41st International Computer Music Conference
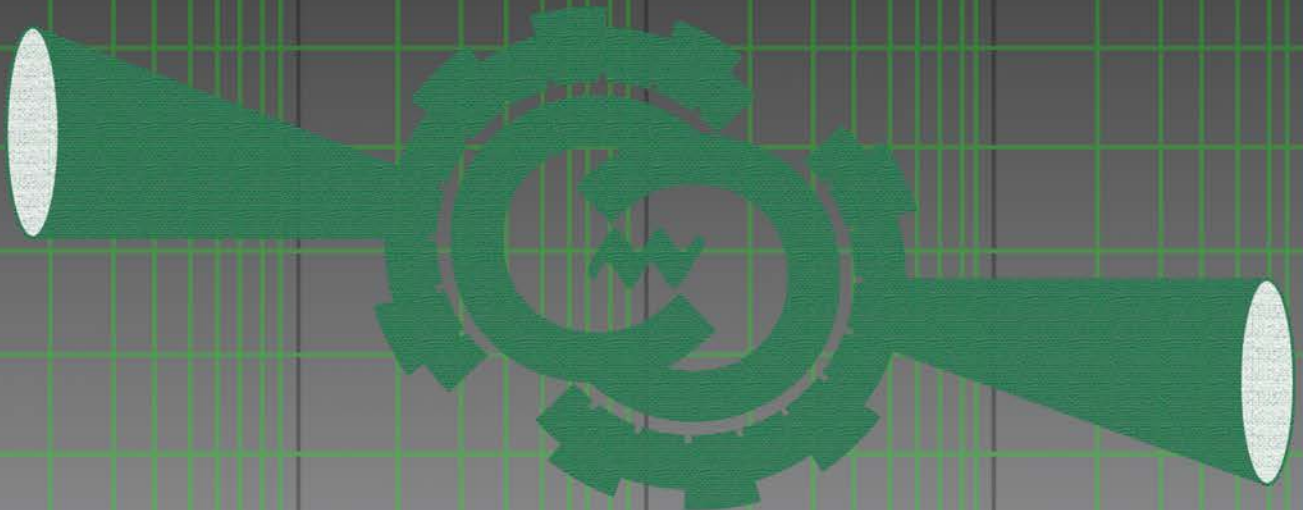
ICMC 2015

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Looking Back, Looking Forward

Denton, September 25 - October 1

Proceedings

Hosted by the Center for Experimental Music and Intermedia

UNT UNIVERSITY OF NORTH TEXAS

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Proceedings

Proceedings of the 41st International Computer Music Conference 2015
September 25 — October 1, 2015
University of North Texas, Denton, TX, USA

Looking Back, Looking Forward

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The Decibel ScorePlayer: New Developments and Improved Functionality

Cat Hope
Edith Cowan University
c.hope@ecu.edu.au

Aaron Wyatt
Edith Cowan University
music@psi-borg.org

Lindsay Vickery
Edith Cowan University
l.vickery@ecu.edu.au

ABSTRACT

The abstract should be placed at the start of the top left column a In 2012 Western Australian new music ensemble Decibel launched a commercially available score reader application (app) for the iPad, on the iTunes store.[1] The Decibel ScorePlayer allows for network-synchronised scrolling of proportional colour music scores on multiple iPads. It is designed to facilitate the reading of scores featuring predominantly non-traditional notation in rehearsal and performance. The Decibel ScorePlayer has recently been further developed to include a range of new functions. These include new score models, enhanced instructions delivery, network communication based on the Open Sound Control (OSC) protocol and the ability to package audio playback as part of a score file and improved networking protocols. This paper discusses the evolution of these additions and the way they have been driven by, and adopted in, compositions and performances by the ensemble.

1. INTRODUCTION

Decibel New Music Ensemble has been performing animated graphic scores since its inception in 2009, with many of the works being written by the group's members. The ensemble of six musicians includes three composers, two Max programmers, an iOS programmer, and two java programmers. The group operates with an 'iterative cyclic web' methodological model where basic research, creative work, practice-led and research-led models combine, cross over and interact as part of the overall research process [1]. Integral to the research is the creation and interpretation of musical works in which new ideas are conceptualised, tested, evaluated and disseminated in performances, recordings and archiving. This artist-led framework has proven successful where artists who are also programmers provide insights unavailable to programmers who are not [2].

