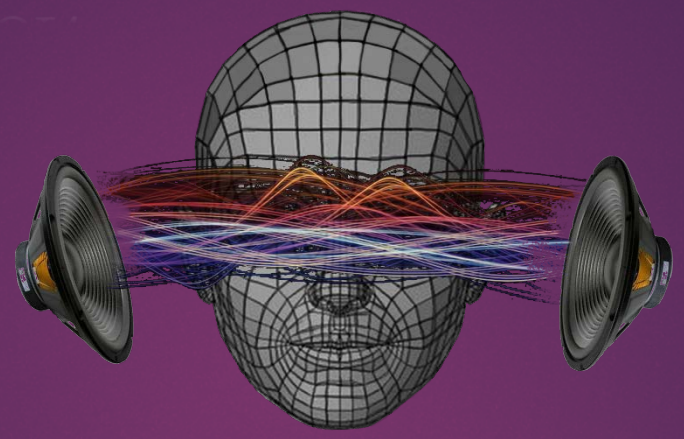
UNIVERSITY OF WEST LONDON
London College of Music

Sounds In Space Conference, University of Derby, 2018



3D Audio for Music

AN INVESTIGATION INTO 3D RECOMPOSITION FOR BINAURAL REPRODUCTION

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Principle Researcher - Jo Lord

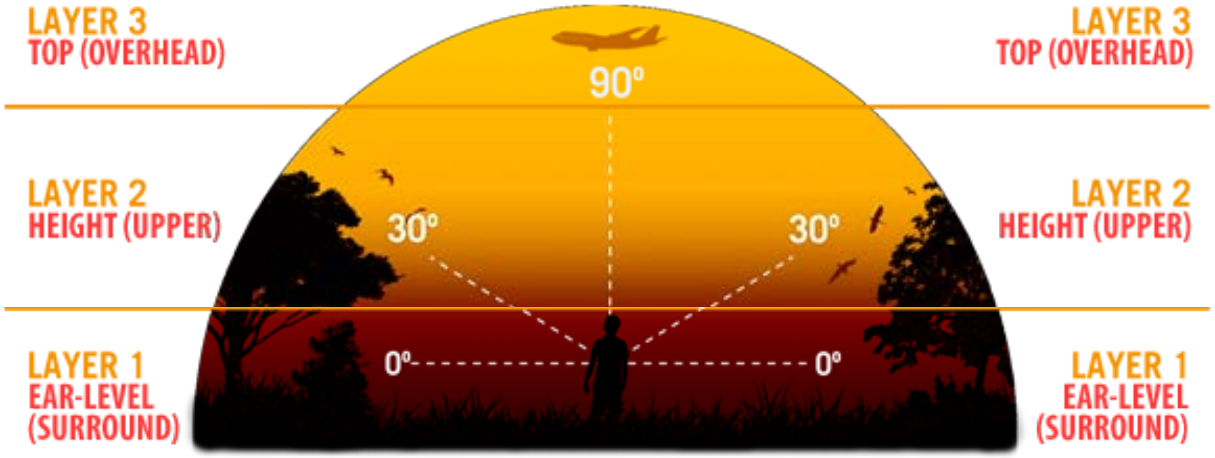
Supervisors: Dr Andrew Bourbon & Dr Simon Zagorski-Thomas

Objective: Practical / Musicological Investigation of 3D Audio for Music Production

