tactile.motion: An iPad Based Performance Interface For Increased Expressivity In Diffusion Performance

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ABSTRACT

This paper presents recent developments in interface design for the diffusion performance paradigm. It introduces a new custom-built iPad application tactile.motion, designed as a performance interface for live sound diffusion. The paper focuses its discussion on the intuitive nature of the interface's design, and the ways it aims to increase expressivity in spatial performance. The paper also introduces the use of autonomous behaviors as a way to encourage live control of a more dynamic spatial field. It is hoped that this interface will encourage new aesthetics in diffusion performance.

1. INTRODUCTION

The ascendance of the new interfaces for musical expression (NIME) community has encouraged electronic musicians from all areas to question the performance interfaces they use. Many performers are rejecting traditional interfaces and designing their own tools for performance. In the last ten years the paradigm of diffusion performance has been greatly influenced by this trend. Traditionally, diffusion concerts are performed on a mixing desk or version thereof, with each fader mapped directly to the gain of a speaker, or group of speakers. Recently many diffusion artists have being experimenting with designing and performing on a range of new interfaces, these interfaces have often afforded a greater range of spatial trajectories. In light of this a new branch of the diffusion paradigm has emerged, focusing on designing interfaces for increased spatial expression and intuitive relationships between performative gesture and spatial output. This paper presents a new contribution to this field.

The paper begins by identifying previous developments in the field of interface design for diffusion performance. There is a focus on significant multi-touch interfaces for both touch tables and mobile devices. It then goes on to introduce tactile.motion, a new performance interface designed specifically for diffusion performance. The basic functionality, special features and wider spatialisation system are all discussed. Section Four discusses the increasing use of autonomous behaviors in diffusion systems and the way tactile.motion intui-

tively incorporates these behaviours. The fifth section looks at how tactile.motion is used in a performance environment. The paper concludes by proposing future directions for tactile.motion.

2. RELATED WORK

There have been many new interfaces designed for diffusion performance, particularly in the past decade. A great number of these interfaces focus on the gestural relationships between the performer and the space. Multi-touch devices have emerged as an expressive and intuitive platform for electronic music performance throughout the wider performance field.

The use of multi-touch platforms as a user interface in spatial rendering has been explored by a number of research teams. MTG's Multi-touch Interface for Audio Mixing [1] was developed for the Reactable [2] as a graphical control interface. Spatial positioning of an audio file is possible in either stereo or surround space. The interface is designed as a studio-mixing tool and affords control of many parameters of the mixing process including reverb and E.Q. Spatial aspects of the interface are present however, they are only one feature and dynamic spatialisation is not the primary goal of this interface. Evaluations of the user interface presented in [1] suggest that interacting directly with a multi-touch system is an intuitive way to control musical parameters.

A further graphical interface for studio mixing was presented in [3]. In a similar way to the first, this system focused on creating a more intuitive environment for audio mixing to occur. There was a focus on the use of tangibles as well as direct touch control, and specifically in this case on smart tangibles. The concept most relevant to diffusion interface design that is incorporated by both studio-mixing environments is that of the stage view. Originally proposed by Gibson [4] the stage view differs from the more traditional channel-strip view that was the common form for both studio mixing and diffusion performance environments. With the stage view, the user interacts directly with a graphical representation of the stage and a sounding object within. For diffusion interface design this same concept is easily adapted to have the performer interact with a representation of the concert hall, or the speaker array. The tactile.motion interface presented in this paper extends the concept of the stage-view to the diffusion performance paradigm.

The SoundScape Renderer was first introduced in 2008 as a spatial rendering system running on a touch table [5].

Since then the SoundScape Renderer has been ported to, and is available for, Android [6]. The system is capable of higher-order ambisonic, binaural or VBAP rendering. Unlike the first two mixing-based applications presented, the SoundScapeRender is specifically designed for interfacing with higher-level spatial scenes, however was still conceived as a rendering and collaborative interactive installation tool rather than a performance interface.

