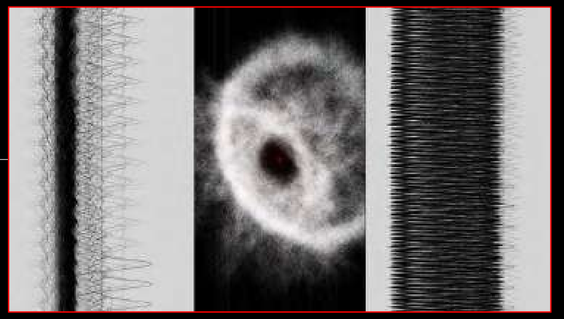
Visualization Kyoka and Shohei's EEG - diagram 02

We prepared pre-render data(video) for performance. It consists of 2 minutes of neutral, 8 seconds of fixation, and visualization. These diagram/structure is inspired by Prof. Tatsuya Daikoku(Tokyo University).

We simply visualized the behavior of brain waves and confirmed the difference in the behavior of each EEG.







Scene: Neutral
*2min
*No sound and visual
*To calm brainwave.

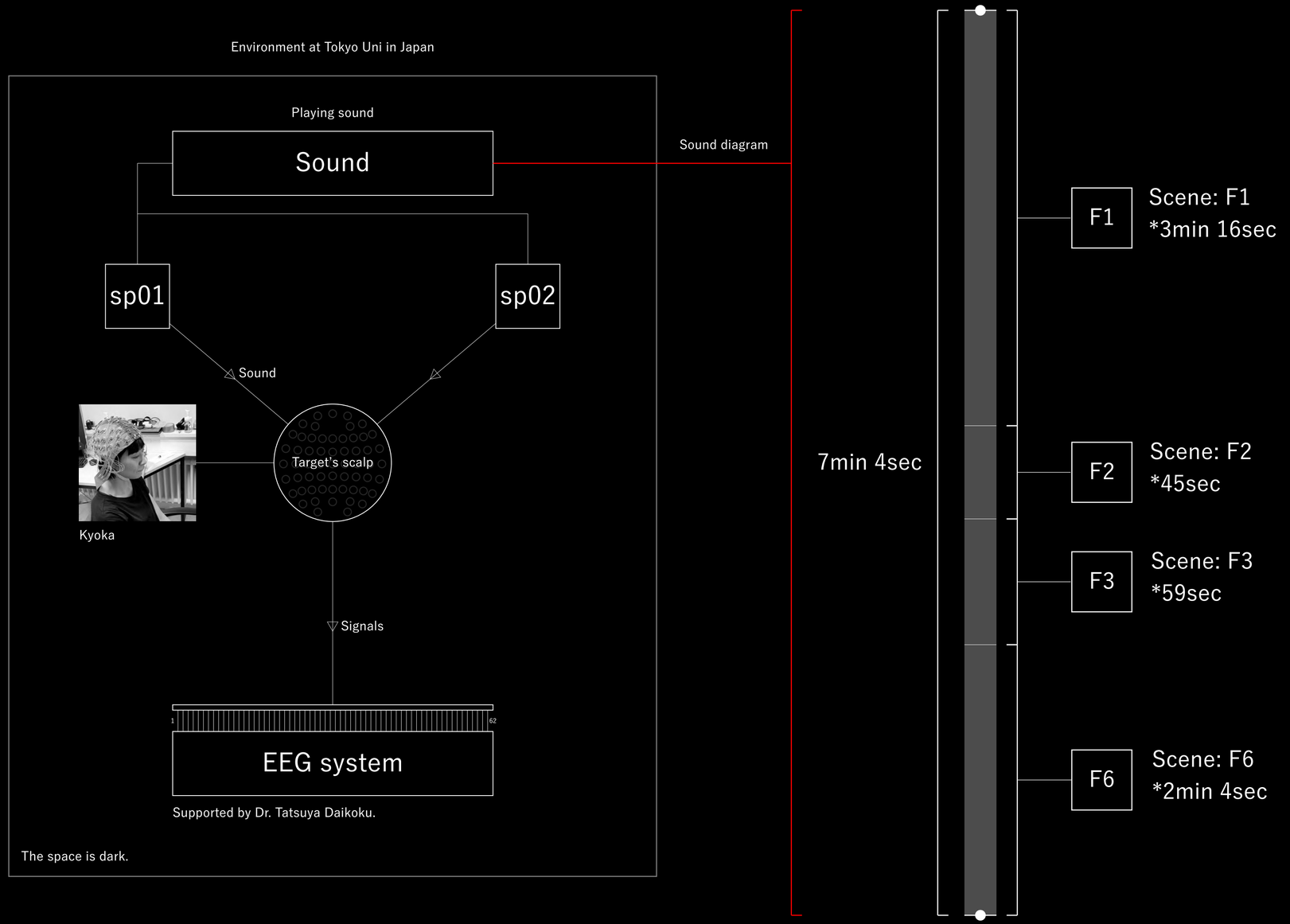
Scene: Fixation
*8sec
*To focus on screen.

Scene: Audio visual
*2min 31sec
*by Kyoka and Shohei

4min 39sec

Case using sound

Prepared an environment

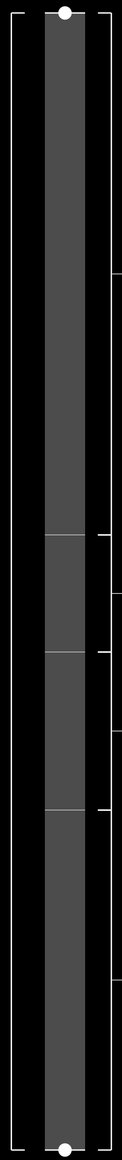


The case focusing on only sound.

Material - Sound F1, 2, 3, 6

By Kyoka

7min 4sec



F1 Scene: F1 *3min 16sec
Test syntax with water as elements that seem to touch the five human memories, from the general to the personal, are placed in the music.

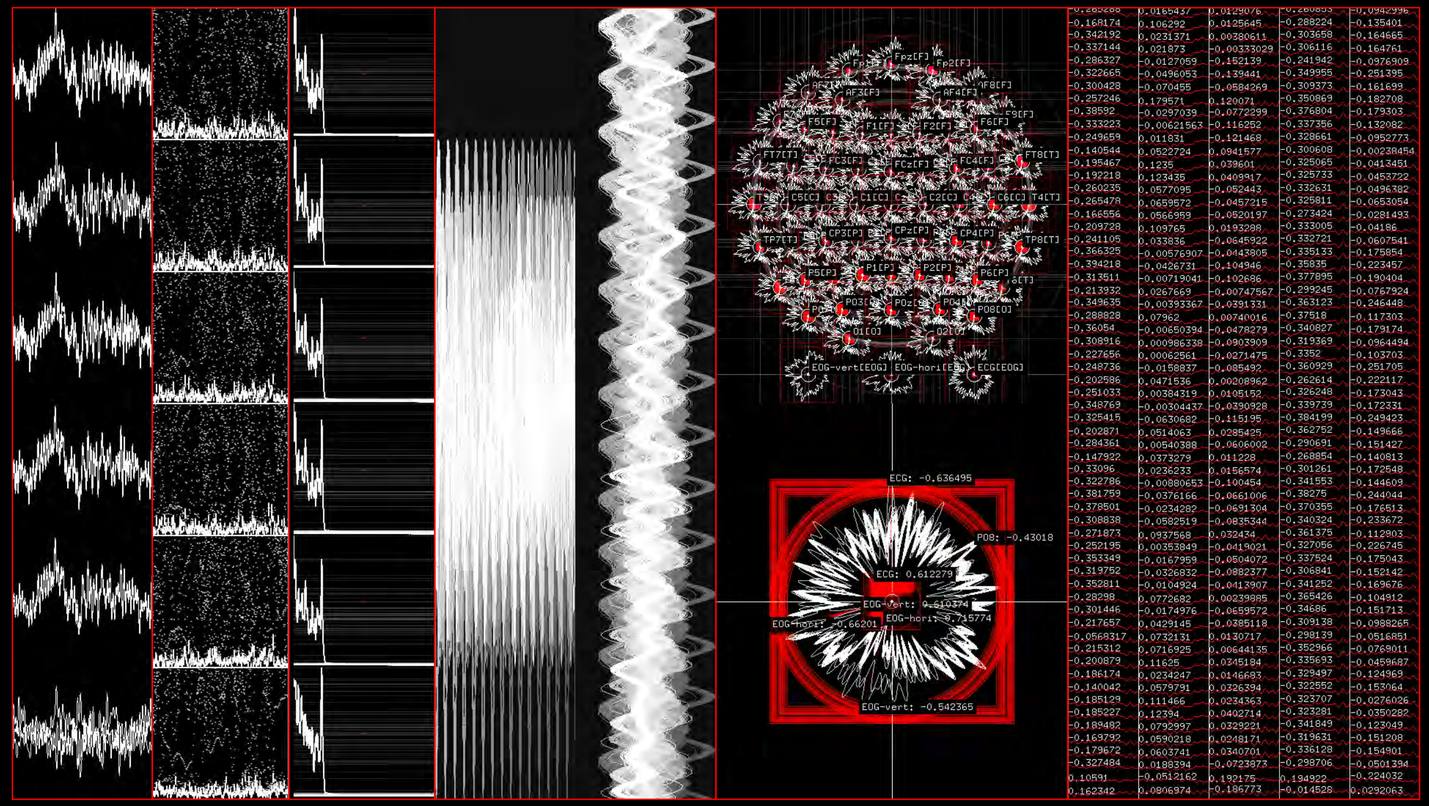
F2 Scene: F2 *45sec
Test plot type with sinwaves 400hz +60hz.