The Decibel ScorePlayer was originally built from prototypes in MaxMSP. This continues to be an important devel-

opment pathway driving enhancements of the iOS app. Most score models generated within the ensemble have been ported to the latest version of the player. Although the audio processing capabilities of a dedicated computer are unlikely to be replicated on tablet computers in the near future, the capacity for graphical display is in many ways superior. The modular design of the early iterations of the Decibel Score-Player app has meant that developments have been easy to add as requirements become necessary through performance testing [3], but also through blue sky compositional thinking.

The Decibel ScorePlayer is different from other score reading software in its focus on graphic notations primarily, but also its simplicity. This simplicity is perhaps result of the software being developed from within a music ensemble where programming is engaged to provide tools for performance of the group, and works composed from within it. Whist GRAME's INScore has the facility to read graphic notations using a cursor and various coloured fields [4], programming skills are required to apply this functionality to the score. The Decibel ScorePlayer does not require any programming ability to use, and works in association with an easy to use desktop app to create scores that are then loaded into the player through iTunes.

2. ADDITIONAL SCORE MODELS

The original Decibel ScorePlayer app provided a simple function - to read predominantly graphic notations in an organised, coordinated manner. The scores appear as images that would scroll from right-to-left past a play head at a predetermined speed, which could be altered for rehearsal purposes. The *.dsz* score file could include individual parts as well as the whole score, which could be selected by swiping up and down on the tablet screen. But it wasn't long before the composers within the group sought to have other functions implemented.

A rhizomatic, rather than single plane score model was introduced, in which interlinked staves or images can be freely traversed by the score-reader. This is exemplified in the cross-fading of multiple background "scores" Vickery's 'Trash Vortex' (2015) for bass clarinet, percussion and electronics, an example of which can be seen in Figure 1. This image is created by overlaying three separate image files.

The selection and collation of multiple images into a single, larger linear image that is different on each iteration, was also developed in Hope's 'Fourth Estate' (2014) for piano with two a.m. radio's and ebows.

Figure 1: a screen shot of the score for Lindsay Vickery's 'Trash Vortex'. The white shapes indicate the 'path' that is followed when reading.

The capacity to display more traditionally notated scores was also added to the repertoire of score models. In this model, a complete "page" or a subset of staves can be advanced either manually by swiping left on the iPad to turn the page (first applied to Darien Brito's 'An Additive Stream' (2013) for string quartet and electronics at ICMC 2103), or according to a fixed timing. Vickery's 'Night Fragments' (2012) for mezzo soprano, flutes, clarinet, cello, keyboard and electronics features automated page turns. This was made possible through the adoption of an OSC networking protocol to synchronise the iPad score with a Max patch that provides audio processing for the work, and coordinates the turns and the processing.
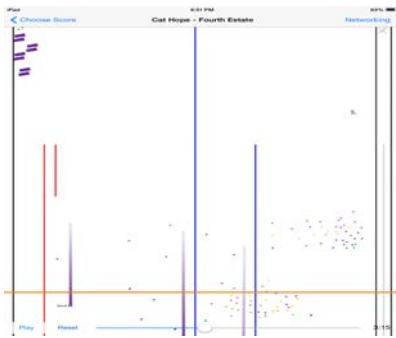
Figure 2: A screen shot from Hope's 'Fourth Estate' showing the seamless join of two tiles (where the number 5 appears on the right is the join). Note the vertical, rather than horizontal scroll.

Larger, longer scores have required animation the content of the scrolling layer itself. This can be as simple and pragmatic as having a scrolling image that loads smaller image 'tiles' into memory as needed (that is, out of the current visible frame); ones that would otherwise be impossible given the limited memory constraints of the iPad. The first score of this type was Vickery's 'Agilus, Mimoid, Sym-

metriad' (2012) for string quartet and electronics. The same technique facilitates the aleatoric structure of Hope's 'Fourth Estate', which randomly recompiles the order of eight images each time the piece is opened in the iPad, before it begins to scroll. It appears as a single, seamless image to the performer, and except of which can be seen in Figure 2

