Gesture Control of Sound Spatialization

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1 Introduction

Sound spatialization has been explored as a musical tool by many composers and a number of systems have been developed for controlling the position of sounds in space. Even in the simplest implementations, sound spatialization is a multi-dimensional application and with the development of more complex systems incorporating modeling of sound source and room parameters the number of controllable parameters has increased dramatically. Surprisingly, the interfaces for controlling these systems have remained generally unchanged and so in most cases using gesture to control spatial parameters is generally restricted to the most common tasks, such as placing a sound source in 2-dimensional space. On top of this, the actual interfaces to these systems generally consist of a 2-dimensional display with only mouse- or joystick-based input. Yet, it is the multi-dimensional nature of sound spatialization that makes it interesting for gesture control – giving rise to the question of how we control large parameter spaces in an intuitive manner.

This paper describes ongoing development of various systems for the gesture control of sound spatialization. This includes the development of standard gesture tracking systems, e.g. data gloves and position trackers, and also novel methods of control based on musical performance gestures and new gesture controllers. The final goal of this work is to develop general methods – as well as specific implementations – for allowing gesture control of spatialization systems which can be used in real-time during concert performances. In particular, we are focussing on those aspects of the control of spatialization which are not common practice, that is, we focus less on current control of position of sound sources and instead develop systems which allow for gesture control of sound source parameters and room model parameters.

2 Controlling spatialization parameters using gesture

In order to determine how we can best offer gesture control of sound spatialization, we began by examining existing spatialization systems to determine the types of control parameters which they offer. These systems range in complexity

from sound source panning systems to complex positioning and room model systems such as ViMiC[1]. These parameters form the basis for our examination of the control of spatialization. Some examples of parameters include sound source position and orientation, source presence, room size and reverb time[2].

A number of issues arise with the control of sound spatialization, which must be dealt with in order to arrive at an effective system. These issues can arise from the spatialization system itself, or from the gesture control system. In particular we are concerned with issues such as the continuous or discrete nature of variables (whether control or spatialization variables), the resolution of control, the frequency of parameter updates, the integrality and separability[3] of control and spatialization variables and the cognitive load placed on the performer by the system. Along with these general issues, there are a number of issues which specifically relate to the controllers for spatialization and which must be examined when designing new gesture control systems. These include the use of absolute or relative positioning systems, the use of current or ballistic control, whether the sensing methods used have a return-to-zero feature or not, the choice of isometric or isotonic sensing, and the provision of feedback to the performer.

One example of a system which we have implemented to allow for control of spatialization is that of a pressure-sensitive floor, which is used to control spatialization parameters using the position of the performer's center of mass. Motion capture of cello performance has shown that this is a continous, slowly varying parameter, primarily in one dimension. This makes it suitable for controlling single spatialization parameters which do not need to change quickly over the course of the performance. While this control parameter could be used to change the position of a sound source, it would result only in a sound which moves slowly from side to side in a repetitive manner over the course of the piece, which may not make for an interesting or useful effect. Also, in such a case, if the performer were to try and use this interface to deliberately steer a sound this would result in extra loading on the performer which might distract from their performance. On the other hand, using this control to manipulate a sound source parameter such as brightness allowed control over the system without requiring as much thought on the part of the performer. This presentation will include examples of other control systems which we have developed to allow for gesture controlled sound spatialization.

References

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