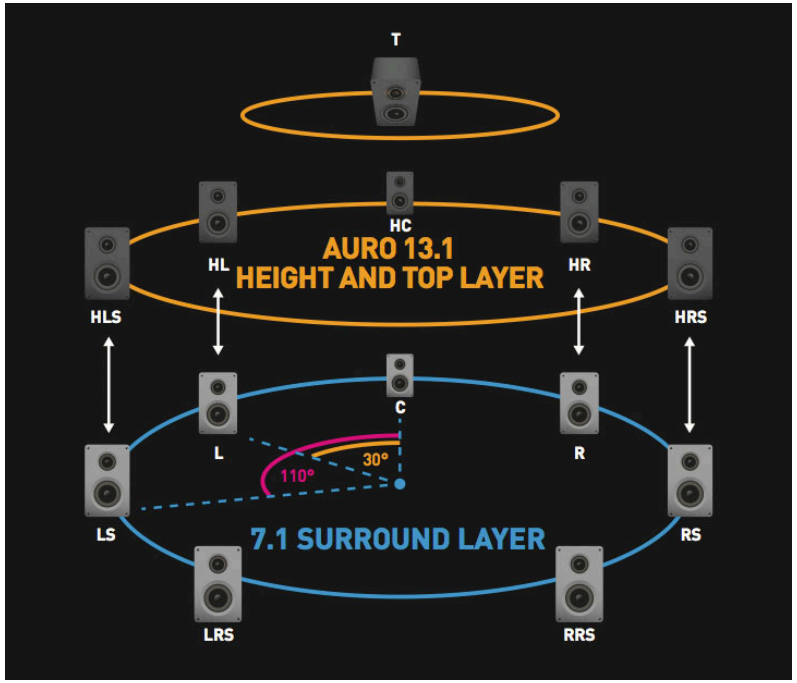
- Development of 3D Production Technique and Creative Effects; through Periphonic Staging, Non-standard use of FX, Hyper-Realistic Production and Sonic Cartoons
- Seeks to challenge traditional front orientated listening.
- Define a new creative and democratic approach to music production and composition processes.

- Research as Practice
- Data Collection and Analysis : reception of production technique and the musical experience afforded. Workflow and creative practice analysis.

A new approach to record production



Auro Build Concept
Auro Technologies (n.d) http://www.auro-3d.com/system/concept/



Auro 13.1 build.
Image- Auro (n.d) http://www.auro-3d.com/system/concept/

3D Over-Headphones - Why?

"There's great attraction in being able to recreate spatial audio through any normal stereo speaker system" SOS Interview with Qsound Labs (1995)

- Affords convenient consumption
- In keeping with consumer listening behaviour
- Convenient Data Collection
- Negates variables: implications of room acoustics and badly configured speaker set ups, sweet spot
- Headphone based mixing
- Democratic production

Consumer Experience
Auro Technologies (n.d) http://www.auro-3d.com/consumer/experience/

A new approach to record production

- Recompose stereo mixes to 13.1 using Auro 3D Creative Tool Suite and 13.1 speaker array.
- Convert discreet legacy audio to 3rd order ambi, pan channels, decode to headphones.
- Blue Ripple O3A (VST)
  -Upmixer specifically caters for Auro 3D configurations
  -Binaural Decoder (for headphones)
  -Stereo Decoder (binaural speaker playback)
- Limited creative agency - staging & mixing for 3D domain
- Pluginalliance DearVR - More creative agency, real-time monitoring of the end result, far more spatial and coherent

Objective: Musicological Investigation of 3D Audio for Record Production

- ‘How can 3D record production technique enrich the music experience beyond that of stereo?’
- ‘How should we mix 3D music for current user listening trends?’
- ‘Is the future of 3D record production and consumption specifically headphone based?’

3D Recomposition & Production Technique

"Too much movement is not good – it sounds messy… Simple patterns"

'Hidden Behind Static' – Andrew Caldecott (composer/programmer)

X-Y-Z Plane Experiments, Kinetic Stability and Localisation

- **'Penny Drops':** Rhythmic - Kinetic & Periphonic Staging, Sonic Cartoons.
- **'Monomorphic':** Musical – Periphonic Staging, Kinetic Reverb & Delay, Stereo x Quad technique.

3D Recomposition & Production Technique

"Utilising hard stereo panning alongside the 3D spatialisation can be used to create a secondary 'hyper-space' perceivably outside of the music in the listener's head"

'Hidden Behind Static' – Andrew Caldecott (composer/programmer)

Spatial Blending and Hyper-Realism

- **'Far From Here':** Musical – Conceptual Blending, Sonic Cartoons, Depth, Distance & Intimacy.

- J. Lord - **'Art's Self Alteration':** Rhythmic, Musical, Game-Audio influenced- Periphonic Staging, Sonic Cartoons, Ecological Production.

