Music in Virtual Worlds:
"Mixed-Reality Performance"

Robert Hamilton

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http://ccrma.stanford.edu/~rob/mito/

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About Me: current interests

About Me: current interests

- Interactive Musical Systems
- Composition & Performance
- Instrument Design and Control
- Space and Spatialization
- Virtual Worlds
- Networked Musics
- Integrated Media

About Me: current interests

Network Music

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Network Music

Audio (streaming) across networks

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Network Music

Data (streaming) across networks

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Network Music

- Data (What are you sending?)
- Distance (Where are you sending it?)
- Latency (How fast is your connection?)

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Project Overview: Prior Work - Networked Performance

Networking Models: **Open Sound Control**

Control messages sent over networks (local or wide) can be used to control musical systems

- Open-ended, dynamic, URL-style symbolic naming scheme
- Symbolic and high-resolution numeric argument data
- Pattern matching language to specify multiple recipients of a single message
- High resolution time tags
- "Bundles" of messages whose effects must occur simultaneously
- Query system to dynamically find out the capabilities of an OSC server and get documentation

http://opensoundcontrol.org/introduction-osc

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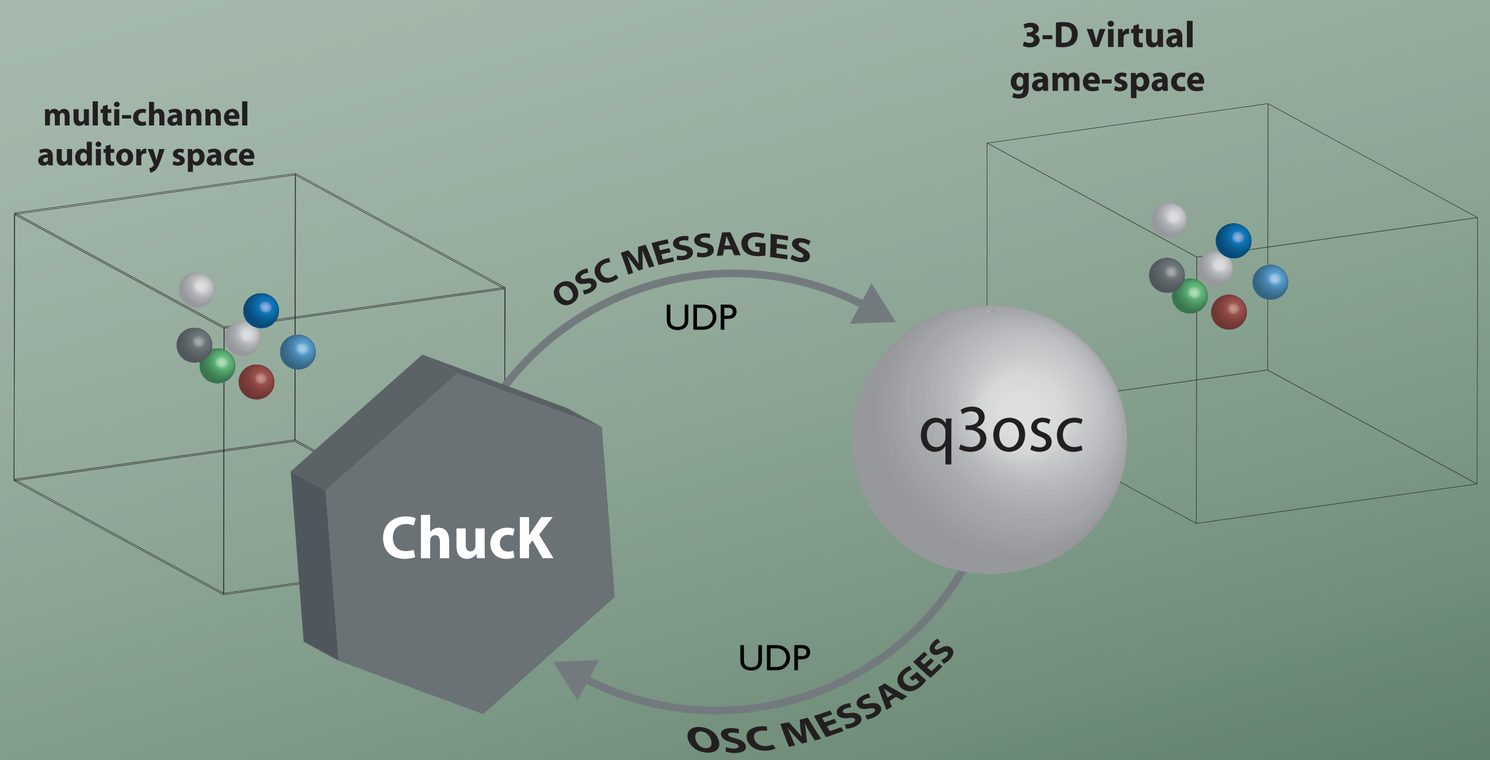
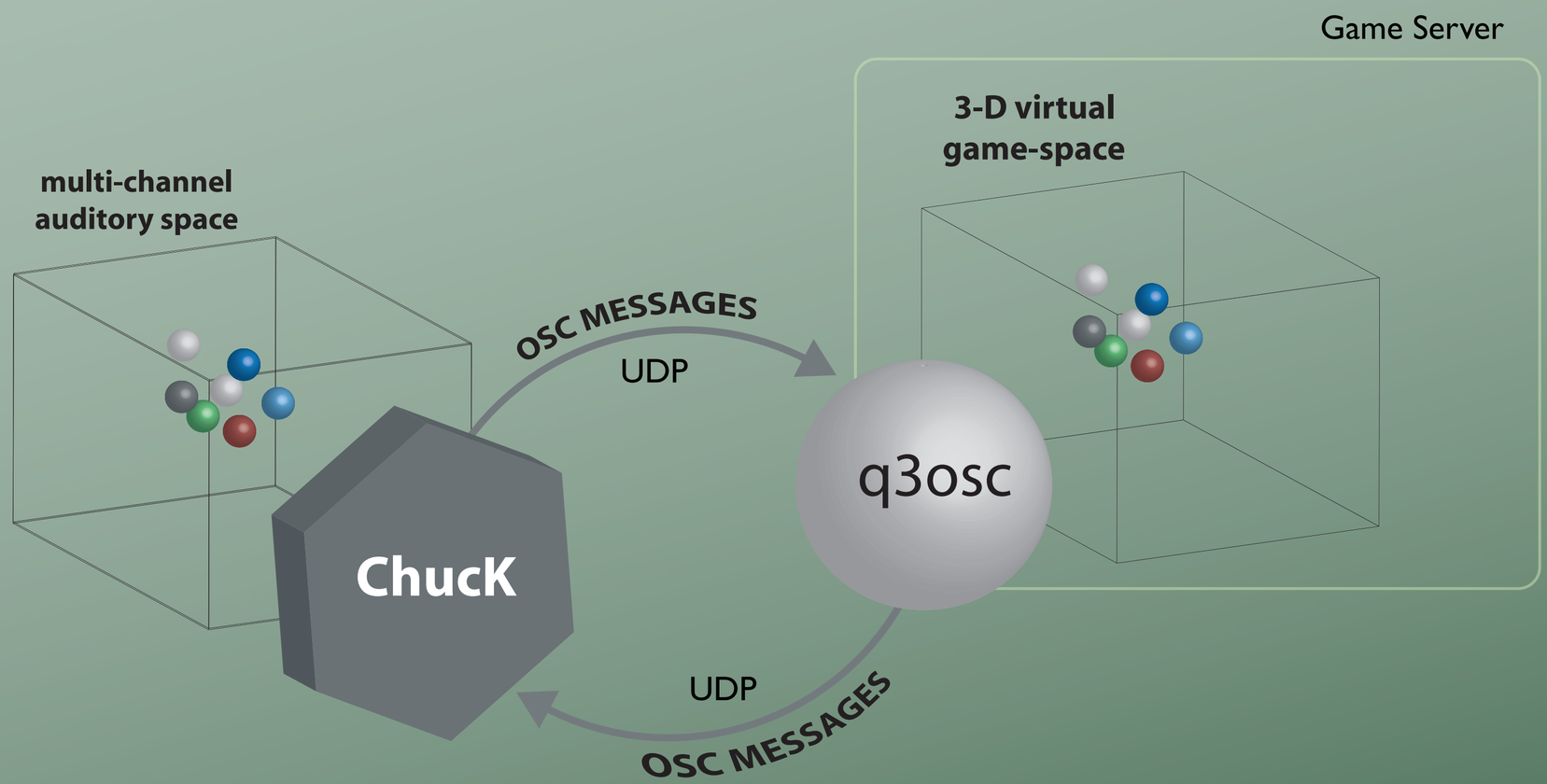
Networking Models: Bi-directional OSC Stream



Networking Models: Bi-directional OSC Stream



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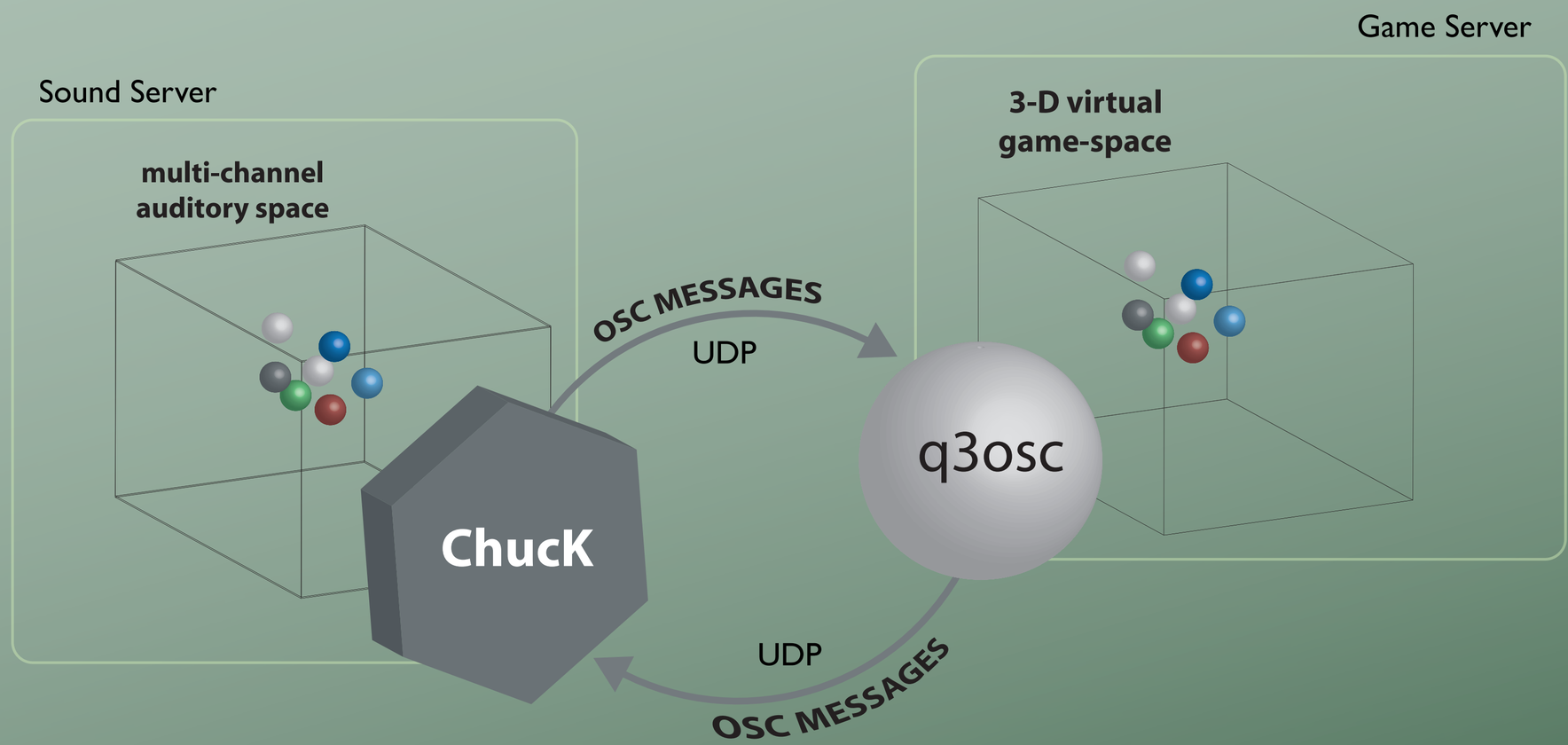
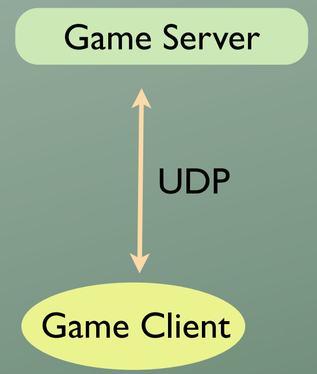


Networking Models: Local + Remote Game Connections



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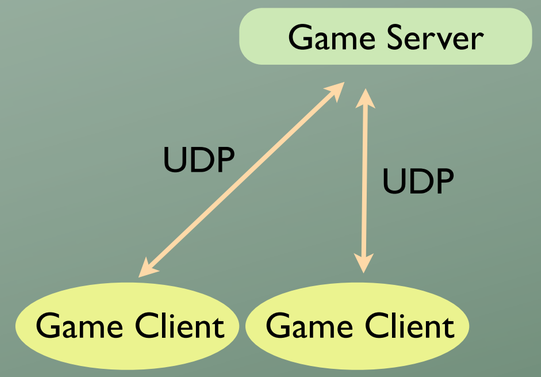

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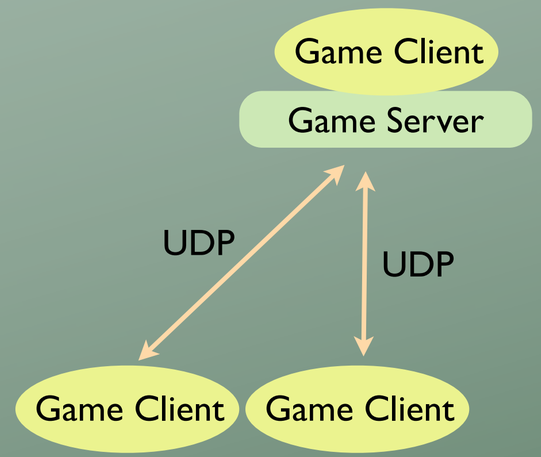

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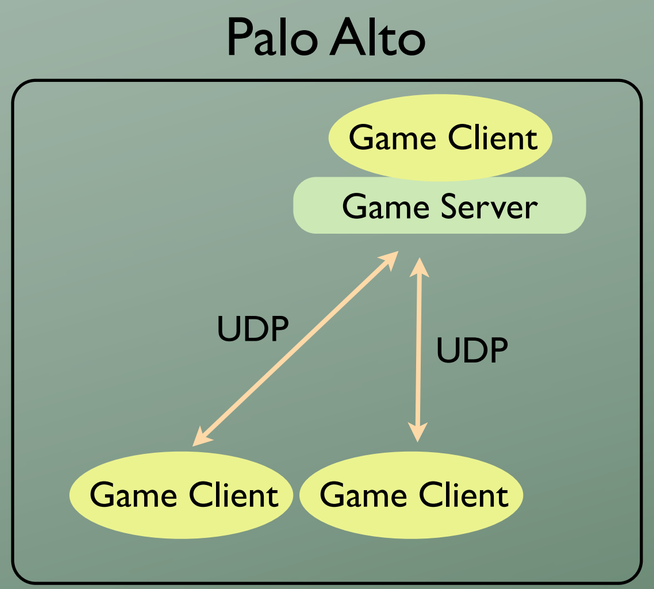

