TEN HAND PIANO

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PSOs @ CASA DA MÚSICA

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Displaced *Soundscapes*

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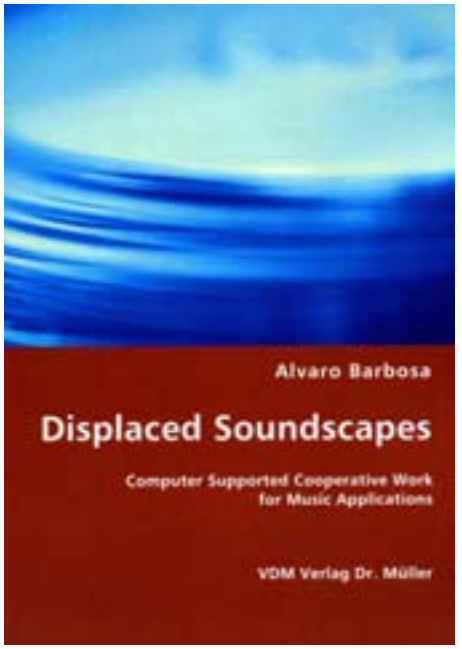
Displaced *Soundscapes* is a metaphorical description of the way lively generated sounds can be perceived over the Internet.

(Book) Barbosa, A. 2008. “Displaced Soundscapes”
VDM Verlag (ISBN: 978-3-8364-7154-1)



- Extensive Survey (up to 2006)
- Research on Latency and Internet Acoustics
- Models for Networked Music Systems
- Implementation “Public Sound Objects”

Latency and Network Acoustics

For the Human ear to perceive two simultaneous sounds, they should not be displaced in time over **20ms** (Hirsh, 1959)

The perception of two different sounds performed simultaneously is strongly dependent on:

- sound characteristics (ADSR, Timbre, Pitch or Loudness)
- music style (rhythmic, melodic,…)
- complementary feedback modalities (visual or physical stimuli)
- musicians background and experience

Background on Network Collaborative Practices

Jitter and delay asymmetry introduce further disruption in Network Communication.

Furthermore Latency is not a technological condition that can be overcome in the near future. Consider mobile or satellite technology or a communication setup that spans worldwide.

Moscow – Santiago (fiber-optic link)

Bidirectional Latency= **94,3 ms**

EPT<20ms

(Schuett 2002, Lago 2004)

EPT<25ms

(Alexander Carôt 2006)

Minimizing Latency's Disruption

Fast Network Connectivity

Large bandwidth, Smart Routing, Fast protocols, Fast ADC/DAC, …

Latency Adaptive Tempo (LAT)

Tolerance to Latency increases in lower musical Tempo (BPMs). This inverse proportion principle results in a possible application which consists of a simple software function for network acoustic communication systems, that dynamically adapts the Musical Tempo (typically a referenced by a metronome sound) to the maximum value tolerated by the least "latency-tolerant" musician of an ensemble.

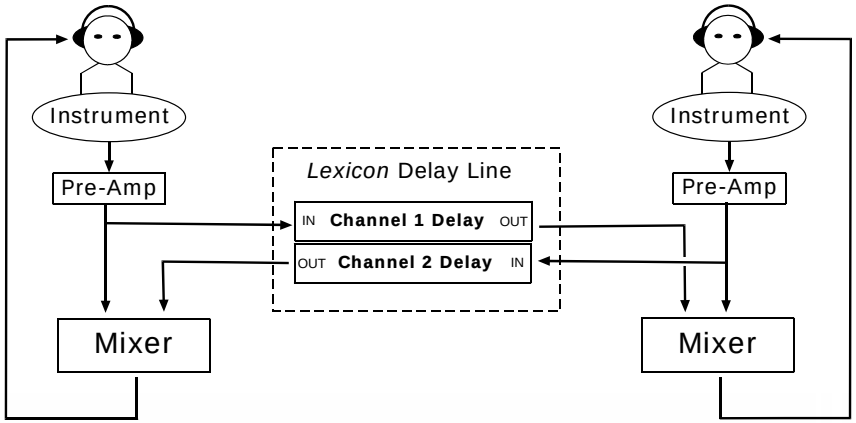
This dynamic adaptation is based on real-time latency measurement between peers.