Sonic Schema: Realism vs Hyper-realism

Stereo

Periphonic / ‘3D’

Sonic Schema: 3D Binaural Staging

- Working in layers similar to that of the Auro set up: Lower, Height, Top and FL, RL, FR, RR segments.
- Integrating stereo and quad style arrangement: pairing of sound source positions: front-back, left-right, up-down and on the diagonal.
- Instruments arranged in layers through assessment of frequency content.
- Utilising spatial FX in a different manner to create movement and space
- Conceptual Blending- Integrating stereo panning to create a secondary spatial environment.
- Production influenced by our understanding of human perception and psychoacoustics

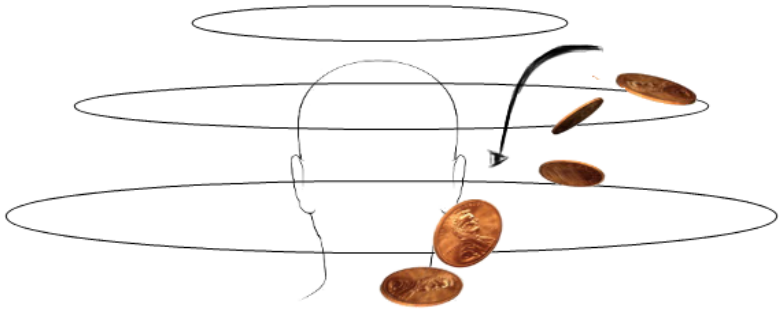
Sonic Schema: Sonic Cartoons

"… sounds which suggest interpretation through their metaphorical relationship with our embodied experience …the notion that we understand music schematically… through association with sounds that do have identifiable causes" – Simon Zagorski-Thomas (2015)

- Static and automated kinetic technique creating exaggerated movement
- Experimenting with localisation on XYZ and the movement between height layers.
- Immersive staging and arrangement.
- Production technique utilising sonic cartoons that stereo/single-tier surround could not achieve.
- Ecological approach to perception of production.

Penny Drops - Sonic Cartoons

- **Penny Drop Sample –** Split the sample between rear L height and lower layers to create a schematic representation of movement. Penny falling off a ledge. Designed to test the movement and linking between lower and height layers.
- A technique not possible in stereo/surround



'Penny Drop' sonic cartoon. Exampling vertical stereophony, periphonic panning and investigating cohesion of inter-layer linking.

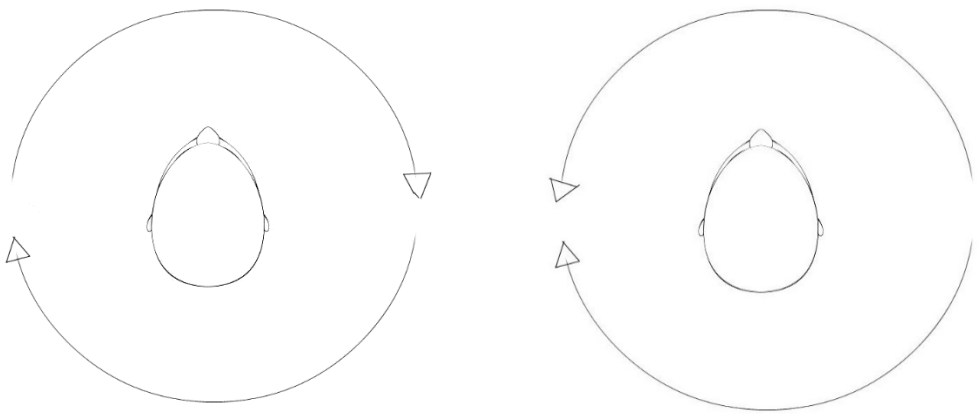
Penny Drops - Sonic Cartoons

Percussive Stops –

- Humans are perceptually more sensitive to changes in their environment than constants.
- Create more impact and discernible movement with judicious arrangement of samples.

