Locus Sono: A Listening Game for NIME

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ABSTRACT
This paper/poster describes the development of an experimental listening game called *Locus Sono*; a 3D audio puzzle game where listening and exploration are the key forms of interaction. The game was developed by a motivation to create an interactive audio environment in which sound is the key to solving in-game puzzles. This work is a prototype for a larger planned work and illustrates a first step in a more complex audio gaming scenario, which will also be partially described in this short paper.

Author Keywords
NIME, sound installation, audio gaming, video game music, video game sound

ACM Classification
[Applied Computing] Sound and Music Computing, [Software and Its Engineering] Interactive Games.

1. INTRODUCTION
In the past 20 years, video games have really come into their own as a medium, and have become an extremely effective site for all kinds of experiences. With the continuing increase of processing power in modern computing, as well as the proliferation of affordable game engines such as Unreal and Unity, more and more people are getting involved in game development [1]. This has resulted in an extremely healthy indie game movement, as well as a new site for media artists to explore the creation of interactive artwork. However, the function of audio and music in games is still primarily relegated to traditional roles of providing sound effects, dialog, and dramatic music scoring to provide emotive accompaniment to game play [2]. Most games have not effectively incorporated developments in full-sphere 3D audio, procedurally generated sound, and the use of audio as a major game mechanic [3][4].

In the field of electroacoustic music, there has been strong interest in 3D audio since at least the 1970s [5], through the practice of multichannel *diffusion* (live mixing for surround systems), *ambisonics* (full-sphere surround sound), and *binaural*/*transaural* audio (3D sound through stereo systems). As well, *generative* music (algorithmic composition in real time) has also been a major site for research and creation in the field of computer music [6][7][8]. Yet these explorations have been explored only minimally in video games.

As more and more games enter the realm of virtual reality through products such as the Oculus Rift, Playstation VR, and other game system ad-ons, the equivalent audio systems for VR are finally being explored. One big advantage for composers and sound artists is that these developments can translate to an increase in audiences for meaningful 3D audio experiences. This has always been a barrier for composers and sound artists who wish to bring their multichannel creations to consumers, since there has never been a wide adoption of home surround systems for music listening. Current research suggests that with the rise of Internet streaming services, most music consumers now listen to music on their computers with the built-in speakers or headphones [9][10]. However, it seems that many gamers do utilize surround systems for gaming at home, even though there are very few titles that take full advantage of these systems [3]. Furthermore, the use of VR sets and good quality headphones means that interactive binaural audio, in conjunction with head tracking, has huge potential in these gaming environments.

As an artist who has worked with interactivity in many ways, I've looked for ways to pull listeners into environments that are alive and responsive to them in some way. But motivation is a difficult problem to overcome in these situations. In the gallery context, for example, the normative flow of visitors through the space severely limits the kinds of interactions that can be achieved, and the time commitment to develop into something meaningful.

Games, on the other hand, inherently invite the experiencer to commit time, upon explaining the rules, and the player becomes motivated by achieving the goal(s) set out by the rules of the game. In that context, what if sound was the primary form of interaction? What kinds of musical and sonic experiences can be created in that environment? How might 3D audio enhance that experience? What about field recording and soundscape composition? How could games enhance our understanding of our changing soundscape?

2. AUDIO GAMING
In 2005, the music video game genre exploded with the release of *Guitar Hero* (Harmonix Music Systems 2011), spawning a subgenre of games in which players engage with pre-composed musical pieces by performing actions that engage specifically with the music's structure and content (usually rhythm). Particularly in Japan, this genre of games has led to a resurgence of arcade culture, where games like *MaiMai* (Sega 2012) and *Taiko: Drum Master* (Bandai Namco Games 2001) are extremely popular, some of which have also been ported to home console systems (Hashi 2013). Many of these games are essentially a kind of rhythmic *karaoke,* where the challenge is to effectively simulate some portion of the music through player interaction. For example, *Pulse* (Cipher Prime Studios 2011), a tablet-based game, requires you to tap rotating spots on circles that radiate from the center of the screen in time to the music.

More recently, games like *Proteus* (Kanaga et al. 2013), a so-called open world video game, encourage the player to explore the aesthetics of the game, which is procedurally generated. In this game, the music is tied to the same procedurally generated functions as the graphics, creating a tightly coordinated, always changing score. As a genre, open world games have created another unique space for sound work, particularly as they have emerged in the MMO (massively multiplayer online) gaming universe.