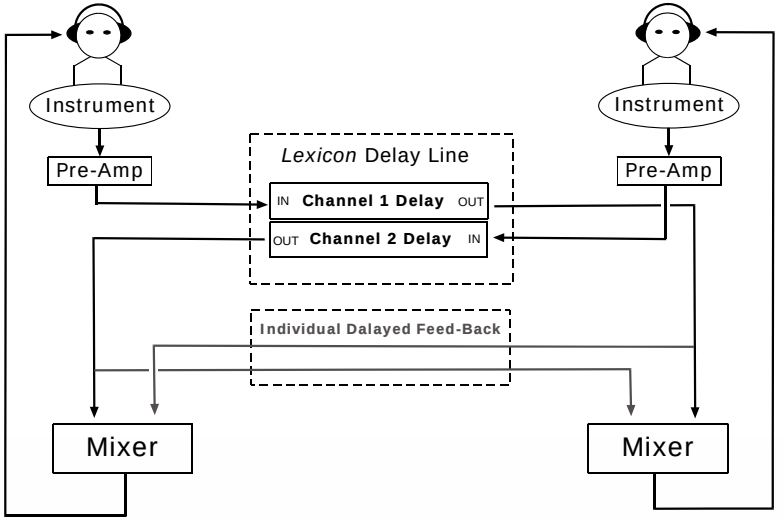
LAT allows musicians to rehearse music as fast as their Network connectivity speed allows them to.

Individual Delayed Feed-Back (IDF)

A specific Feed-Back Topology that can enhance individual latency-tolerance.

If instead of having ensembles in which each musician receives direct acoustic feedback from their own instrument mixed with delayed feedback from the other performers, **every musician listens to his acoustic feed-back delayed, together and in sync with the others**.





Accepting Net-Delay

- Music is often (if not always) “custom designed” to the media where it will broadcasted.

  Whether it is about adapting a a performance technique to the acoustics of a specific Church (like the XI century Venetian polychoral music style) or to condition the duration of popular music songs based on audio storage capacity of early recording technologies.

- An approach to face such scenario is accepting net-delay as the natural acoustics of Internet

- To create music that makes sense in the internet media

Video @ Atau Tanaka’s Interview, 2001

http://crossfade.walkerart.org/

The Shared Nature of the Internet

- Going beyond the paradigm in which we connect two or more remote spaces for a performative session by creating a **shared space** in a computer network, inside which users can achieve a certain degree of **immersion and flexibility in their behaviour**
- Users can freely join or leave this space, choosing to participate or just to listen to an on-going acoustic piece
- It is not oriented towards a time limited event scenario

Shared Sonic Environments

Auracle

Neuhaus and Freeman@Gtech

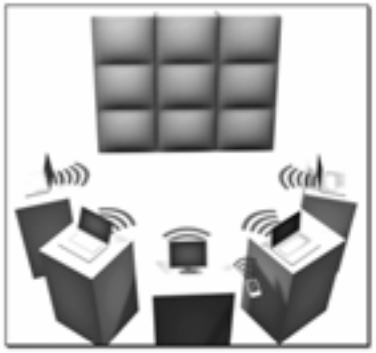
Co-Audicle for CHUCK

Wang @Princeton

Public Sound Objects

(Barbosa@MTG)

Original PSOs – 2004/2006, MTG (BCN)