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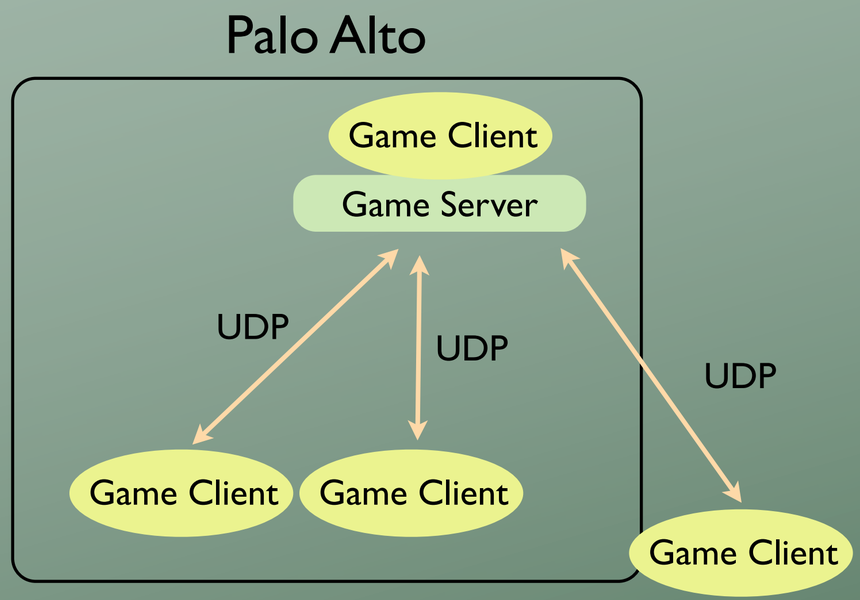

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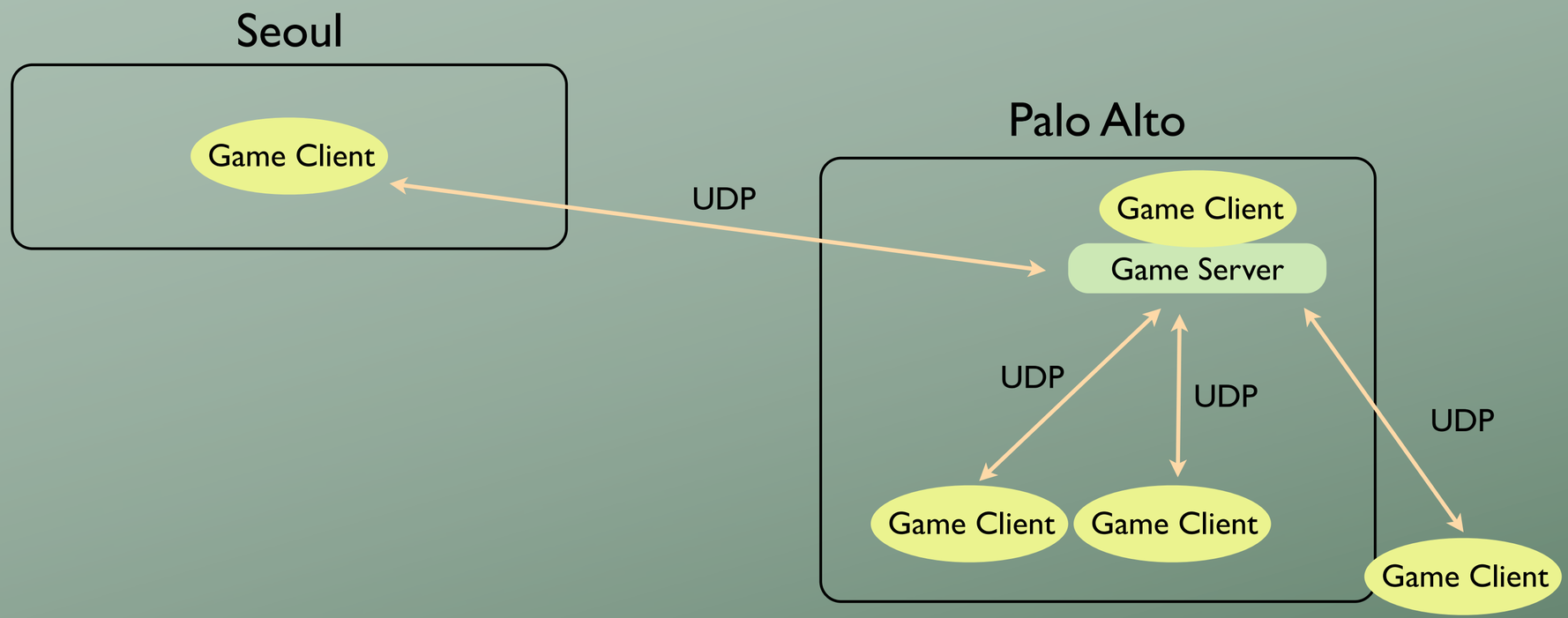

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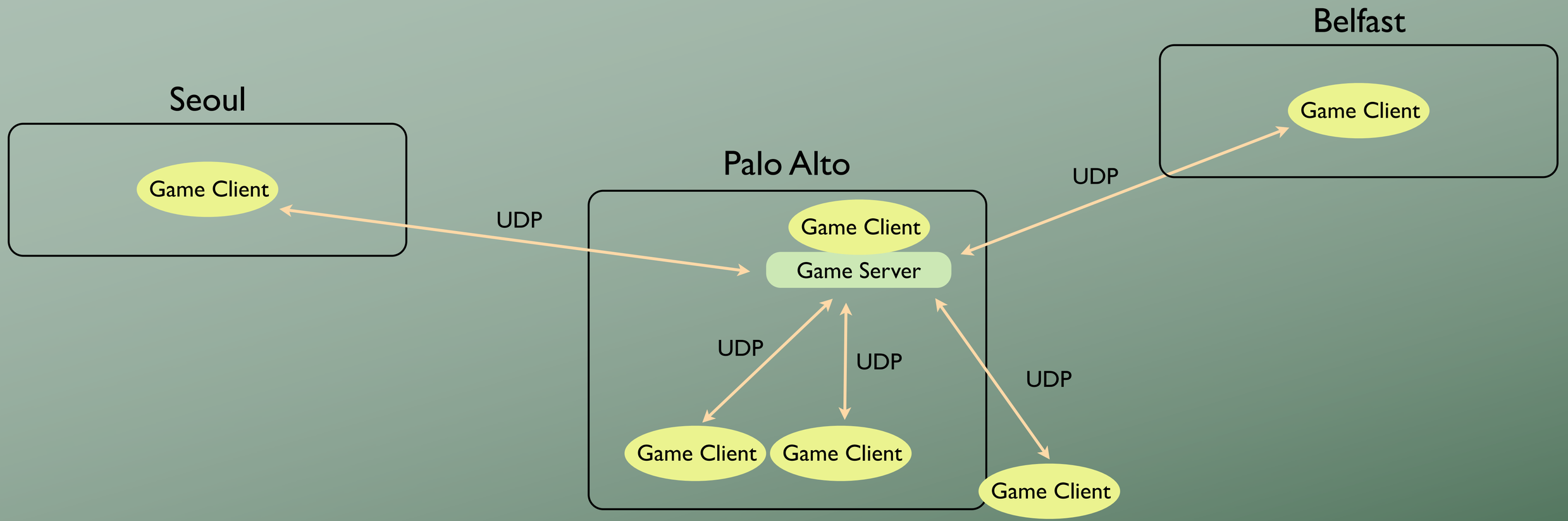

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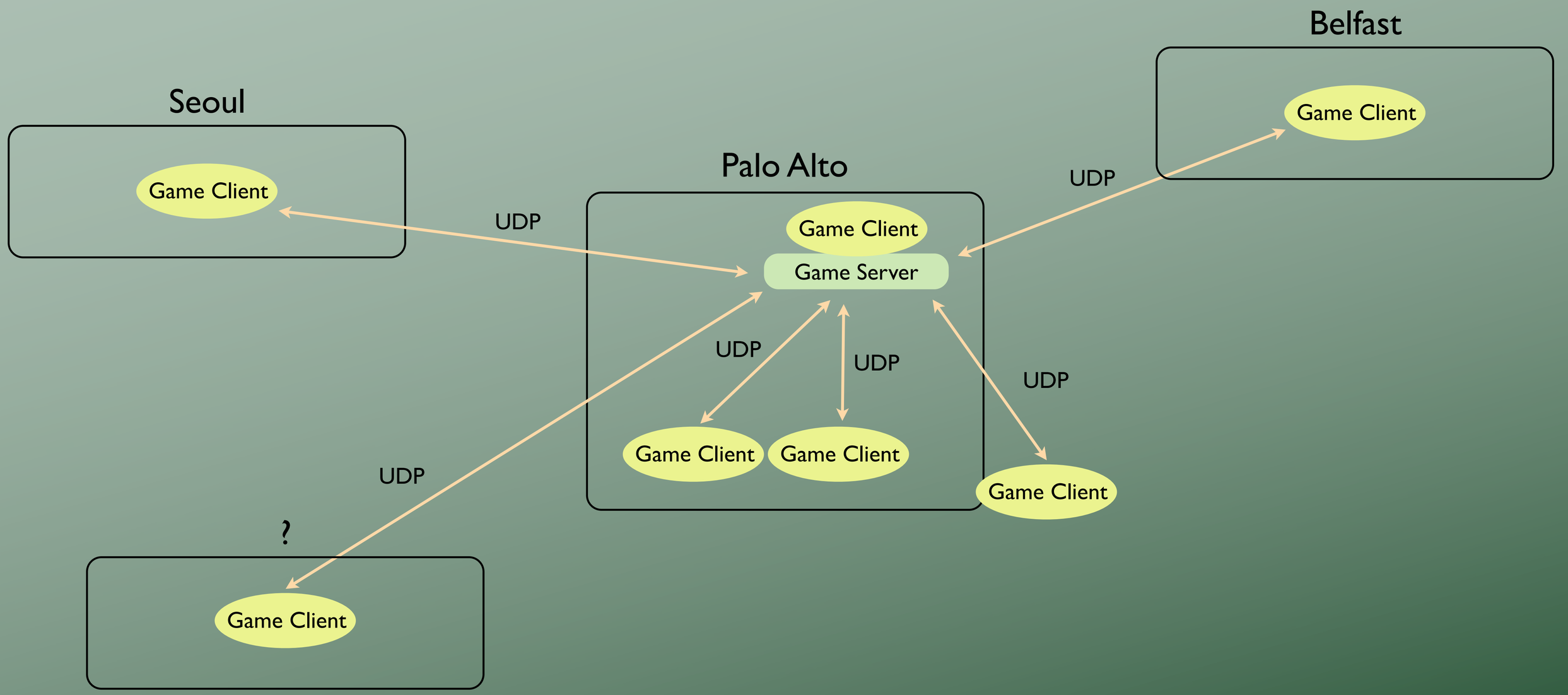

MVW (Music in Virtual Worlds)

rob@ccrma.stanford.edu

MVW (Music in Virtual Worlds)

Q3OSC

ioquake3
Open Sound Control
Audio Synthesis

rob@ccrma.stanford.edu

MVW (Music in Virtual Worlds)

Q3OSC

ioquake3
Open Sound Control
Audio Synthesis

Sirikata
+ OSC

Sirikata
Open Sound Control
Audio Synthesis
Streaming-Audio
Laptop Ensemble
Acoustic Instruments

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MVW (Music in Virtual Worlds)

Q3OSC

ioquake3
Open Sound Control
Audio Synthesis

UDKOSC

UDK (Unreal 3)
Open Sound Control
Audio Synthesis

Sirikata
+ OSC

Sirikata
Open Sound Control
Audio Synthesis
Streaming-Audio
Laptop Ensemble
Acoustic Instruments

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Q3OSC

ioquake3 + Open Sound Control + Audio Synthesis

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Q3OSC

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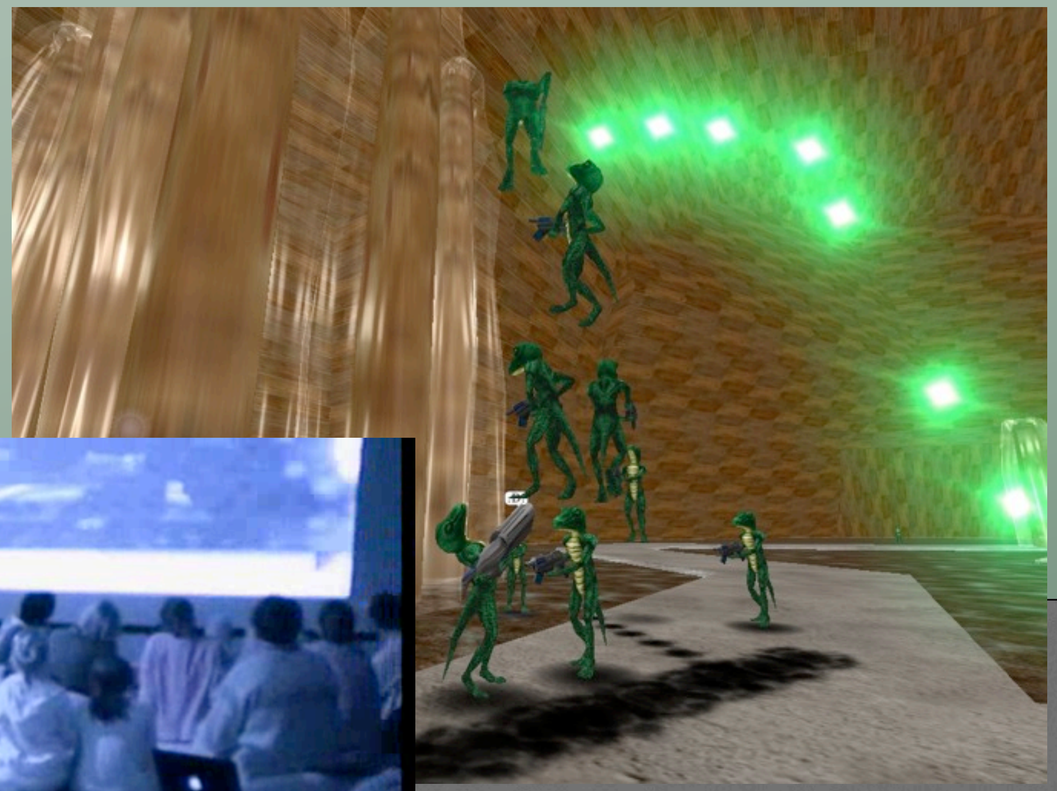
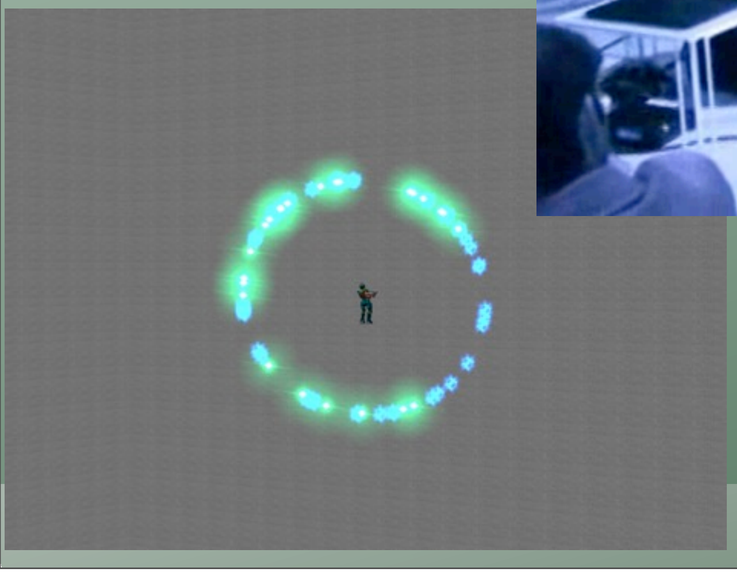
Q3OSC





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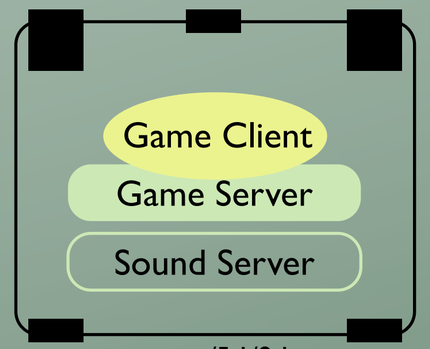
Performance Practice: Multiple Paradigms

Performance Practice: Multiple Paradigms

Single-user with a stereo/user-centric Sound-Server

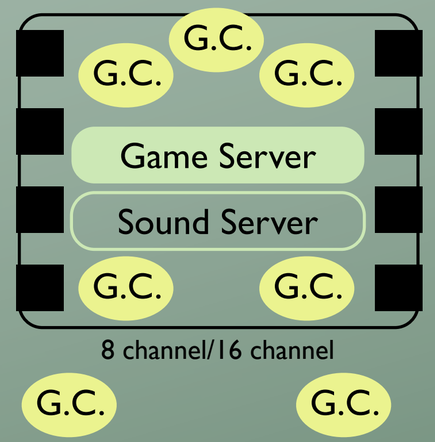
- standard gaming user-centric model
- remote users can sonify the environment and participate remotely with a concert-space presentation
- performance can be entirely virtual with all sonification carried out at client locations