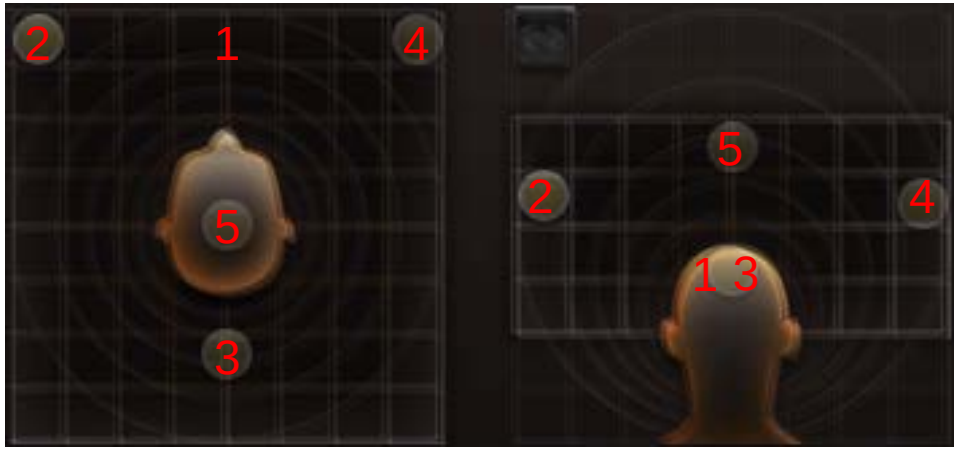
Similar in theory to implementing diminuendo to better impact crescendo.

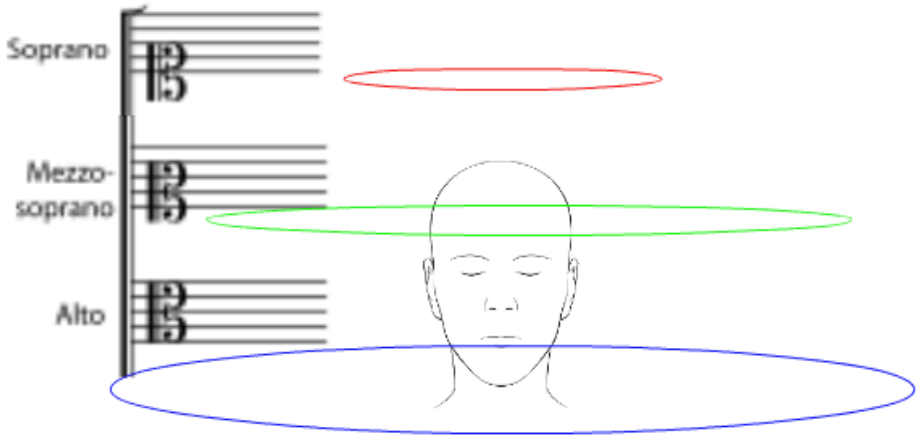
- Implemented in the height layer.
- Not possible in stereo / incoherent in single tier surround



Vocal Layering and Staging

Immersive choral effect: Multiple voice lines arranged based on register, pitch, and the interaction of the vocal content.





Influenced by reading such as: ‘Tone Height of Multiharmonic Sounds’ - Roy D. Patterson (1990)

Vocal Staging – Far From Here

- Depth and Intimacy experiments

- Conceptually based on contextual analysis of the composition, exploiting emotion, the lyrics and vocal performance:

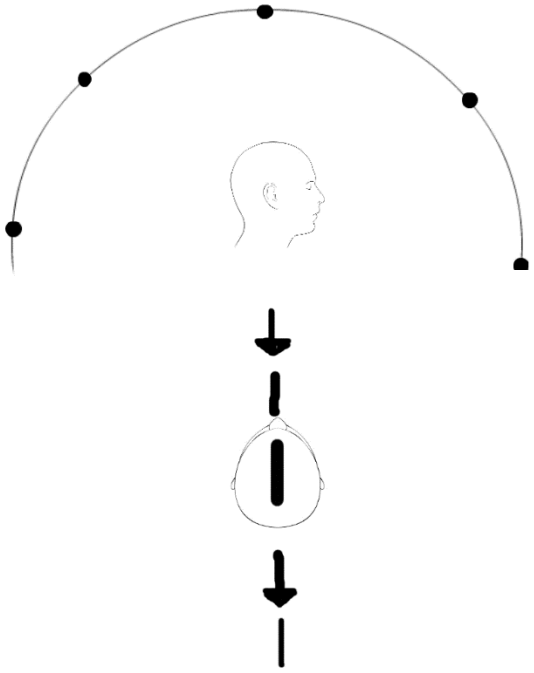
Lyrics reflect the spatial production of the voice: **Far,** far from there. Go to any where, than **here** (Starts with a distant, ambient voice, the lyrics dictate increase presence, closeness, depth)