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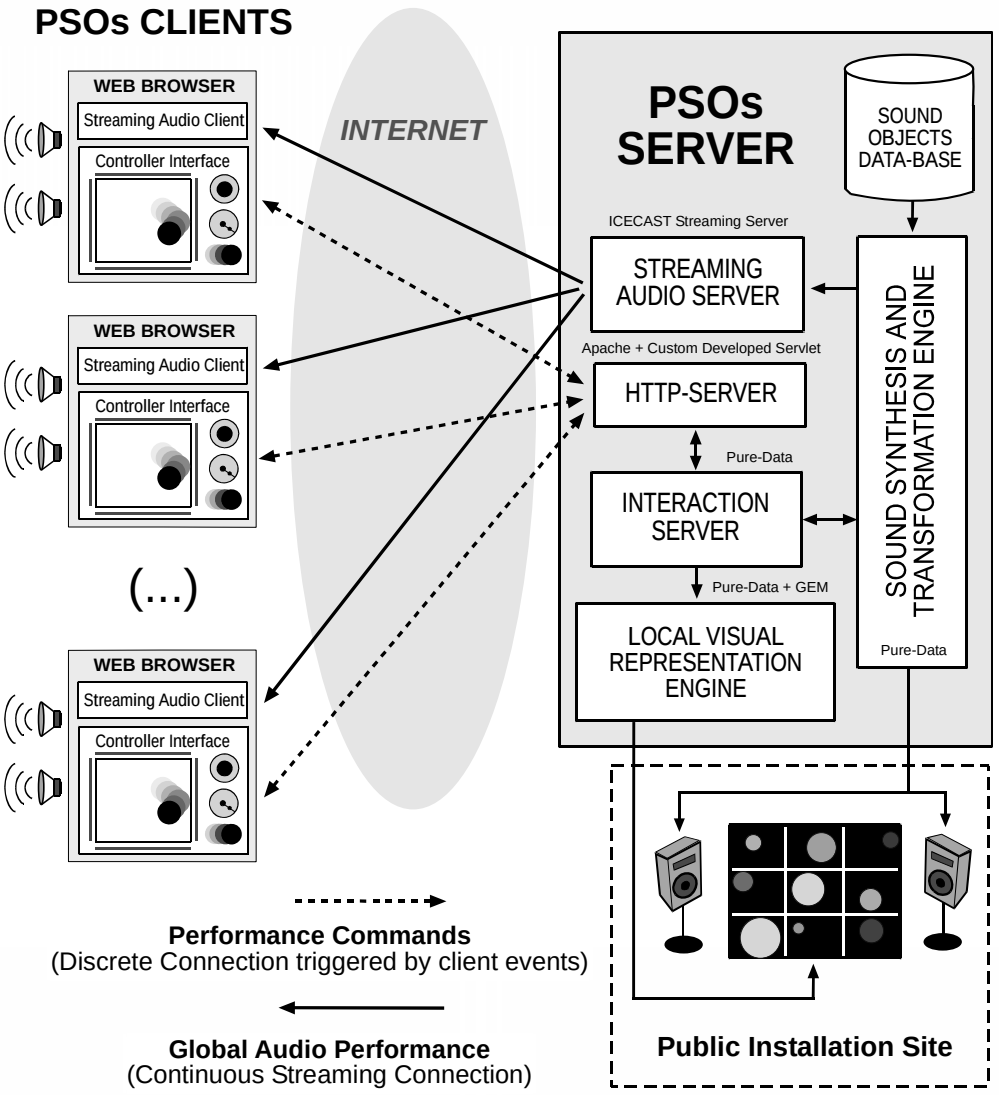