Performance Practice: Multiple Paradigms

One Sound-Server with multiple speakers

- n-number of virtual local performers
- single concert-space for video and audio presentation
- can make use of more sophisticated methods of spatialization (Ambisonics)
- creating virtual audio environments through processing



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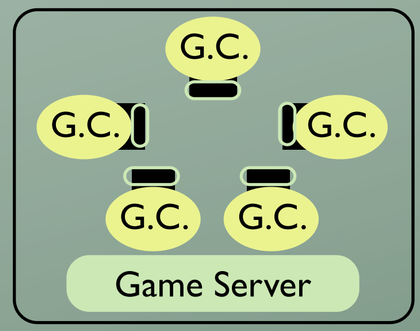
Performance Practice: Multiple Paradigms

n-number of Sound-Servers with point-source speakers

- n-number of virtual local performers connected to Sound-Servers
- single concert-space for video and audio presentation
- one-to-one correlation between virtual speaker locations and physical speaker locations



n-channels (point-source)

One Sound-Server with multiple speakers

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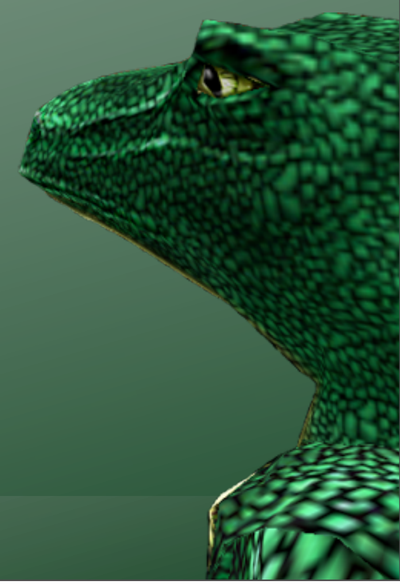
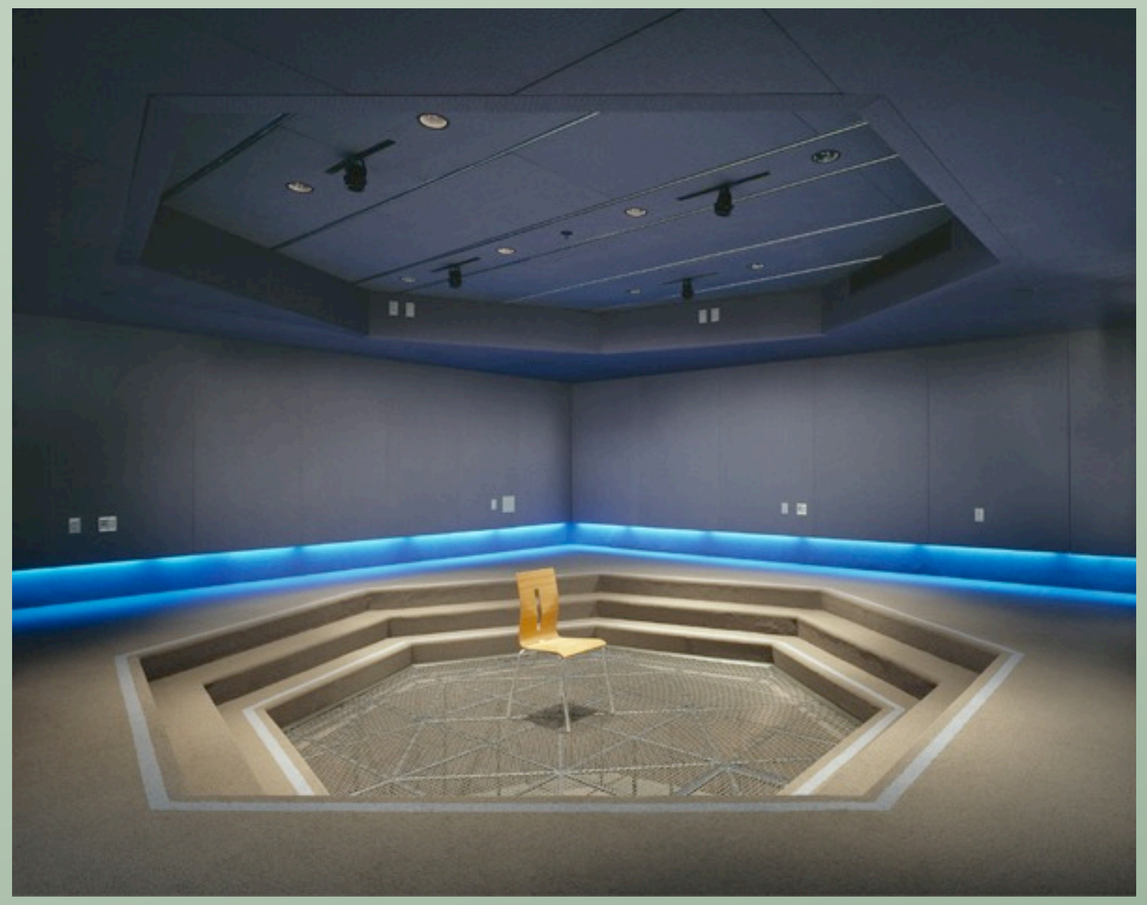
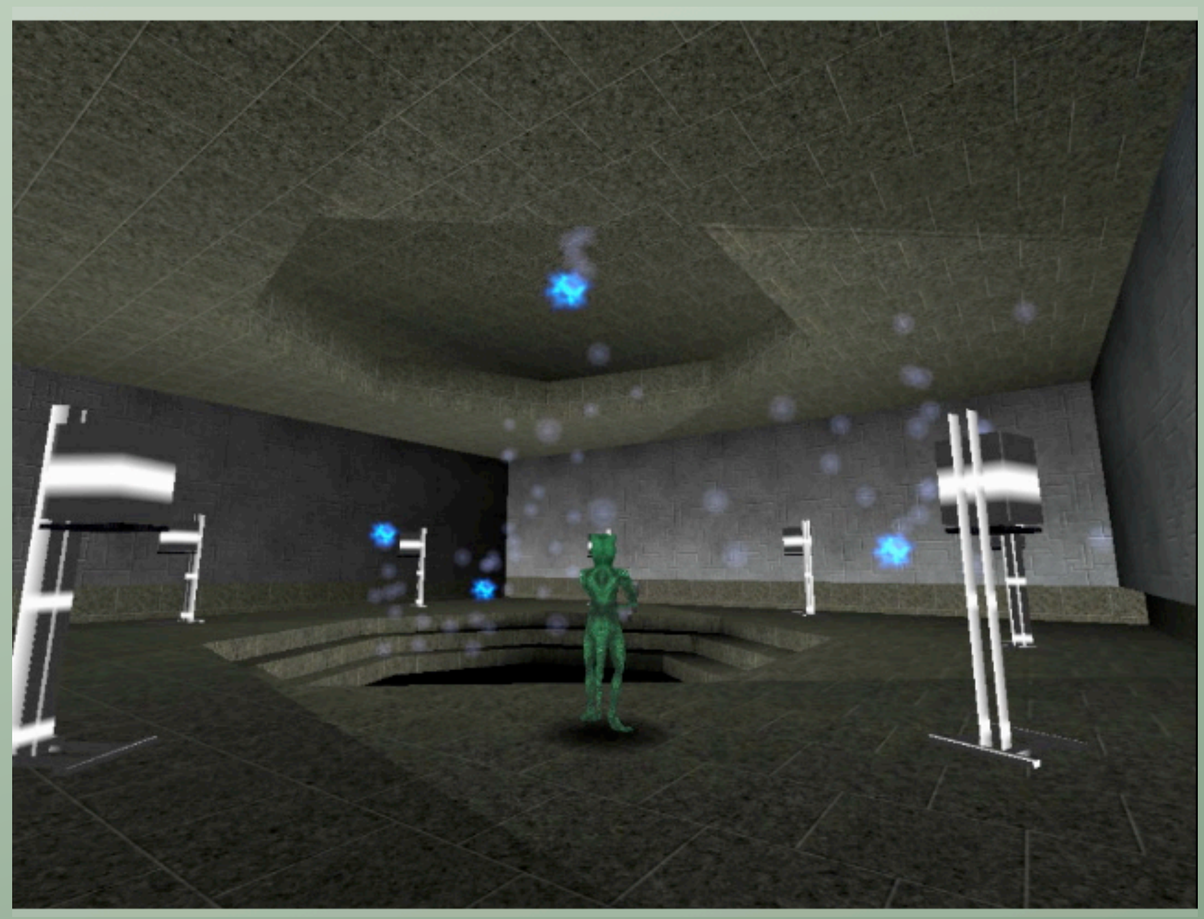


Immersive Audio Environments



16-Channel Spherical
Speaker Environment



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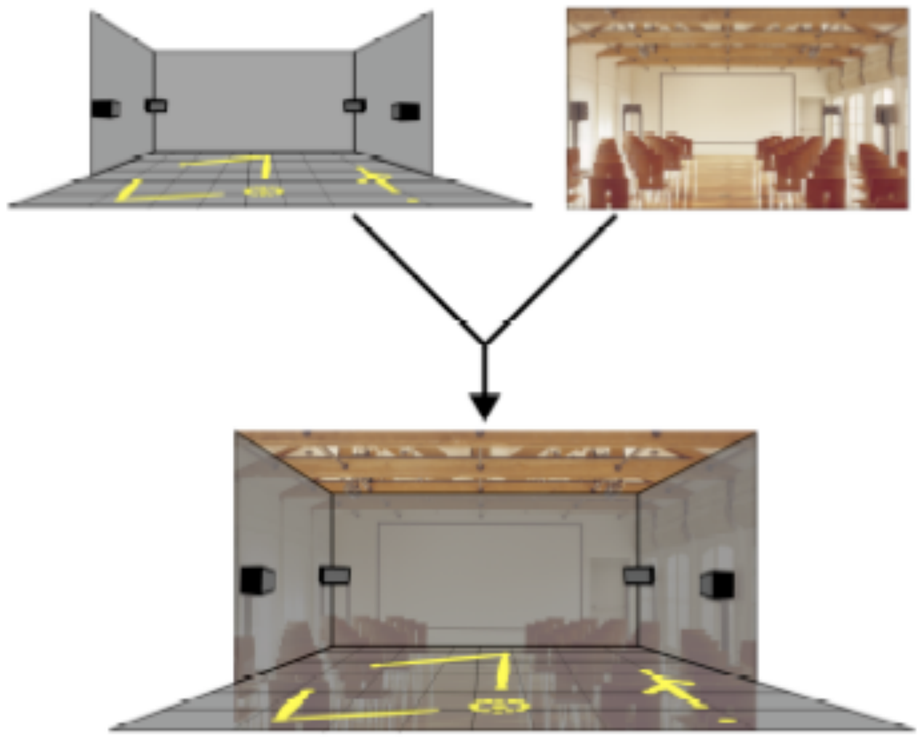
Place and Perspective: Space-Centric Presentation



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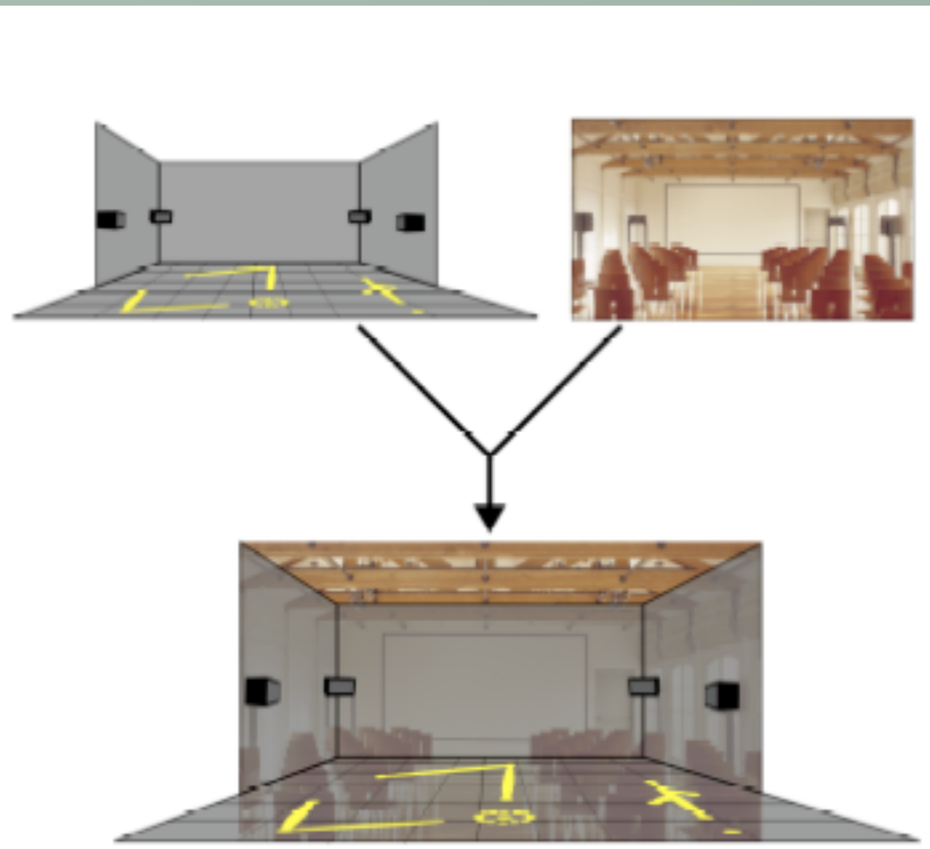
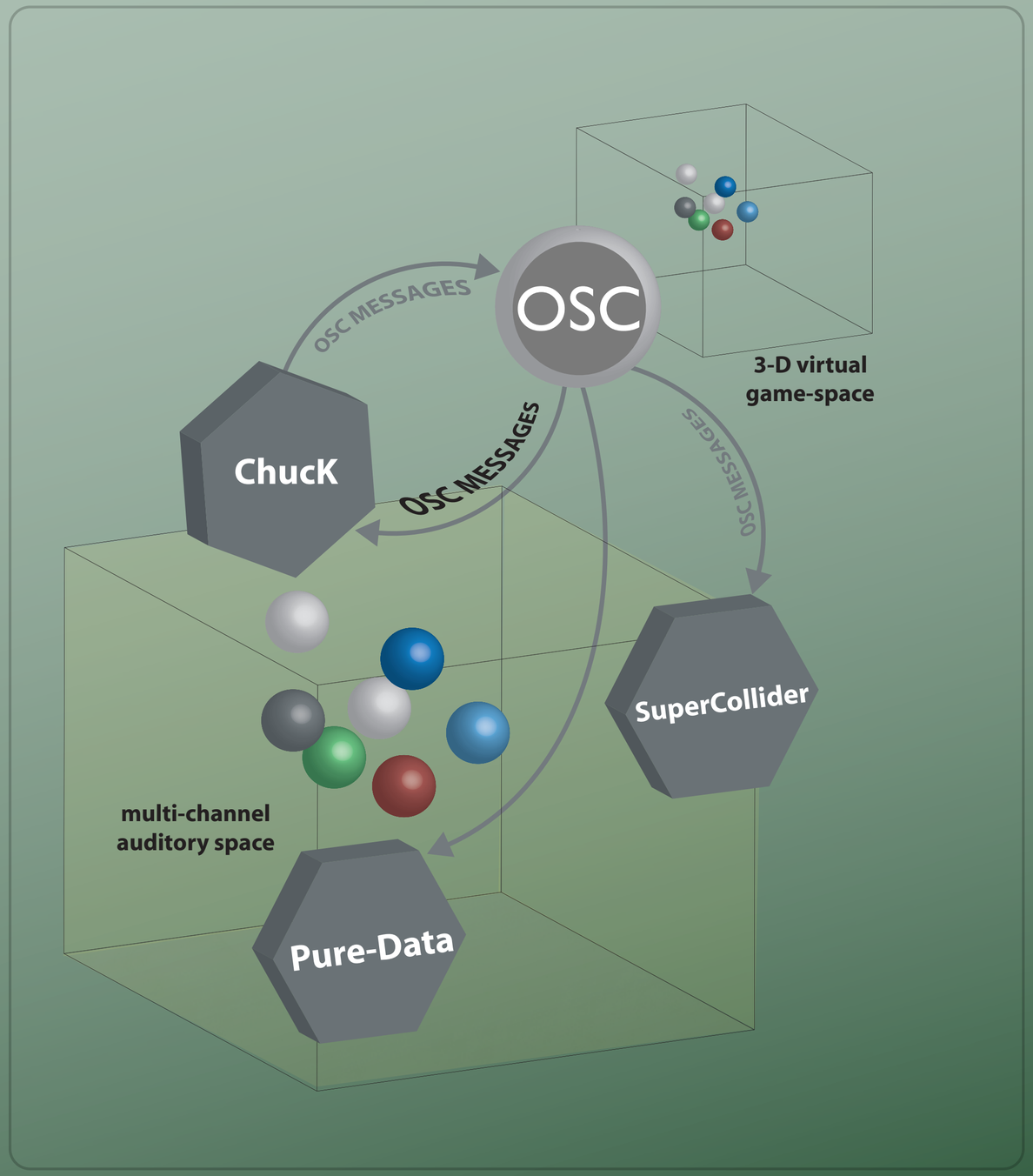


