

Spatialization Techniques in *Nué* (鶺鴒)

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Abstract

この論文は私の最近のマルチスピーカーシステムとフィックスドメディアのための作品<鶺鴒>について論じる。曲名は猿の頭、狸の胴体、虎の手足、そして蛇の尻尾を持つ日本の神話の怪物の名称から引用している。全体を作るための様々な部分の組み合わせは4台のMeyer CQ-1 スピーカー、4台2組のMeyer UPJ-1Pスピーカー、4台のMeyer MM-4スピーカー、2台の自作スピーカーというように名前の由来がシステムに反映されている。スピーカシステムの解説と同様にこのシステムに生かされた音響技術の解説も行う。

In this paper I will discuss my recent work, *Nué* for multi-speaker system and fixed media. The title of the piece refers to a Japanese chimera, a mythical creature with the head of a monkey, body of a tanuki (a raccoon dog), arms and legs of a tiger, tail of a snake and the song of birds. This combination of different parts to make a whole is reflected in the speaker system, which combines four Meyer CQ-1 speakers, two pairs of Meyer UPJ-1P speakers, four Meyer MM-4 speakers, and two speakers of my own make. I will discuss compositional choices involved in the design of the speaker system.

1. Introduction

My work *Nué* was premiered at Sonic Interaction 2011 vol.1 as part of a concert by Sonology Department of Kunitachi College of Music.

There is 6-channel multi-speaker system around the periphery of the audience in the hall. Most music spaces are desired to deliver acoustic diffusion equally to all the audience, however it is difficult to realize such an acoustic diffusion by our speaker system in the hall (there is more than 100 people). So I will introduce a solution to this problem in *Nué*.

2. Description of *Nué*

The title of the piece *Nué* refers to a Japanese chimera, a mythical creature with the head of a monkey, body of a tanuki, arms and legs of a tiger, tail of a snake and the song of birds. This is the basic music composition and acoustic concept for this work. The combination of different parts to make a whole is reflected in the speaker system and sounds. In the use of source material from the sound of five kinds of

flutes: piccolo, concert flute, tenor flute, bass flute, and contrabass flute. Moreover special techniques were used to record each flute: multi-phonetic, overtone, whistle-tone, voice-tone, and key-percussion. The reason these flutes are chosen as sound material is that they are often used to represent the song of birds, such as in works by Messiaen. These sound material were recoded and edited with Pro Tools LE. After that these materials were processed with Max/MSP and Pro Tools LE.

3. Spatialization techniques

3.1 Multi-speaker system

It is difficult to realize an acoustic diffusion distributed equally to all the audience by our speaker system in the hall (Fig.1 gray area). In order to satisfy the requirement for equal acoustic diffusion, six speakers were placed within the previous speaker system. The addition of speakers brought equal acoustic diffusion, but also it brought musical accent with the change of moving sounds, and the change of timbre.

3.1.1 Direction and Directivity

We have always used a speaker system with four Meyer CQ-1 speakers (Fig1. speakers numbered 1,2,5 and 6) and two pair of UPJ-1P speakers (numbered 3 and 4). These speakers are put around the audience in a circle. The direction of the speakers is toward the center, and the horizontal directivity of speakers is a radiation of 90 degrees. In order to distribute sounds with more than 6 speakers to the whole audience, there are two ways in which the speaker has direction: one is the direction of speaker, the other is the directivity of speaker. Firstly, about the direction of speakers: four speakers with different directions from each other speaker system were put in-between each speaker system and the audience (Fig.1, numbered 7, 8, 11 and 12). The direction of the speakers were straighter than the outer speakers, and they face each other. Moreover, location of speakers were symmetrical with respect to a point. The studio-monitor speakers were used for these four speakers at first, but the height of these speakers on speaker-stands were above the height of person's ear while sitting. As a result, the acoustic impression is a little better than the usual speaker system. The speakers and their heights were modified to the Meyer MM-4 speakers, which is small enough to install on a micro-

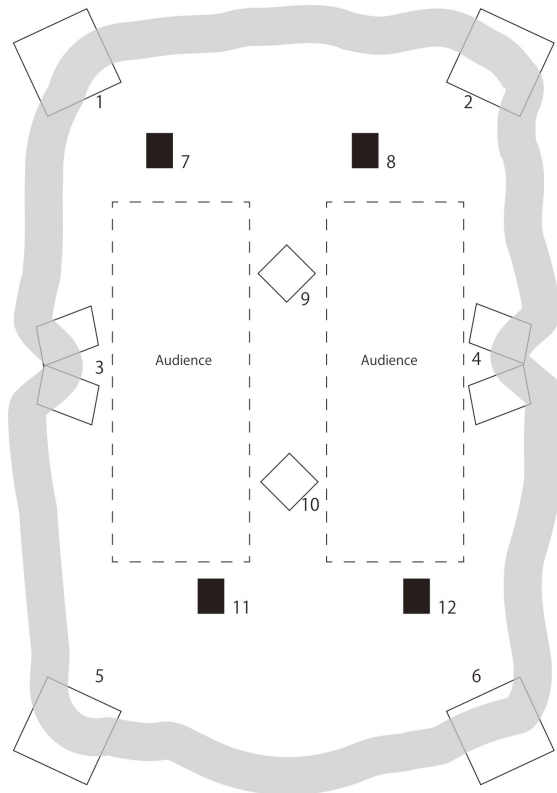


Fig.1 Location of speakers

phone stand. Meyer MM-4 speakers were lifted up to overhead of the audience, and the vertical axis of speaker was also modified. If the acoustics of the previous speaker system is two dimensions, the overhead sound brings this acoustic diffusion into three dimensions.

Next, an explanation about directivity.

A speaker usually has directivity. For instance, we can listen to sound from the front of speaker which has high directivity, but we can't listen to sound from the rear. But we can listen to the sound of a non-directivity (omni-directional) speaker anywhere. If a non-directivity speaker is put on center of the audience, more equal acoustic diffusion is expected. So I made the cubic non-directivity speaker with an undergraduate student. (Fig.2) The two cubic non-directivity speakers which has six speaker-units and the same sounds are diffused from all units were placed between the two sections of the audience. (Fig.1 Number the 9 and 10) The sounds of our self-

made non-directivity speakers were different from the other Meyer speakers. This speaker created the impression of a different acoustic. Moreover, the acoustic diffusion became equal.



Fig. 2 Non-directivity speaker

4. Conclusion

The total number of speaker is twelve. The chosen six speakers with the view of direction and directivity were added to within the original six speakers around the audience. The acoustic diffusion became more than six speakers. The movement of sounds and the timbre were a rich change by the addition of speakers. I am interested in the discovery of the interaction between the produced movement of sounds and the location of speakers.

Author's profile

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Tatsuya Fujishiro, a graduate student at Kunitachi College of music, was born in Japan, 1988. He has been studying composition, electronic music and computer programming with Shintaro Imai and Shu Matsuda.