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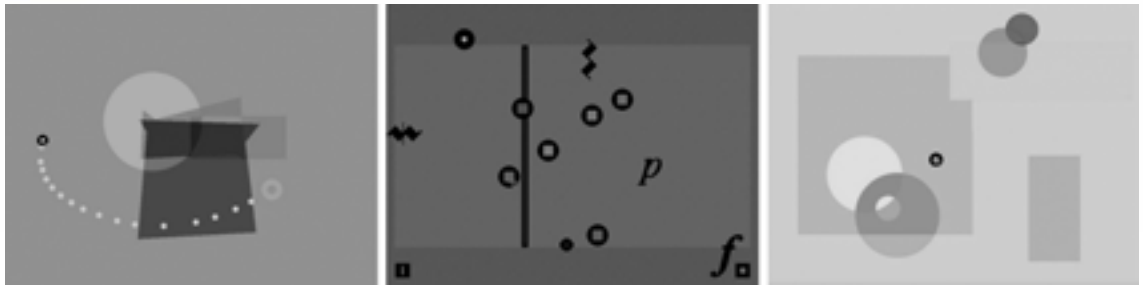
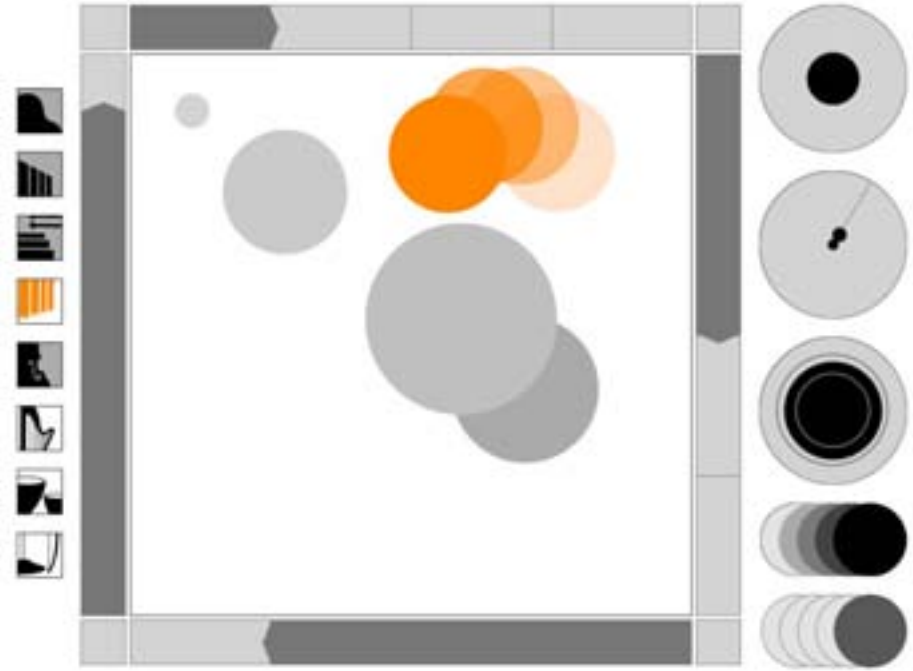


Inspiration in Small Fish (Fujihata and Furukawa 1999)
A Behavior Driven Interface



PSOs Interface

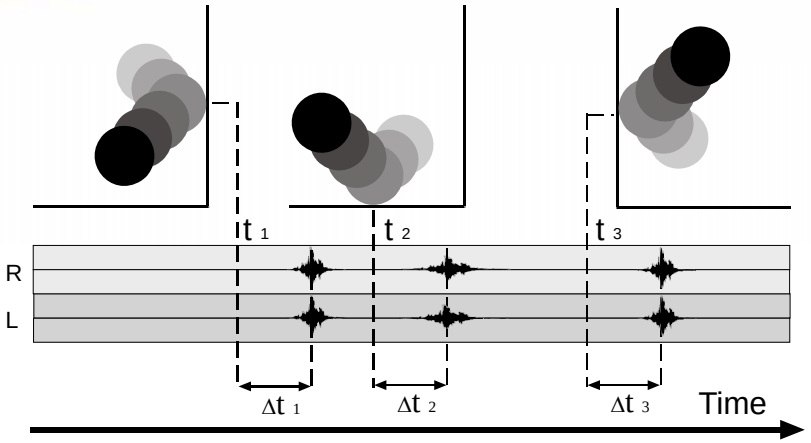
It is based on Pitch, Dynamics, Tempo and Timbre.

