ISSN NO : 1071 - 4391 The MIT Press

vol 15
issue
05

The SINE WAVE ORCHESTRA

---
natra haniff
editor, leonardo electronic almanac
http://lea.mit.edu natra [@] leoalmanac [dot] org\n
----------\n\n",0]); D(["ce"]); //-->

Two approaches to collective sound creation in different temporal settings: The SINE WAVE ORCHESTRA stay and The SINE WAVE ORCHESTRA mediate

Click here to download pdf version. (97kb)

by Kazuhiro Jo
Artist, Researcher
The SINE WAVE ORCHESTRA /
RCAST, University of Tokyo
4-6-1, Komaba, Meguro-ku, Tokyo
153-8904
jo [at] jp [dot] org

Ken Furudate
Artist
The SINE WAVE ORCHESTRA
anagma [at] arch-project [dot] com

Daisuke Ishida
Artist
The SINE WAVE ORCHESTRA
daisuke-ishida [at] jp [dot] org

Mizuki Noguchi
Artist, Web Designer
The SINE WAVE ORCHESTRA
miznog [at] mac [dot] com
http://homepage.mac.com/miznog/

Keywords
sound art, collective creativity, sound installation, sine wave

Abstract
In this paper, we present two works of The SINE WAVE ORCHESTRA that show different approaches to collective sound creation. One work is The SINE WAVE ORCHESTRA stay. The other is The SINE WAVE ORCHESTRA mediate. We examine the creative and technical consideration in each work and discuss two approaches to collective sound creation.

Introduction

There have been a number of works that enable people to create sound representation collectively [1, 2]. In some of these works, people share the time and space, and in some of them, people share only the time and create collective sound representation over the network. However, few numbers of works are concerned with

the creation of collective sound representation in different temporal settings. The two works presented in this paper are both enabled people to create sound representation in different temporal settings. In these works, people one by one participate to add/interpose his/her performance in asynchronous manner. The collective sound representation is changing by involvement of further participants.

Figure 1: The SINE WAVE ORCHESTRA stay

The SINE WAVE ORCHESTRA

The SINE WAVE ORCHESTRA (SWO) is a collective sound project that has been performing for the past several years [3]. The authors have served as the core organizer of the project. We started this project with a motivation to create a sea of sine waves as a collective sound representation. Under the basic concept that each participant plays a sine wave by changing its frequency, amplitude, and/or phase, people are invited to create a collective sound representation. As a result, the sum of a series of sine waves of specific frequency, amplitude, and phase, might represent some sort of periodic sound as Fourier showed [4]. There have been several works of SWO, which show different styles of collective sound creation by choosing different temporal, physical, environmental, and procedural settings [5, 6, 7]. We explored to realize the concept not only in shared time and space but also in different temporal settings. Following the latter, this paper examines the creative and technical consideration, and discusses the approaches of collective sound creation in different temporal settings, taking examples from two SWO works — The SINE WAVE ORCHESTRA stay — and — The SINE WAVE ORCHESTRA mediate.

The SINE WAVE ORCHESTRA stay

The SINE WAVE ORCHESTRA stay (SWO-stay) was premiered at *open nature* exhibition at NTT InterCommunication Center from 29 April 29 – 3 July 2005 [8]. The system consists of a set of controllers, control engine, light, sound synthesis engine, and multiple speakers. The controllers connect to the control engine. The control engine controls the light and the sound synthesis engine. The sound synthesis engine, connected to 116 speakers, synthesizes sine waves in real time. The multiple speakers mounted on the wall horizontally encircle the participant. The controller, light, and multiple speakers are set in an anechoic chamber.

Every participant gets instructions about the work before he/she enters it. At first, participant goes into the anechoic chamber. When he/she touches the controller, the volume of a sine wave and the brightness of the light increase from the ordinary level. Then, he/she chooses the frequency and the position, and leaves his/her own sine wave in the work. The volume of the sine wave and the brightness of the light decrease to the ordinary level. Then the volume of the sine wave gradually attenuates over the period of two weeks to disappear. Every time a participant enters the work, one sine wave is added to the system. During the exhibition, the collective sound representation is changing from a phase where each sine wave is discriminable to a cluster, which consists of mutually interfering sine waves like a white noise that contains all frequencies.