F3 Scene: F3 *59sec
Structure test for plot type with Groove and flow.

F6 Scene: F6 *2min 4sec
Pattern test for plot type with Groove and flow.

Visualization Kyoka’s EEG - diagram 01

Visual ingredients

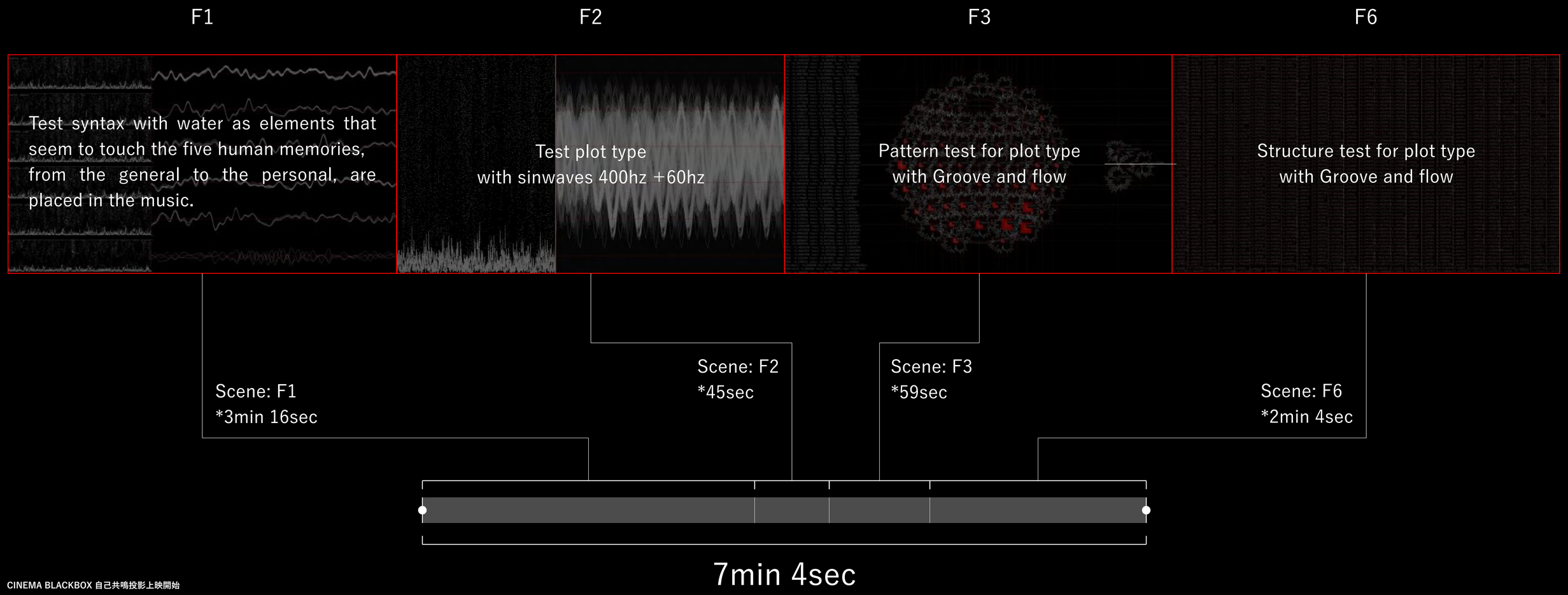


Kyoka’s EEG

Each of Kyoka's brainwave visualizations matches the time axis
when listening to the music(F1, 2, 3, 6) she created.

Visualization Kyoka’s EEG - diagram 02

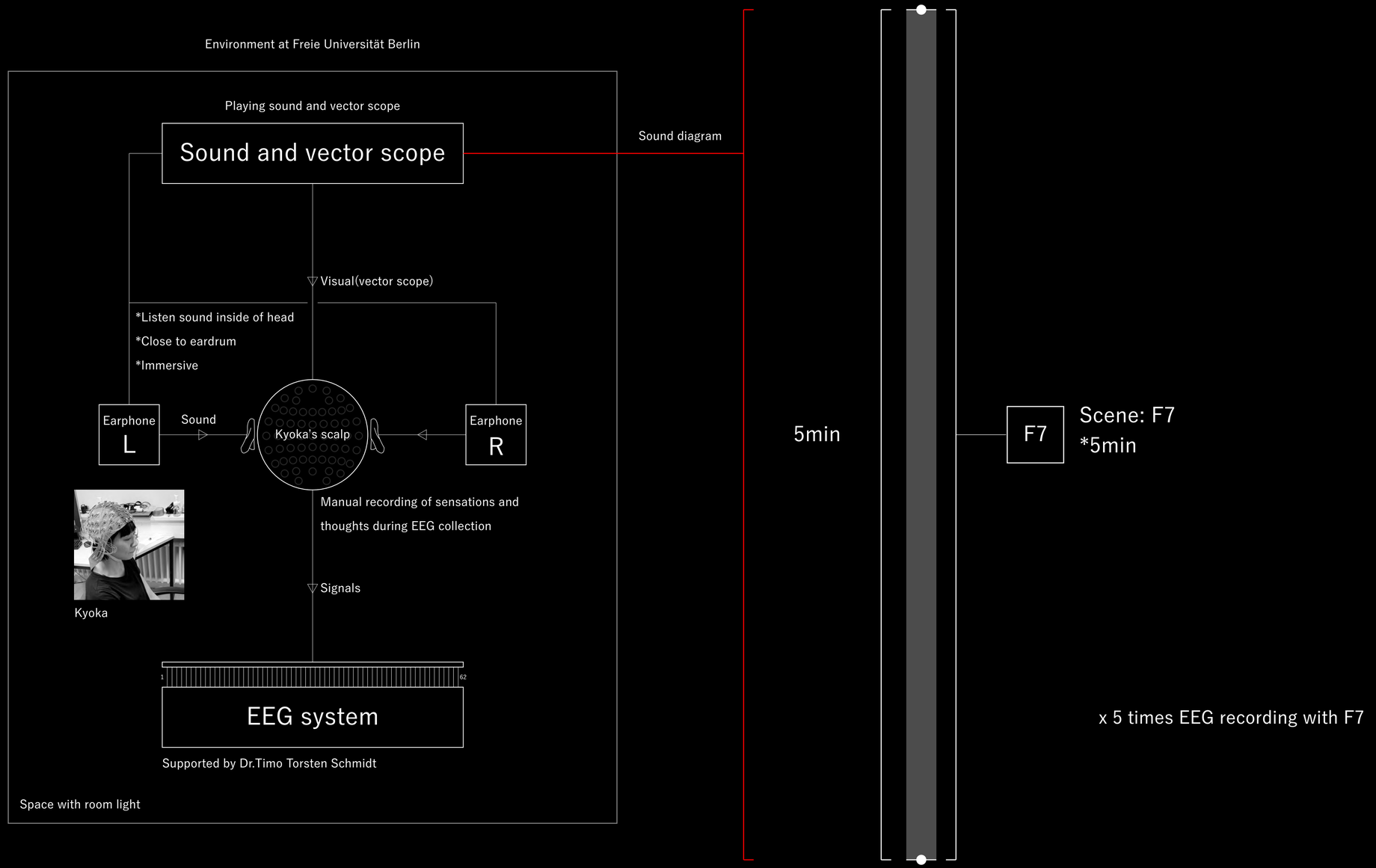
Kyoka prepared 4 types sound(F1, 2, 3 and 6). Each sounds are tests for some plot type of syntax.