- Space, not Player becomes the reference for multi-channel Audio Spatialization

- Object positions in auditory space are not translated based on Player view or position

Controlling Sound with (virtual) Motion

- Open Sound Control



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Controlling Sound with (virtual) Motion

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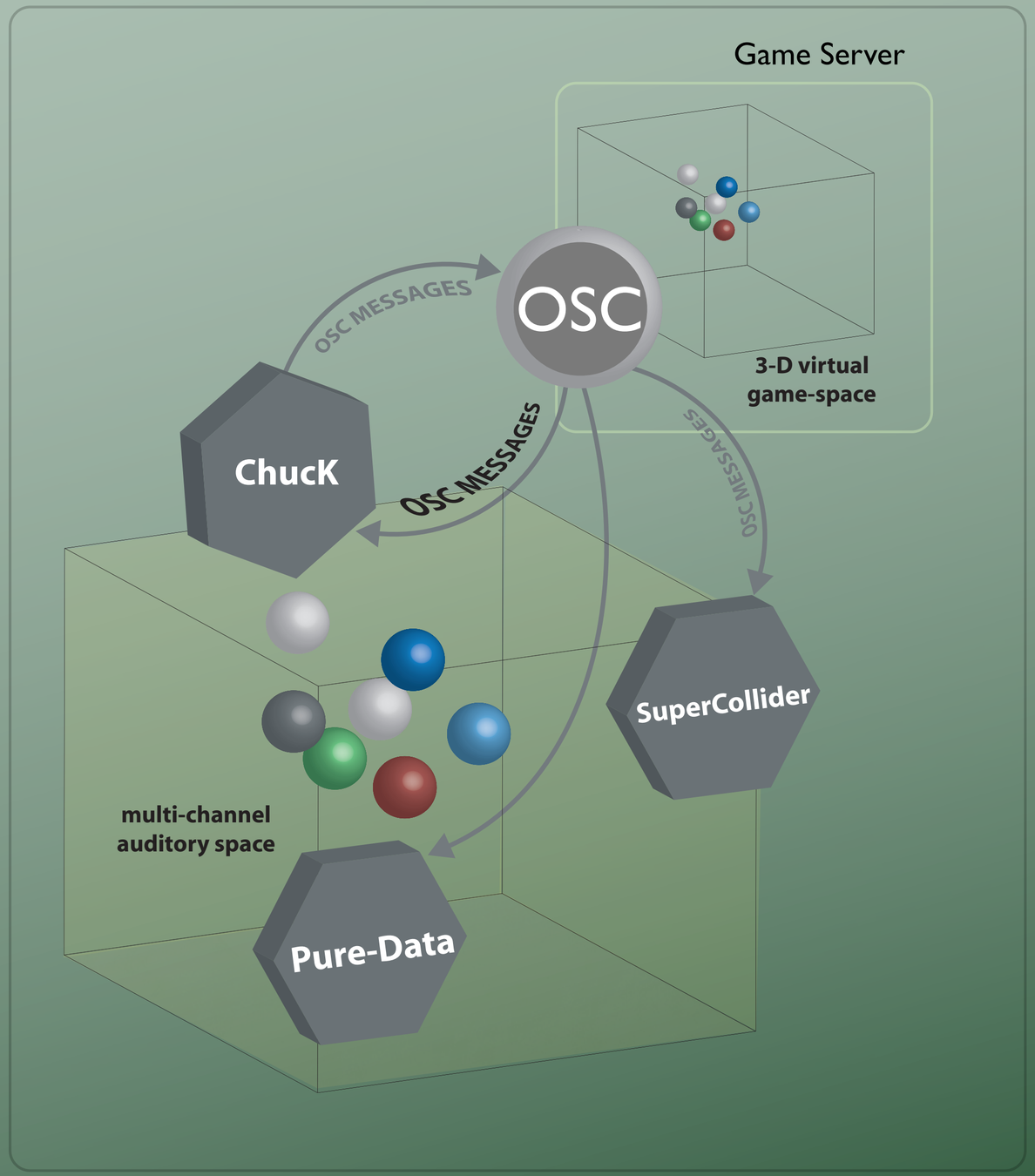

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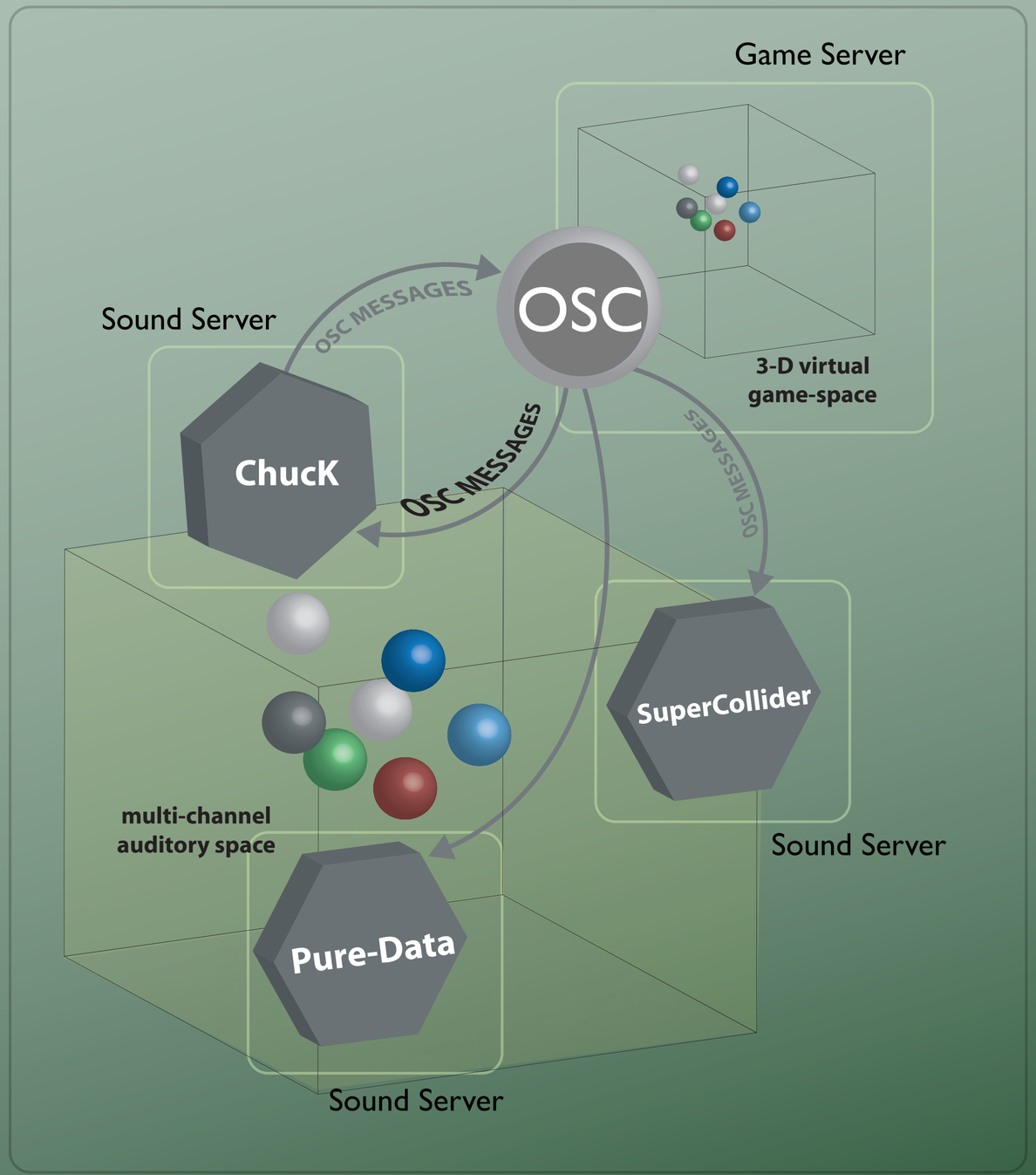

MiTo 2009:
Mixed-Reality Performance

Sirikata + Open Sound Control + Audio Synthesis + Network Audio

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MITO

Mi 12 .IX sabato

crossover

Robert Hamilton

In collaborazione con
Stanford Humanities Lab
Center for Computer Research
in Music and Acoustics
della Stanford University
Politecnico di Milano

Politecnico di Milano
Sede di Milano Bovisa
Aula Carlo De Carli
ore 22

ingresso gratuito

Mixed Reality Performance

Terry Riley

"In C", per Orchestra di Laptop e strumenti acustici

Juan-Pablo Caceres
e Robert Hamilton

Canned Bits Mechanics, per tre remoti disklavier al CCRMA, piano e visualizzazioni in Sirikata

Robert Hamilton
e Juan-Pablo Caceres

Dei Due Mondi, per esecutori interattivi in Sirikata

Dialoghi, improvvisazioni in rete

Con la partecipazione di
Jeffrey T. Schnapp,
fondatore e direttore del
Stanford Humanities Lab
Juan-Pablo Caceres,
Robert Hamilton,

Mixed Reality Performance è un esperimento in cui spazi fisici e musicisti di diversi continenti si incontrano nella realtà virtuale della rete. Promossa da MITO SettembreMusica in collaborazione con lo Stanford Humanities Lab e lo Stanford Center for Computer Research in Music and Acoustic, questa produzione è un esperimento d'interazione tra musicisti collocati in spazi definiti attraverso la realtà virtuale: un pianista suona e la sua musica viene manipolata da musicisti virtuali; dall'altra parte dell'oceano, altre realtà acustiche vengono manipolate e restituite all'interno di uno scenario virtuale tridimensionale proiettato sulle pareti. Lo spettatore è immerso in un mondo sonoro ricreato, in un'istallazione che segna la nascita di spazi performativi in Sirikata, la più recente piattaforma informatica open source.

Polytechnico di Milano Bovisa

Great Networking
5 Video Screens
8-channel sound (top notch)

MITO Settembre Musica
Torino Milano Festival Internazionale della Musica
3_24.IX.2009
Terza edizione

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Polytechnico di Milano Bovisa

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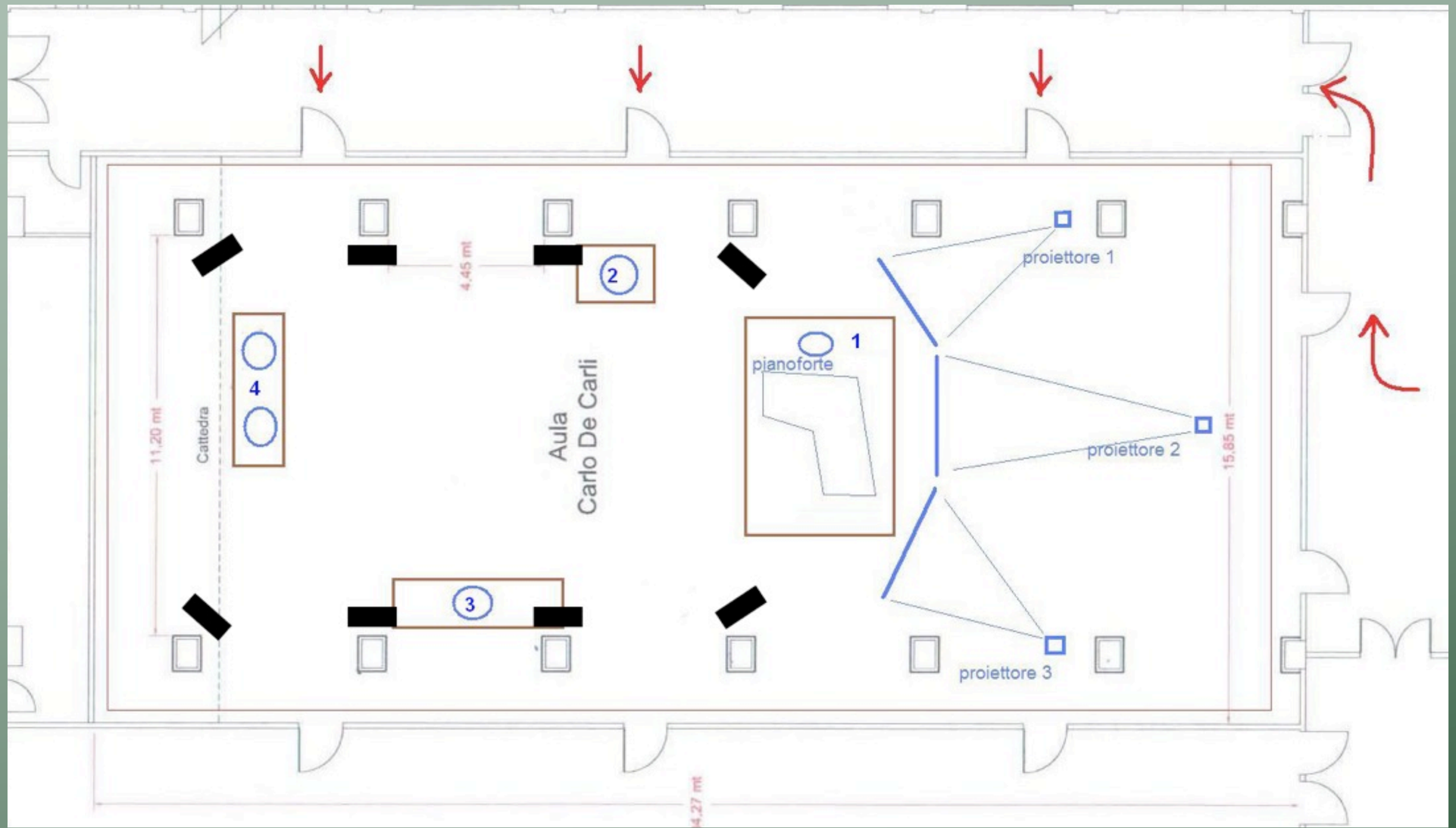
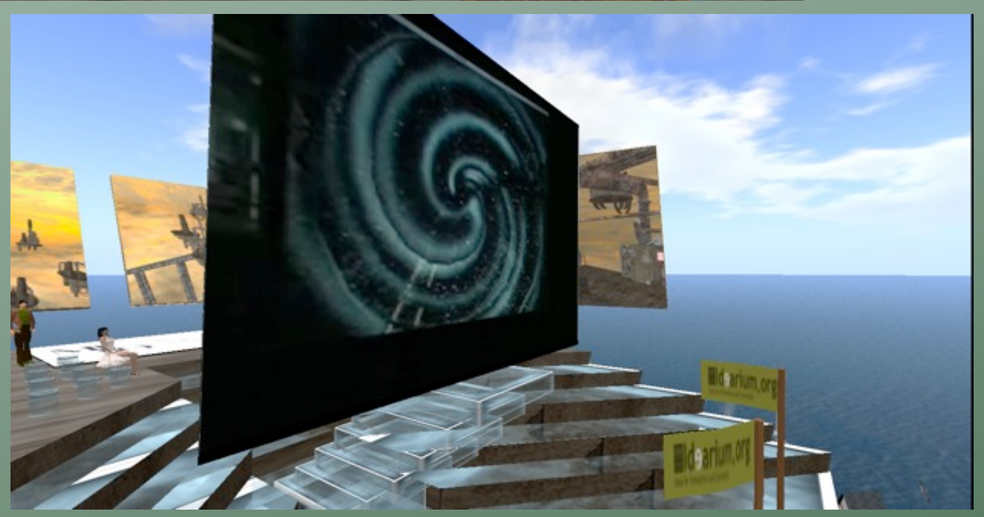