Controller

SWO-stay sets two rotational controllers in the center of an anechoic chamber. One is for changing the frequency of a sine wave, and the other is for changing the position of sine wave in omni horizontal direction. To generate a release message for the sine wave after the configuration these parameters, the participant push on both controllers. At that moment, the frequency, and position of the corresponding sine wave are fixed, and these control data are sent to the control engine.

Control Engine

The control engine receives data from the controller and sends them to the light and sound synthesis engine. The frequency and position control changes are only used for sound synthesis engine. The release message of the sine wave is used for both light and sound synthesis engine. After the release message is received, the control engine is locked in order to restrict multiple releases of sine waves from one participant.

Light

A light is mounted on the ceiling. When it receives release message from the control engine, through MIDI based light controller, the brightness of the light is decreased corresponding to the volume of the sine wave.

Sound synthesis engine

The sound synthesis engine treats all sine waves left by the participants. The frequency and position change from the control engine transmitted through the network are used as parameters of real time sine wave synthesis. Sound synthesis engine changes the frequency of a sine wave and the audio interface's output channel (116ch). Every audio interface's output is connected to one of the multiple speakers. When it receives a release message from the control engine, the volume of the sine wave is decreased to the same level as the other sine waves, which corresponds also to the brightness of the light. The volume of each sine wave gradually attenuates over two weeks to disappear.

Multiple speakers

All the sine waves from the sound synthesis engine are output through multiple speakers mounted on the wall of the anechoic chamber. In total, 116 speakers encircle the participant from omni horizontal direction.

Anechoic chamber

The controller and multiple speakers are set in an anechoic chamber. In order to hear only the sine waves, which are transmitted directly from multiple speakers, and to prevent invasion of any noise from the outside, the door of the room is kept shut while people are inside.

The SINE WAVE ORCHESTRA mediate

The SINE WAVE ORCHESTRA mediate (SWO-mediate) was premiered at *Re: search, Art Collaboration between Australia and Japan* exhibition at sendai mediatheque from 26 November 26 – 25 December 2006 [9]. The system consists of eight sets of boards with a moving fader and a speaker, a control engine, and a sound synthesis engine. The moving faders connect to the control engine. The control engine controls the sound synthesis engine. The sound synthesis engine connects to eight speakers, and synthesizes eight sine waves. Each set of the board was hung from the ceiling in the exhibition space.

Figure 2: The SINE WAVE ORCHESTRA mediate

There is an instruction about the work on the wall of the exhibition space. When participant touches the moving fader, the fader stops to move. Then, he/she changes the frequency of a sine wave by changing the position of the fader with his/her hand. The sine wave is output from the speaker on the same board. All of his/her performance is recorded.

After the participant releases the fader, the control engine recursively moves the fader along with the performance. Along with the position of the fader, the frequency of the sine wave is changing by the sound synthesis engine. When another participant touches the fader, the control engine interposes his/her performance in previous performances. Every time a participant touches the fader, the length of the recursion is increased. The eight sets of a fader and a speaker might have a different period of

recursion.

Board, Moving fader, Speaker

SWO-mediates uses eight sets of wooden boards — 3600mm x 450mm x 30mm — with a moving fader, and a speaker. The speaker is mounted on the center of the board, and the fader is vertically mounted on the bottom of the speaker. Each speaker outputs a sine wave from sound synthesis engine. Moving fader consists of a knob with touch sensor, a variable resistor, and a motor. When the participant moves the fader, the position of the fader is sent to the control engine. The control engine also moves the fader by sending data to the motor. The boards are hung from the ceiling in same direction and alternately arranged in 8m x 8m matrix.