Data - Brainwave(EEG) 02 at **Berlin**

Case using sound, and vector scope for sound visualization

Prepared an environment

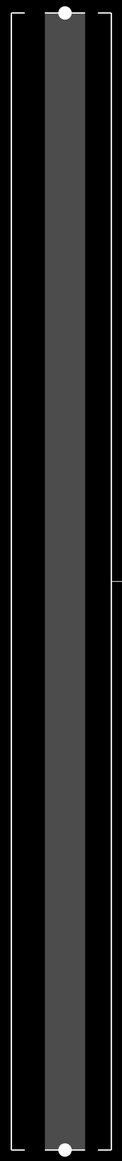


Sound and environment prepared as updated version of brainwave experience
at University of Tokyo for this time at Freie Universität Berlin.

Material - Sound F7

By Kyoka

5min

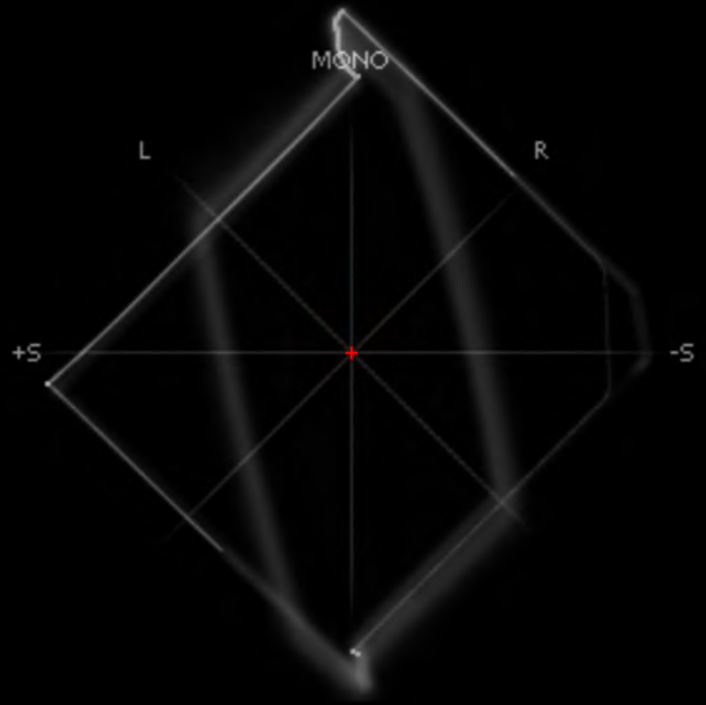


F7

Scene: F7
*5min

Binaural music through earphones with seeing vector scope.

Vector scope



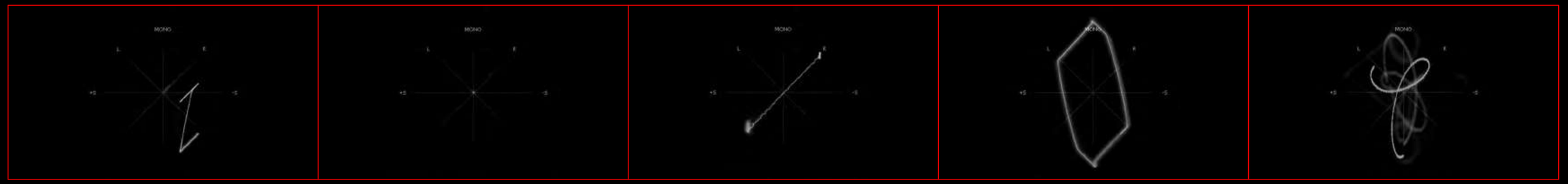
EEG measurement and analysed brain waves and emotional recordings are made, while listening to binaural music through earphones seeing vector scope.

Visualization based on Kyoka’s F7

F7

1. Kyoka prepared a five-minute sound (F7). Two music syntax example (page 6) are used for this sound.
2. Elements that seem to touch the five human memories, from the general to the personal, are placed in the music.
3. Play sound with random personal information that is easily conditioned. For example, a name.

visual ingredients



visualized based on F7

Scene: F7
*5min x 5 times

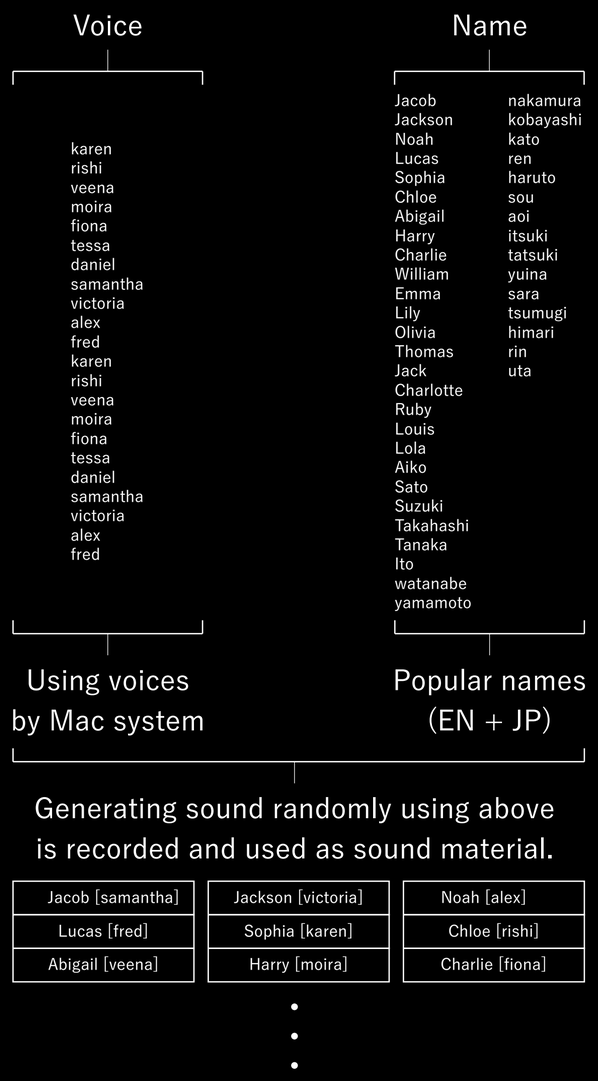
Scene: Neutral
*5min
*No sound, no vector scope
*To record neutral state of EEG

Eyes opened(0 - 30 sec), Eyes closed (31sec - 5min)

Eyes opened

Test use of personal information

Test syntax as playing sound with random personal information that is easily conditioned. For example, a name, are placed in the music to easily touch people's unconscious attentions.

