CONDITIONS FOR DEVELOPMENT OF AN INTERCHANGE FORMAT FOR SPATIAL AUDIO

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ABSTRACT

A composer suggests some critical issues for the design of an interchange format for spatial audio, with an emphasis on creative musical applications.

1. INTRODUCTION

The ambitious goal towards which this panel was convened is to "cover all needs and create a format which everyone is willing to use" [1]. While I am undecided about the need for an interchange format at this time, I am certain that it is time for the discussion that will be stimulated by this panel. Both the motivation to create spatial music and the means to do so are rapidly increasing. This can be seen in the increasing number of multi-channel performance spaces and studios being built, the acceptance of 8-channel music as a de-facto standard at major electroacoustic music festivals, and most importantly, the fact that composers are eagerly embracing available opportunities to compose spatial music.

2. WHY FORMATS?

In order to have a chance of being accepted, a format, standard, or protocol must solve an existing problem. In particular, it must bring order to a "Tower of Babel" situation, facilitating communication, and thus more efficient practice. Before we can define an interchange format for spatial audio, with the intention of facilitating spatially focussed electroacoustic music, we need to identify the problems that need to be solved, and the different conceptual and practical frameworks under which composers represent spatial audio, both to themselves and to others. We should not assume *a priori* that we know what these frameworks will be. For example, the panel proposal suggests an interchange format for audio scenes; however we should not assume that audio scenes are, or will be, the preferred mechanism for representing spatial audio. Rather we should examine past and present spatial music practices for indications of what may be required for a useful interchange format.

3. EARLY SPATIAL MUSIC

Spatial elements have a long history in the practice of electroacoustic music. One of the earliest electronic instruments, the Telharmonium, first publicly presented in 1906, produced its sound through acoustic horns distributed throughout the performance space. A slightly later version of the Telharmonium propagated its music over telephone networks, in perhaps the ultimate form of spatial distribution [2]. Some of the earliest tape music performances, such as the premieres of Stockhausen's Gesang der Jünglinge and Varèse's Poème Électronique contained significant spatial elements. Space is the essential element in Audium performances which have been ongoing since 1960 [3]. These early electroacoustic performances were site-specific so that the issue of transferring pieces to a different space did not arise. However the problem of mapping a relatively small number of recorded tracks to a larger set of speakers did present itself in Poème Électronique [4], as well as in the earliest Audium performances, which mapped from four channels of audio to 136 speakers in the space.

4. PERFORMED DIFFUSION

An important strand of current spatial electroacoustic music practice is "diffusion," in which relatively few pre-recorded tracks are dynamically routed to any number of speakers in the concert space. This approach involves performance, and a significant degree of interpretation. Since diffusion involves "performing the space," the practice invites us to consider which aspects of an electroacoustic performance should be precisely specified and which should be left to the performer. Spatial aspects could be an optional part of a larger system of electroacoustic performance representation. In any case, in order to be successful, a spatial audio interchange will need to support performed diffusion, as it is deeply embedded in current electroacoustic music practice.

4.1. Fixed Diffusion

Another popular spatialization strategy is to make an isomorphic mapping between composed tracks and speakers in the performance space. In this case, any desired spatial attributes are encoded into the recording, and a performance consists of playback into the space, with a possible adjustment of overall gain as necessary. I call this strategy "fixed diffusion." There already exists an implicit interchange format for this kind of music, namely providing all of the individual tracks as

monophonic audio files, along with a diagram showing how they should be assigned to speakers. The very simplicity of this arrangement merits consideration. It may well be that an effective spatial audio interchange format will reduce to this model, just as a stripped down musical score might provide only pitches and rhythms, while a more expressive score would notate dynamics, phrasing, tempo fluctuations and so forth.

4.2. Mediated Diffusion

A strategy that combines some aspects of performed diffusion with fixed diffusion is what I call "mediated diffusion" in which spatial placement of sources is mediated by one or more algorithmic processes. This might involve a panning program like VBAP [5], which takes determinate spatial directives, or it might involve automated spatial placement according to methods that might be indeterminate of spatial mapping in advance of performance. Mediated diffusion can achieve levels of complexity in diffusion that would be impossible to perform manually in real-time. I expect to see increasing use of mediated diffusion in the future because it fits so well with other aspects of current practice in live computer music. Both the potential complexity of spatial representation and its potential indeterminacy in mediated diffusion present special challenges that should be considered in defining a spatial audio interchange.

5.   EXISTING FORMATS

Before designing a new interchange format, it is advisable to consider existing formats, in order to know what solutions have already been proposed. Any new format that does not provide at least as much value as existing formats is unlikely to find broad acceptance. One implicit format already mentioned is a combination of individual tracks, a geometrical map of speaker placement, and assignment of tracks to speakers. Ambisonics [6] is another spatial audio format that has developed some serious adherents. Natasha Barrett, a composer who has done a considerable amount of work with ambisonics discusses the system in a recent interview, providing valuable comparisons with other spatial strategies, such as stereo diffusion and wavefield synthesis [7].

6.   SPATIAL ORCHESTRATION

As more multi-channel spaces are built, more compositions will be designed to take full advantage of these spaces, thus a space with 48 speakers might have a body of 48-channel pieces composed for it. Transporting such pieces to other spaces with significantly different speaker architectures presents a different challenge than performed diffusion from a recording with relatively few channels. It remains to be seen to what extent such pieces can be automatically transferred between multi-channel spaces. Perhaps in time we will develop spatial profiles for each of our multi-channel spaces that will facilitate at least a partially automated exchange. For the present, I suggest that we should try performing multi-channel works in several different multi-channel spaces, creating a "spatial orchestration" of the piece for each venue, transferring features from the original version as faithfully as possible, while taking advantage of unique opportunities afforded by the particular hall for which the piece is being re-orchestrated. This process, while laborious will teach us much about desirable features for a new interchange format for spatial audio.

7.   CONCLUSIONS

The issues raised here concern the conditions for designing a useful interchange format for spatial audio. Primarily, I have suggested that we need to take a broad look at past and present electroacoustic music practice as it pertains to spatial audio diffusion. Other spatially focussed audio research and performance applications should perhaps receive similar attention.

8.   REFERENCES

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