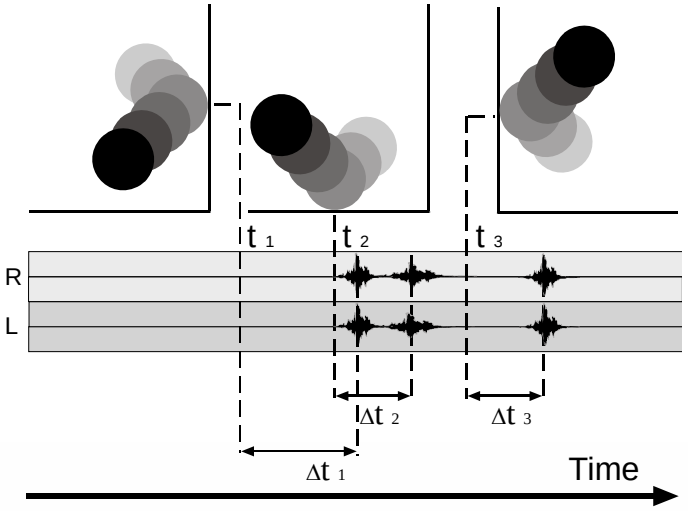
It tolerates Latency because:

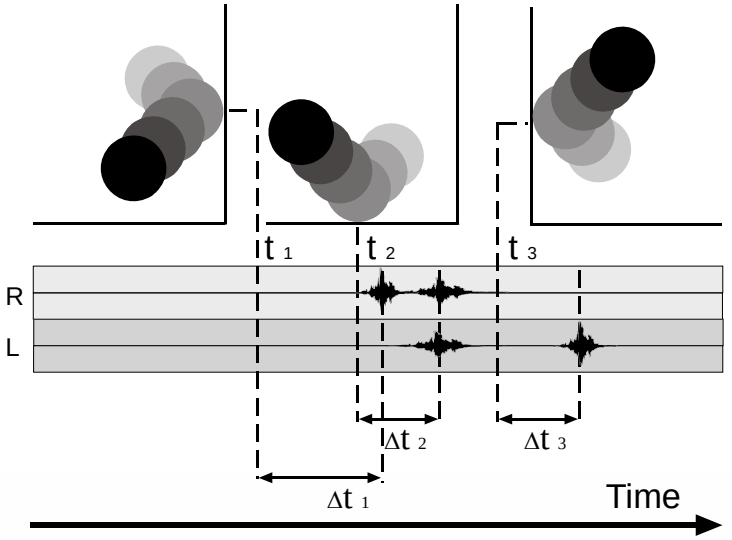
•The resulting soundscape is musical. Yet, it does not require a strict synchronization between sound events

- Behavior driven interactive Interface (loose coupling interaction)
- Adaptive speed and dynamics (to network conditions)
- Individual Delayed Feed-Back (same piece to everyone)
- Coherent with visual cues (spatialization of sound helps)

Public Sound Objects: Panorama Cues







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Local Network of PSOs – CITAR (Porto)

commissioned by "*Casa da Musica*"