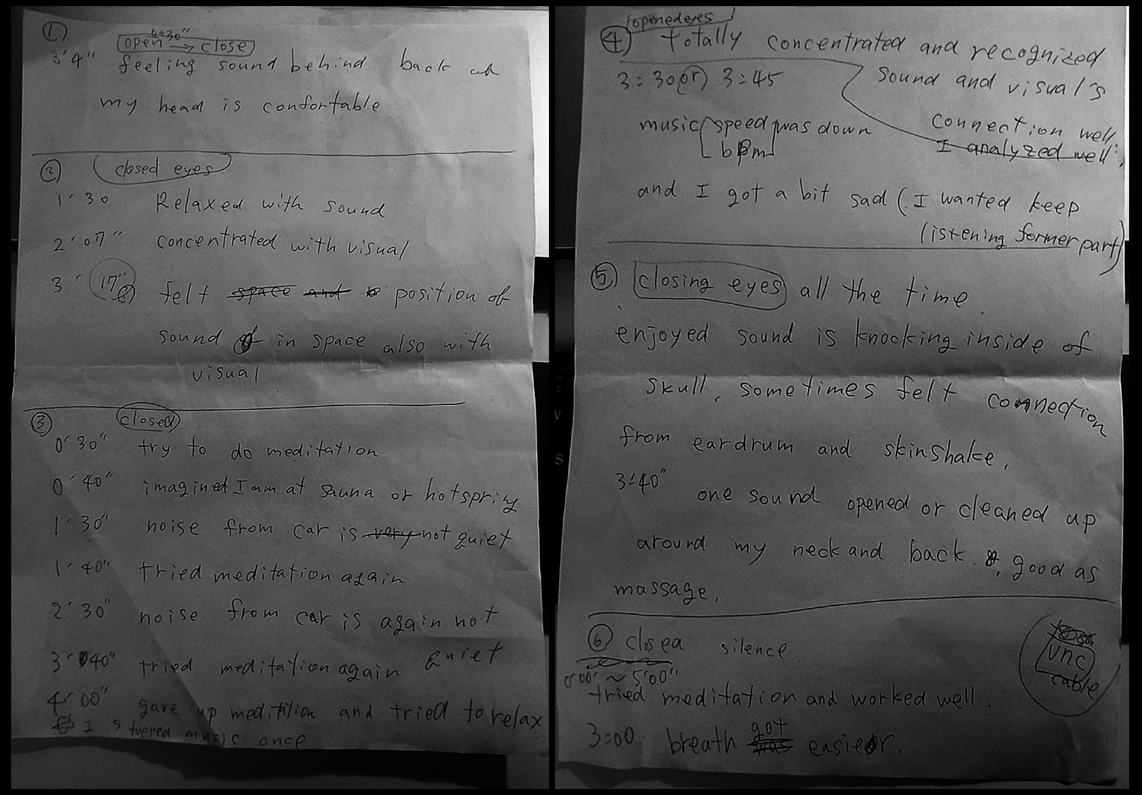


Advantages of manually recording sensations and thoughts during EEG collection

The idea of manually recording one's emotions and thoughts during EEG collection was thankfully suggested by Dr. Timo.
This was due to the consideration that recording subjective emotions and states would be accurate and useful for later analysis of EEG data.

After this experience, we decided questionnaire was to be continued also at performances.

We believe that the data from this questionnaire will make the CINEMA BLACKBOX even more interesting, updated, and sublimated in the future.



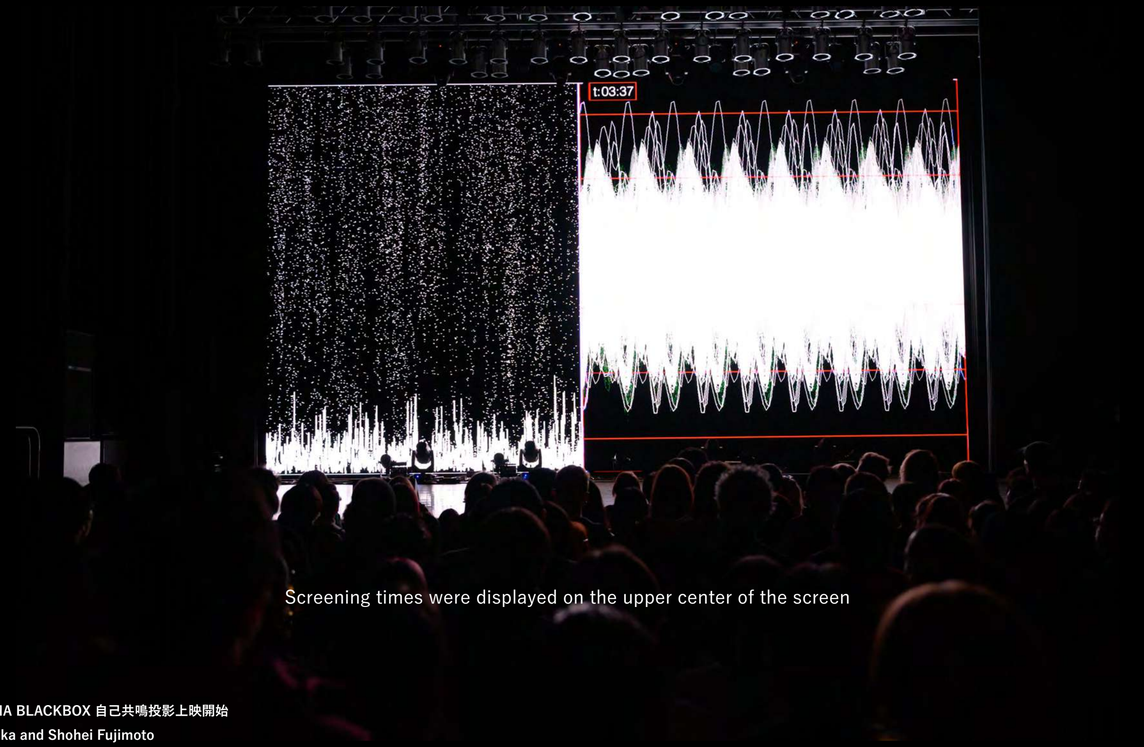
Note by Kyoka at Freie Universität Berlin

Audience’s feelings(feedback)

Based on experiences in Tokyo and Berlin, we conducted a questionnaire to record audience sentiments. Screening times were displayed at the top center of the screen 20 minutes after the show began. The questionnaire on emotions (*A, B, C) received 276 responses from 60 audience members.

A: surprised, paid attention, shocked
B: relaxed, comfortable, focused, even you can sleep
C: enjoyed, keep excited

*Submit as Time + Feeling



Screening times were displayed on the upper center of the screen

Feelings *ABC

Time		Feeling
0	20	C

0	20	C	2	5	A	3	55	A	5	19	A	7	9	C	9	14	A
0	26	B	2	10	B	3	55	A	5	20	A	7	10	C	9	40	A
0	26	A	2	10	B	4	2	A	5	29	C	7	17	C	9	45	C
0	38	B	2	16	B	4	5	C	5	33	C	7	20	C	9	47	A
0	45	B	2	20	B	4	5	C	5	40	A	7	20	A	9	47	C
0	49	B	2	27	B	4	8	C	5	47	C	7	20	C	9	50	C
0	53	A	2	34	B	4	10	C	5	50	A	7	24	C	9	53	C
0	56	A	2	40	C	4	15	A	5	55	C	7	32	C	10	0	A
1	0	B	2	41	C	4	20	C	5	55	C	7	37	C	10	1	C
1	8	A	2	43	A	4	24	C	5	59	C	7	40	A	10	5	C
1	9	B	2	55	B	4	25	C	6	0	A	7	40	C	10	10	C
1	9	B	3	0	C	4	26	A	6	0	A	7	42	C	10	15	A
1	12	C	3	4	B	4	30	C	6	0	B	7	47	C	10	17	C
1	17	B	3	9	A	4	30	C	6	23	A	7	55	A	10	19	C
1	17	A	3	10	C	4	40	C	6	24	C	7	58	A	10	20	C
1	20	A	3	10	A	4	43	C	6	25	A	8	0	A	10	20	C
1	24	A	3	11	C	4	49	A	6	35	C	8	0	A	10	21	C
1	25	B	3	19	A	4	50	C	6	40	C	8	9	C	10	29	C
1	42	C	3	19	C	5	0	A	6	51	A	8	9	A	10	33	C
1	43	C	3	30	B	5	1	A	7	0	C	8	10	A	10	38	C
1	47	B	3	30	C	5	3	A	7	5	A	8	19	C	10	43	B
1	51	A	3	45	B	5	4	C	7	5	A	8	27	B	10	50	C
1	56	B	3	50	A	5	10	C	7	6	A	8	44	C	10	52	B
1	57	B	3	50	A	5	10	C	7	7	C	8	45	C	10	52	C
1	59	B	3	50	C	5	15	A	7	7	C	9	0	A	10	55	A
2	1	B	3	52	A	5	19	C	7	8	C	9	7	C	11	1	A

