Composing Space: The ecology of artificial auditory environments

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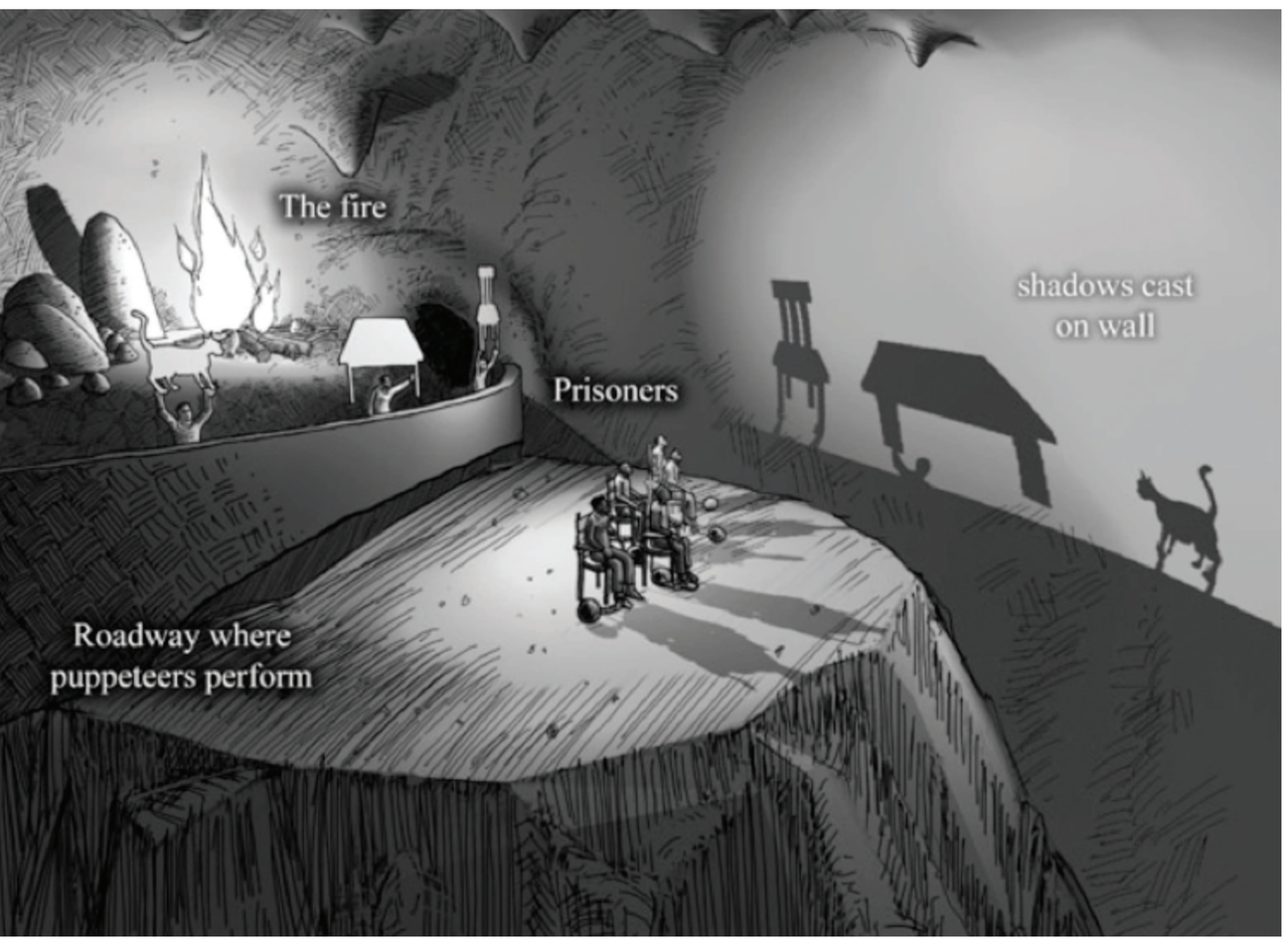
Introduction

Whilst various spatial formats for music reproduction exist their reason for existence is not always clear; "spatiality" as a set of musical parameters remains on the periphery of musical thought.

Stereo simply presents, through the impression of a frontal stage with a left-right dimension, is predicated on a proscenium arch-type presentation, simulating a stage area with musicians arrayed on a line between the speakers. Surround formats (5.1, 6.1, 7.1) are still predicated on a frontal stage, with surround channels largely depicting ambience, perhaps with a few special effects. No commercially available formats depict height information.

Composers have little incentive to explore spatial aesthetics, and manufacturers have even less motivation to develop a system for which no material exists.