http://en.wikipedia.org/wiki/Casa_da_musica

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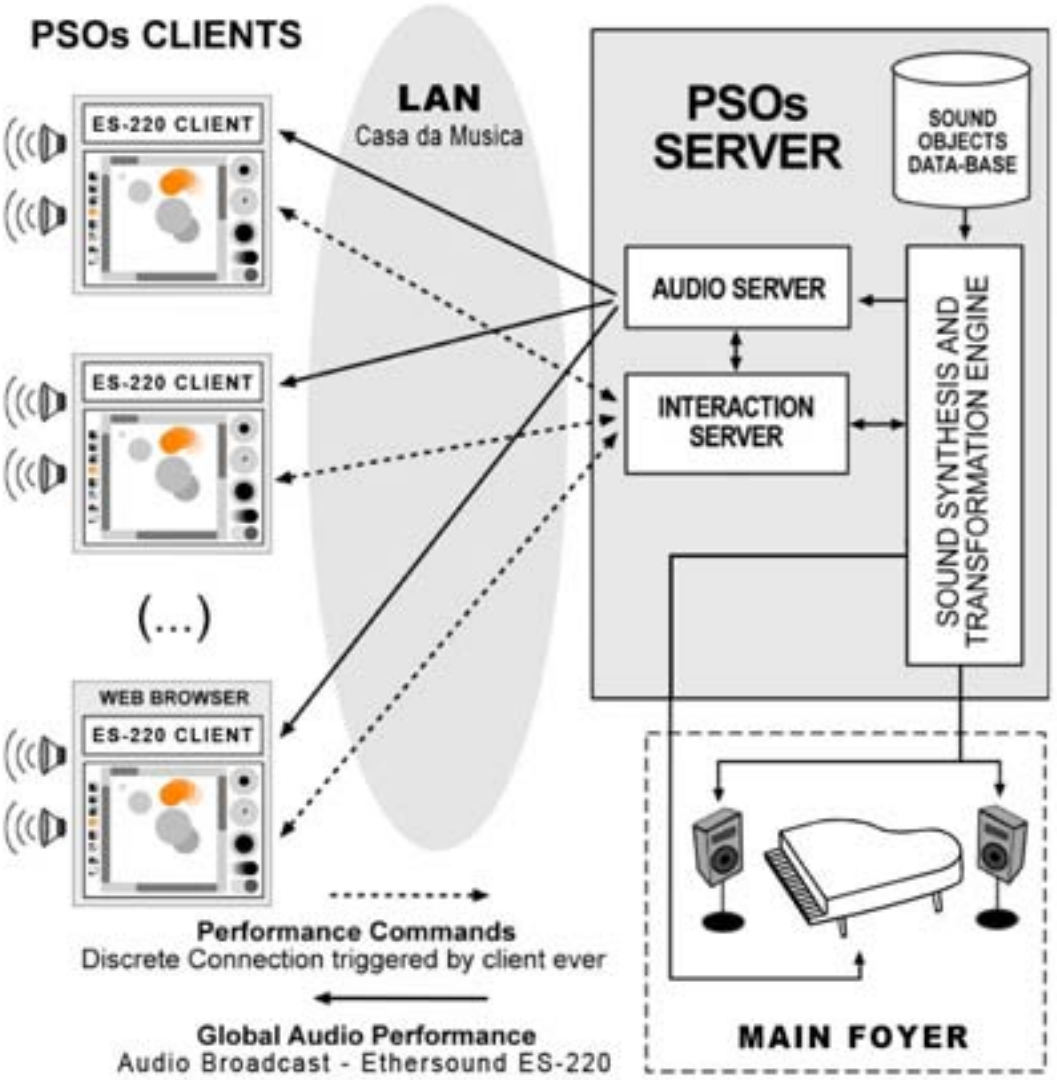

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Ether ES Sound

EtherSound ES220/ES220-L

Configuration	
Size	1 U 1/3 19" rack: 42 x 146.5 x 210 mm optional 19" rack mount bracket for up to three units
Local audio channel selection	Manually by internal rotary switches
Inputs/Outputs	
Audio	2 balanced analog mono line inputs, 2 servo-balanced analog mono line outputs ES220: inputs AND outputs ES220-L: inputs OR outputs (jumper selectable)
Input/output impedance	22.2 kΩ / <100 Ω
Maximum input level	+22 dBu or +10 dBV (jumper selectable)
Maximum output level	+22 dBu (software adjustable)
Analog output gain	from -72 dBu to 0 dB (software adjustable)
Connectivity	
Analog/digital audio	15-pin D-Sub
EtherSound	2 EtherCon female RJ45 compatible (connections "IN"/"OUT")
GPIO	4 inputs and 4 outputs on 15-pin D-Sub