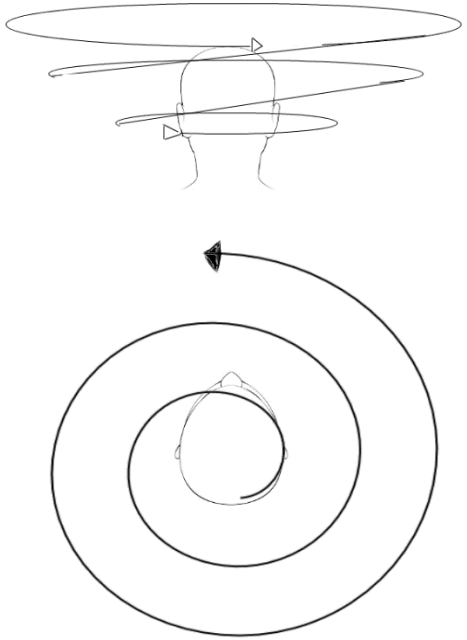
- Panned automation and high frequency compression: compression high frequency as well as automated near/far provides a heightened and exaggerated sense of depth.

Creative Effect: Movement

Crank – ‘Crank’ cartoon was designed to test localisation of XYZ planes. Spectral not high enough for good localization and trajectory mostly problematic for imaging.

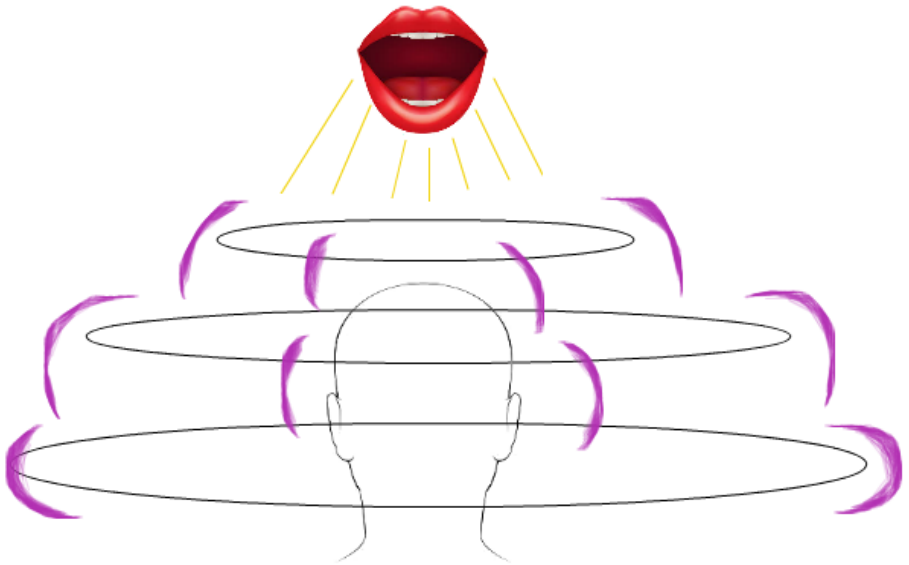
Spiral HH – ‘Winch’ cartoon performs well on the array, as does the crank but both in headphones are tricky. Too much movement from high hats and crank sound at once causes distraction and spectral masking. Designed to test localisation of XY and the movement between lower and height layers.





Creative Effects: Movement & Space

- Travelling reverb & vertical panning.
- Illusion of a heavenly voice, ‘Fingers of God’ effect (Monomorphic)
- Hyper-realistic spatial context of the vocal chorus.
- Dry sound source panned center top. Bussed and panned surround reverb across the lower layers.
- Automated panning – creates the illusions of kinesis.