3. TACTILE.MOTION

The interfaces previously discussed proved the multi-touch environment affords sufficient expressivity and warranted further and more specific development for the live diffusion paradigm. tactile.motion is a new performance interface, currently under development by the authors. The application was initially conceived as a mobile version of the author's previous work, tactile.space [7] developed for The Bricktable [8]. One of the main goals in porting to the iPad was to increase the accessibility of the user-interface. Running tactile.space involved extensive and somewhat expensive hardware, calibration of open source tool Community Core Vision[1], compiling the main application built in Processing, and manually loading audio files into a custom built Max Patch. This process took valuable time and expertise, significantly restricting the number of performers and institutions able to use the interface. Now running on the iPad, tactile.motion requires no calibration, is not affected by stage lighting, can be used by novice performers and will soon be available for free download from the Apple App Store. The iPad has a much lower cost than a touch table, and many people may already own the device. It is hoped that these factors, as well as new features, will ensure that the new app is much more accessible to a wider audience.
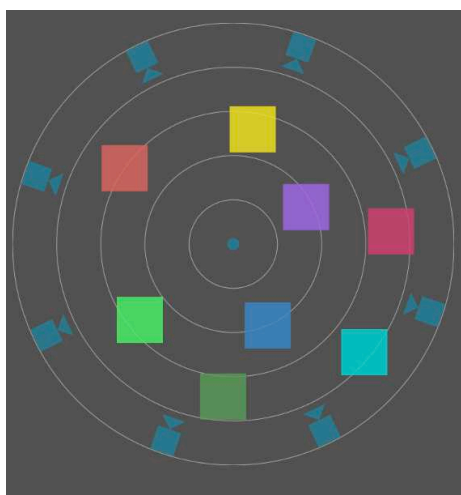
3.1 Basic Functionality

Figure 1. tactile.motion basic GUI

In its most basic form, tactile.motion (shown in Figure 1) allows a user to drag a visual representation of an audio file, an 'audio object', around the screen and place it within a speaker array. The positioning of audio objects

1 ccv.nuigroup.com

in this way creates an intuitive and easily learned diffusion interface. There is no limit to the number of audio objects that may be moved simultaneously. The user is able to perform any number of complex trajectories in real time simply by tracing the desired trajectory on the screen. The high frame rate, smoothing algorithms and accurate touch detection afford the user a remarkably natural feeling when dragging an object.

The audio objects position is calculated in polar coordinates, in relation to the centre of the speaker array. The data is then sent over an ad-hoc network hosted by the computer, to be received by a custom built Max/MSP patch. The OSC [9] protocol was chosen for sending the data due to its flexibility and ease of use. The full spatialisation system is displayed diagrammatically in Figure 2.
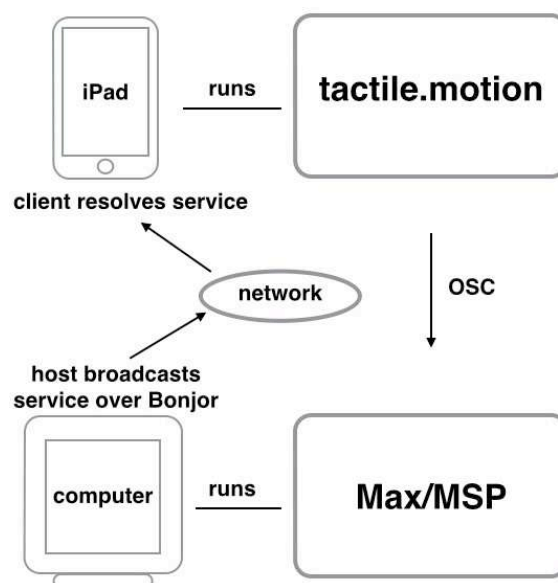

Figure 2. System Overview

tactile.motion communicates with the custom built Max Patch over a wireless network. The computer running the Max patch hosts the network. The user can connect to the computers network through the standard Settings menu on the iPad. The patch then broadcasts itself as an available OSC service via Apples Zero Config protocol, Bonjor. The settings page of tactile.motion displays a list of the names of available services and the user selects the Max patch. On selection of the service the application retrieves the services address and port information and uses them to send the out going data. The Bonjor system was chosen because of its ease of set-up for the user. The user needs no prior knowledge about the network or the address and port information and they are not required to input any of this data themselves. Instead they simply select 'tactile.motion host' from the list of available services and the application handles everything else.