Streaming Broadcast in *Second Life*



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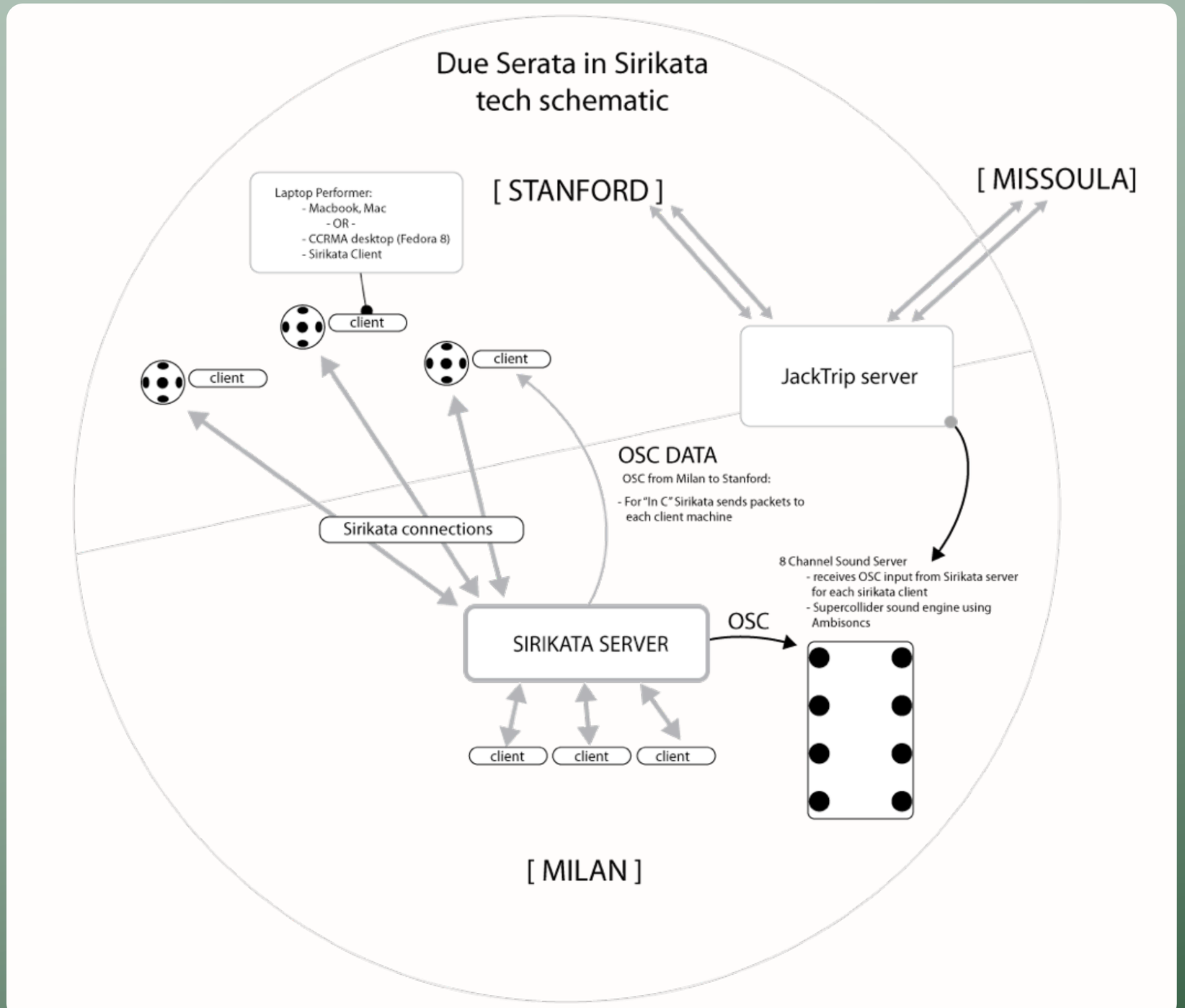
Due Serata in Sirikata
tech schematic
[STANFORD]
[MISSOULA]
Laptop Performer:
- Macbook, Mac
- OR -
- CCRMA desktop (Fedora 8)
- Sirikata Client
client
client
client
JackTrip server
OSC DATA
OSC from Milan to Stanford:
- For "In C" Sirikata sends packets to each client machine
Sirikata connections
8 Channel Sound Server
- receives OSC input from Sirikata server for each sirikata client
- Supercollider sound engine using Ambisoncs
SIRIKATA SERVER
OSC
client
client
client
[MILAN]

In C by Terry Riley; realization by Robert Hamilton, Juan-Pablo Caceres and the Sirikata/MiTo Team

Virtual Ensemble (Sirikata + STK)

Live Ensemble (via JackTrip)

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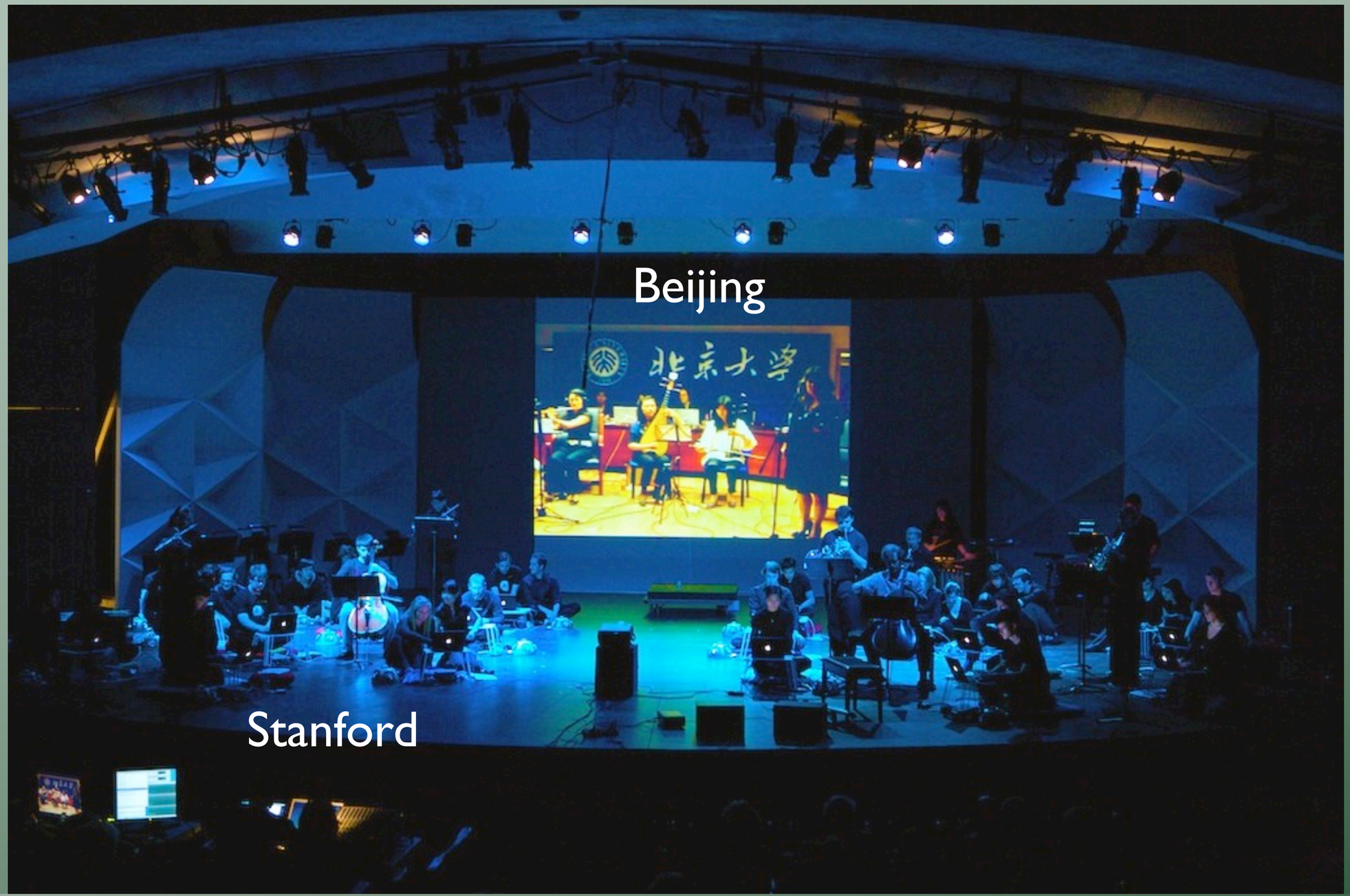
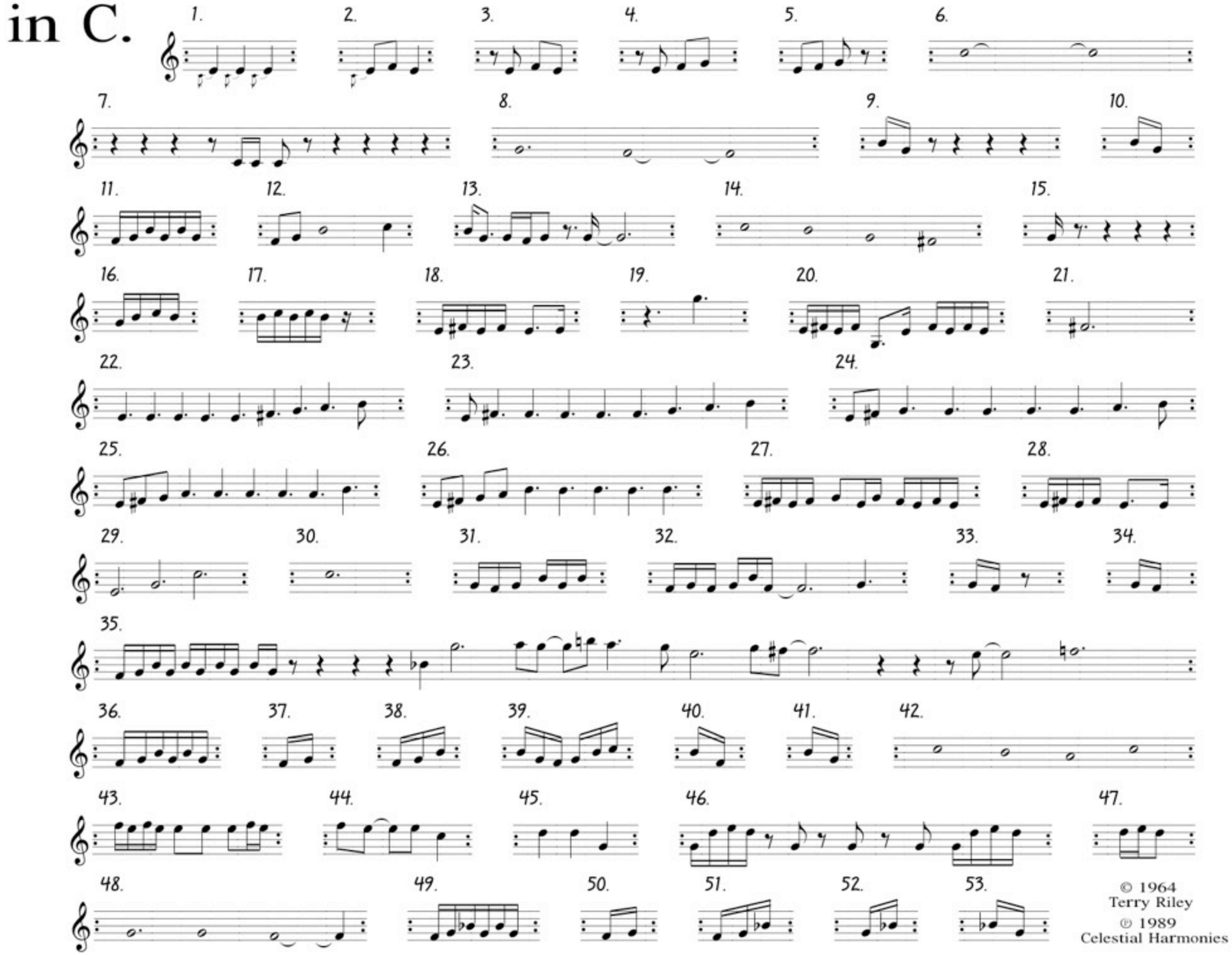
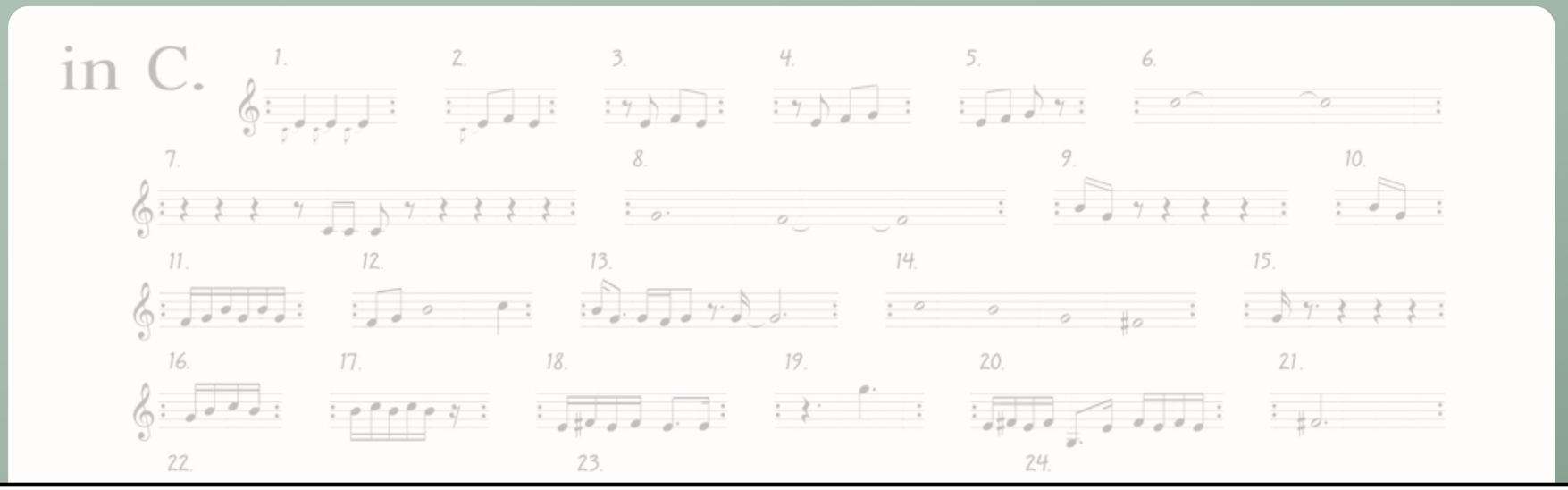
北京大学

2008 - Stanford Laptop Orchestra (SLOrk) + Acoustic Instruments



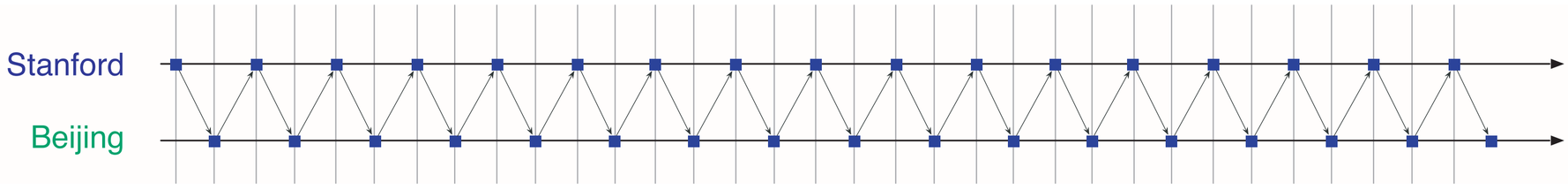

in C.
1. 2. 3. 4. 5. 6.
7. 8. 9. 10.
11. 12. 13. 14. 15.
16. 17. 18. 19. 20. 21.
22. 23. 24.
25. 26. 27. 28.
29. 30. 31. 32. 33. 34.
35.
36. 37. 38. 39. 40. 41. 42.
43. 44. 45. 46. 47.
48. 49. 50. 51. 52. 53.
© 1964
Terry Riley
℗ 1989
Celestial Harmonies



From Riley's Performance Instructions:

"One of the joys of *In C* is the interaction of the players in polyrhythmic combinations that spontaneously arise between patterns."