11	10	C	13	6	A	15	40	B	18	48	A	21	8	A			
11	15	C	13	7	A	16	30	B	18	50	C	21	10	A			
11	18	A	13	20	A	16	32	C	18	50	A	21	25	B			
11	25	A	13	22	A	16	32	A	18	58	C	21	36	B			
11	35	B	13	22	C	16	40	C	19	0	C	21	37	A			
11	36	A	13	32	A	16	55	C	19	9	B	21	45	A			
11	54	C	13	36	A	17	0	C	19	15	C	21	50	A			
11	55	C	13	50	A	17	0	A	19	16	B	21	54	C			
12	0	C	13	50	A	17	0	C	19	20	A	22	0	C			
12	17	A	13	55	B	17	8	B	19	25	A	22	4	B			
12	17	C	13	55	A	17	13	A	19	37	C	22	4	A			
12	22	C	14	0	B	17	20	A	19	40	A	22	16	B			
12	29	A	14	0	C	17	20	A	19	50	B	22	19	C			
12	30	C	14	5	C	17	27	C	19	53	C	22	22	B			
12	35	A	14	25	C	17	27	A	20	0	A	22	26	C			
12	35	C	14	31	B	17	38	A	20	0	B	22	30	B			
12	35	C	14	39	A	17	50	A	20	7	B						
12	36	C	14	45	A	17	58	C	20	14	A						
12	38	C	14	54	C	18	0	A	20	14	C						
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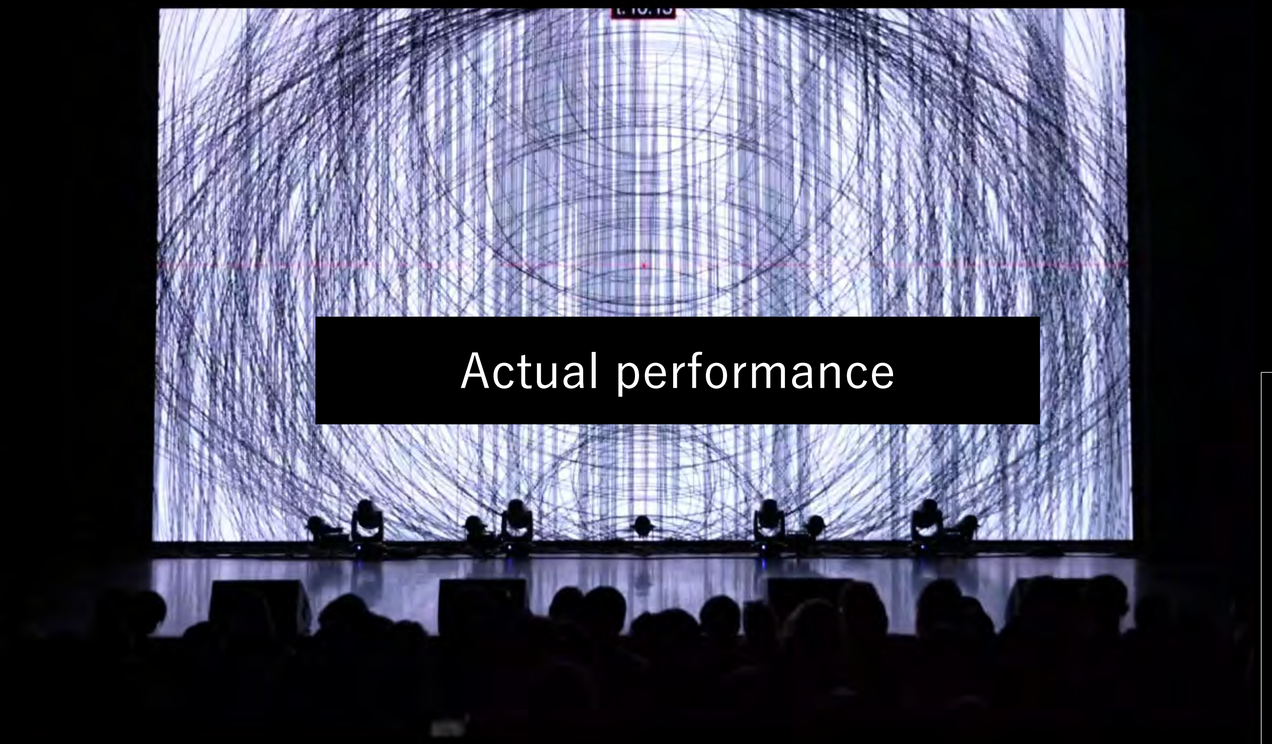
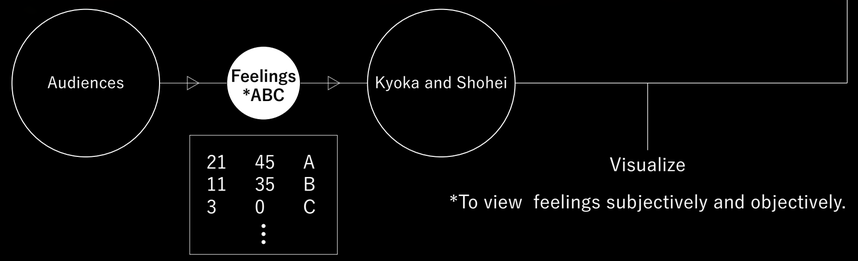
12	47	C	15	1	C	18	17	A	20	33	C						
12	55	C	15	15	A	18	21	B	20	40	B						
13	0	C	15	24	A	18	26	B	20	40	B						
13	0	B	15	30	B	18	30	B	20	44	A						
13	0	C	15	31	C	18	36	A	20	49	A						

276 answers from 60 audience

Visualize audience’s feelings(feedback)

After the performance, we visualized the survey results and created a video comparing them to the actual live video.





- A(red): surprised, paid attention, shocked
- B(blue): relaxed, comfortable, focused, even you can sleep
- C(green): enjoyed, keep excited

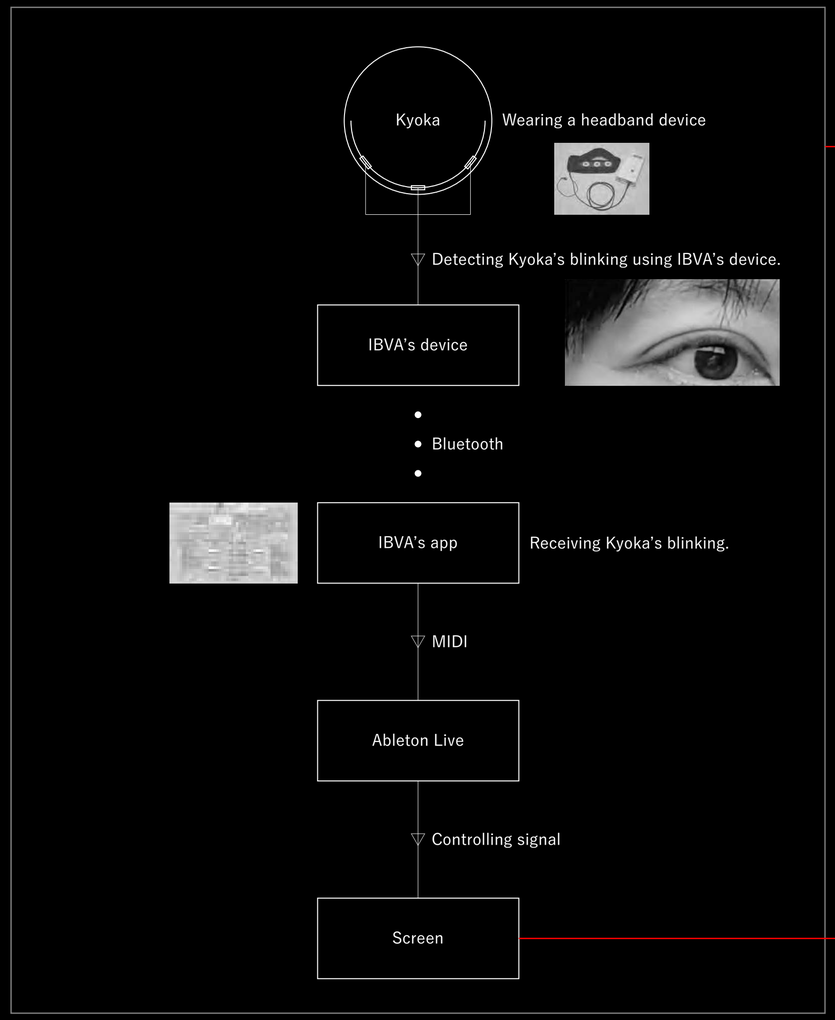
- *White:
  The undulations of the white line show how well the customers' answers matched each other in about 5 seconds.
  Larger undulations indicate greater concentration of the same responses.