In designing the OSC protocol the aim is to make it as generic as possible. The authors are currently developing a number of other diffusion performance interfaces and are aiming to create a modular spatialisation system, where any part of the system can be interchanged for an-

other. The protocol used must be common amongst all user interfaces, and be intuitive enough to be incorporated into other spatialisation systems. The OSC messages sent when and audio objects position is updated are as shown in Figure 3.

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Protocol
object i/f/f
object number/distance/theta

Example Message
object 3/3.25/2.91
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Figure 3. Example of OSC message, the distance is in metres and the theta in radians

4. AUTONOMOUS BEHAVIORS

One of the ways new diffusion systems work to increase expressivity is to add a palette of predetermined trajectories that can be set in motion during performance. One popular direction is to implement common motions from particle system behavioral patterns such as those introduced by Kim-Boyle [10] and apply them to spatial movement.

In a traditional diffusion set up, with a mixing desk as user interface, many desirable spatial trajectories are extremely difficult to perform. Some systems through the late 90s began to introduce a capability of triggering circular motions [11] and other spin based trajectories. Spin based trajectories are one area that was particularly difficult to achieve in real time, with the standard configurations of a mixing desk. There are a number of examples of systems that allow the performer to trigger and control these trajectories [12], [13], however at this point the triggering has mostly occurred manually, and the behaviors are controlled by inputting parameters directly into a computer, or through a mixing desk.

4.1 Spin Trajectories

Tactile.motion aims to build on the concept of triggered autonomous motion, but also to add a performative element into the process. In order to do so, tactile.motion is able to recognize specific gestural trajectories on the iPad and translate them into spatial motion. For example dragging an audio object in a circular motion (shown in Figure 4) around the sweet spot triggers a spin-based trajectory.
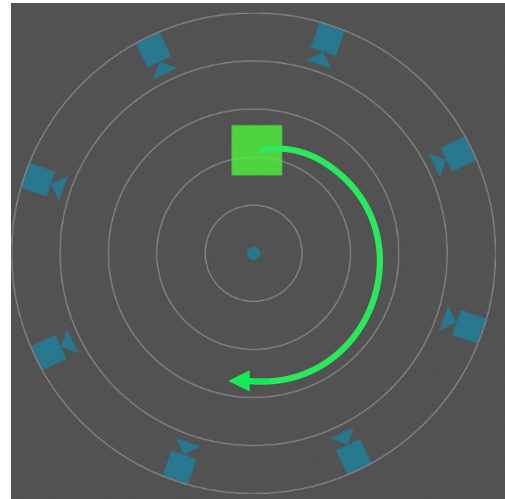

Figure 4. Spin motion trajectory

In order to be recognized as a spin motion the object must be moved at a constant rate and remain at a relatively constant distance from the centre point. If the object deviates from an ideal circles path too much it will be considered a standard 'drag motion'. If the velocity changes to dramatically throughout the motion it will not be recognized. Once the motion is recognized the system deciphers the average velocity with which it was drawn and uses that velocity to continue the motion. The object continues along the path spinning around the centre, in the circular motion until the user double taps it, causing it to stop[2].