To achieve this, the simple CALayer class object (part of Apple's Core Animation Framework), which is used to displace the score image [5] was replaced with an object that conforms to the ScorePlayer's new Scroller Delegate objective C protocol, as seen in Figure 3. This object can contain code to animate the contents displayed on its background layer, with source images taken from a supplied set of tiles. The number of tiles is set at initialization using the initWithTiles:: method. Loading of the necessary images is then triggered by the changePart:: method, which allows for compatibility with the part changing framework. The timing for this animation can then either be managed independently or can be taken from the position of the background layer as the parent ScrollScore module moves it across the screen. This is handled by the code placed in the setPosition: method.

```
@protocol ScrollerDelegate <NSObject>

@required
@property (nonatomic) CGFloat height;
@property (nonatomic, readonly) CGFloat width;
@property (nonatomic) CGPoint position;
@property (nonatomic, readonly) NSInteger numberOfTiles;
@property (nonatomic, strong) CALayer *background;
@property (nonatomic) BOOL loadOccurred;

+ (BOOL)allowsParts;
+ (NSArray *)requiredOptions;

- (id)initWithTiles:(NSInteger)tiles options:(NSMutableDictionary *)options;
- (void)changePart:(NSString *)firstImageName;
- (CGSize)originalSizeOfImages:(NSString *)firstImageName;
- (CGSize)originalSize;

@end
```

Figure 3: The Scroller Delegate protocol definition.

Vickery's 'Silent Revolution' (2013) developed the use of parts in a new way. Rather than showing each part as a separate, distinct file for that particular instrument, it overlays these over background information common to each part. The piece is unique in the way the score features illustrations that are not read as music, but rather, inform the interpretation of the piece in other ways, as can be seen in Figures 4 and 5. The individual parts would be difficult to read accurately within the images if it were not for these parts. Whilst this did not involve new features in the Decibel ScorePlayer application itself, it did offer a different way of presenting parts to the readers, supported by the associated ScoreCreator application [5].
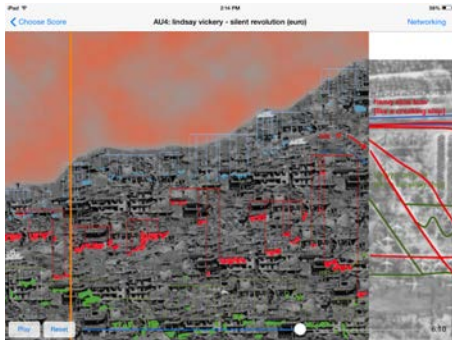
Figure 4: Vickery's "Silent Revolution" screenshot showing all parts on screen.

Figure 5: Vickery's 'Silent Revolution' showing the same part of the score, but with the blue part highlighted against the lighter background. The number is in the black box is a cue for the electronics.
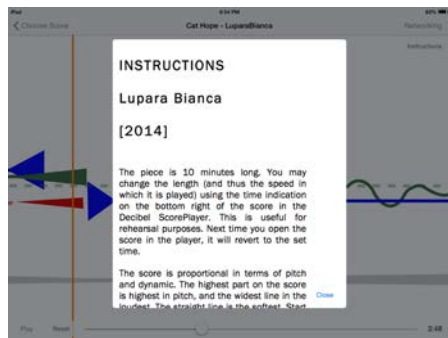

Figure 6: Instructions file as it appears on the Decibel ScorePlayer

The increasing complexity and innovation of notation in some of these graphic scores has required clear and readily available performance instructions. This new development has been enabled by a pop up document available by touching a button on the upper right hand corner of the score, can be seen in Figure 6. The button only appears if an instructions file has been added to the score file, which can be done in the ScoreCreator.

3. NETWORKING AND OSC

Problems with the network protocol had become evident in the early versions of the Decibel ScorePlayer. Performers were being knocked off, or unable to join the network. Originally, the app automatically created a server on the first iPad in the group to open the score. The connection problems were due to an issue with service discovery via the Bonjour protocol, which seemed to particularly affect ad-hoc networks using Automatic Private IP addressing [6]. Rather than finding the existing server, new iPads joining the network sometimes attempted to create their own server resulting in a naming collision. This prevented them from joining the existing network of devices and at times brought down the original server. This was resolved by removing the automatic server creation, and instructing the user to manually connect to other devices that have been found on the network. While less convenient than the original, automated network system, it has greatly improved the stability of the network. This was rectified in the publicly released version 1.4.0 (with the code first implemented in internal build 1.2.8), and the first performance using this new networking capacity was in early 2014.