Hidden Audio Channel Metronome



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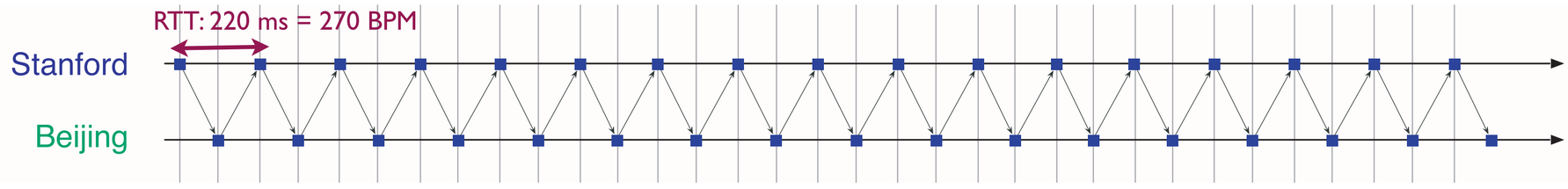
Hidden Audio Channel Metronome



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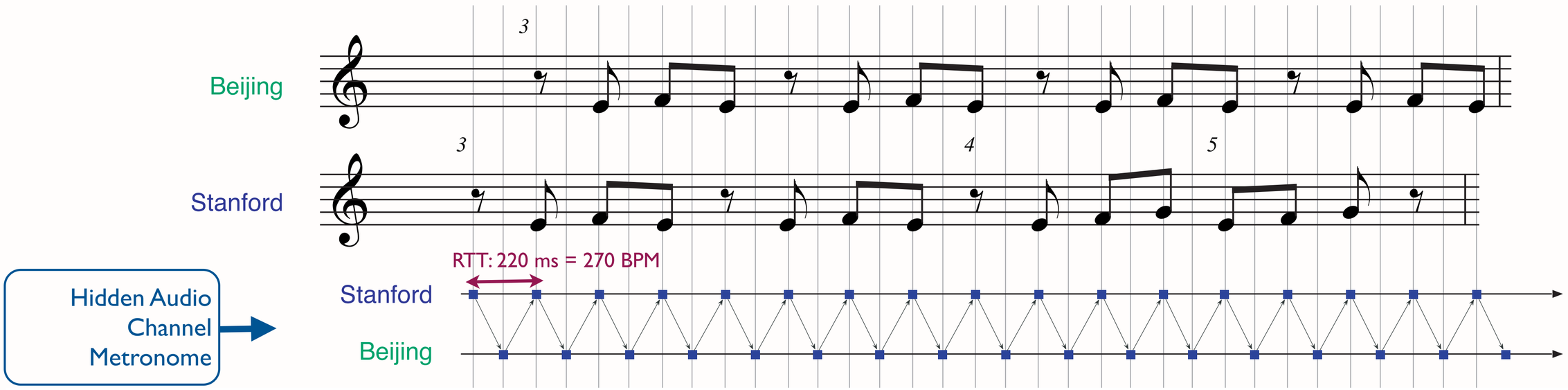

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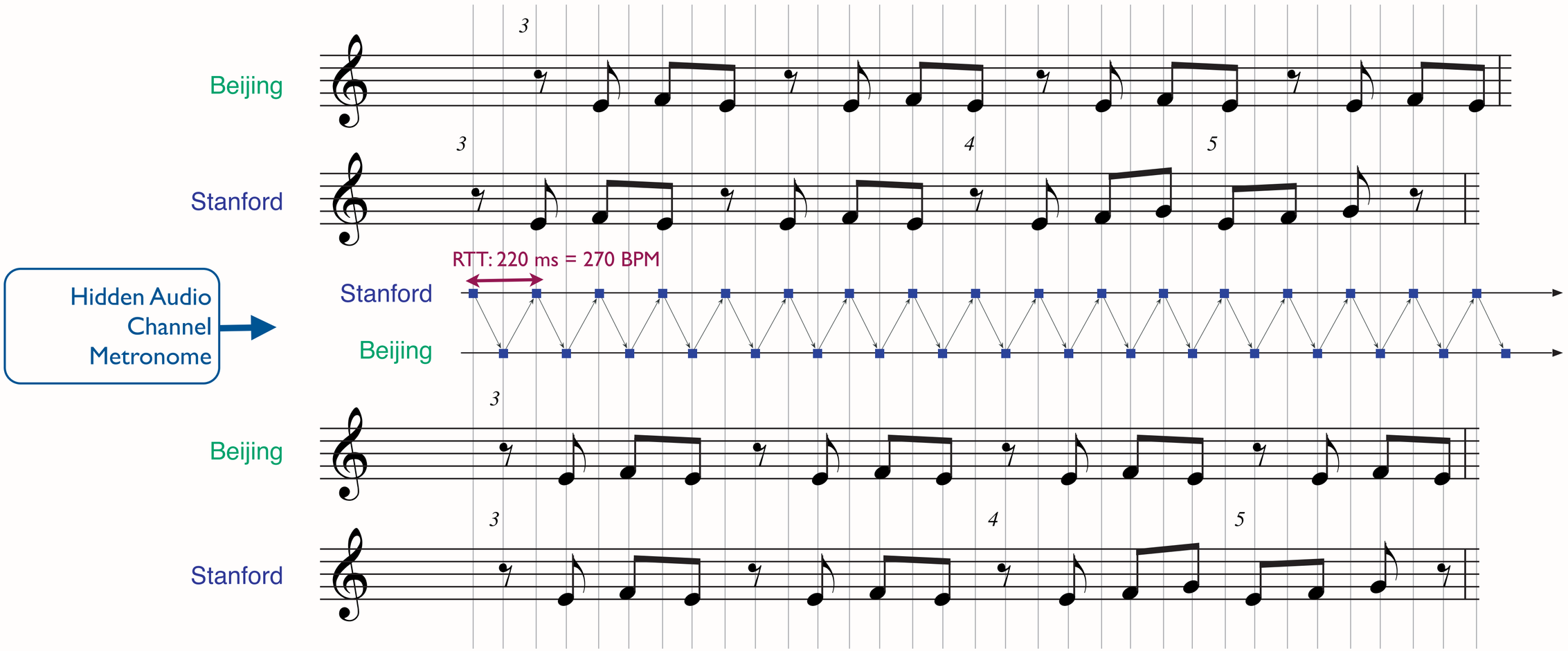
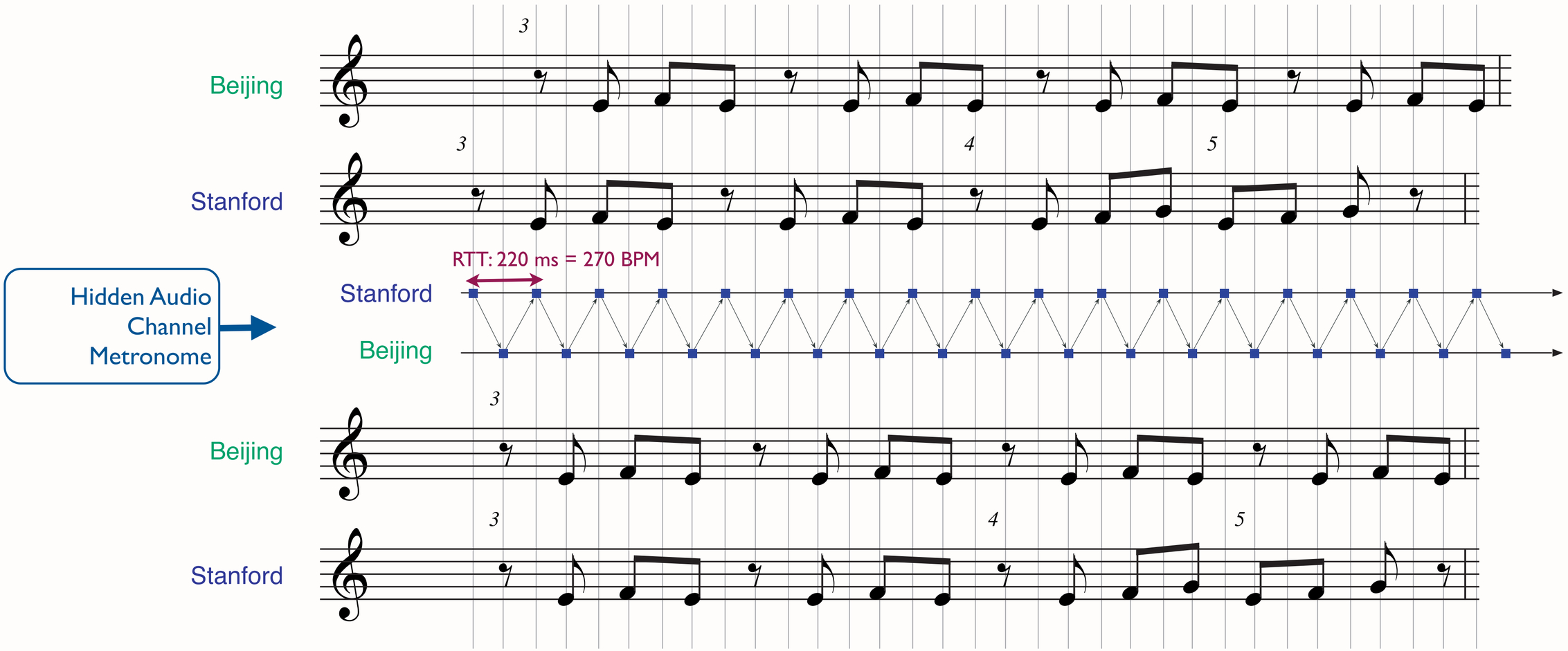