CINEMA BLACKBOX 自己共鳴投影上映開始
by Kyoka and Shohei Fujimoto

Data - Blinking

Prepared an environment

Environment at actual performance

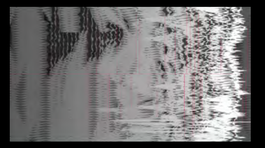


Outline

Real-time EEG was obtained using IBVA, a device that can connect MIDI equipment to EEG.

When measuring EEG at the university, we learnt it difficult to obtain accurate EEG when eyes blinking. Therefore, we dared to use blinking to control the image on screen. In the video, we test sound control by blinking.

Visualization on screen



Reason for using blink

When measuring EEG, blinking moves the scalp and thus creates noise in the EEG measurement.

And in fact, controlling EEG in a live environment was as difficult as controlling natural wind.

So, I dared to add accents and changes by consciously blinking while subconsciously controlling the sound and images with my brain waves like natural wind. In this test video, the snare rhythm is sounding like the wind with my brain waves, while changing the volume with the blink of an eye.

Data - Kyoka’s music syntax

Complements and reinterprets traditional music theory, or offers an entirely new music theory

Examples of a syntax

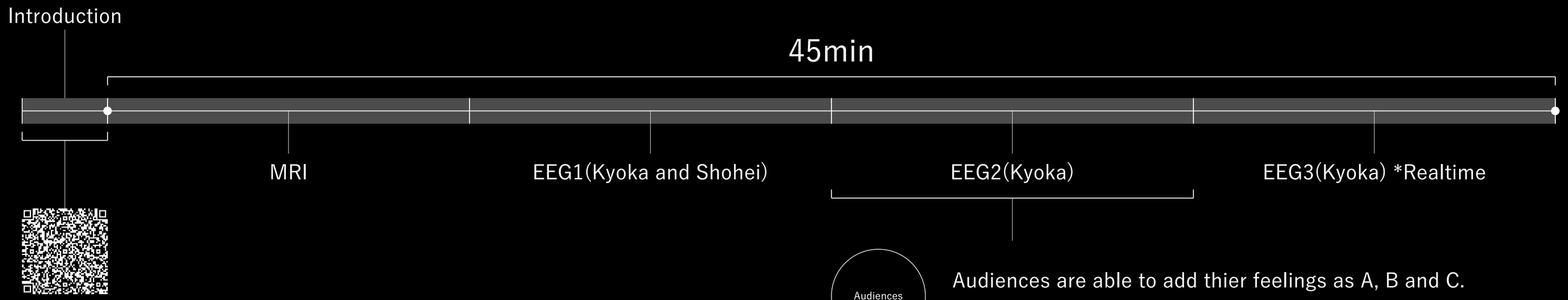
1. Use of Entropy in Composition Dare to put elements in certain sound patterns that the brain judges to be errors to get people's attention.

2. Elements that seem to touch the five human memories, from the general to the personal, are placed in the music.

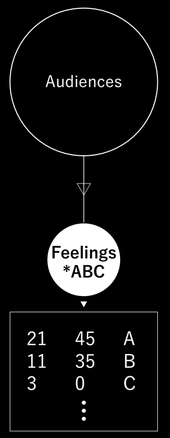
3. Play sound with random personal information that is easily conditioned. For example, a name.

Actual performance

Diagram and structure

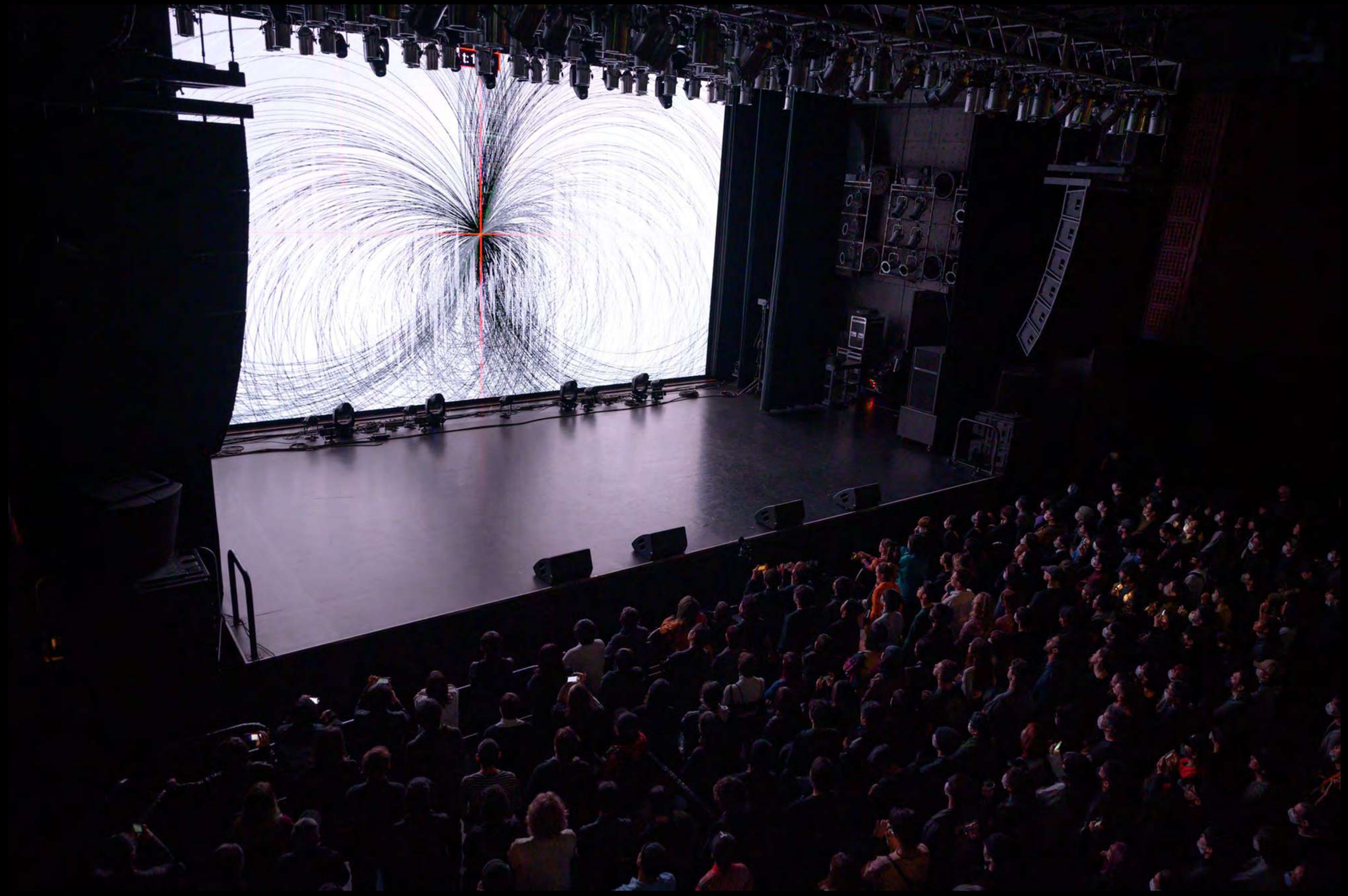


Asking about cooperation from audiences via Google form.
*To obtain feedback from audiences.
*To view feelings subjectively and objectively.