4.2 Drift Trajectories

The spin-based trajectory is the first gestural triggered motion implemented by tactile.motion. At the time of writing a drift motion is under development. This motion uses similar algorithms to the circle recognizer in order to determine if the objects trajectory follows a straight path towards the speaker array (as shown in Figure 5).
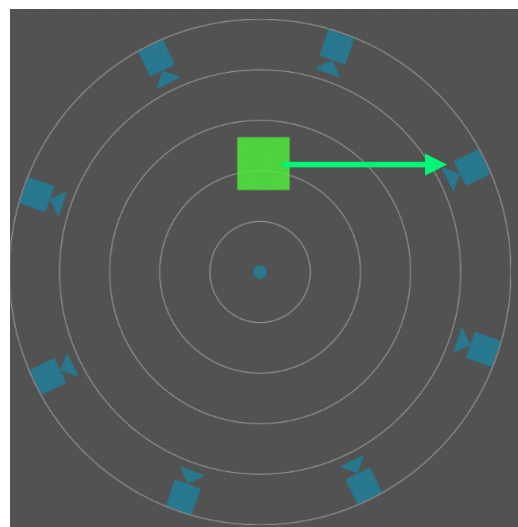

Figure 5. Drift motion trajectory

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2 The double tap to stop is currently in trial mode to test if the gesture is intuitive. Stopping the autonomous motions may change in the future.

There are two proposed implementations of the drift motion, one being a straight drifting path be it vertical, horizontal or angular. The other is a for a ping-pong like effect that would ricochet off the edge of the speaker array and continue to do so as it makes its way throughout the space.

A number of other autonomous behaviors derived from particle systems are planned for tactile.motion such as a random walker function and an attractor function. Also planned are the capabilities to group audio objects and have them be moved together, or respond to behaviors simultaneously. It is believed that the addition of these behaviors, whilst keeping their triggering and control as gesturally intuitive as possible, will encourage an increasing expressive range in diffusion performance.

5. PERFORMANCE USE

Performing with tactile.motion creates a very different experience to a traditional diffusion concert. The mixing desk exhibits a problematic coupling of gesture to sonic output. This can leave the audience without a clear indication of ways the performers actions affect the sound. The mapping of vertical faders directly to speaker gains, and the configuration of the faders greatly influences the potential trajectories. With the tactile.space interface the performer is manipulating phantom source positions rather than speaker gains. The ease of moving a sound source exhibited by the interface encourages the performer to more actively create a dynamic sound field. This affords performers with a new range of potential trajectories, and spatial aesthetics.

The interface was featured in a piece called fine.tones. The main spatial concept of the piece was to have sine tones 'chasing' each other around the space. Slowly ascending and descending sine tones were moved slowly in a circular motion around the audience with the velocity of motion slowly increasing throughout the piece. With tactile.motion the circular movement was simple and gesturally intuitive to perform live.

Feedback from performers using the interface has so far being positive. A full user study is scheduled to take place later in the year where a group of around twenty acoustmatic composers will perform with and evaluate the interface and their experience using it.

As discussed in section 3.1 tactile.motion is designed with enough modularity to be incorporated into any diffusion system. However, there is also a custom Max patch that has been developed along side the application as its audio driver. The patch uses a Vector Base Amplitude algorithm [14] to decipher and implement gain factors for each speaker in order to create phantom source positions. The patch can take up to 8 audio inputs, either live or audio files and works with up to 16 speakers. The patch is also designed with the goal of modularity, therefore whilst these values are the current ones it would be a very simple process to add a capability of more speakers, or inputs. The current design focus is on increased communications between the patch and the app to further reduce set up times and reduce the expertise needed to run the system.

6. CONCLUSIONS

The use of multi-touch user interfaces in music performance has widely been received by the community. Artist driven developments of these interfaces have led to them being able to significantly increase the expressive range within sub-fields of electronic music. Recent trends in diffusion practice have embraced the design of new interfaces for performance. The new tactile.motion interface aims to encourage diffusion performers to more actively engage with phantom source positions in the space. The ability to freely move audio objects around a speaker array means that complex spatial trajectories can be performed with ease and encourages performers to do so. The addition of intuitively triggered autonomous behaviors further increases the aesthetic potential and allows the performer to dynamically control a much larger number of sound sources at once.

At the time of writing the application is already actively being used for performance. Many future developments are proposed some of which were outlined in section 4.

Acknowledgments

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