Audio specifications		
Sampling frequency	48 kHz or 44.1 kHz (Primary Master: 48 kHz only)	
A/D and D/A converter resolution	24 bits	
Frequency response at 48 kHz	20 Hz – 20 kHz: ± 0.2 dB	
Dynamic range -60 dBfs with Fs=48 kHz (20 Hz/20 kHz, unweighted)	>102 dB	
Distortion and noise (THD+N) at 1 kHz (-1 dBfs with Fs=48 kHz)	<-95 dB (0.0018%)	
Phase difference between channels: 20 Hz/20 kHz	0.5°/2°	
Crosstalk:	Inputs:	Outputs:
at 1 kHz	<-116 dB	120 dB
at 15 kHz (-1 dBfs with Fs=48 kHz)	<-92 dB	105 dB

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Client

Server

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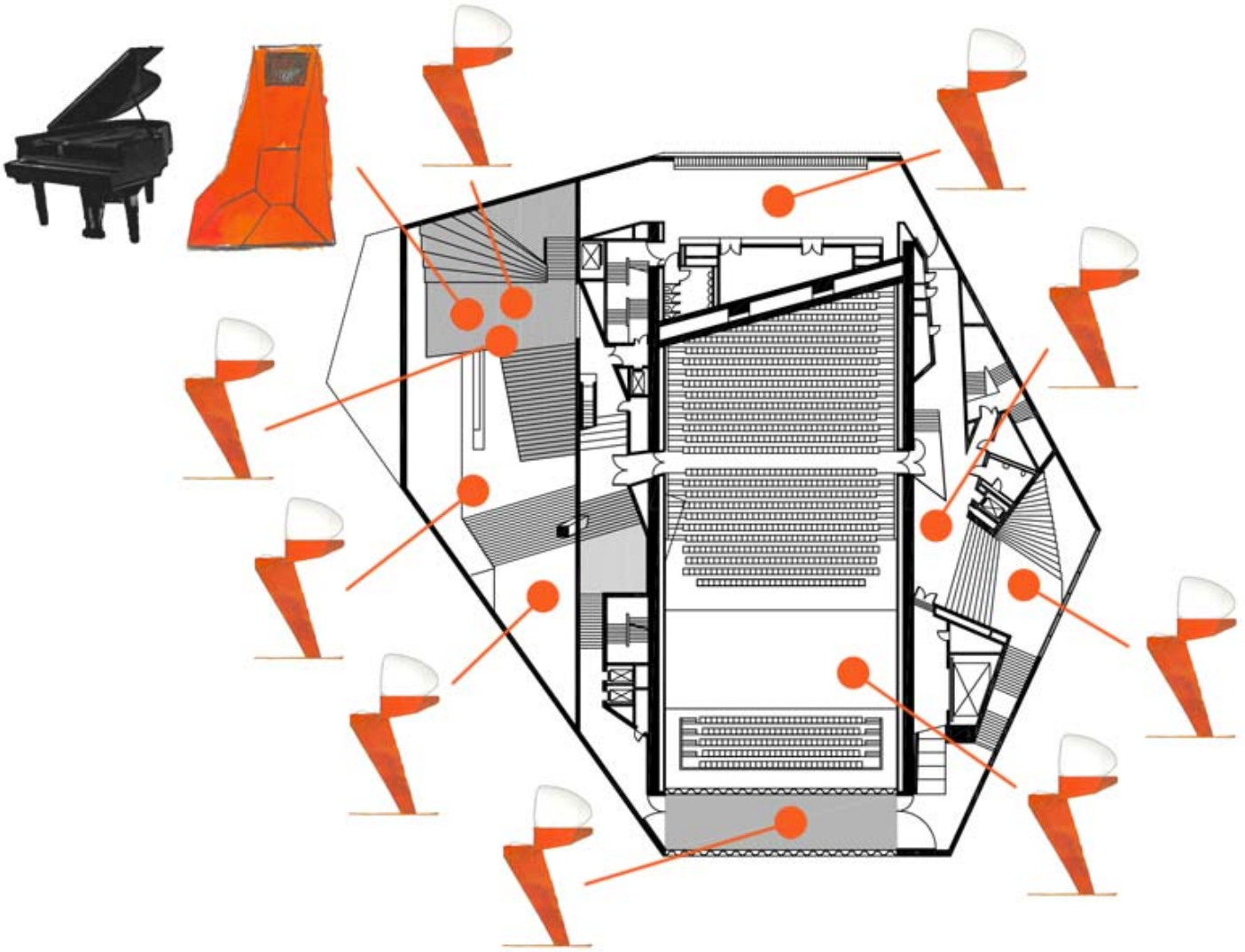