Audiences are able to add thier feelings as A, B and C.
A: surprised, paid attention, shocked
B: Relaxed, comfortable, focused, even you can sleep
C: enjoyed, keep excited
*Submit as Time + Feeling (Ex 1322A)

Mood



MUTEK.JP Edition 7

Date: 10 Dec 2022

Venue: Spotify O-EAST, Tokyo, Japan

Photo: Shigeo Gomi

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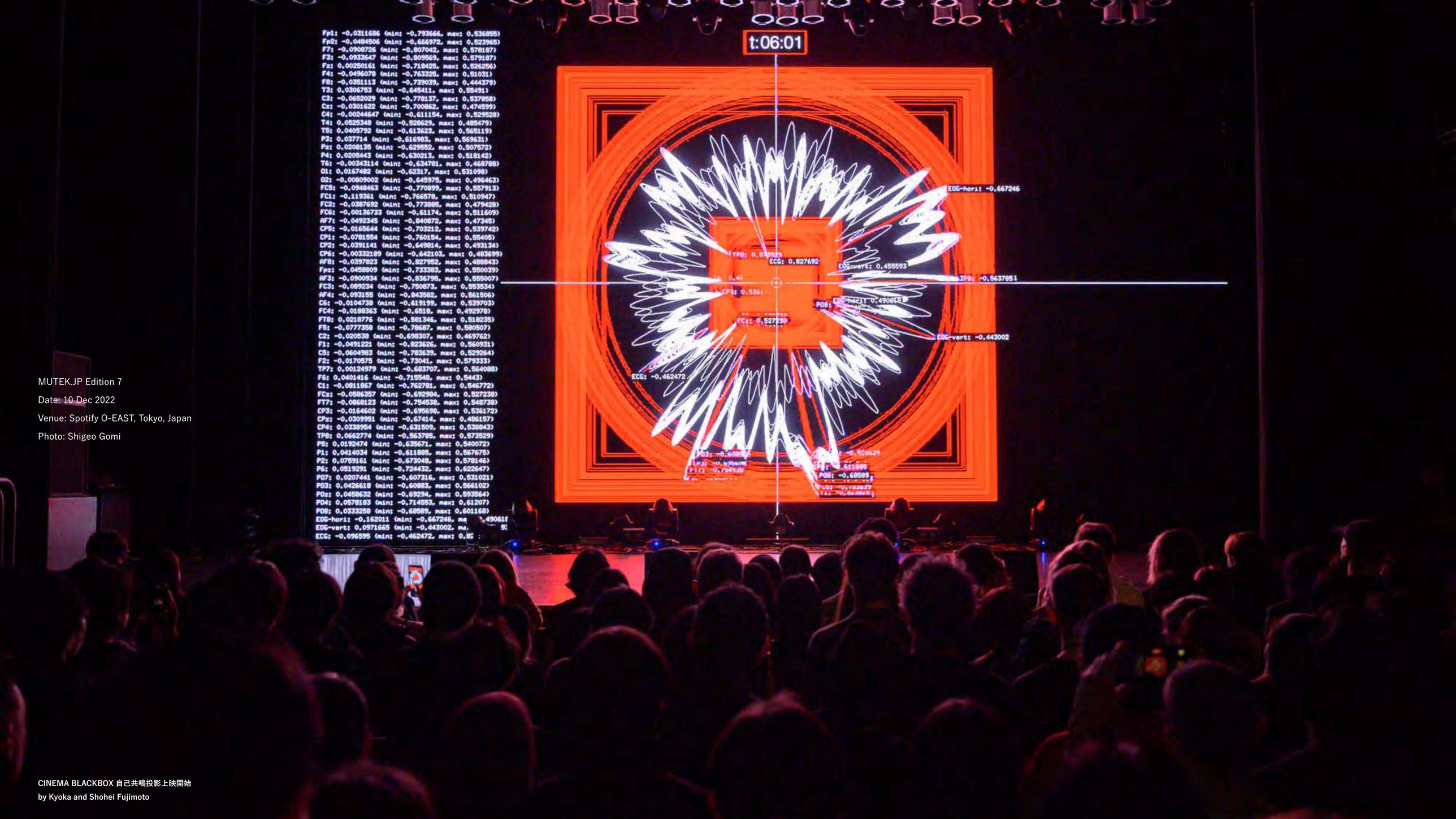

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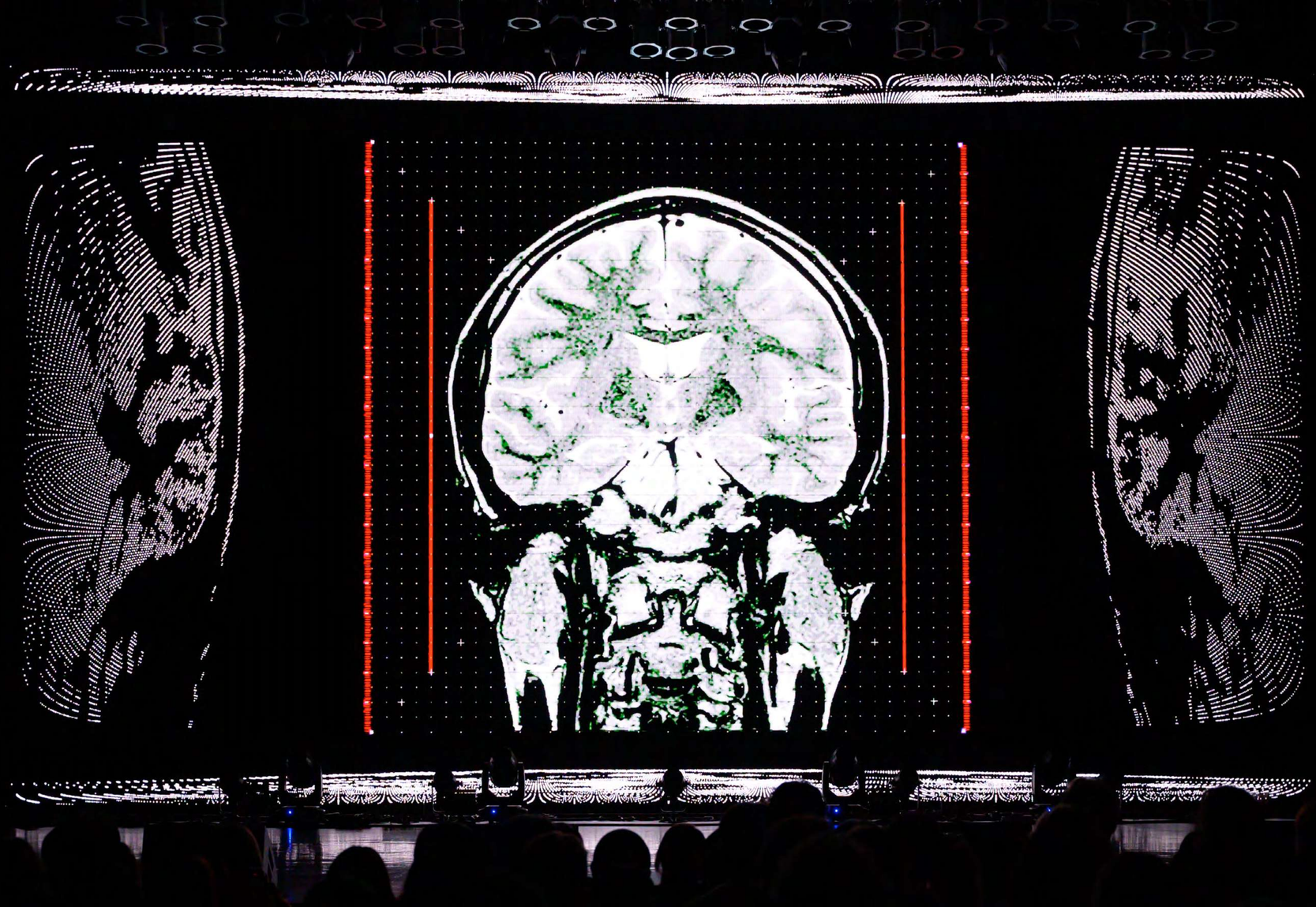

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Credit

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Special thanks to

Dr. Tatsuya Daikoku [The University of Tokyo]

Dr. Timo Torsten Schmidt, Giannini [Freie Universität Berlin]

Susanna Ylikoski [Voice], So Young H. Kim [Original text]

Masahiro Kahata [IBVA developer]

Ismael Zouaoui [IBVA Research Collaborator]

Installation plan

Installation plan(View: Top)