The consequences of this deadlock are that artificial spatial sound is poorly understood from perceptual and aesthetic perspectives, and the available tools are constrained by available systems and usages. We thus have a situation analogous to Plato's cave, where available perceptual impressions are artificially constrained.



Contemporary commercially available spatial sound tools are not designed to efficiently manage such salient aspects of auditory spatial environments, as distance, motion, physical interactions, object and place size or physical construction. Although these are readily comprehensible to human perception, they do not form part of the mainstream musical lexicon.

Composers wishing to maximise their use of spatiality must generate their own tools and even subvert systems' original engineering design constraints. The engineering approach to spatial sound is to focus on managing sound field characteristics that appeal to elements of the head related transfer function (HRTF) – such as interaural differences (ITD and IAD) and, where possible, pinnae effects.

In complementary fashion, we focus on what we know of available perceptual impressions in real spatial environments, in order to pursue appropriate engineering solutions. Thus, a *sound field* is characterised as the audible part of an environment.

What is actually *in* the "sound world"?

We think in terms of *artificial ecologies,* where spatial soundscapes exemplify artificial environments wherein physical and perceptual rules can be creatively subverted; the challenge is to retain perceptual plausibility – in the same way that cartoons can be perceptually plausible yet physically improbable.

The scheme described here is based on a 'modular through-and-through' conception of perception, where specialised subsystems rapidly identify, within a received sound field, those components that denote place, physical features, entities (position and behaviour), trajectories and events.

It is hypothesised that by composing in terms of the artificial causal ecology (including the physics), these perceptual modules can be appealed to directly in isolation or in concert to produce novel perceptual impressions.

In this way of thinking, we hear:

- **Things, in**
- **Positions, in**
- **Places.**
- **Engaged in events**

Place

- How big is it?
- What shape?
- Is it enclosed (or partly so), symmetrical?
- What are the surfaces made of? – is it smooth, or textured, empty or cluttered

Things

- These things are our sound sources – BUT… in real environments, when you listen to ***sounds,*** you're listening to the **audible** part of ***'things'*** (in positions)

What are these things like?

- Are they ***objects*** or ***organisms?*** (they have different behavioural properties that are readily perceptually detectable)

Physical properties of things:

- Big – small
- Heavy – light
- Dense and solid, or hollow
- Soft, flabby or spongy – hard, rigid

Behavioural properties:

- If things move/are moved, you can hear if they are hollow and round (they bounce and roll) or:
  - Angular and dense (sharp impulsive clunks with loads of low frequencies)
  - Flimsy and clattery, soft and squidgy
  - Easy/hard to move?

Why? Hearing Causality:

- It takes energy to move things – why are these things making noises?
- Wind, water, sun heating things up, gravity…

"agency"? – are some of these things alive?

- Maybe they are machines… (can you relax a bit?)
- Either way, they can move in ways you want to know about
- Perception is very finely tuned to this kind of complex *thing*

Positions (in terms of direction and distance from the perceiver):

- Obviously, things' directions are what appeal to elements of the head-related transfer functions (HRTFs) – the staple tools of spatial sound systems – "panners"
- What panners don't do is distance" (from the perceiver, i.e. *range*) – surely an integral part of position in place
- What panners don't do well is *movement* – a most important part of perceiving in *real* environments. Surround panners move items in circular trajectories
- In a hierarchy of perceptual importance, *position,* though significant, is a relatively minor player, especially compared to **movement**
- We can suppose that perception is well developed to detect, comprehend, track and anticipate movement
- Contemporary spatial sound technologies are poorly aligned with *perceptual significance*

What kind of movements are interesting?

- Fast, slow
- Accelerating, slowing down, starting, stopping
- Approaching, passing, departing
- Flocking, scattering, chasing, *interacting*
- Impacts, scraping, shuddering, bouncing, skipping, rolling, fluttering ricocheting
- Trajectories, taking off, landing, soaring, swooping, gliding
- Effortful, effortless
- Purposeful, meandering, random

Conclusions

Whilst pioneering composers continue to explore the possibilities of spatial music, they sometimes face unnecessary (if not insurmountable) impediments in the form of unsuitable technological implementations.

This work is part of on-going research to develop intuitive compositional spatial sound tools that can incorporate elements of naturally available spatiality into musical syntax.
In highlighting unnecessary technical constraints that are underwritten by conceptual constraints, we hope to help to break the deadlock. We look forward to spatial composition becoming more ambitious, subtle, engaging, immersive and innovative.

References

Plato (360 BC) The Republic (Book VII) trans. Benjamin Jowett., available online, retrieved Sept 2004 from http://classics.mit.edu/Plato/republic.html