Control Engine

The control engine separately receives and records data of touch and position from eight faders. Each position data of the fader is directly sent to the sound synthesis engine for changing the frequency of a sine wave. When a participant moves the fader, the control engine records the position data in time series. After the participant releases the fader, the engine recursively send the data to the motor to move the fader. When another participant touches the fader, the engine stops to send data to the motor and start to record the position. After the release, the engine interposes the recorded data into the part where it stops to send data to the motor. Every time a participant touches the fader, the length of the positional data is increased.

Sound Synthesis Engine

The sound synthesis engine germinates eight sine waves for eight speakers. It changes the frequency of each sine wave based on the positional data of the fader from the control engine. Each sine wave is treated as a separate audio signal and directly connected to each speaker. The volume of each sine wave is fixed.

Discussion

We presented two works of SWO, SWO-stay and SWO-mediate. During the exhibition period, about 8,000 people participated in SWO-stay and 3,000 people participated in SWO-mediate. Both of the works enable people to create collective sound representation in different temporal settings. The collective sound representation is changing during the exhibition period by involvement of further participants. However, the approaches to the collective sound creation are crucially different in the two works. We would like to examine these two approaches as — layered — from SWO-stay and — continued — from SWO-mediate.

In layered approach shown in SWO-stay, the number of sine waves depends on the number of participant. Each participant fixed the frequency and the position of a sine wave and one by one added it to the collective sound representation. Every time a participant enters the work, the number of the sine waves is increased. As a result, sine waves are layered and the collective sound representation is changing from a phase where each sine wave is discriminable to a cluster, which consists of mutually interfering sine waves like a white noise that contains all frequencies.

In continued approach shown in SWO-mediate, the number of sine waves is fixed. Each participant interposed his/her performance in previous performance. The frequency of the sine wave is recursively changed along with the performance. Every time a participant enters the work, the period of the recursion is increased. As a result, sine waves are continued and the collective sound representation is changing from a phase where each recursion of a sine wave is discriminable to a drone, which consists of continuously changing sine waves with the different period of recursion.

From the nature of sine waves, it is difficult to differentiate a sine wave from the others. However, through informal observations with the participants, we have noticed that some people tried to identify their own sine wave of his/her performance after they add/interpose them to the collective sound representation. As a key for identification, in layered approach, people tried to use the frequency and the position of the speaker and in continued approach, people tried to use the fragment of the change of the frequency. We have no comparative data about the difficulty of identification between two approaches. However, it might be an interesting question that how the difference of approach affects to motivate people to participate the collective sound creation.

Conclusion

Through this paper, we presented two works of SWO — SWO-stay — and — SWO-mediate —, and we proposed two approaches — layered — and — continued — for collective sound creation in different temporal settings. We could argue that it is useful for us as a base for further developing of our works. It may be also useful for the analysis and creation of other types of collective sound creation projects.

Acknowledgements
SWO-stay was supported by Musetex, Division of Orbit Limited. We would like to thank Yukiko Shikata, Minoru Hatanaka, Dominick Chen, Kento Shimizu, Kumiyo Nakakoji, Yasuhiro Yamamoto and the reviewers for their many useful and constructive suggestions.

References
1. T. Blaine, and S. Fels, “Contexts of collaborative musical experiences”, Proceedings of the 2003 Conference on New interfaces For Musical Expression (NIME03), Montreal, Quebec, Canada, pp. 129-134, (May 2003).

2. G. Weinberg, “Interconnected Musical Networks Towards a Theoretical Framework”, in *Computer Music Journal* , Vol. 29:2, pp. 23-39, (2005).

3. The SINE WAVE ORCHESTRA, http://swo.jp.

4. J. J. Jenkins, “Acousticinformation for objects, places, and events”, Proceedings of the First International Conference on Event Perception, W. H. Warren, Jr., R. E. Shaw (Eds.), L. Erlbaum Associates, pp. 115-138, (1985).

5. K. Jo, K. Furudate, D. Ishida, M. Noguchi, “The SINE WAVE ORCHESTRA stay”, Proceedings of ACM Multimedia 2005, pp.571-573, ACM Press, (November 2005)

6. K. Jo, K. Furudate, D. Ishida, M. Noguchi, “A Performance of The SINE WAVE ORCHESTRA”, Proceedings of the Ninth Conference on Participatory Design: Expanding Boundaries in Design (PDC '06) — Volume 2, CPSR, Trento, Italy, pp. 24-25, (August 2006).