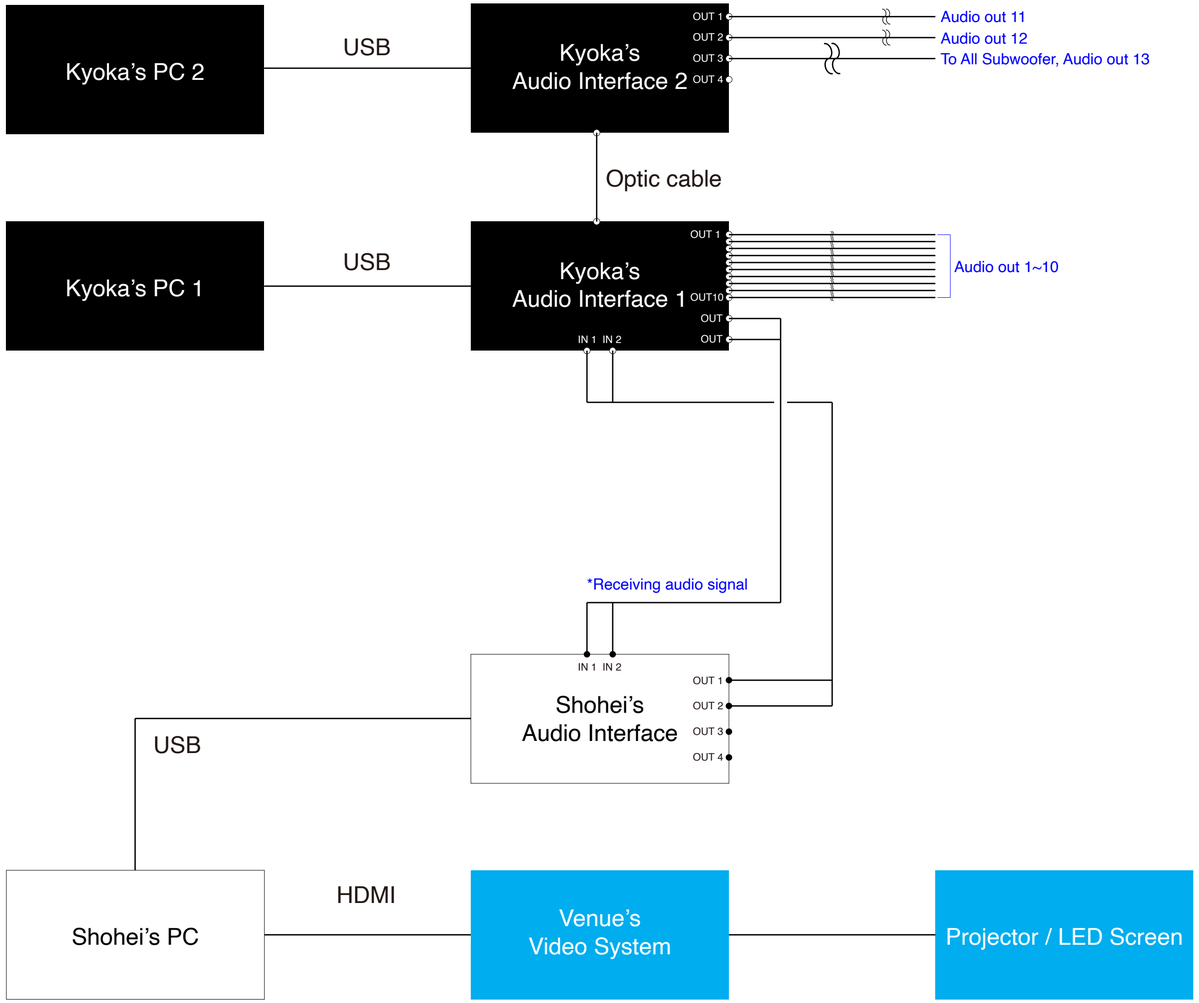
*W: 3000mm
*L: 1000mm
*H: At least 1000mm
*Power consumption: 3000 W

Installation plan(View: Front)

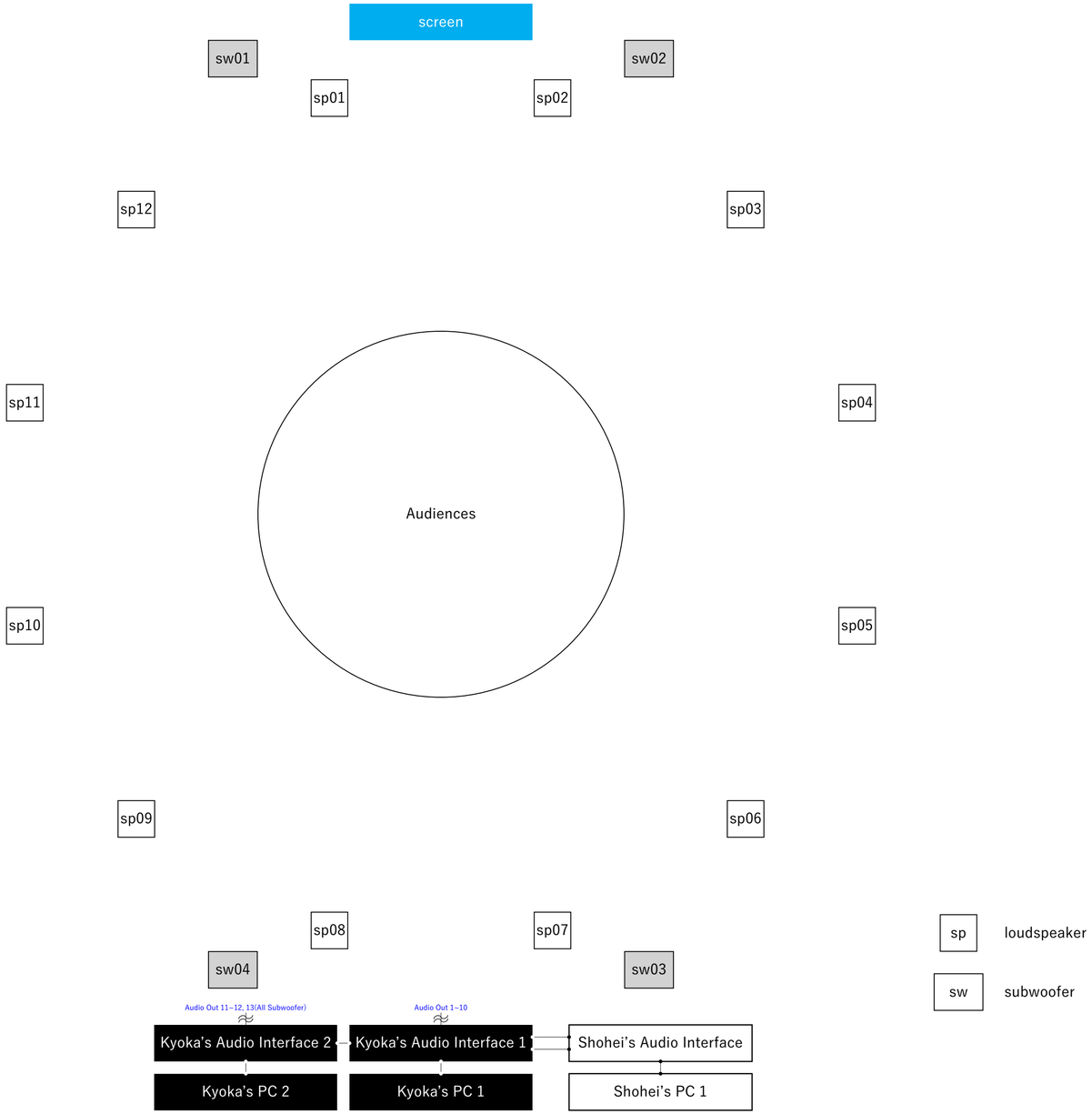
In this project the CINEMA BLACKBOX,
we perform in PA room(no on stage) to emphasize concept.

System

System diagram



Sound system 12.1ch



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FUTURE IMPROVEMENTS

FUTURE IMPROVEMENTS

Since EEG is suitable for obtaining data on the state of relaxation and concentration, it may be necessary to measure skin information such as goose bumps, pupil and eye movements, respiration, and heart rate in order to learn about states other than relaxation. A dialogue with scientists is needed to determine and consult realistic and effective measurement targets.

Kyoka has idea to develop a music theory that applies brain science research to music and new music syntax that automatically composes and performs music to naturally regulate the rhythm of the autonomic nervous system 24 hours a day (preferably 365 days a year).

Shohei has idea to develop this work with more potential of light via fact which our skin(in other words, another brain) has and information based on properties human have.

The collection and analysis of physical data requires the cooperation of brain science research institutes and medical institutions. It is just necessary to keep research and work on.

THANK YOU

by Kyoka and Shohei Fujimoto