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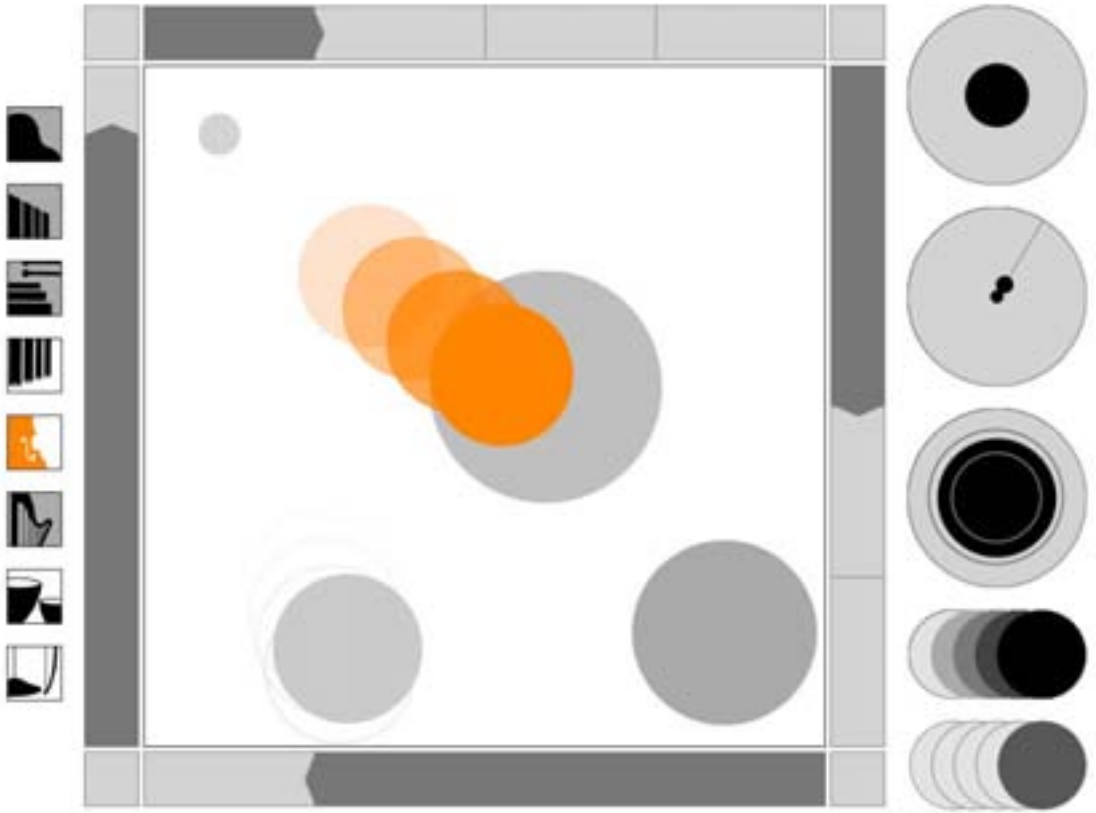

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Thank You!!!!

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