The exciting rise of so-called audio games is also quite compelling. *Blindside* (Rasmussen and Astolfi 2012), for example, is an audio adventure game set in a 3D audio environment, where you must navigate in darkness using only audio cues. In another example, *Fract OSC* (Phosfiend Systems 2014), the puzzles themselves are musical, and they unlock larger musical streams in the game. Ultimately, this game becomes a fully functional digital audio

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workstation in which players can create their own musical compositions.

As these new genres of games show, the role of sound in games is expanding, and the duality between sound effects and music has been called into question [10][11]. While it is still common practice to separate out these roles, particularly in larger game studios, many game developers have become much more sensitive to the need to rethink that relationship. One great example of this is the game *Limbo* (Playdead 2010), with sound created by electroacoustic composer Martin Stig Andersen. The award-winning sound design contained no "music" per se, but rather, contained quiet and beautifully composed textures based on field recordings and other non-musical sounds [13].

It is within this climate that I have wondered about the possibilities of sound-centric games, or of interactive sound pieces, which have a game flowing through them. What kinds of interactions are possible here, and how might the motivation of game play be leveraged for meaningful compositional development? Would a game be a good location for a multichannel, generative composition?

3. LOCUS SONO

Locus Sono is a first-person audio puzzle game, created in the game engine Unity 3D. The game demonstrates a simple audio game mechanic that involves locating sonic "sweet spots" in an otherwise silent soundscape. In looking at various game engines, Unity 3D seemed well positioned as a platform for experimentation, since its audio engine is relatively decent, and it offers cross platform support. The audio engine sports some basic 3D sound features like Doppler, and is able to handle multiple streams of audio. It is particularly strong at handling multiple looping files, even relatively long files (several minutes each). It is easy to access parameters like panning, volume changes, and playback speed of sound files, all of which can be linked to player actions. In addition, there have also been some successful attempts to expand upon Unity 3D's audio engine, including both OSC-based solutions and more recent attempts at embedding Pure Data (libpd) into Unity 3D (Patrick Sebastien's libpd4unity, for example).

In learning Unity 3D, which took some time, I concentrated on open 3D landscapes, placing looping sounds in various places with fixed boundaries, to see how effective it was to walk into these pools of sound. It was easy and effective to program, for example, the players distance from the center of the sound and map that to volume.

Eventually I developed a kind of "tri-zone" concept, where three sounds are placed separately, but overlapping at a specific location. The player has to find that sweet spot – listening for three sounds together. This was relatively easy to set up and worked effectively, depending on the sounds used, and suggested ideas for composition. Each tri-zone is a site for a composing in distinct layers, but spread out, with a small intersection point that the player must find by ear. Further, upon arriving in the tri-zone, the player "records" the tri-zone, activating a physical structure in the center of the zone. This activation results in sound layers moving closer to the player, and drawing in other sounds as well. In short: the player locates the tri-zone, activates it, and the composition "blooms."

Locus Sono is a playable computer game (Mac, Windows, Linux) with 5 levels illustrating various forms of the tri-zone concept. The player unlocks new levels by discovering all of the tri-zone areas in the current level. The ultimate goal is to find the "Listening Room," which is basically a final end experience that is a kind of audio fun house, with lots of sounds including several audio compositions.

The game can be downloaded here:

http://www.scott-smallwood.com/games/locussono/

4. REFLECTIONS AND FUTURE WORK

Locus Sono is a first step toward an exploration of the possibilities of sound in 3D space, both in terms of compositional challenges and using audio as a major component of puzzle solving. The next step is to move away from looping sound files exclusively, and to instead have some elements of procedurally generated sound as well. This would give access to compositional changes based on player action. For example, perhaps the player not only has to find the tri-zone, but upon locating it, must then manipulate the sounds themselves to bring them into "tune," so to speak. Maybe they are slightly off pitch, or out of sync.

There are many ideas here, and prototyping is currently being done in Max/MSP and Pure Data. I am currently working on porting one of these ideas into Unity 3D via libpd. Although I'm just scratching the surface, I feel that gaming offers real potential for meaningful sonic interactions, and opens up new audiences for interactive multichannel, multilayered compositions.

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