

MAPS AND LEGENDS: FPS-BASED INTERFACES FOR COMPOSITION AND IMMERSIVE PERFORMANCE

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ABSTRACT

This paper describes an interactive multi-channel multi-user networked system for real-time composition and immersive performance built using a modified version of the Quake III gaming engine. By tracking users' positional and action data within a virtual space, and by streaming that data over a network using OSC messages formatted as UDP packets to a multi-channel Pure Data patch, actions in virtual space are correlated to sonic output in a physical space. Virtual environments designed as abstract compositional maps or representative models of the users' actual physical space are investigated as means to guide and shape compositional and performance choices. This paper analyzes both the technological concerns for building and realizing the system as well as the compositional and perceptual issues inherent in the project itself.

1. INTRODUCTION

In the context of highly realistic 3-dimensional video games, sound is commonly utilized as a critical element in the communication of virtual spatial cues as well as in the enhancement and definition of actions by gamer-controlled avatars and other game entities alike. By presenting a user-centric sound field to the gamer – where the intended listening audience is one player alone within a front-focused stereo, 5.1 or other commercially standard sound field – designers create insular sound-worlds, reinforcing the immersive experience through their use of realistic 3D models and environments with auditory cues and behaviors based in the reality of the virtual world.

As platforms for creating, interacting with and acting within virtual environments, video game engines such as the open-source Quake III engine offer artists a powerful new paradigm to explore novel methodologies for the control of sound and music with a low cost to entry and a flexible and extensible development environment. Used in conjunction with a data-transmission protocol like Open Sound Control (OSC) over UDP, in-game parameters controlled by multiple game users can be passed to any number of music and sound generation software environments, creating a seamless network-based transmission of data from the virtual realm to physical auditory space. In this manner, composers and performers alike can explore new relationships with composed and improvised musical materials by subverting traditional models of performer/composer/audience relationships and by distributing them in new contexts across networked physical and virtual space.

Towards this goal, from the standpoint of the composer, it becomes necessary to explore novel forms

of compositional structure based in the virtual environment and designed to fully exploit the dynamic nature of both the control and sound-generation systems while at the same time contributing a satisfying and logical structure to the musical product. One solution – referred to henceforth as the “compositional map” – draws inspiration and structure from the topography of the virtual environment itself and aims to build upon this visual and musical structure by leveraging the inherently flexible and indeterminate system of player motions and actions. Within this composer-defined visual and musical space, in-game performers reacting with their virtual environment as well as with one another via their avatars, collectively move the musical work forwards from inception to completion in a quasi-improvisatory fashion.

2. SYSTEM OVERVIEW

maps and legends is an evolving integrated software system making use of the immersive environment of the Quake III engine as the user-interface for a flexible composition and performance system. Pre-composed computer-generated musical cells are assigned to each in-game performer and are triggered, processed and controlled by the performers' interactions with and paths through the environment. By tracking multiple performers' coordinate locations within virtual space and by subsequently spatializing those locations across a multi-channel performance space, an auditory correlation can be formed between the physical and virtual environments, engaging the attentions of both performers and audience members alike within the musical soundscape.

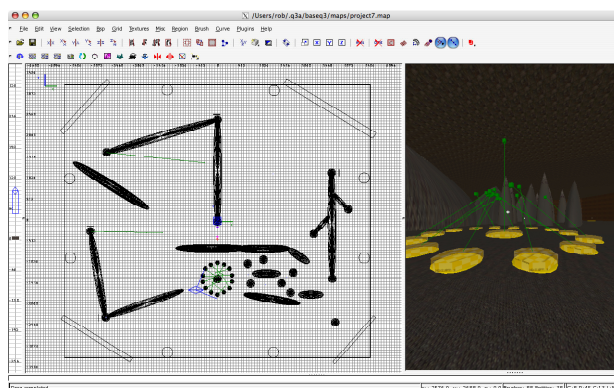


Figure 1: Maps and Legends compositional map shown from both a top-down structural view (left) and a rendered “ground-level” view (right) in the GtkRadiant editor.

maps and legends was designed as a fully-rendered 3-dimensional virtual compositional map built using the GtkRadiant game-level editing software [5] (see Figure 1). While clearly-visible pathways, directional arrows, and active directional jump-pads are built into the map to encourage or force performer motion in certain pre-defined or composed directions, each performer retains a high-level of independence and improvisatory flexibility, allowing for spontaneous new interpretations of the pre-composed materials.