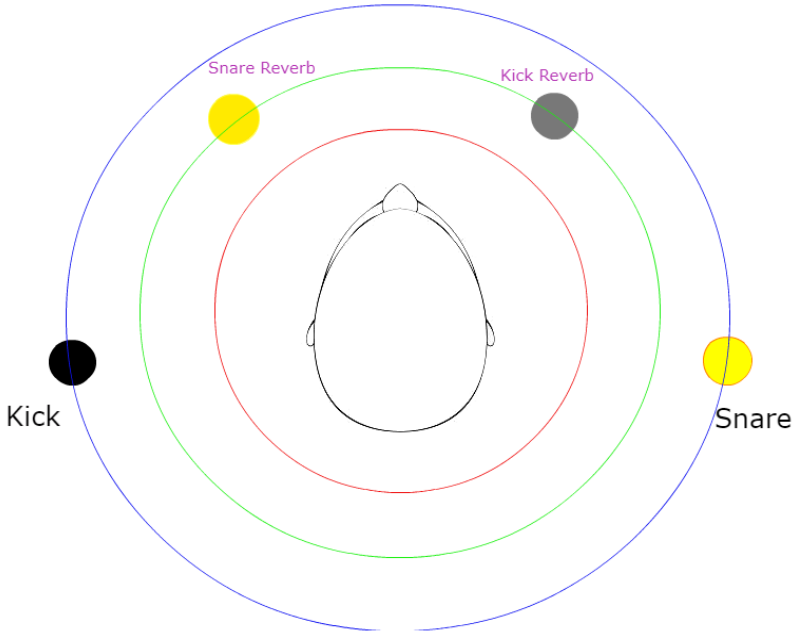


‘Heavenly’ voice sonic cartoon with automated vertically panning reverb.

Creative Effects: Movement & Space

Reverb as Movement & Space

- Opposed panned reverb w/pre-delay
- Movement without kinetic automation.
- Experiments with delivering an enhanced sense of space and movement using panned reverb.
- Results in delivering a ‘slapback’ spatial effect that creates a hyper-realistic perception and illusion of a tunnel.



Key points:

- Does not respect the front
- Defines new creative technique that could never have been constructed on a 2D system (sonic cartoons)
- Takes multiple listens to acknowledge the spatial production techniques and break away from traditional front orientated listening behaviour.
- Skewed / different spatial perception – tunnelling, variation of headphone reproduction.
- Altered approach to composition process.

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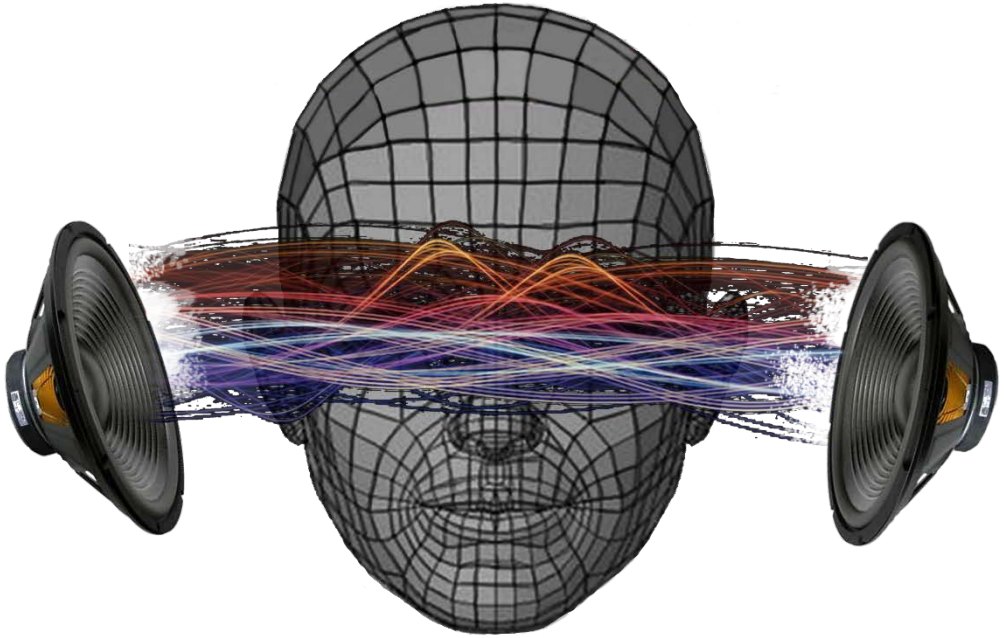
Thank you! Any questions?



Listen to my productions here → https://bit.ly/2IwFnWE