7. K. Jo, Y. Yamamoto, K. Nakakoji, “Styles of Participation and Engagement in Collective Sound Performance Projects”, in Engage: Interaction, Art and Audience Experience, E. Edmonds, L. Muller, D. Turnbull (eds.), Creativity and Cognition Studios Press, Sydney, Australia, pp. 110-119, (November 2006).

8. The SINE WAVE ORCHESTRA,”The SINE WAVE ORCHESTRA stay”, *open nature* (Tokyo, NTT Publishing Co., Ltd., 2005) pp. 34-35.

9. The SINE WAVE ORCHESTRA, “The SINE WAVE ORCHESTRA mediate”, *Re: search, Art Collaboration between Australia and Japan* (Sendai, sendai mediatheque, 2007) pp. 73-82.

Author Biographies
Kazuhiro Jo was born in Fukushima in 1977, and is currently based in Tokyo. He is a member of The SINE WAVE ORCHESTRA and The SINE WAVE QUARTET, and graduated from Kyushu Institute of Design, graduate school division of Audio and Visual Communication Studies (MDes). After working at Software Development Lab, IBM Japan, he now studies at RCAST, University of Tokyo as a doctoral course student. His research area is Auditory Interaction Design. He also acts as a member of a performance unit named aeo with eye (Boredoms) and Taeji Sawai (portabole[k]ommunity), a co-organizer of dorkbot tokyo (http://dorkbot.org /dorkbottokyo/), and a member of Monalisa project (http://monalisa-au.org/plog/).

Ken Furudate was born in Kanagawa in 1981, and is currently based in Kyoto. He graduated from IAMAS in 2002 and started The SINE WAVE ORCHESTRA (S.W.O. http://swo.jp/) in 2002. He is also active as a member of audio visual unit softpad (http://softpad.org), 710.beppo (http://arch-project.com/), which is a VJ unit that has played at some festivals such as *sonar sound tokyo, metamorphose*, etc He is also a main organizer of headphone concert festival Le Placard (http://leplacard.jp/, http://leplacard.org/) in Japan. As a solo artist, he is also active as a noise musician.

Daisuke Ishida is a sound artist born in Tokyo 1980, and currently based in Berlin. Started solo activities in 2000. Participated MobLab: Japanese-German media camp 2005. Is a member of The SINE WAVE ORCHESTRA and The SINE WAVE QUARTET, which was founded in 2002.

Mizuki Mizuki was born in Tokyo in 1979, and is currently based in Saitama. A web designer. (Taka Ishii Gallery: www.takaishiigallery.com, gallery.sora: www.gallerysora.com). A member of The SINE WAVE ORCHESTRA and The SINE WAVE QUARTET.

Citation reference for this Leonardo Electronic Almanac Essay

MLA Style
Kazuhiro, Jo; Furudate, Ken; Ishida, Daisuke; Noguchi, Mizuki. “Two approaches to collective sound creation in different temporal settings: The SINE WAVE ORCHESTRA stay and The SINE WAVE ORCHESTRA mediate.” “LEA-ACM Multimedia” Special Issue, Leonardo Electronic Almanac Vol. 15, No. 5 - 6 (2007). 10 May 2007<http://leoalmanac.org/journal/vol_15/lea_v15_n05-06/jkazuhiro.asp>.

APA Style
Kazuhiro, Jo; Furudate, Ken; Ishida, Daisuke; Noguchi, Mizuki. (March 2007) “Two approaches to collective sound creation in different temporal settings: The SINE WAVE ORCHESTRA stay and The SINE WAVE ORCHESTRA mediate,” “LEA-ACM Multimedia” Special Issue, Leonardo Electronic Almanac Vol. 15, No. 5 - 6 (2007). Retrieved 10 May 2007 from <http://leoalmanac.org/journal/vol_15/lea_v15_n05-06/jkazuhiro.asp>.