Users running the game-client software and connected over a standard high-speed network control their avatars and through them the musical work using standard Quake III game control methodologies – typically a combination of computer-keyboard controls for motion and a mouse for view-angle. Game-clients connect to a host game-server which in-turn streams OSC-formatted data reflecting their players’ actions and coordinates to a sound-server in the performance venue running Pure Data (PD). Sound generation and processing for each independent performer are handled by and spatialized within an 8-channel PD patch, circumventing the sound-system of the game itself and substituting the composer’s musical environment for Quake III’s stock in-game sounds and music.

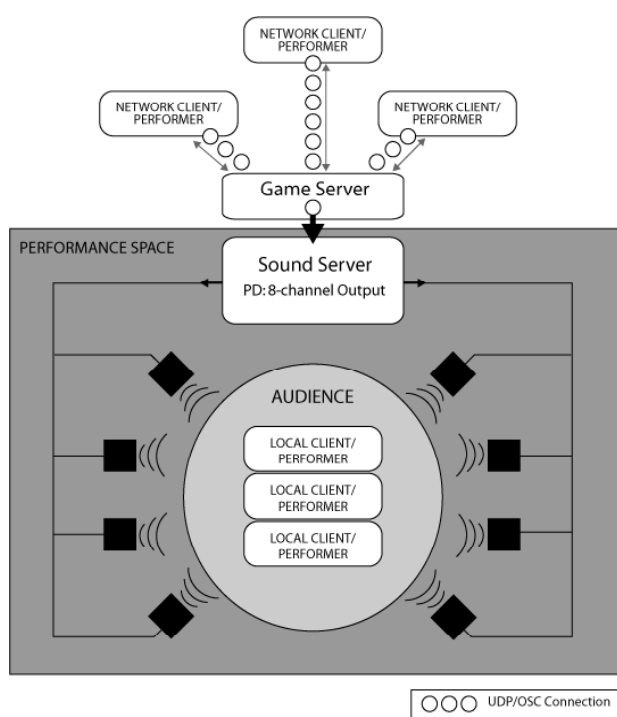


Figure 2: System diagram of Client/Server interactions

At the heart of *maps and legends* is a set of software modules, currently Linux-only, created by multimedia artists Julian Oliver and Stephen Pickles entitled *q3apd* [3] which modify the open-source network code of the Quake III game engine to stream a variety of in-game data – including global XYZ player positioning coordinates, directional velocity and view-angle – formatted as OSC messages over a network as UDP packets. As users connect to the host game server, data from their characters’ movements and actions are sent to a PD patch which parses incoming OSC messages and

extracts multiple player-specific data points. In this manner, the global position of individual game players within the virtual game-space, and certain subsequent actions performed by each user, are mapped to a number of sound-generation and spatialization control parameters creating a rich interactive-system for musical control.

3. PRIOR WORK

The use of networked/multi-user video game paradigms for music and sound generation has become increasingly common as generations of musicians who have grown up with readily accessible home video game systems, internet access and personal computers seek to bring together visually immersive graphical game-worlds, wide-spanning networks and interactive control systems with musical systems. Though its graphical display is rendered in 2-dimensions, *Small Fish* by Kiyoshi Furukawa, Masaki Fujihata and Wolfgang Muench [4] is a game-like musical interface which allows performers/players to create rich musical tapestries using a variety of control methods. *Auracle* [3], by Max Neuhaus, Phil Burk and their team from Akademie Schloss Solitude allows networked users to collaborate and improvise using vocal gesture. Oliver and Pickles’ own works, including *q3apd* and *Fijuu2* [7], a fully-rendered three-dimensional audio/visual installation controlled with a game-pad, tightly marry the video-game and musical worlds through the use of immersive graphics and familiar game control systems. And work on the *Co-Audicle* by Ge Wang, Perry Cook and the Princeton Soundlabs team is actively seeking to build a user-community of collaborative performers through networked extension of the ChuckK language and its *Audicle* front-end [11].

Compositional precedents for modular composed forms allowing for performer control over a work’s structure can be found in the polyvalent form of Karlheinz Stockhausen’s *Zyklus* [9] for one percussionist, as well as in the variable form of his *Klavierstück XI* [10] for solo piano. In *Zyklus*, Stockhausen’s strictly composed sectional materials are designed to be interpreted in a performer-chosen direction, reading through the score either forwards or backwards, starting performance on any given page. Similarly, in *Klavierstück XI*, nineteen composed and precisely notated musical fragments are ordered by the performer. These flexible structural concepts are also prevalent in John Cage’s body of chance-based musical works including his *Music of Changes* [1] or *String Quartet in Four Parts* [2], where pre-composed musical cells were selected through chance operations and formed into a definitive compositional structure.