Beijing
Stanford
Hidden Audio Channel Metronome
RTT: 220 ms = 270 BPM
Stanford
Beijing
Beijing
Stanford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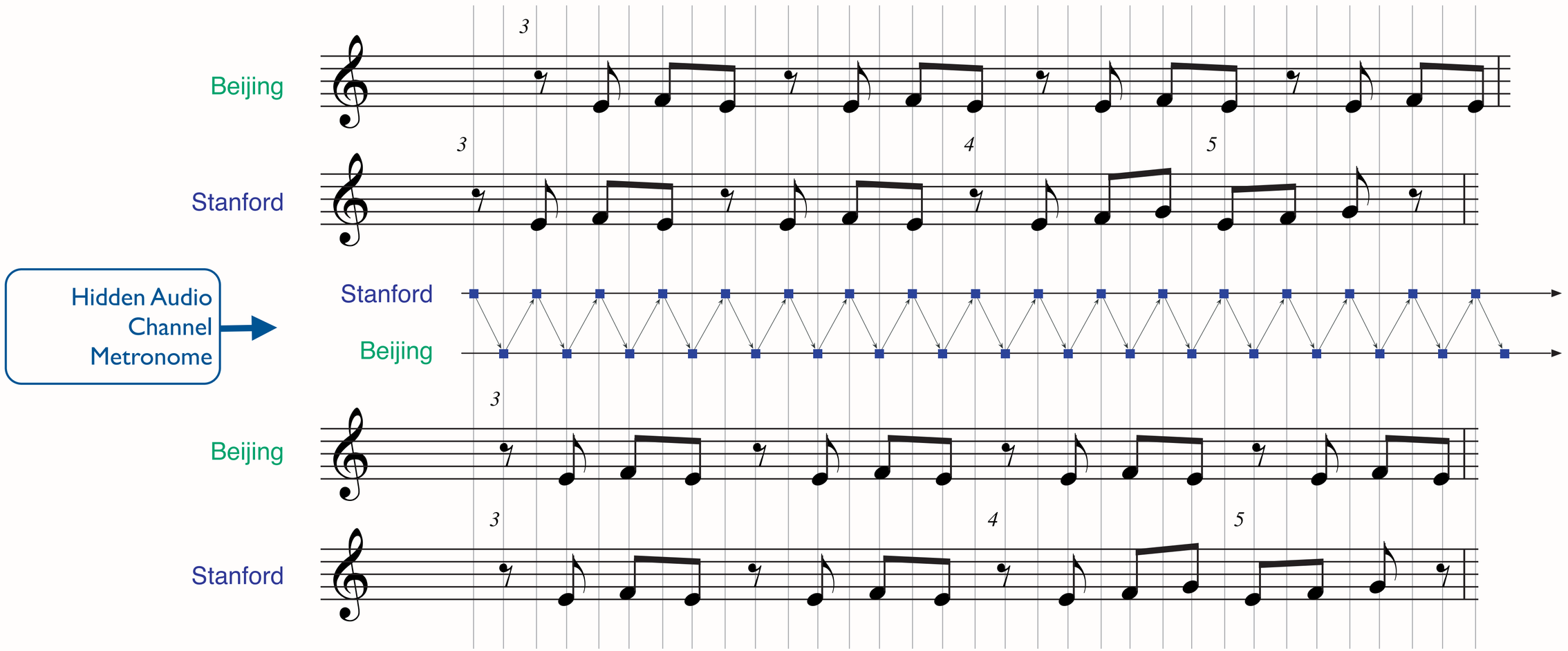
Beijing
Stanford
Hidden Audio Channel Metronome
Stanford
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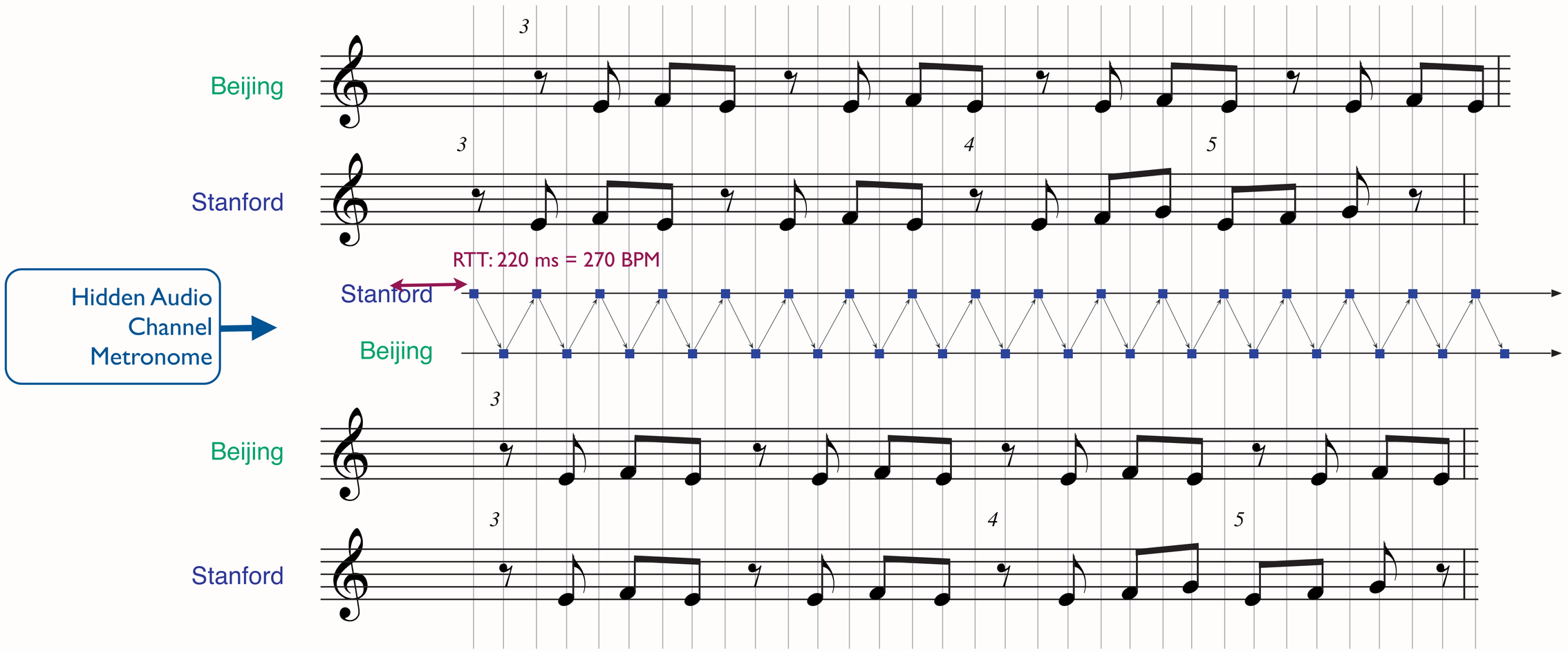
Stanford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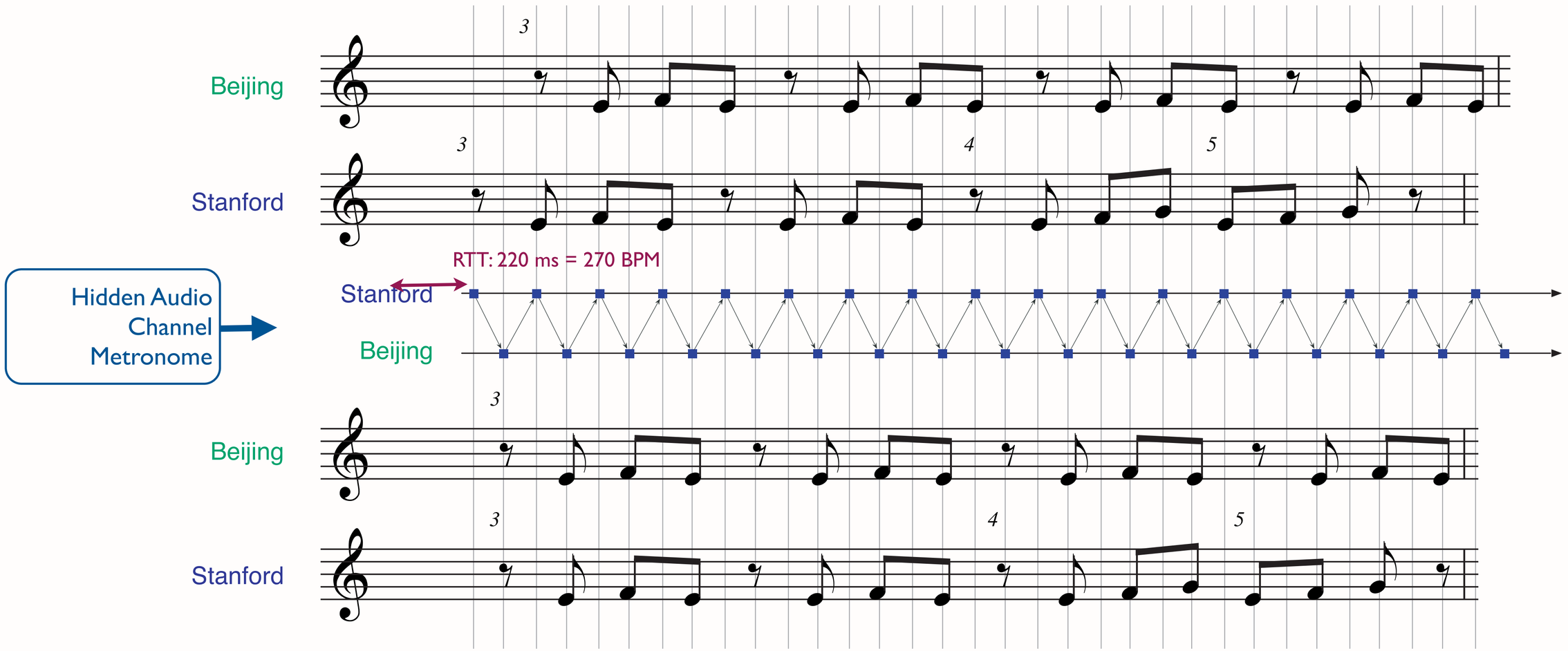
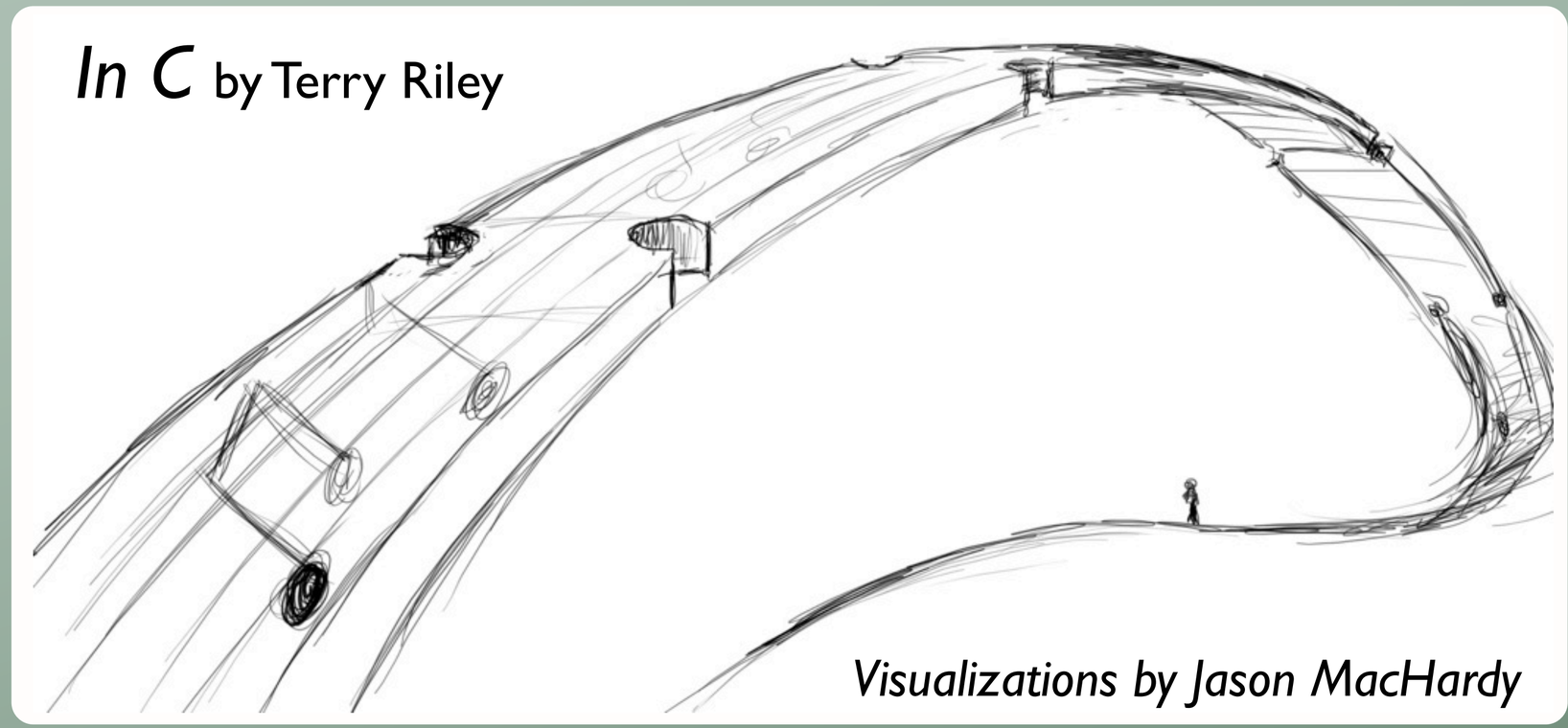
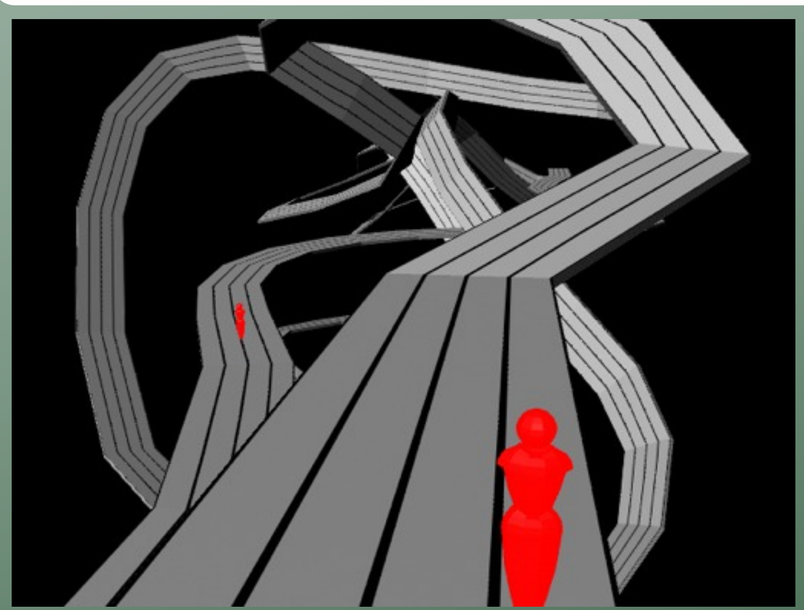
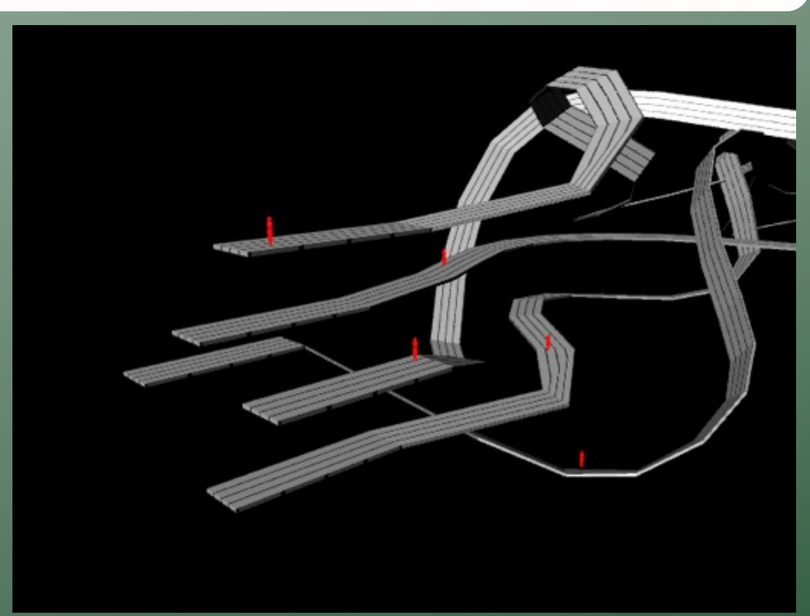

Beijing
Stanford
Hidden Audio Channel Metronome
RTT: 220 ms = 270 BPM
Stanford
Beijing
Beijing
Stanford

Musical "pathways" for each individual performer







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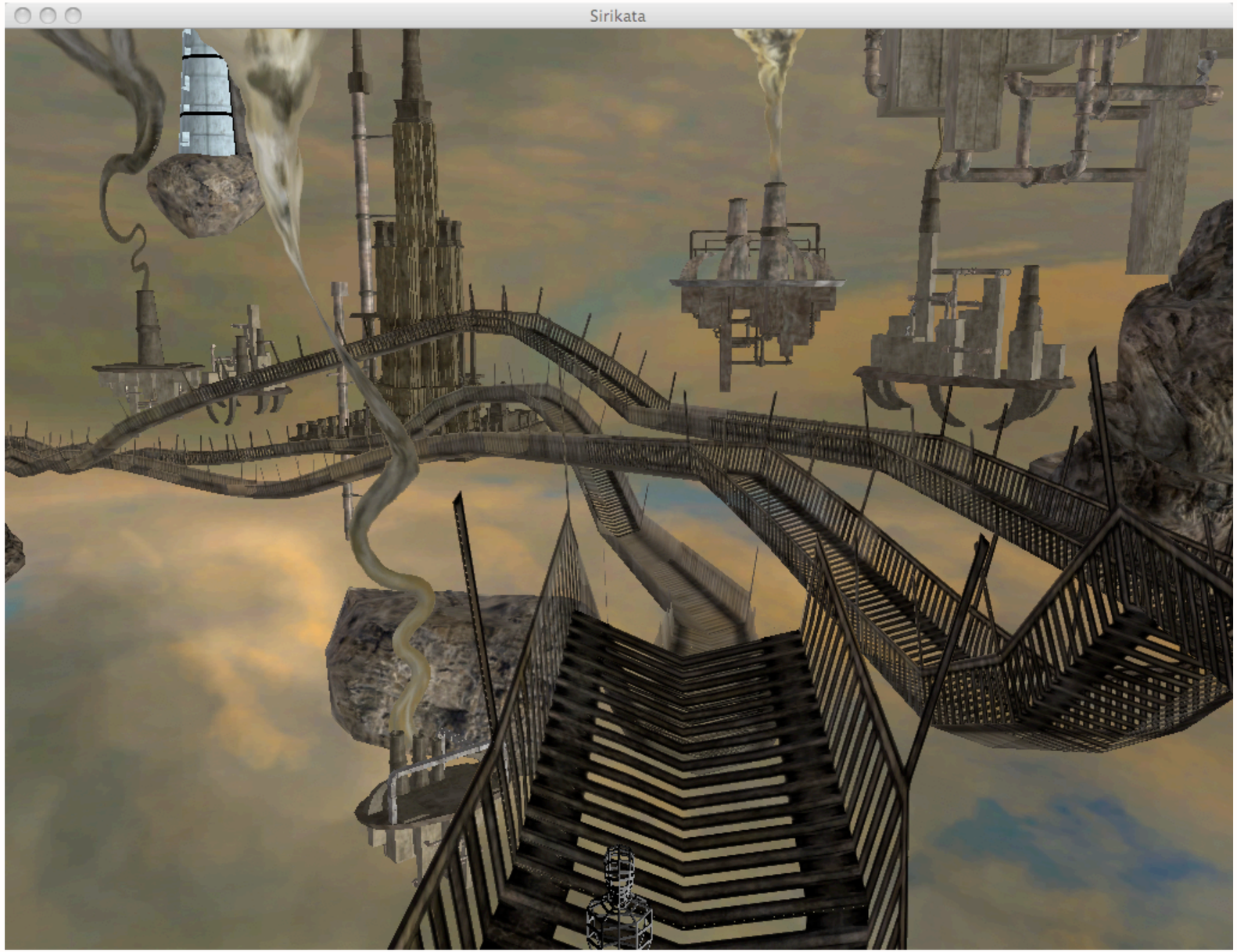
Musical "pathways" for each individual performer

In C by Terry Riley



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Canned Bits Mechanics by Juan-Pablo Caceres & Robert Hamilton