The addition of OSC communication allows for the coordination of functions that were previously independently conducted by the iPad and computer, most crucially audio processing. The current implementation reports the score position via OSC as a number between 0 and 1 (where 0 is the first frame of the score and 1 is the last) in the format */Control/Tick 0.445*. The amount of time elapsed can therefore be calculated by multiplying this number by the duration of the score. In this way audio processing can be cued by the position of the score itself. Conversely, the score can be repositioned by sending a /Control/Seek 0.5 message to the iPad.

Other currently implemented control commands are:

/Control/Play (start score),

/Control/Reset (stop and reset score) and

/Control/SetDuration (change the duration of the work).

The move to base the Decibel ScorePlayer's updated networking protocol on OSC has been a particularly exciting recent development. This has allowed for the ScorePlayer to communicate with other applications and devices, making it possible to entirely automate the triggering of electronic processing and effects. While the iPads themselves communicate with one another over an established Transmission Control Protocol (TCP) stream, external devices can send and receive OSC messages over a User Datagram Protocol (UDP) packet after first registering themselves with the server. At present, the Decibel Score-Player implements most of the OSC 1.0 specification, although it currently ignores the time tags that are included in OSC Bundles [7].

Future possibilities afforded by OSC communication include the transmission of transformative and/or generative score data from computer to the iPad, enabling a more interactive role for the tool. Significant work has been done with

OSC hand networked performance, making it a useful protocol for this project. [8]

4. AUDIO PLAYBACK FROM THE IPAD

Another new development for the Decibel ScorePlayer has been the ability to incorporate an audio file into the score, that can be played synchronously from the iPad, through the headphone jack, as the score plays. This is useful for pieces that include a playback part, that previously would be separate from the score and require careful synchronisation in performance. This function adds the possibility of a large range of legacy "instrument and tape" repertoire being read in the score player. Unlike important work with scrolling scores and audio such as the Music Animation Machine by Stephen Malinowski [9], or the sound generating notations of David Kim Boyle and Ryan Ross Smith, this feature seeks to provide the user with an easy way to add audio to their score without any programming knowledge.

In 2010, Vickery created a MaxMSP score player for his performance of Denis Smalley's piece 'Threads' (1985) for bass clarinet and tape, that enabled the score to be read accurately alongside playback [10], and provided the impetus for this development in the iPad app. The app allows for centralised control of playback for the audio component, synchronised with a score in an arrangement that conveniently "bundles" together all materials necessary for a performance of the work. The audio and score are directly linked, and line up exactly so if the performer wishes to jump to various points in the piece, the audio will play as intended at that point of time. This offers significant benefits over other technologies for playback, which can be inconvenient to reset and find the correct point on the media (tape, CD, computer) during repetitions of segments of the work that often make part the rehearsal process.

The code was implemented using the mid level Audio Queues application protocol interface (API) that forms part of the Core Audio framework in iOS. This allows for audio playback to be accurately synchronized with the animation of the score in a way that would not be guaranteed with the use of the higher level AVAudioPlayer class. Hope's 'Signal Directorate' (2014) for bass instrument(s) and playback was the first piece to use the Decibel ScorePlayer to deliver the score synchronized with audio playback from within the iPad, in February 2015.

4. CONCLUSION

The past twelve months has seen substantial developments for the Decibel ScorePlayer. These have included new score types, inspired by, imported to and developed for the player. An easy way to access performance instructions or special selected options according to the work has been provided. The addition of audio playback to the score 'bundle' has opened up the potential for the Decibel ScorePlayer to be used to play historic works that feature playback. The inte-

gration of OSC has enable the score player to work reliably with other, remote computers, and offers a wide range of possibilities that the group is only beginning to explore. More reliable networking capability has also mean that the app is more stable in live performance, and less trouble shooting is required for users who purchase the app from the iTunes store.

The next developments for the Decibel ScorePlayer will be an update of the ScoreCreator application, to enable the addition of the audio to the score bundle. The porting of the app to Android is another important step that will enable more people with a larger range of devices to use the new potential of the Decibel ScorePlayer.

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