4. MAPPINGS AND SOUND GENERATION

By mapping OSC data-streams from the *q3apd* mod to various sound processing and spatialization controls in PD, a virtually-enactive control system is created allowing for musically expressive and flexible control through the virtual physicality of performers’ avatar motion. The linking of virtual gesture to sound and spatialized auditory motion sets the stage for an

5. DISCUSSION AND CONCLUSIONS

As an immersive environment for interactive networked performance and modular composition, the system designed for *maps and legends* affords composers and performers alike an extremely powerful and novel musical experience. As the tools for generating virtual environments are flexible and robust, and through the use of *q3apd* and OSC can interface with a variety of software-based musical environments, there exist many compositional and performance methodologies which can be explored using such a system.

During development of *maps and legends* it became clear that the relationship between virtual environment and physical listening space played a key role in an audience's ability to become immersed in the projected audio-visual landscape. After presenting different visual displays to an audience during performance – either an in-game global vantage point or a performer's standard first-person view – early usage indicates that perhaps the perceptual illusion of superimposed spaces succeeds or breaks down based at least in part on the perceived alignment of the virtual viewpoint with the audience's physical viewpoint. When no visual environment is projected to an audience, the resulting musical experience changes dramatically, offering less sensory confusion and a seemingly greater ability for audience members to focus on the musical work at hand. However, without visual cues to help define the virtual environment, the musical soundscape lacks the clear indications of performers' deterministic vs. improvised gestures.

A key goal in building *maps and legends* was the development of a system capable of immersing an audience in a virtual sound world, creating a perceptual superimposition of virtual and physical environments (see Figure 5). Towards the expansion of this concept, a realistic slightly larger-than-scale virtual model of CCRMA's new heptagonal 16-channel Listening Room was created, complete with accurate speaker placements (see Figure 6). Game players sitting in the actual Listening Room could enter the model and move their

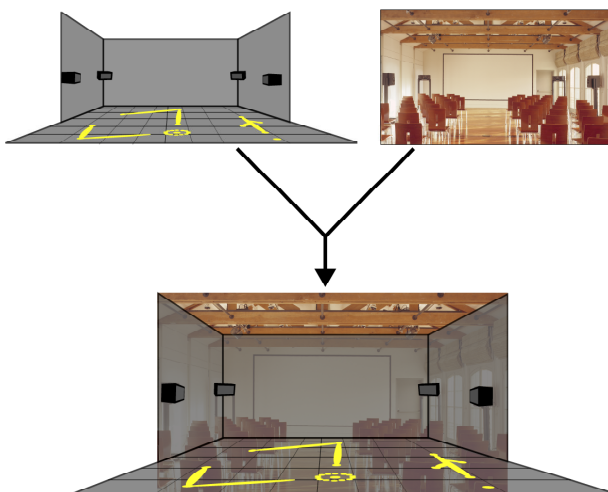


Figure 5: Superimposition of a virtual game-space on top of a physical performance space

avatars through the virtual room, controlling sound across an 8-channel sound field mirroring corresponding real-world physical speaker locations. For individuals controlling the system as well as individual watching on a projected video screen, effects ranging from sensory confusion to mild discomfort were reported. Though not intended as a full-blown perceptual study, the immediate reactions of those involved hint at deeper issues with users' cognitive abilities to separate virtual environments from physical environments.

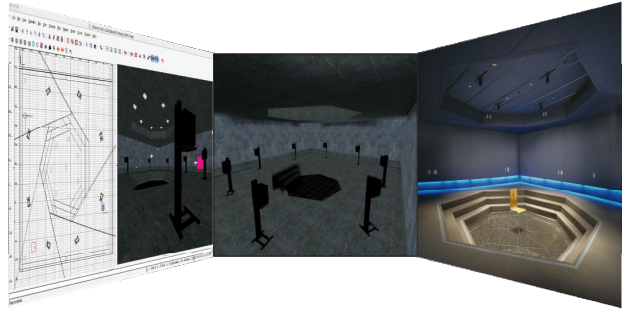


Figure 6: Schematic, In-game and Real-world images of CCRMA's Listening Room

6. REFERENCES

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