Live Piano

Remote controlled Disklavier

Avatar + control points

Soundfile playback:
- player piano sounds

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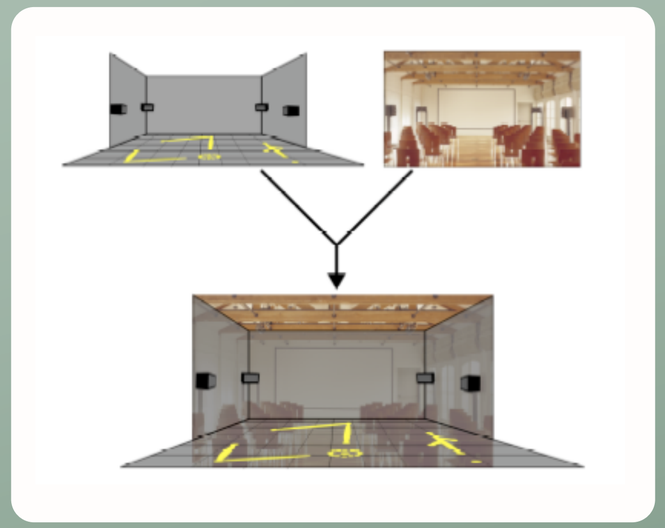
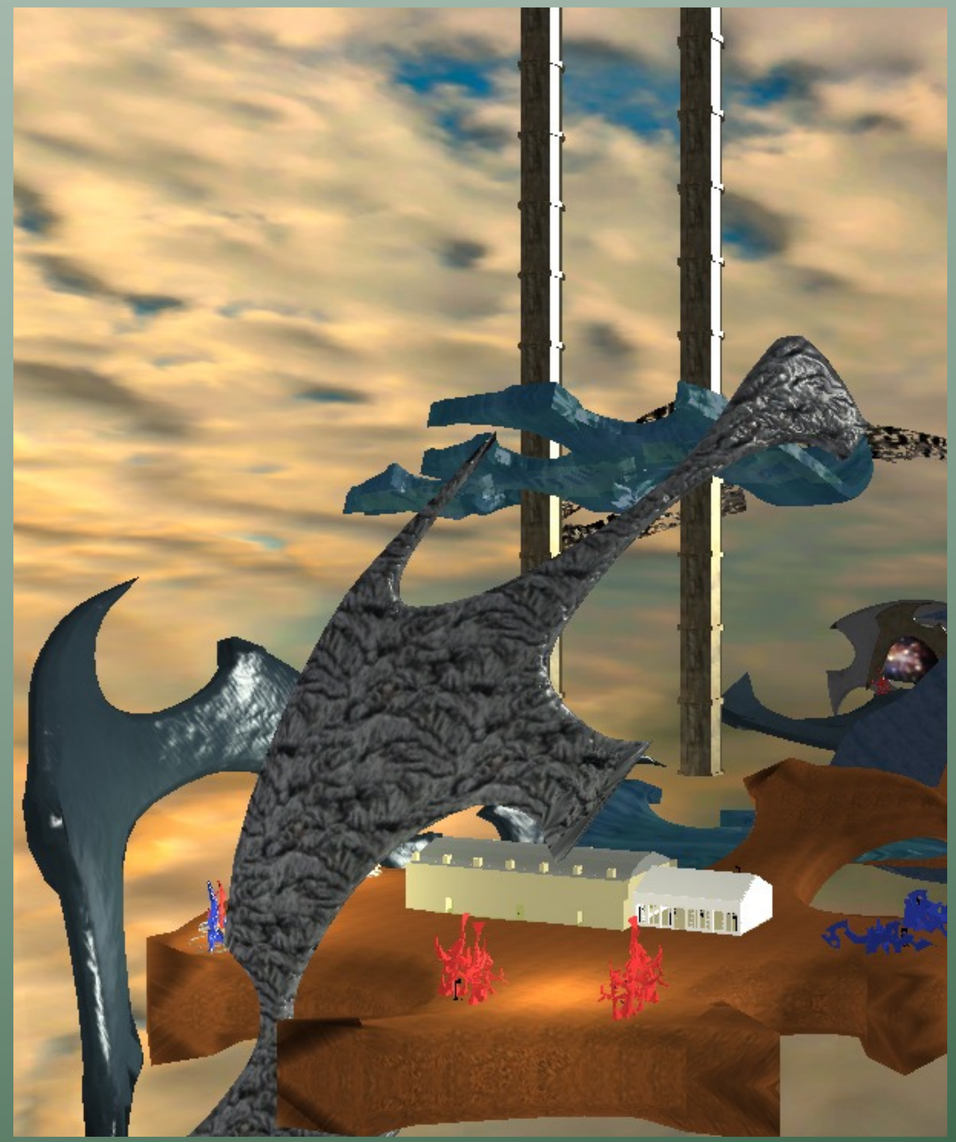
Dei Due Mondi by Robert Hamilton & Juan-Pablo Caceres





8-Channel Ambisonics (SuperCollider)
Speaker-to-User distance
Multiple Speaker Fields
Re-creation of CCRMA Stage &. Bovisa Polytechnical Institute Hall

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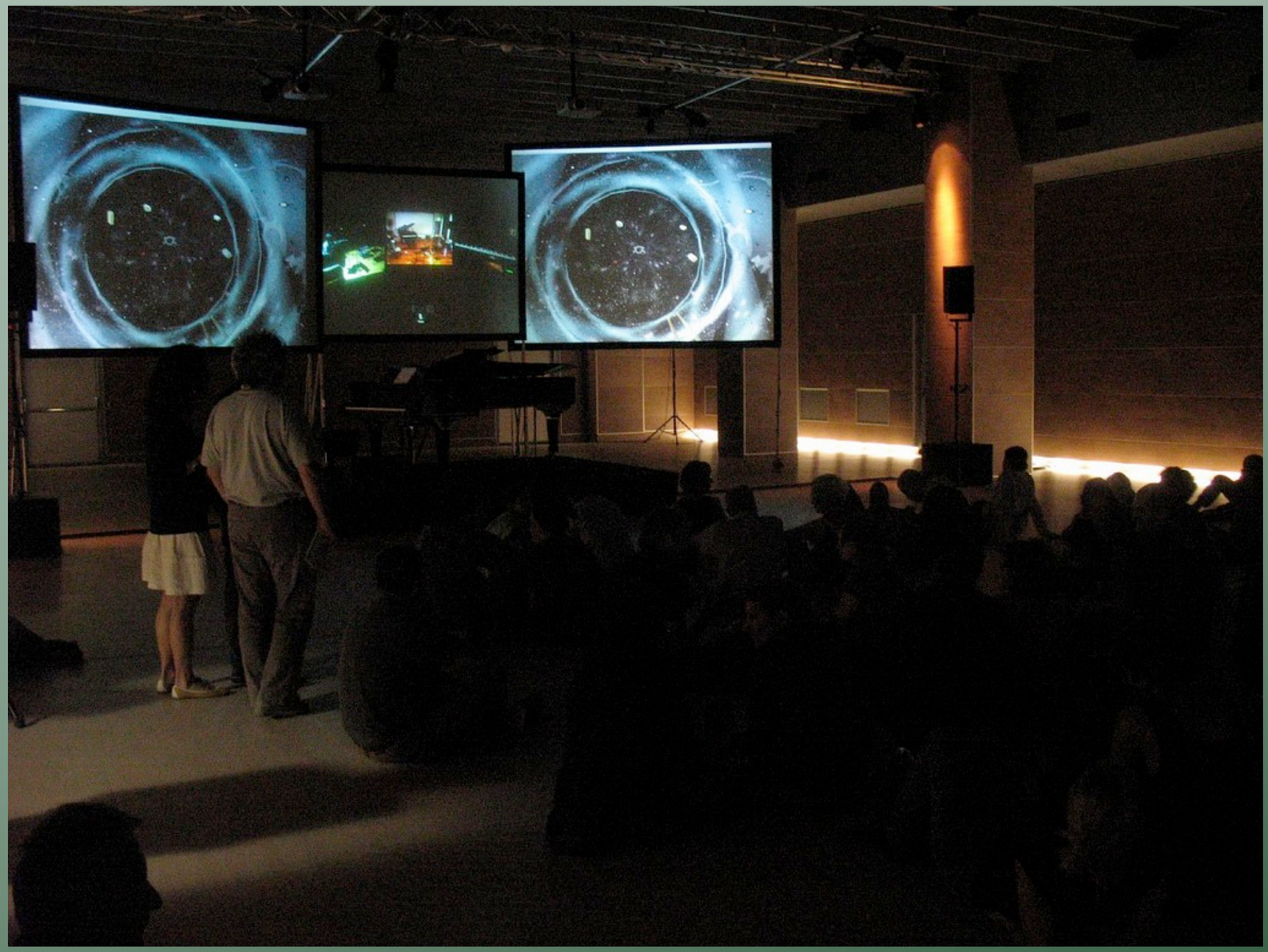
Dialoghi a group improvisation

Chris Chafe (Celleto/Montana)
Charles Nichols (E-Violin/Montana)
Lee Heuermann (Soprano/Montana)

Chryssie Nanou (Sirikata/Milano)
Rob Hamilton (Sirikata/Milano)

Debra Fong (Violin/Stanford)



MITO Settembre Musica
Torino Milano Festival Internazionale della Musica
3_24.IX.2009
Terza edizione

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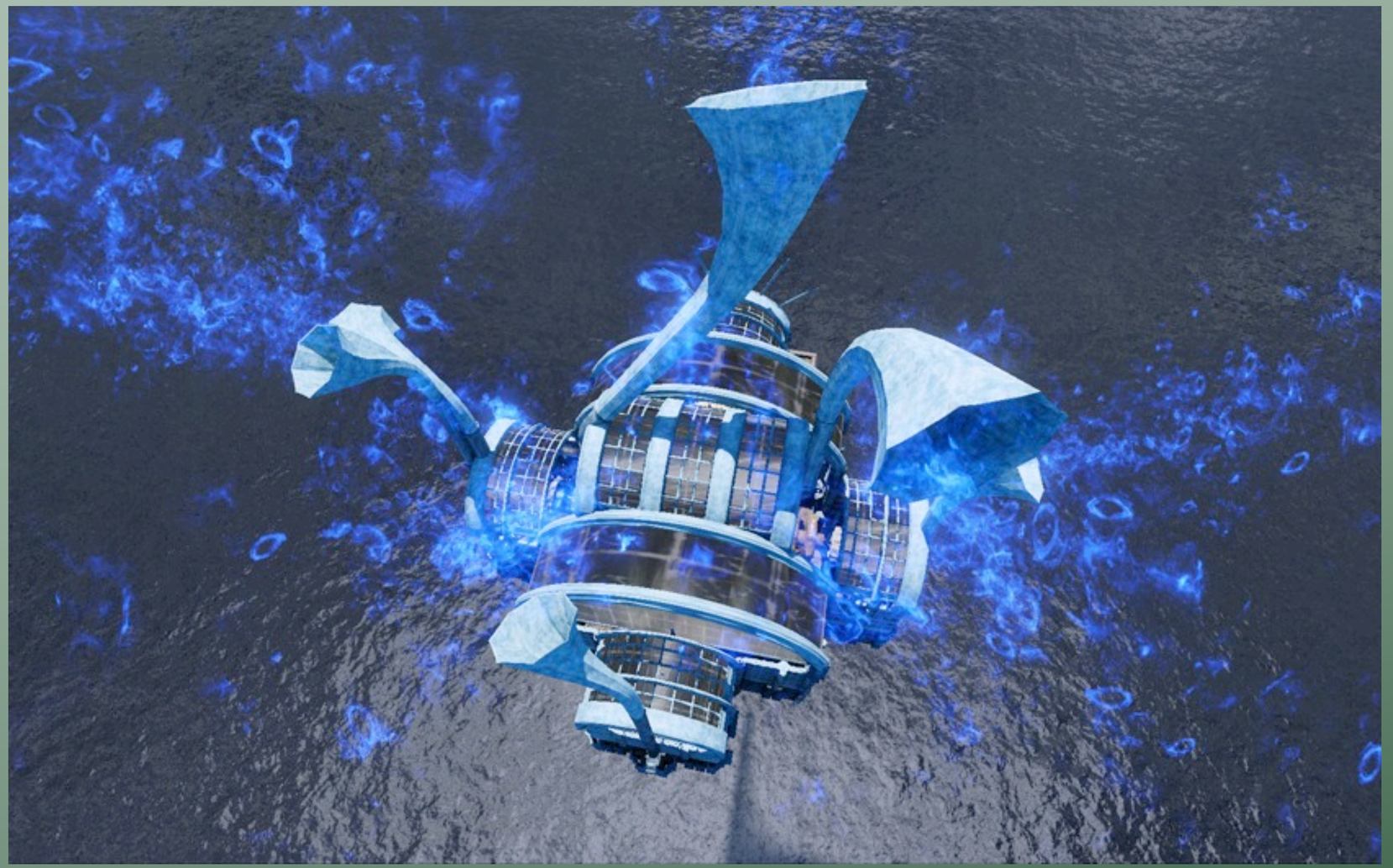
MiTo 2010: Interactivity + Audience

UDK (Unreal3) + Open Sound Control + Audio Synthesis

http://www.mitosettembremusica.it/en/programma/08092010-2200-play-your-phone-politecnico-sede-di-milano-bovisa.html

Tele-harmonium



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Tele-harmonium

Piano: Chryssie Nanou
UDKOSC: Robert Hamilton

Music by Robert Hamilton
Art Direction by Chris Platz

Tele-Harmonium is the first piece realized using UDKOSC, a modded UDK (Unreal Development Kit) project which incorporates an Open Sound Control implementation (OSCPack by Ross Bencina) to allow in-game motions and actions to drive synthesis and spatialization in a SuperCollider sound server. In this way, messages like client and projectile positioning, actor motions, etc. from the game engine are sent formatted as OSC messages over UDP to OSC-capable multi-channel sound engines written in a variety of computer-music languages (SuperCollider, ChucK, Max/MSP, PD) and used to control complex sound and music generation code. Similarly, messages from the sound engines (i.e. measuring microphone amplitude or a musical note's frequency) or external controller data (i.e. iPad or Wiimote) can be sent back into UnrealScript via a thread running in the DLL, and used to control a variety of UDK params (system gravity, game speed, projectile homing target location).

The piece makes use of Scarlatti's Sonata For Keyboard in D Minor, K.213 (L.108) "The Lover" as a central theme, both through direct quotation and through modification.

http://vimeo.com/15792555

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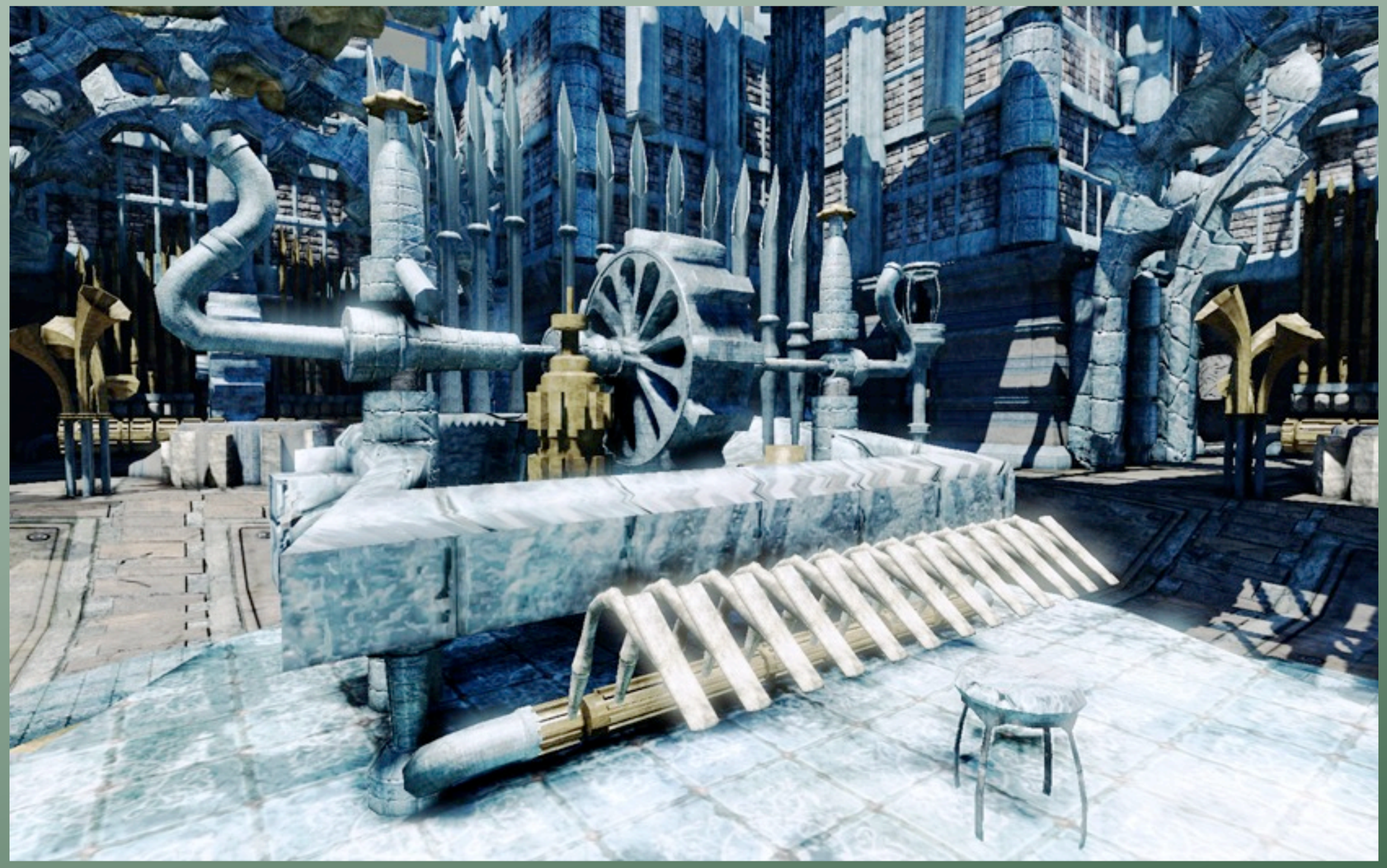
Tele-harmonium



Tele-harmonium

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Tele-harmonium

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What's Next?

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What's Next?

"Terra Sonata" (working title)

- http://www.chrisplatz.com/taxonomy/term/1

Questions?
Thanks

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